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Title

An Overview of the Idaho Power Hatchery Mitigation Program

Abstract

An Overview of the Idaho Power Hatchery Mitigation Program

Paul E. Abbott
Idaho Power Company

Abstract.- The Idaho Power Company (IPC) anadromous hatchery mitigation program was implemented in 1963 by order of the Federal Power Commission after previous efforts to provide fish passage around the three-dam Hells Canyon Complex (HCC) proved unsuccessful. Between 1961 and 1967 IPC constructed four hatchery facilities to mitigate the impacts of construction and operation of the HCC. These facilities include Oxbow and Niagara Springs fish hatcheries in the Snake River basin and Rapid River and Pahsimeroi fish hatcheries in the Salmon River basin. Initial hatchery production levels were derived from counts of adult Chinook (Oncorhynchus tshawytscha) and steelhead (O. mykiss) observed passing the dam sites during project construction. Current hatchery production is defined by agreement between IPC and several state and federal agencies (known as the 1980 Hells Canyon Settlement Agreement) and includes 1 million fall Chinook, 4 million spring/summer Chinook and 400,000 lbs of steelhead annually. Evaluation by IPC suggests that adult Chinook and steelhead produced from IPC hatcheries contribute to commercial, tribal and recreational fisheries and that hatchery production remains a viable mitigation tool to supply anadromous fish for harvest. In applying for a new operating license for the HCC, IPC proposes to continue operating its hatchery facilities at current production levels. Additionally, IPC recommends facility modifications and program enhancements to improve hatchery operation and better evaluate performance of hatchery reared fish. Additional terms and conditions for ongoing hatchery operation have been proposed by Federal Energy Regulatory Commission (FERC) staff based on recommendations from state and federal agencies, tribes and non-governmental organizations and are incorporated into the Final Environmental Impact Statement. A final ruling on these recommendations will be made by FERC Commission.

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Title

Conservation of Native Freshwater Mussels in the Pacific Northwest: Where Do We Start?

Abstract

Freshwater mussels, a group of bivalve mollusks of the order Unionoidea, comprise one of the most imperiled faunal groups in the world. Of the 300 plus species of freshwater mussels that have been described in North America, 70% face some level of threat to their existence; 51 have been listed as threatened or endangered and 35 have been declared extinct. The Pacific Northwest is home to two described species, and a species complex whose taxonomy is under review. Unfortunately, little is known about the distribution, status or ecology of freshwater mussels in the region. The Pacific Northwest Native Freshwater Mussel Workgroup was formed with stated goal of ensuring that “freshwater mussel research, management, and educational activities are coordinated, prioritized, and are consistent with identified information needs." The current project of the workgroup is a critical needs document that outlines 5-, 10-, and 20-year visions for research and conservation. Because few data are available, the workgroup decided to survey qualified academics, resource managers and public advocates who have been involved with freshwater mussel research and conservation in the Pacific Northwest. These individuals were asked to rank research and conservation initiatives proposed by the workgroup according to biological benefit and feasibility. The results of the survey were used to develop a consensus opinion based on “Best Professional Judgment.” By comparing biological benefit against feasibility a decision matrix was created by which initiatives were prioritized. Now that priorities are established, the process of developing long term visions and initiatives can begin.

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Title

Steelhead Habitat Restoration in the Satus Creek Watershed

Abstract

The Yakama Reservation Watersheds Project perform watershed level restoration projects thorughout the Ahtanum, Toppenish and Satus Watersheds. These three watersehds are home to Mid Columbia ESU steelhead, and yearly redd surveys have shown that about 50% of the total spawning in the Yakima Basin occours within these three streams. The diversity and number of restoration projects conducted within the three watersheds can’t be briefly explained therefore this presentation focuses on two restoration projects, the Satus Creek Side Channel Reconnection Project and several examples of montane wet meadow restoration in the Dry Creek Meadow Complex. The goal of these projects is to improve hydrologic function by slowing runoff, raising the water table, improving floodplain connectivity, and enhancing riparian vegetation. Direct benefits to summer steelhead include increased summer base flow and increased off channel rearing opportunities.

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Title

What does the Klamath Basin Settlement Agreement mean to the Water Users?

Abstract

Klamath Project Water Users invested tremendous time & resources into the process of developing workable & permanent solutions to one of the West's most bitter water wars. The results will affect water users & water management in the Klamath Basin forever. The progression required building trust, a shared vision & meaningful relationships w/ former opponents.
The Klamath Basin Restoration Agreement is a result of an intense negotiation. It sets forth a series of compromises & commitments from various parties. Klamath Project Irrigators had three constant objectives from the outset:1)The need for a secure & reliable supply of water; 2)A requirement for "affordable" irrigation & drainage power rates; & 3)A need for regulatory assurances in the form of a HCP.
Irrigators w/in the Klamath Reclamation Project have faced continual uncertainty month to month (even day to day) whether adequate water supplies would be available to sustain crops. Uncertainty makes planning & management exceedingly difficult & producers in the Project continually face the threat of another water shut-off. Low-cost power had historically been assured through association w/ the hydropower dams. The formation & ratification of the Klamath River Basin Compact (1957) between the U.S., CA & OR underscored the need for reasonable & low cost power rates in the Upper Basin. Affordable energy is critical to maintain efficiency in water use both for irrigators & for National Wildlife Refuges.
Water Users & irrigation districts in the Klamath Project participated in the Settlement process aware of the prospect of salmon reintroduction, absent from the Upper Basin for over 100 years. Klamath Project irrigators prefer to help with (or at least not fear) the return of salmon. This agreement seeks to institute some means of protection from the regulatory & financial encumbrances that would accompany any such effort.

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Title

Improving Survival for Fish Passing Through Turbines by Developing New Turbine Designs and Modifying Operations for Existing Turbines.

Abstract

The U.S. Army Corps of Engineers' (COE) Turbine Survival Program (TSP) is part of the COE Columbia River Fish Mitigation Program. The TSP was established to evaluate the turbine environment and the effect of that environment on juvenile salmonids passing through the turbines. The TSP includes four main objectives; 1) Evaluate and recommend measures to improve survival of fish passing through the Kaplan turbines, 2) Identify biological design criteria for design of fish passage improvement modifications of existing turbine units, 3) Investigate modifications to the existing turbine designs that have potential to increase fish survival, and 4) Recommend a course of action for turbine rehabilitation or replacement that incorporates improvements for fish. Phase I of the TSP focused on the development of tools necessary to evaluate the turbine environment and the effect on fish. Phase II is the implementation of those tools to evaluate the effect of turbine passage on fish and to identify and evaluate operational and design alternatives to improve the turbine passage conditions. Results of the TSP Phase I and II efforts will be presented.

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Title

NMFS and Ecoinformatics: Using technology and databases to help restore endangered and threatened salmon populations.

Abstract

The evolution of computer science and database technology has impacted fisheries science in countless ways. The discipline of ecoinformatics, or the management of biological and environmental information with a focus on both human and computer elements, is quickly becoming an essential tool within the NMFS organization, and it too continues to evolve. At the Northwest Fisheries Science Center we have developed several such tools to aid Technical Recovery Teams (TRT) in the management and production of data critical to salmon ESA listing decisions. The Salmon Population Summary (SPS) database and the Salmon Population Analyzer (SPAZ) statistical program were created to aid in the production of regular Status Review Reports. SPS is a database system that stores salmon abundance, wild fraction, harvest numbers, and age structure data summarized at the ESU and Population level across the Northwest Region. SPAZ is a statistical package that utilizes the data generated in SPS to produce population trend data that then feeds directly into the listing and de-listing decisions under the ESA. In the recent past each TRT chair had different methods and practices when dealing with their own salmon data. This resulted in a very tedious and laboring endeavor when it came to generating the needed salmon population summaries and trends for a Status Review. Moving forward, it is our intent, with both SPS and SPAZ, to allow those tasked with the job of restoring endangered and threatened salmon species the ease and flexibility to manage their own data on a central system. SPS and SPAZ will demonstrate how a large agency in charge of managing data over a very large spatial scale can benefit from the tools created within ecoinformatics.

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Title

Optimizing the reintroduction potential for Lahontan cutthroat trout in a California lake

Abstract

Lahontan cutthroat trout (LCT) have experienced significant declines across their native range as a result of habitat degradation and loss, overharvest, and the introduction of non-natives. Reintroductions of LCT into native habitats remains to be an important component in the recovery and viability of LCT as a species. In many systems, the complete removal of non-natives is niether socially nor logistically feasible, and managers must consider the most effective means for successful LCT reintroductions in the presence of non-natives. Recent work has suggested stocking of LCT may largely result in an increase in the growth of non-native predators and subsequently the proportion of the population exhibiting piscivory. Here, we evaluated alternative reintroduction and management strategies for LCT into a medium-sized lake in California where numerous non-native species are present. We used extensive sampling methods and mark-recapture techniques to assess non-native abundance and temporal shifts in the diets and distribution of non-natives within the lake. Next, we integrated diet data, stocking scenarios, thermal history, and functional feeding responses of predators into a bioenergetics framework to evaluate the most effective means for LCT reintroductions. We found lake trout had the highest relative abundance, but moderate abundances of rainbow trout (a species known to hybridize with LCT), large brown trout (a benthic predator), and kokanee (a known pelagic competitor) were present in the lake. Across seasons and depths we found little refugia for LCT from negative interactions with non-natives. We found lake trout growth largely varied with feeding response and stocking strategy, thus highlighting the importance of considering alternative feeding responses in bioenergetics modeling. Further, our results indicate the need to consider alternative stocking strategies and non-native management options to increase the most cost-effective means for successful LCT reintroductions.

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Title

Potential bias in salmonid survival rates from capture-recapture models where multiple life-history forms coexist within a population

Abstract

The use of PIT tag technology with capture-recapture methods has increased substantially in fisheries research and monitoring to evaluate population structure, vital rates, and trend. With this, a large number of research projects have implemented the use of passive instream antennae for year-round sampling and to increase the number of recaptures and precision of survival rates. Despite the substantial increase in their use in fisheries research and monitoring, few studies have evaluated the potential bias in survival rates where passive instream antennae are used for additional recaptures. Specifically, the variability in the behavior of resident and migratory individuals within a population may introduce bias in survival rates due to violations of model assumptions; the magnitude of this bias may be related to the proportion of the population exhibiting resident or migratory life-history expressions. Here, we evaluate the extent of this bias in capture-recapture studies where active sampling and passive recapture data are used to quantify survival rates for freshwater salmonid populations exhibiting both resident and migratory life-history expressions. We conducted our analyses using a Barker capture-recapture model based on field estimates from a bull trout population in Eastern Oregon. With the Barker model, fish exhibiting migratory life-history expressions have a higher probability of recapture at passive instream antennae between sampling intervals than resident fish, resulting in large amounts of individual heterogeneity in capture. Our results indicated this heterogeneity in capture probabilities can result in biased estimates and low precision in survival rates. Our analyses also highlight the importance of prior consideration of antennae placement within a study site to maximize the number of recaptures and minimize the heterogeneity in individual recapture rates.

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Title

Implications of climate change for Okanagan Basin water availability and salmonid restoration planning

Abstract

We assembled a basin-wide water budget for the 2050s period and ran these net Okanagan Lake inflows through the established operating rules embedded within the Okanagan Fish/Water Management Tool. Our study found that average egg-to-yearling survival for endangered Okanagan River sockeye will fall by 44%. Alarmingly, our simulated 2050s water availability conditions led to the complete loss of high juvenile survival cohorts, reducing the sockeye population's resilience. In addition, our 2050 period fish/water managers were unable to achieve the current September 30 operating benchmark for Okanagan Lake even once in 28 simulated years. Consequences of extensive lake draw-downs would be catastrophic, highlighting the need for more serious preparations. The solution includes much more strenuous surface and groundwater license restrictions and sensible, enforceable demand management regulations on all new and existing water extraction activities. Creation of water banks, water markets and water license buy-backs are also foreseeable. Politicians, planners and regulators should meaningfully move forward with these anticipatory water conservation and management steps now to avoid the creation of increasingly complex and insoluble problems later. Failure to do so will have dire consequences for aquatic ecosystems and the quality of life in the Okanagan.

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Title

DISTAL, PROXIMAL AND GENETIC INFLUENCES ON SPRING CHINOOK SALMON MIGRATORY TIMING

Abstract

Selective harvest of migratory species can inadvertently alter the genetic composition of a population when the migration is controlled by both genetic and environmental factors. Accurate predictions of run timing are essential to reducing this selection. However, existing prediction models, which relate run timing to environmental properties, are only partially successful. We develop a model that includes genetic and environmental run timing factors and predict the run timing of Chinook salmon (Oncorhynchus tshawytscha) at Bonneville dam on the Columbia River ($P < 0.00001$, $r2 = 0.78$). In the model, the run timing of precocious males, returning one year prior to the adults, characterizes the genetic component of adult run timing, while distal (upwelling) and proximal (river flow) factors describe the environmental influences. We find that interannual variations in the population/genetic composition of the run explains 50% of the interannual run timing variation while distal and proximal factors account for 25%. We suggest that accurate run timing predictions are possible for migratory species that preserve genetic run timing traits across maturation states.

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Title
Habitats for Kids and Fish

Abstract
Connecting kids with nature can happen in a lot of ways. The Pacific Region of the U.S. Fish and Wildlife Service has adopted an elementary school with the intent of developing a Wildlife School Ground Habitat project. Staff from the Region will assist the school in building raised beds for gardens, substituting natural plantings for grass and typical ornamental shrubs, and developing a nature trail designed to give kids a positive outdoor experience.
Two local high schools will assist by contributing woodshop projects and assistance from their horticulture classes. Wildlife friendly plantings around the school and along the nature trail are planned. Getting students outside and experiencing nature in a variety of ways is the goal.
Fish friendly activities include “Salmon in the Classroom” projects with students participating in the raising of salmon from eggs to fry for release in local streams.
These actions are a result of the Service’s Children & Nature initiative, sparked by the inspiring message by Richard Louv in his thoughtful book, Last Child in the Woods.
The efforts of one government agency to address “nature deficit disorder” in America’s children will be highlighted. Children of today deserve an opportunity to experience the natural world in order to at least have a chance of becoming the conservationists of tomorrow.

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Title

Fish and wildlife conservation and economic growth: a western perspective.

Abstract

Economic growth is an increase in production and consumption of goods and services, facilitated by increases in human population and consumption. Due to human niche breadth and resource use, economic growth results in increasing exploitation and competitive exclusion of fish and wildlife. Some economists say technological progress can support unlimited economic growth. Other economists say that principles of ecology and physics apply to economic growth, imposing an eventual limit. Western America's pioneer economy exploited the productivity of natural systems for human benefit. As it became evident that natural systems were limited, the region embraced a new technology-based economic vision. However, regional commerce still depends on natural systems to provide products and services that sustain growth as well as amenities that attract and retain residents. The American Fisheries Society has adopted a position statement on human population growth and technology. The Wildlife Society adopted a position statement recognizing adverse effects of economic growth on wildlife and other natural resources. The Ecological Society of America is considering a similar position statement. Other professional organizations have adopted or are considering positions that say natural resources and ecosystem services can only be sustained under a mildly fluctuating but relatively stable steady state economy. Under the premise that economies cannot grow without limit, scientists and economists may want to collaborate on defining a future in which the economy is stabilized at a steady state before it reaches that limit.

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Title

More Than a Coil of Wire – Development a PIT-Tag Detection Array for the John Day River

Abstract

Straying rates are an essential adjustment factor to adult survival estimates used to evaluate whether the adult salmonid Federal Columbia River Power System Biological Opinion survival goals are being met. Currently, radio-telemetry is the only methodology used to obtain straying rates. Mean values from the years of radio-telemetry studies can be used as a correction factor for assessing adult performance, but that would not reflect any annual variation that might normally occur. An alternative is to develop tributary PIT detection systems that can give us annual estimates of straying. The goal of this project is to evaluate the feasibility of using PIT-tag systems to estimate straying rates in large tributaries. The project was initiated in spring 2006 and comprises several phases: site selection, scour analysis, permitting, antenna design, fabrication, and installation, and data collection and analysis. We collected hydrologic and bathymetric data in December 2006 and deployed “dummy” antennas at the site in February 2007 to evaluate potential scour of similar structures. Electrical and mechanical antenna design and test phases were executed in spring and summer 2007 with installation of the antennas in September 2007. Two 60 ft long arrays, each consisting of 3-20 ft antennas, were installed the week of 17 September 2007. The two arrays are separated by 30 ft; each extending into the river channel from the right-bank. Twenty-eight steelhead were detected by early November 2007. Sixteen of the detected fish were from the John Day River and twelve of the detected fish were from the Snake River; two fish were detected twice. We will continue monitoring the site for PIT-tagged fish and evaluate its durability and performance during spring 2008.

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Title

Assessment of Juvenile Salmonid Passage Through a Barrier Culvert Using PIT-tags

Abstract

An array of PIT-tag antennas was used to monitor passage of juvenile salmonids prior to and following replacement of a culvert assessed as a fish barrier in Slikok Creek, Alaska. We implanted PIT tags in juvenile salmonids (55-120mm) and released them upstream and downstream of the culvert. PIT-tag antennas (up to 6.4m wide) were installed 30m upstream of the culvert, the entrance of the culvert, retro-fitted to the exit of the culvert, and 20m downstream of the original culvert. Following replacement of the original culvert, the two antennas at the entrance and exit of the culvert were replaced with two 1.2x5.2m antennas. Fish movements are being monitored to determine 1) if “stacking” occurs as fish approach the culvert and 2) the proportion of successful passage events through the culvert at low, medium, and high discharge. Some of the challenges we overcame include: interference between transceivers, “noise” associated with cable length and water depth, milling of fish in antenna field, rounding up enough people to install a 400 lb antenna, and bears modifying the site. Results will provide better understanding of culvert function relative to natural stream conditions and juvenile fish movement: 1) are older culverts necessarily a barrier, as determined by current assessment criteria? 2) do new culverts with improved design criteria significantly increase juvenile fish passage?

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Title

Using stressor gradients to determine reference expectations for great river fish assemblages

Abstract

We describe an empirical modeling approach for determining least disturbed conditions for the great rivers of the Upper Mississippi River basin: The Missouri, Upper Mississippi, and Ohio Rivers. We used multivariate analysis to identify reference strata (reaches for which a single reference expectation was appropriate) on each river. We created a multimetric stressor gradient using a suite of site- and landscape-scale metrics. Site-scale metrics included water chemistry, aquatic and riparian habitat, and human disturbance metrics. Landscape-scale metrics included land use, land cover, and proximity to human disturbance. The gradient was scaled from 0 (least stressed) to 1 (most stressed). Missouri and Mississippi River fish assemblage metrics were responsive to stressor gradients based on 19 - 25 abiotic stressor metrics. Ohio River fish assemblages were responsive to a three-metric gradient. We used the y-intercept of quantile regression to predict the fish metric value for a stressor gradient value of 0 (the index value at a site with the lowest mean stressor gradient score in the reference stratum) which we designated as least disturbed condition for the metric. We trisected the difference between predicted least disturbed condition (ceiling value) and a floor value set at the 5th percentile of the sample to create thresholds for three condition classes: least-disturbed, intermediate, and most disturbed. A multimetric index of fish condition, optimized for each river using the stressor gradient, exhibited longitudinal variation that was closely associated with the location of major urban areas along each river. We conclude that empirical modeling based on an abiotic stressor gradient can be used to examine the responsiveness of biotic metrics to stress, and can provide an alternative approach to deriving internal reference expectations for great rivers with few, if any, minimally disturbed sites.

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Title

Monitoring status and trend of aquatic habitat in coastal watersheds of Oregon

Abstract

Aquatic habitat survey methods to assess status of current conditions are well developed. However, the analytical methods to evaluate trend in habitat given the inherent variation present over time and across the landscape are particularly lacking. We present a linear mixed models approach for assessing trend in aquatic habitat data collected from 1998 – 2007 as part of a long term monitoring effort in coastal drainages of Oregon. We describe the trend in habitat conditions, determine the relative contribution of the variance components influencing trend detection capabilities, and discuss the implications of this trend assessment on future habitat monitoring. Using a rotating panel design based on a spatially balanced probability sample, randomly selected sites were surveyed annually or every three years, within five geographic regions along the coast. Five habitat response variables were considered; wood volume, active channel width, percent of fine sediments, percent of pool habitat, and pool frequency. Trends were detected among the first three habitat metrics and generally varied by geographic region. Site-to-site variability accounted for most (70 – 90%) of the overall variation. We used results from the wood volume and pool frequency analyses to generate simulated datasets with hypothesized trends of 1-2% per year, in order to estimate trend detection power under the current survey design as a function of the duration of the monitoring effort. Results of the simulations will aid in both optimizing information gain at these scales and determine the appropriateness of the survey design to monitoring trends in aquatic habitat in the Pacific Northwest.

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Title
The Practical Application of Hatchery Reform in Washington State

Abstract
Hatchery Reform, as proposed by the Hatchery Scientific Review Group (HSRG), has become an increasing important concept in the operation of Washington State hatcheries. The HSRG produced three principles for hatchery management and over 1,000 specific recommendations for reform within the Puget Sound and coastal Washington regions. The principles are being applied by WDFW to facilities statewide. They include: 1) clear goals for each stock, 2) scientifically defensible programs and 3) a transparent and accountable feedback loop to determine if the programs are achieving the goals.
An example of an integrated broodstock plan that has been implemented for summer chinook (Wallace River Hatchery) is presented in detail.

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Title

Use of PIBO Effectiveness Monitoring data to influence management decisions on federal lands in the UCRB.

Abstract

Large Scale Effectiveness Monitoring programs such as PIBO and AREMP can provide useful information to local field units when making management decisions. The power of such large data sets is that it allows the decision maker to evaluate present management actions at many different scales, from local field units to the scale of entire basins. In addition these types of analyses can strength adaptive management decisions by allowing the user to account for both environmental factors such as climate and site attributes such as watershed area or gradient, ultimately leading to more informed management decisions.

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Title

Landscape Genetics and Conservation of Oregon chub (Oregonichthys crameri)

Abstract

Oregon chub are endemic to the Willamette River Basin of western Oregon. They were listed as endangered under the U.S. ESA in 1993. At the time of listing, only eight populations were known to exist with over half containing fewer than 100 individuals. Oregon chub inhabit backwater habitats that have disappeared or become fragmented over the past 100 years. Isolation and low abundance of chub populations creates a high risk for extinction. Currently, new populations are being established and transfer of fish among populations is being considered. We conducted a landscape genetic analysis to help guide these important restoration efforts. Genetic diversity was examined within and among 20 natural and four introduced populations at 10 microsatellite loci. We observed moderate levels of diversity, 11 alleles per locus and average expected heterozygosity of 0.77, with the exception of one population that displayed signs of a genetic bottleneck. Estimated ratio of effective to census size was 0.09. Phylogeographic analysis of the natural populations revealed four genetically distinct groups that corresponded to sub-basins of the Willamette River. These results are being used to guide fish transfers among populations, reintroduction efforts, and recovery goals in terms of abundance and geographic distribution of populations.

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Title

Development of a Quantitative Life-Cycle Model to Estimate Hydropower Related Impacts to Lower Clackamas Basin Salmonids

Abstract

Hydropower operations on the Clackamas River are estimated to increase maximum summer river temperatures by 1-2° C in portions of the river between River Mill Dam and Clear Creek. During the low flow season, temperatures in this reach exceed the standards set by Oregon Department of Environmental Quality for spawning and rearing of salmonids.We developed a quantitative Life Cycle Model to estimate the magnitude of hydroelectric project impacts on lower Clackamas River salmonids resulting from elevated temperatures. The model predicted changes in all salmon and steelhead populations under existing temperature conditions compared to historic conditions. For populations within the main-stem, our model predicted that the effects of elevated temperature were greatest for spring Chinook, coho, and steelhead, with minimal impacts for fall Chinook. Furthermore, the model was used to evaluate which proposed mitigation projects would fully compensate for losses in population.

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Title

How Does the Klamath Basin Restoration Agreement Affect Reclamation Operations?

Abstract

The FERC relicensing process for the PacifiCorp facilities located on the Klamath River triggered the need for many parties in the Klamath River watershed to come together and develop a basin-wide resolution of multiple natural resource management controversies and concerns. Regionally-based restoration agreement negotiations including 24-parties have been conducted since early 2005. The involved parties include several federal agencies including Reclamation, the State of California; the State of Oregon; four Indian Tribes; three counties; agricultural groups (e.g., Klamath Water User's Association); and a coalition of environmental groups. On January 15, 2008, the parties released the Klamath River Basin Restoration Agreement (Agreement). Many parties support for the Agreement hinges on PacifiCorp's agreement to decommission/remove four dams on the Klamath River; Copco 1, Copco 2, J.C Boyle and Iron Gate. To date, PacifiCorp has not agreed to decommission any dams. Other elements contained within the Agreement are water and power "certainty" for agricultural interests, including a process for reducing irrigation allocations, fisheries reintroduction and restoration, a county program, and a governance mechanism. In order to fully implement the restoration agreement, federal and state legislation and appropriations must be passed and PacifiCorp must agree to terms governing the decommissioning of their facilities. Upon implementation of the Restoration Agreement, Reclamation's Project operations will change as a result of Project irrigators and refuges receiving a specific allocation of water each year rather than an unlimited supply. There allocation will be lower in drier years when uses have historically been the highest. This change will provide more environmental water in dry years while greatly increasing water supply certainty for water users and refuges.

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Title
The Okanogan Basin Monitoring and Evaluation Program (OBMEP)

Abstract
Started in 2004, The Okanogan Basin Monitoring and Evaluation Program (OBMEP) used state of the art statistical designs to develop a population scale monitoring and evaluation program for the Okanogan River basin to provide status and trend data for all anadromous fish species and their habitat over the next 20+ years. The primary components of our program include the use of experimental design and standardized protocols that were developed a-priori. The four pillars of our program are includes:

1) The collection of status and trend data relating to habitat, water quality, and anadromous salmonids at the population scale,
2) Integration of baseline data with habitat assessment to help direct future restoration actions,
3) Leadership in data management and information sharing by incorporation web based accessible data with responsive report preparation, and
4) Extensive coordination at local, regional, and international scales to ensure the efficient use of limited resources.

This poster will provide and overview of this model population scale monitoring and evaluation program. Program biologists will be on hand to share details through an interactive portal to the projects web site. Feel free to stop by and ask questions.

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Title

Designing a regional-scale freshwater classification for use in Conservation Planning

Abstract

Biotic inventories of freshwater ecosystems have not been conducted as regularly or comprehensively as inventories of terrestrial ecosystems, limiting our ability to describe and account for freshwater biodiversity and to incorporate this information into broad scale planning efforts. To address this, The Nature Conservancy has developed a hierarchical approach to classifying and mapping freshwater ecosystems that uses geography and the physical environment to represent the composition and distribution of freshwater biodiversity within and across ecoregions.

Using the 1:100,000 National Hydrography Dataset, river reaches are stratified into discrete habitat types using abiotic factors such as size class, elevation, gradient and geology, factors that are known to strongly influence freshwater species diversity. Each habitat type represents a different physical setting that forms a unique set of habitats, and, by inference, a unique species assemblage. Habitat types are then combined to create aquatic ecological systems. Each ecological system type represents a set of watersheds with similar combinations of habitat types. Within a given planning area, analysts can determine the relative abundance of different freshwater habitat types, identify rare systems, and set conservation goals for each aquatic ecological system. By including representations of each ecological system in our conservation efforts, we hypothesize that we are likely to represent the variety and variability of freshwater species and habitats that exist in the region.

The freshwater classification has been incorporated into ecoregional-scale conservation plans across the western U.S. In Oregon, over 2000 different freshwater habitat types and 200 ecological systems have been developed and incorporated into 7 different ecoregional plans. The classification can also provide a framework for developing species habitat models, stratifying the landscape to determine reference conditions for biological integrity assessments, or prioritizing stream segments for sampling for specific species.

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Title

Status, diet, and needs of “salmon-eater” Orcas in Puget Sound. WA.

Abstract

Killer whales (Orcinus orca, Linnaeus, 1758) are found in all oceans and contiguous seas from the equator to the polar ice edges of the northern and southern hemisphere. Though they are described as one species, it is now well known that there are several ecotypes that are morphologically and genetically distinct, and they differ in traditions such as prey preferences (fish or mammals, etc.), vocal dialect, and migratory behavior. Within an ecotype there may be clans with very similar traditions, yet they further partition into pods composed of matrilines of closely related individuals that never emigrate from the mothers. One such clan is J clan, composed of J,K, and L pods that summer in southern British Columbia and Washington State coastal and inshore marine waters, consuming salmon migrating toward rivers of the region for spawning. There are currently eighty-seven of these whales, designated Southern Resident Killer Whales (SRKW’s) and listed as an Endangered stock under the US Endangered Species Act (ESA) and the Canadian Species At Risk Act (SARA); and, their total biomass is on the order of 650,000 pounds of predator that must eat on average about 4% of their individual body weight per day in order to survive. Scale sampling and fecal sampling in trail of these killer whales has revealed that the prey consumed by these predators is at least 85% Chinook salmon (O. tshawytscha), of both wild and hatchery origin. Given that this prey requirement may be 1,200 or more adult-size fish per day to feed SRKW’s in their present status, and perhaps twice that number for the SRKW recovery goal under ESA and SARA, fishery managers may wish to consider how these requirements will be met with diminishing stocks of Chinook salmon within the SRKW foraging range.

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Title

Population estimates of native and introduced catostomid species and their hybrids in an isolated headwater tributary to the Green River in Wyoming

Abstract

The bluehead sucker Catostomus discobolus and flannelmouth sucker C. latipinnis are two native catostomid species that are in decline within the Colorado River Basin. It is likely that future conservation efforts by state and federal management agencies will focus on isolated populations in small tributaries, but little is known about the abundance or population structures of these species in small tributaries. Information is also needed on the abundance and population structures of introduced white suckers C. commersoni and hybrids between white suckers and the two native species. We addressed these information needs in a study of Little Sandy Creek, a small isolated stream in the east-central Green River basin of Wyoming. During the summer 2007 we estimated the abundances and length structures of bluehead suckers, flannelmouth suckers, white suckers, and hybrids greater than 100-mm total length over a 43-km segment of the creek near the upstream extent of the distributions of these catostomids. Three-pass depletion estimates of abundance were used in two different sampling designs (1) 50 randomly-selected 75-m reaches and (2) 12 randomly-selected 200-m reaches. White suckers were common throughout the study area. More variation in abundance estimates was observed among 75-m reaches compared to 200-m reaches. Abundances of the two native catostomids were low in most of the sampled reaches, but they were high in some reaches apparently related to habitat features in these reaches. Over the entire study segment, the most abundant catostomids were white suckers and hybrids.

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Title
Iskuulpa Watershed Restoration

Abstract
The Iskuulpa Creek Watershed Project was developed by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) to offset habitat losses related to the John Day and McNary hydroelectric projects and to provide dual benefits to fish and wildlife. Originally named the Squaw Creek Wildlife Project, it was initiated in 1995 under the Northwest Power Planning Council's fish and wildlife mitigation program. Through this project, CTUIR aimed to demonstrate integrated management of fish and wildlife resources in a watershed context. As a wildlife mitigation area, target species were chosen to represent the broad habitat types in the watershed, including forest, grassland, and riparian and to track progress toward Bonneville Power Administration's mitigation obligation. These species included Western Meadowlark, Downy Woodpecker, Black- capped Chickadee, Dusky (Blue) Grouse, Yellow Warbler, Great-blue Heron and Mink. The project provides 4,567 Habitat Units of protection credits for the wildlife mitigation species listed above. Iskuulpa Creek also provides 10 miles of anadromous and resident fish habitat, supporting summer steelhead, redband trout, spring Chinook, and coho. Iskuulpa Creek is critical to natural production of summer steelhead in the Umatilla Basin with over 25% of summer steelhead spawning in index areas of the Umatilla Basin spawning in Iskuulpa Creek. Following permanent protection of 5,936 acres of land in the watershed through fee title acquisition, project management has focused on protecting, enhancing and restoring fish and wildlife habitats. Project activities will be discussed.

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Title

Effects of livestock grazing on springsnail presence and water quality in Cascade-Siskiyou National Monument spring habitats

Abstract

Forty aquatic mollusks are known to occur in springs in the vicinity of the recently designated Cascade-Siskiyou National Monument, southern Oregon. Many of these are recently discovered, undescribed springsnail taxa. The diversity of springsnails in the Monument is so great that these small animals were designated as objects of scientific interest, specially called out by the monument proclamation language for protection from impacts due to livestock grazing. We examined the effects of livestock grazing on springsnails and water quality in springs within and in the immediate vicinity of the Cascade-Siskiyou National Monument. Aquatic mollusks, water quality characteristics, and grazing utilization levels were collected from 57 coldwater springs in 2003 and 2004. We collected 24 different mollusk taxa with site richness ranging from 0 to 9 taxa. Our results did not show differences in spring-associated snail presence among ungrazed, moderately grazed, or heavily grazed springs. Smaller springs, however, were significantly less likely to have springsnails than larger springs. These smaller springs also had significantly warmer water temperatures and lower dissolved oxygen concentrations at sites with higher levels of grazing use. Our results show that smaller springs may be more vulnerable to springsnail extirpation events and are more susceptible to water quality impairment.

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Title

Are there two subgroups of North Pacific Albacore in the coastal fishery of North America?

Abstract

The Pacific Fishery Management Council regulates the North Pacific Albacore (Thunnus alalunga) fishery, one of the few remaining open-access fisheries along the west coast of North America. The Council is now considering limiting access to control excess capacity. To help ensure the long-term sustainability of this fishery, scientists, managers and policy-makers need a better understanding of the distribution of this species and of the fishery. Currently, all stock assessments and management decisions for North Pacific albacore are based on the assumption of a single, uniform stock. However, there is evidence that the stock may not be as homogeneous as once thought. Tagging studies indicate the possible existence of two sub-groups of albacore in the eastern North Pacific distributed north and south of 40o North. This study investigates the proposed North Pacific albacore sub-groups in the coastal fishery (east of 1300 West) using statistical analysis of more than 40 years of catch records. The study assesses the differences between the two proposed subgroups using three population metrics: 1) the start and end time of the fisheries, 2) catch per unit effort (CPUE), and 3) size characteristics of fish caught. Data is analyzed using both geostatistical and nonlinear regression techniques, such as krigging and generalized additive models, respectively. Preliminary results of the start and end timing of the fisheries indicate two seasonally different patterns of catch north and south of 40o North, with the southern fishery lasting longer and characterized by more consistent CPUE throughout the season. These initial results may support the two sub-group hypothesis. If there are, in fact, two sub-stocks of North Pacific albacore, we may need to revise international and national management strategies for this commercially and culturally important species to reflect greater stock complexity along finer spatial scales.

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Title

Setbacks and Progress in the Recovery, and Status of the Devils Hole Pupfish

Abstract

2007 presented a series of unforeseen challenges to recovery of the Devils Hole pupfish, Cyprinodon diabolis. The iconic nature of this species makes its status the subject of intense scrutiny. With the oversight comes additional funding and accountability.

Several new biologists were added to the staffs of Death Valley National Park, U.S. Fish and Wildlife Service, and Nevada Department of Wildlife. Following firefighting and law enforcement models, the agencies established an ad hoc Incident Command Team that focuses solely on the recovery of the species. The Incident Command Team consults with the Devils Hole Recovery Team members individually and as a group as well as other biologists with specialized knowledge as needed to inform their recommendations.

Setbacks associated with the recovery include:

- Limited success and the resulting decision to discontinue the use, at least temporarily of both Hoover Dam and Point of Rocks Refugia,
- Loss of most pure Devils Hole pupfish in captivity to a variety of maladies including nephrocalcinosis and lymphosarcoma.

Progress includes:

- No decrease in the Spring pupfish survey and a 7% increase in the Autumn survey over 2006 numbers in Devils Hole,
- Establishment of a supplemental feeding regime in Devils Hole,
- Bi-weekly larval surveys of Devils Hole,
- Clarification of genetic questions surrounding the species,
- Retrofitting, refurbishing, and isolation of Willow Beach National Fish Hatchery to maintain and research Devils Hole pupfish and hybrids,
- Progress toward the construction of a new refuge and propagation facility near School Springs on Ash Meadows National Wildlife Refuge,
- Initiation of transparent decision aiding process to inform future management actions.

Results of the April 5, 2008 dive survey in Devils Hole will be presented.

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Title

Restoring the wetlands at the Williamson River Delta---a freshwater delta at the north end of Upper Klamath Lake

Abstract

Prior to 1940's, the Williamson River Delta (the Delta) contained a vast expanse of wetlands that straddled the last 6-10 kilometers of the Williamson River and extended into Upper Klamath Lake. Nearly 2,400 hectares of wetlands were later leveed, drained, and converted to croplands. Starting in the mid-1990's, the historic Delta wetlands were identified by experts (including the National Academy of Sciences) as critical nursery habitat for rearing Lost River and shortnose suckers. The Nature Conservancy and its partners are rehabilitating the Delta in an effort to restore ecosystem function to the lower Williamson River. The project involves converting about 2,400 hectares from cropland to wetlands that will be connected to Upper Klamath Lake and the Williamson River. The two primary goals of the restoration effort are to: (1) restore nursery habitat for endangered Lost River and shortnose suckers; and (2) provide a nutrient sink at the mouth of the Williamson River. The more than 10-year effort was initiated in 1996 and involves cooperation from stakeholders and scientists from throughout the Klamath Basin and beyond. Project planning and design involved using a flow model in an effort to ensure maximum hydrologic connectivity while minimizing construction costs. Restoration construction began in 1999 when the first of three small-scale projects was completed. These experimental restoration efforts were monitored to assess whether restored wetlands met project objectives. Monitoring results and construction experience from these early-action projects informed the design for the larger restoration effort that began in 2005. Monitoring results and construction experience from these early-action projects informed the design for the larger restoration effort that began in 2005. Construction activities in 2006 and 2007 resulted in the reflooding of about 1,400 hectares of larval sucker habitat.

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Title

Broad scale population monitoring design and analysis with an emphasis on improving precision of survival estimates through remote PIT tag antennas

Abstract

Fish population monitoring in large systems often requires reliable information on population dynamics. Capture-recapture can be a useful method for estimating population parameters in fisheries. In addition to estimating abundance, capture recapture models have been developed to estimate a multitude of population parameters including survival, recruitment, rate of population change, movement, and habitat occupancy rates. During the last two decades computer software programs capable of analyzing a multitude of capture-recapture data types have been developed. These programs allow estimates to be incorporated into models that help researchers understand the complex effects of species, sex, age, and environmental covariates. Sample sizes and recapture rates, however, must be large enough to estimate these parameters to a useful level of precision. A common difficulty in capture-recapture studies is that estimate precision not only depends on the number of individuals marked, but also on the percentage that are re-encountered. For example, we began efforts in 2005 to augment recapture rates by using fixed underwater PIT tag antennas at strategic locations. Detections using these antennas dramatically increased recapture rates of previously tagged fish. Between 2005 and 2007, 20,884 previously marked suckers were detected on remote antennas compared to only 4,868 suckers recaptured with a more traditional method of fish captured by trammel net, individually scanned for PIT tags, and subsequently released. We illustrate the degree to which these systems have improved survival estimate precision and also led to more biologically realistic survival models. In many instances, fixed underwater PIT tag antenna systems placed at strategic locations could be incorporated into capture-recapture study designs to increase recapture probabilities and dramatically improve estimate precision and modeling capabilities.

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Title

How water temperature and flow affect disease processes: the case of Ceratomyxa shasta in the Klamath River

Abstract

Water temperature plays a key role in the outcome of infections caused by many pathogens. In the case of parasites with complex life cycles, water temperature may have a direct effect on the prognosis of disease in the fish. However, these parameters may have direct or indirect affects on the life cycle at numerous other points. For Ceratomyxa shasta, which utilizes a freshwater polychaete worm as its invertebrate host, water temperatures directly affect rates of parasite replication in both hosts, survival of the invertebrate host and survival of life stages outside the hosts. Fish become infected at temperatures as low as 4°C, but progress of the disease is temperature dependent. In the Klamath River, fish encountering temperatures greater than 16°C have reduced survival with mean time to death inversely correlated to temperature. Parasite densities increase at temperatures above 10°C; above 20°C, both polychaete and parasite survival decreases. The relationship between elevated water temperature and declines in invertebrate host and parasite survival offers a possible explanation for decreased parasite abundance in the Klamath River in late summer

The direct effect of flow on infection and mortality of the fish is harder to evaluate, but some relationships can be drawn in relation to the life cycle. In a laboratory study conducted at two velocities (0.05 m/s and 0.01 m/s), a higher proportion of the polychaete population became infected at the slower velocity. Fish that were held in the outflow of the slower velocity treatments consequently had a shorter mean day to death than those held in the faster velocities, indicating an increased exposure dose. Flow may also indirectly affect infection by altering migration timing, and thus parasite exposure, and at low flows parasite stages may concentrate the infectious stage for the fish, resulting in increased disease severity.

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Title

Controlling Disease In Klamath River Salmon: Where Do We Go Next?

Abstract

Severe infection by the myxozoan parasite Ceratomyxa shasta has contributed to the declining numbers of juvenile KR fall Chinook and coho salmon and subsequent impacts on later adult returns. In 2007, a multidisciplinary panel of fish disease experts and fishery managers met to develop a research plan focused on management actions to reduce disease (ceratomyxosis) in natural juvenile salmon of the KR. This proposed research effort is in addition and complementary to on-going disease monitoring in the basin. The reach from Iron Gate Dam to the Scott River was identified as the primary management area, based on juvenile salmon infection status and data from fish exposures, invertebrate host surveys and water sampling studies.

Potential management actions would have the goal of:
1. Reducing polychaete host populations in the selected KR reach,
2. Reducing the effects of the infectious actinospore on juvenile salmon,
3. Reducing the input of myxospores from specific salmonid fishes
4. Decreasing fish exposure/increasing fish resistance

A preliminary ranking of management actions was made based on the likelihood that the action would result in a reduction in ceratomyxosis in natural salmon populations of the Klamath River. Other considerations included the effect on non-target organisms and the ability to monitor effects. The panel recommended several actions as being the most likely to cause a biological effect and as high priority for further research. We have proposed to test the feasibility of the highest priority management actions through controlled laboratory and field experiments. At the same time, a disease model will be developed that will inform these efforts and enable us to make predictions on disease effects as passage plans progress.

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Title

Fisheries management approaches for control of an invasive pathogen: Myxobolus cerebralis –resistant rainbow trout and their role in Colorado sport fish management

Abstract

Myxobolus cerebralis, the pathogen that causes salmonid whirling disease, has caused severe population-level effects in wild rainbow trout populations in the intermountain West since its detection in the 1990's. The parasite has also impacted culture facilities, particularly those relying on open water sources. A rainbow trout strain resistant to M. cerebralis was recently identified and is being utilized in Colorado to combat the effects of the parasite. Two separate lines of research and development of the strain are being pursued. The first involves evaluation of the domestic catchable strain, and the second is a breeding program for re-establishment of wild rainbow trout populations. The domestic strain is to be used as a highly resistant, fast growing production fish for put-and-take waters. Evaluations demonstrate this strain strongly outperforms other strains with regard to growth and return to creel and will provide benefits by reducing parasite loads in fish culture facilities and receiving waters. The wild rainbow trout strain development focuses on applications for re-establishment of naturally reproducing wild populations. Resistant wild strain rainbow trout were produced by crossing the resistant domestic strain with wild Colorado River rainbow trout. Preliminary assessments are encouraging. First generation crosses stocked into the Gunnison River as fingerlings survived in the wild at the same rate as pure Colorado River rainbow trout. Natural reproduction of the crossed strains in the wild was also documented in 2007. Additional evaluations are ongoing to enhance survival of the resistant strains in the wild and re-establish wild populations that have been destroyed by the parasite. The potential of this strain is also under consideration in other states, with the goal of minimizing negative impacts of whirling disease on wild and cultured trout populations.

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Title

Hatchery Reform as a Catalyst for Increased Coordination with Harvest Plans and Habitat Restoration

Abstract

Washington's hatchery system represents a tremendous investment by its citizens. Washington State hatcheries provide 75 percent of salmon caught in Puget Sound and 90 percent of the salmon caught in the Columbia River. Recreational fisheries are estimated to bring in nearly a billion dollars annually to the state economy, while commercial fisheries provide another $250 million. Although important from an economic perspective, information indicates hatchery fish can also pose a risk to natural populations of salmon and steelhead, and the federal Endangered Species Act listings for several of the salmon and steelhead populations within the state have identified hatcheries as contributors to the natural population declines. To address these risks, the Washington Department of Fish and Wildlife has supported a fundamental paradigm shift in how hatcheries are viewed; hatcheries are not an isolated replacement for habitat, but an integral component of the watershed – they must be designed, operated, and evaluated in the context of the ecosystem in which they reside. Decisions about harvest rates, hatchery production, and habitat restoration have traditionally been made according to discipline, occurring in isolation from one another. To support successful implementation of hatchery reform, these disciplines need to be well linked and decisions coordinated. This presentation is the first of two parts; 1) describe the context for a more comprehensive and integrated natural resource management decision making approach, and 2) the basic tenets of hatchery reform, both operational and facility considerations for successful implementation.

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Title

Modeling Temperature and Flow Dynamics of the Klamath River Below Iron Gate Dam

Abstract

Klamath River flow and temperature were simulated using the one-dimensional hydrodynamic flow and water quality models RMA-2 and RMA-11, respectively. With these models we were able to effectively model hourly flow and water temperatures at approximately 150 meter intervals representing nearly 300 kilometers of the Klamath River below Iron Gate Dam. We were thus able to capture detailed temporal and spatial temperature distribution throughout the model domain for annual periods. The characterization included such things as travel times, tributary impacts to main stem water temperatures, water temperature responses relative to equilibrium water temperatures, and daily statistics such as maximum and average values for flow and water temperature. For this application, the calibrated model was employed to assess various flow regimes and meteorological conditions. The methods described herein present an alternative approach to a more laborious process requiring a wide number of permutations examining multiple, specific flow schedules for alternative comparisons. These simulations consisted of using three sets of lower Klamath River tributary hydrology and associated meteorological conditions: drier, average, and wetter conditions. For each years, 23 constant headwater flow simulations ranging from 500 cfs to 7000 cfs were performed where the flow from Iron Gate Dam was held constant for the entire year. Lookup tables containing maximum and average values for flow and water temperature were constructed from these constant flow rates. In this fashion these tables can be used to construct variable flow schedules for Iron Gate releases, and can be an effective way to explore multiple scenarios. These lookup values were then used in a Coho Life Cycle model developed by Cramer Fish Sciences. A prudent follow-up analysis is to perform complete RMA simulations for select alternatives to check for sensitivities to such things as travel time.

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Title

Modeling the impacts of climate change and habitat restoration on Snohomish River Chinook salmon

Abstract

We used a loosely linked system of models of climate, land cover, hydrology, and salmon population dynamics to investigate the impacts of climate change and habitat restoration on Chinook salmon populations in the Snohomish river basin in western Washington. Model results indicated a large negative impact of climate change on freshwater salmon habitat but also suggested that habitat restoration and protection could help to mitigate these effects and might allow populations to increase in the face of climate change. The habitat deterioration associated with climate change is, however, likely to make salmon recovery targets much more difficult to attain. In this talk, we outline our approach and discuss the benefits and challenges of using this methodology to assess salmonid responses to climate change.

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Title

Unexpected effects and unintended consequences: altering emergence timing induces variability in Chinook salmon life history.

Abstract

Perhaps the most manipulated; yet, least evaluated aspect of salmon rearing is the seasonal timing of ponding (1st feeding, emergence). Pond timing may be manipulated in hatcheries because it is easy to either heat or chill egg incubation water and early salmon development is directly related to temperature. A general hatchery practice is to chill early egg takes and/or warm later egg takes to synchronize pond timing across the population. In some facilities, where both spring Chinook salmon and steelhead are reared, the early development of Chinook salmon is accelerated so that salmon fry can be ponded before incubator space is needed for eggs produced by steelhead spawning in late December and early January. Alternatively, at facilities that use surface water for juvenile fish rearing, early development of embryos may be slowed using chilled water and ponding does not occur until March or April, thus avoiding issues with run-off and silting of raceways. The consequences of compression, acceleration or retardation of emergence timing in Chinook salmon hatchery populations has been largely ignored.

We conducted two laboratory experiments, using Sacramento River winter-run and Yakima River spring-run Chinook salmon, to explore the effects of altered ponding time on life history patterns. We observed two common responses: 1). male maturation at age 1 (precocious parr) was suppressed by ponding later in the year and 2). autumnal smolting (under-yearling) was stimulated by ponding earlier in the year. These experiments were specifically designed to eliminate potentially confounding effects of age, size (growth) or genetic differences. Differences among experimental groups in the propensity to either mature or smolt were solely due to the photoperiod fry 1st experienced at ponding. The implications of these findings with regard to hatchery rearing, domestication selection and hatchery reform will be discussed.

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Title

Migration & Survival of Yearling Coho Salmon Downstream from Iron Gate Dam: What We've Learned After 2 Years of Study

Abstract

Abstract: A study to determine if dam discharge affects survival of yearling coho salmon (Oncorhynchus kisutch) in the Klamath River downstream from Iron Gate Dam (river kilometer, rkm, 310) began in 2006. A design with experimental discharges would be the most logical method to answer this question, but the operational and societal cost of such a plan have made this unfeasible to date. The migration and survival of radio-tagged fish were estimated in 2006 and 2007 over 276 km during ambient river discharges. Wild and hatchery fish were used during the first year, but low numbers of wild fish have since prevented their use. Travel times of hatchery fish taken directly from a tank at the hatchery were longer than those of wild fish from a rotary screw trap in a nearby tributary, but their survivals were similar. These differences between hatchery and wild fish appear to be those of migrants and naive fish, and were trivial after about 75 km of migration distance. Apparent survival was lowest in the reach closest to the dam, which was where the fish spent most of their time. The apparent survival from Iron Gate Hatchery (rkm 309) to rkm 13 was 0.653 (SE 0.039) in 2006 and 0.497 (SE 0.044) in 2007. Questions for the future include do we know enough about these fish to incorporate experimental discharges into a successful study, what are the effects of disease on in-river migrants, and how do these survivals compare to those in similar rivers and tributaries?

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Title

The Effects Of The Hells Canyon Complex On Downstream Fish Habitat Substrates In The Snake River.

Abstract

The Hells Canyon Complex (HCC) relicensing process included consideration of potential effects of the project on the sand bars and spawning gravel deposits in the Snake River downstream of the project. The Forest Service participated in evaluation of these potential effects in order to develop License Conditions which will appropriately mitigate project effects on aquatic habitats on National Forest System lands.

Two primary approaches were used in the sandbar and spawning gravel evaluation: 1) to look at historic trends as possible indicators of future trends, and 2) to use models to describe potential future changes. These approaches included analysis of watershed conditions and sediment supply, evaluation of sediment transport and deposition rates; consideration of changes in flow regimes; assessments of in-channel substrates, and review of inventories of the number of sandbars and spawning gravel sites.

The evaluation concluded that the past trend of declining number of sandbars could be expected to continue into the future. The evaluation of trends in availability of spawning gravels was less conclusive. Idaho Power Company agreed to mitigate for the reduced sand supply and to monitor spawning gravels for future potential changes as part of the renewed License to be issued by the Federal Energy Regulatory Commission.

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Title

SOURCES AND RETENTION OF ORGANIC MATTER IN A RIVER NETWORK: THE FUNCTION OF FLOODPLAIN VS. CONFINED SEGMENTS

Abstract

Floodplains are considered hotspots of productivity and retentive features in river networks. However, in montane systems they are typically juxtaposed with more confined segments, and the relative roles of the two segment types, and their potential interactions, have received little investigation. We compared the sources (autochthonous and allochthonous) and retention of organic matter, which fuel the production of aquatic invertebrates and fish, in five floodplain vs. five canyon-confined segments in the upper Salmon River Basin, central Idaho. We hypothesized that floodplains would have higher aquatic chlorophyll a biomass, greater terrestrial litter input, and higher retentive capacity than confined segments. We observed that chl-a biomass and terrestrial litter input in floodplains was actually within the range of values measured for confined segments. As expected, retentive capacity of confined segments, both surface (measured via leaf-release methods) and subsurface (from conservative-tracer techniques) was considerably lower than that of floodplain segments. These results show that floodplains in this region do indeed function as important retentive features. However, production at higher trophic levels in montane floodplains, often attributed to basal productivity within these segments, is likely supplemented by organic matter delivered from upstream confined segments. Further investigation is needed of functional interactions between different geomorphic segment types in river networks.

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Title

Okanagan Nation Management Approach to Sockeye Recovery in the Okanagan Basin

Abstract

Okanagan River sockeye salmon, which spawn near the town of Oliver, British Columbia, are blocked from further upstream migration into their historic distribution range by a series of water control and diversion dams. The Okanagan River sockeye population has been generally declining in number over the past 50 years, and can be attributable to a variety of factors including the operation of hydroelectric and water diversion dams on the Columbia and Okanagan Rivers, channelization of the Okanagan River leading to a loss of spawning habitat, and high water temperatures and low dissolved oxygen levels in the river and in their only accessible rearing lake which can affect over summer survival and delay migration timing. The Okanagan Nation Alliance (ONA) has been the principal advocate of a program to restore sockeye numbers and range by reintroducing them into upstream waters where they once occurred in substantial numbers. Between 2000 and 2003, the ONA, in association with Canadian Okanagan Basin Technical Working Group (COBTWG), undertook a three-year investigation to assess the risks of a reintroduction of sockeye salmon into Skaha Lake. With the risk assessment phase complete, the Okanagan Nation Alliance and the COBTWG, have developed a 12-Year adaptive management program for the experimental reintroduction of sockeye into Skaha Lake. For the duration of the 12-year project, adult migration barriers will remain in place and sockeye will be reintroduced via fry-outplants at varying densities Population responses to the reintroduction, such as growth rate and survival, will be monitored and assessed over the next decade, leading to evidence of the success or failure of the reintroduction experiment.

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Title

Trade-offs associated with alternative egg collection strategies for salmon and steelhead conservation hatcheries

Abstract

Traditional salmon hatchery operations involve collecting maturing adults, spawning them in the hatchery and releasing offspring. The collection of eyed eggs from naturally produced redds represents an alternative approach that has been implemented for ESA-Threatened Chinook salmon and steelhead in the Pacific Northwestern United States. For the three programs (representing six populations) we summarized, the number of eggs collected was close to the number needed for the program. A high percentage of the eggs (mean ± SD) collected from individual redds were viable (steelhead: 94.5% ± 11.6%; Chinook: 94.8% ± 5.8%), reflecting high natural fertilization success and viability to the eyed stage. Eggs collected from individual redds were infrequently damaged (steelhead: 0.2% ± 0.6%; Chinook: 4.5% ± 6.8%) as a result of the hydraulic sampling process. The mean survival of eyed eggs to first feeding in the hatchery was very similar for steelhead (94.6%) and Chinook salmon (95.6%). Approximately 70% of the eggs not collected during hydraulic sampling in a spawning channel were collected as emergent fry, further suggesting a low impact to eggs remaining in the redds. However, the potential mortality of eggs remaining in hydraulically sampled redds has not been experimentally evaluated under natural conditions. For several recent captive populations of Chinook salmon and steelhead a much larger proportion of the wild parent population has been represented in the captive population than would have been achieved by artificial spawning to produce the same number of eggs. The egg collection approach has thus far provided a mechanism to increase genetic variability in captive populations over conventional approaches, while not collecting more eggs than necessary for the programs and leaving a portion of the naturally produced embryos in the natural environment.

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Title

Disentangling Patterns of Trout Survial and Movement Before and After Logging

Abstract

In both the private and public agriculture sectors of North America's Pacific Northwest Region, industrial clearcut timber harvesting continues to be a common logging practice that frequently results in a patchwork of disturbance across the landscape. Though harvest techniques have greatly improved over the past half-century (e.g., riparian buffer strips, cable yarding, and reductions in the areal size of individual timber management units), the impact(s) that current harvest methods have on adjacent (point) as well as downstream (cumulative) segments of the aquatic network is not well understood. Therefore, we sought to quantify spatial and temporal patterns of coastal cutthroat trout (Oncorhyncus clarkii clarkii) survival and movement before and recently after systematic [clearcut] logging treatments in two, experimentally paired watersheds in the Cascade Range Mountains of Oregon, USA. A total of 3,915 trout (>100 mm FL) were implanted with half-duplex passive integrated transponder (PIT) tags and individually monitored seasonally over a 5-year period (3 years pre- and 2 years post-harvest) using three types of PIT-tag data: handheld scanner, mobile tracking antenna units, and stationary gate antenna arrays. These technologies allowed for individual fish identification, passive multi-year repeated sampling of individuals, continuous directional movements at stationary gate arrays, and, when combined, higher recapture rates. By incorporating a range of spatial and temporal scales into our models, we were able to investigate how scale-dependent environmental factors influence trout survival and movement, and how synergism between them may help to evaluate current timber management policies.

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Title

Restoring connectivity for bull trout in the Klamath Basin: resource management in a changing climate

Abstract

Bull trout (Salvelinus confluentus) in the Klamath Basin are at a high risk of extinction as a result of altered ecological processes, which have reduced habitat quality, increased water temperatures, and exacerbated habitat fragmentation. Population isolation has reduced gene flow among populations and resulted in population bottlenecks and hybridization with brook trout (Salvelinus fontinalis) have all resulted in the need to conserve genetic diversity within and among bull trout populations in the Klamath Basin. We will discuss collaborative efforts to restore ecosystem processes and management activities for bull trout conservation. This is an attempt to re-establish life history characteristics that will enhance geneflow among populations in the Sycan Core Area and potentially adjacent Core Areas. The approach we used incorporates hypothesis testing for management strategies against potential management responses and to monitor climate impacts at the watershed scale. The information presented may enhance selecting future management strategies which will require balancing uncertainty inherent in projections of future climate impacts and the risks associated with different management options.

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Title

Yellowstone Lake cutthroat trout - last gasps of life or beginnings of renewal: Will non-native species removal efforts aid Yellowstone cutthroat trout?

Abstract

Yellowstone Lake cutthroat trout, an icon of western trout fishing and once the bright spot in a dim outlook for native cutthroat trout populations throughout the west, are seriously threatened by a nonnative lake trout population. Soon after discovery, Yellowstone National Park initiated an intensive gillnetting program aimed at suppressing lake trout numbers to levels which would allow the cutthroat trout to sustain a healthy population. From 2001 to date we have removed almost 270,000 lake trout from the system. Despite this effort, lake trout in Yellowstone Lake are still present in high numbers and evidence suggests that the population is continuing to expand. A new spawning site was discovered in 2006; 2004 saw the highest number of mature lake trout removed from the lake to date; and increasing numbers of smaller, immature lake trout have been removed for the last six years. Suppression efforts are surely slowing the rate of expansion of lake trout in Yellowstone Lake, but will the program be able to decrease lake trout enough to provide adequate protection for native cutthroat trout? Recent increases in catch of cutthroat trout juveniles throughout the lake are very encouraging. However, an upward trend in catch-per-unit-effort of lake trout by gillnets is cause for concern. In addition, and perhaps even more serious is the three-fold increase in lake trout catch by anglers in 2007. In past years this statistic has been a good indicator of catch rates on the spawning grounds during the following year.

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Title

Role of Intensively Monitored Watersheds in Assessing Salmon Response to Habitat Restoration

Abstract

The basic premise of Intensive Watershed Monitoring (IWM) is that the complex relationships controlling biological responses to habitat conditions can best be understood by concentrating monitoring and research efforts at a few locations. The type of data required to evaluate the response of fish populations to management actions that affect habitat quality or quantity are difficult and expensive to collect. Focusing efforts on a relatively few locations enables enough data on physical and biological attributes of a system to be collected to develop a comprehensive understanding of the factors affecting salmon production in freshwater. Multiple IMWs have been established in the Pacific Northwest over the last ten years. The objectives of these efforts vary and include the examination of forestry impacts on aquatic systems and the effectiveness of watershed restoration efforts. These studies have begun to generate results relevant to natural resource policy decisions in the region. However, some concerns about this monitoring approach persist, especially the length of time required to obtain results and the applicability of relationships established in one watershed to other locations. Considerable progress on both of these issues has been made over the last several years. As a result, IMWs are becoming an increasingly important component of comprehensive monitoring strategies in the region.

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Title
Climate Change Impacts on Columbia River Basin Fish and Wildlife

Abstract
The Pacific Northwest has warmed about 1.0oC since 1900, an increase greater than the global average. Over the next century temperature in the region will increase at a rate of 0.1-0.6oC/decade with increases in winter precipitation and decreases in summer. These changes will have a profound impact on the aquatic habitats in the Columbia Basin including reduced snow pack, earlier snow melt runoff and higher water and air temperatures. Alterations in species ranges in the basin have already been noted with shifts generally poleward or upward in elevation. These changes will accelerate with impacts exacerbated by habitat fragmentation caused by a combination of changing climate and increasing human activity within the basin. Increases in fire frequency and more widespread insect outbreaks have been observed over the last 50 years. Hydrology and water temperature changes will negatively impact tributary habitats and especially affect salmonid fishes. In contrast, flow in the mainstream Snake and Columbia rivers has been so modified by hydrosystem operations that hydrologic effects related to climate change are likely to be minor. Estuary habitats may be affected by sea level rise and an upstream extension of the salt wedge during spring. Ocean conditions also will be affected with a delay in the onset of spring coastal upwelling, altered thermal regimes throughout the North Pacific Ocean and ocean acidification. These changes have the potential to alter marine primary and secondary production, thereby reducing the survival and productivity of Columbia River salmon populations. Mitigating actions that may help reduce the impacts of climate change exist. However, to be effective these actions must be applied in a timely manner at the correct locations. Therefore, climate change needs to be incorporated into basin fish and wildlife planning.

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Title
The Real Poop on Aquacultural Waste

Abstract
A growing concern is resulting in greater scrutiny of constituents in hatchery effluent. The institution of regulatory processes such as NPDES and TMDL has the potential to dramatically limit the allowed point source discharge of wastes from hatcheries to streams and rivers. However, the economic effects of treating effluents can impose high costs on aquaculture businesses, depending upon the treatment options selected. This study discusses a method to examine options to retrofit existing hatcheries with waste treatment systems, which will reduce environmental impacts resulting from aquaculture discharge. The method will allow managers to meet regulatory standards on a case-by-case basis in the most cost effective manner. This method incorporates the most recent published findings on waste generated in soluble and solid forms for nitrogen and phosphorus and relates these measures to current regulatory standards, while considering Best Management Practices recognized by hatchery operators worldwide. We will use common waste treatment examples to discuss the utility of this method for analyzing the highest benefit in waste treatment for the least cost. This method will provide designers and hatchery managers a tool to meet current and future regulatory standards while providing the most cost effective solutions.

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Title
Hatchery impacts on reproductive fitness of steelhead

Abstract
Recent data have shown dramatic differences in fitness between wild and multi-generation hatchery stocks of steelhead when they breed in the wild. We review those data and recent data from the Hood River that show a large drop in fitness after just one or two generations of hatchery culture. We discuss possible mechanisms that could cause such rapid declines in performance.

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Title

Efficiency of Ukrainian and North American Mechanical Control Techniques for Removing Nuisance Northern Pike from Small Arizona Lakes

Abstract

Mechanical control of nonnative aquatic species has often been difficult; yet in some situations, fish populations have collapsed following mechanical control measures. In the Ukraine, northern pike (Esox lucius) are the top predator in many reservoirs of the Dnieper River. Here, mechanical removal methods reduced annual pike catch by an order of magnitude over a ten-year period. Northern pike can develop nuisance populations in Southwestern waters. Here we describe a joint Ukrainian/Arizona effort to research mechanical methods to suppress nuisance northern pike populations in Rainbow and Fool's Hollow Lake, Arizona. Researchers at the Arizona Cooperative Fish and Wildlife Research Unit; Zaporizhzha State University, Ukraine; The Ukrainian Institute of Fisheries; and the Arizona Game and Fish Department selected four mechanical removal techniques jointly. Ukrainian fyke netting with barrier nets to capture spawning fish in the spring; gill netting; electrofishing; and angler reward methods were tested simultaneously in the two lakes over a two-year period. We estimated gear efficiency by season, time of day, and weather conditions using a Jolly-Seber (POPAN) open-population model on program MARK based on capture-recapture methods. Initial comparison of electrofishing and netting methods suggest gill netting and fyke netting with barriers fished in early spring were most effective.

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Title
Defining the Footprint of a Salmon Hatchery

Abstract
Salmon hatcheries have historically been used with the intent to mitigate for habitat loss and augment harvest. There are a number of contentious issues that surround hatcheries, however, including their impact on wild populations. Major concerns about hatcheries' ecological impacts in the freshwater ecosystem include loss of population biodiversity, genetic introgression, and competition with wild juveniles. With this in mind, the State of the Salmon - a joint program of Ecotrust and the Wild Salmon Center - has developed a systematic inventory of hatcheries across the North Pacific. This database provides an important empirical information baseline that can support evaluation of North Pacific wild salmon conservation and research issues. The objectives of this project were to produce the best available GIS coverage of hatchery facilities, create a uniform set of metadata to characterize hatchery operations, and provide a database to characterize salmon hatchery practices. In addition, we are developing a spatial model that will simulate hatchery straying and the potential risk it poses to neighboring wild populations residing in freshwater production areas. This model, calibrated to relevant field data and coupled with site-specific hatchery data, will define a 'zone of influence'. By examining the spatial distribution of known wild salmon populations in the context of this hatchery 'footprint', we can better understand spatial interactions of hatchery and wild salmon in freshwaters across the Pacific Rim. We will provide an example of this approach applied to Chinook salmon Oncorhynchus tshawytscha. This approach may provide researchers as well as fisheries managers a new tool for categorizing and evaluating potential interactions of wild and hatchery salmon.

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Title

Columbia River Fishery Management: Why Hatcheries Are Critical to Sustaining Fisheries in the 21st Century

Abstract

As the Pacific Northwest grew in population over the past 150 years, public policy makers chose to implement a large system of hatchery programs to compensate for losses to natural fisheries and habitat due to the industrial development required to sustain the human population and economy. However, a growing body of ecological and genetic theory and evidence suggests that competition, predation, disease, and genetic/evolutionary fitness problems can result from the interaction of hatchery-origin and wild salmonids. In response, fishery managers have been implementing a number of measures for reforming hatchery practices to make them more compatible with sustainable natural fisheries. This talk reviews these issues and factors affecting Columbia River fishery management decisions over the past 70 years, highlights several hatchery supplementation programs that were implemented to sustain fisheries in upriver areas, and discusses the response of fishery populations in those areas over the past one to three decades.

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Title

Reconditioning Kelt Steelhead: A Novel Management Strategy for Populations in Low Abundance

Abstract

We reconditioned steelhead kelts in short- and long-term programs in a five-year study. Short-term reconditioned kelts were fed for approximately 3- 11 weeks, transported around Columbia River hydroelectric facilities and released, with natural rearing and gonad rematuration occurring in the ocean. In long-term reconditioning, kelts were reared for 6-10 months then released locally. Survival to release for short-term reconditioning ranged from 69-93% and averaged 79%. Post-release survival and return of short-term kelts ranged from 1-9% with returning “ocean-reared” kelts showing an average weight gain of 46%. Survival to release for long-term reconditioning ranged from 19-62% and averaged 36% with captive-reared kelts showing an average weight gain of 38%. Short- and long-term reconditioned steelhead kelts represented 2-11% of the annual spawning escapement from 2001 to 2005 compared to a repeat spawning rate of 1.6% from the literature. Radio telemetry results demonstrated success in migrating to the estuary (short- term) and locating spawning grounds and constructing redds (long-term).

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Title

Challenges and Opportunities-Fisheries Enforcement as population changes

Abstract

Law enforcement to protect our fisheries in Oregon is a challenge that the Oregon State Police Fish and Wildlife Division has met head on and will continue to do so as the population grows. Additionally, as we work with other agencies to protect our resources, is is an opportunity to share ideas in order to inform and educate the public to gain voluntary compliance with the laws that apply. When population densities and natural resources start to overlap, the protection of the resources can quickly become and issue. These enforcement concerns can vary greatly and need to be tailored for the specific situation. In this discussion we will touch on enforcement issues concerning everything from wetland encroachment to species specific topics. As population increases in urban areas we recognize other social concerns, and these indirectly affect the enforcement of fishery regulations. This presentation will explore the challenges of population growth and enforcement of fishery laws. Please Join us for a discussion on how your Oregon State Police are working to develop systems and work with partners to protect your resources.

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Title

Use of predictive models to assess the importance of riverscape connectivity on the distribution of an imperiled fish species.

Abstract

Development of sound conservation strategies for imperiled species requires the identification of occupied habitat and potential threats to these habitat units. Bull trout (Salvelinus confluentus) populations have experienced local declines in distribution and abundance throughout their range; however, in many river systems, species presence/absence and distribution remains unknown. Building on previous approaches, we used a combination of existing redd distribution and abundance data to determine bull trout habitat occupancy in the John Day River Basin, Oregon, to validate a landscape model of distribution and connectivity between occupied habitat units. Connectivity can influence the occurrence and persistence of local bull trout populations through dispersal from surrounding populations. We delineated potential habitat patches (local populations) as stream catchments of adequate size (>400 hectares) and thermal suitability (>1700 meters elevation as a surrogate for <16º C maximum summer temperature) to support juvenile bull trout populations. We then used GIS-based analysis to estimate distance between potential patches and evaluated the relative influence of hypothetical connectivity indices on patch occupancy. Connectivity factors of patch size and distance to other patches appear to be important factors explaining the current distribution of bull trout populations; however, consideration of additional biological factors (e.g., barriers to movement and the presence of other species) may increase the accuracy of models for predicting bull trout occurrence and distribution under different scenarios of habitat restoration or climate change. Models of species occurrence provide requisite predictions of suitable habitat and connectivity, and may streamline sampling efforts as well as increase our understanding of the implications of habitat fragmentation.

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Title

Valley segment-scale determinants of stream refugia and cutthroat trout response in high desert streams

Abstract

Lahontan cutthroat trout (Oncorhynchus clarki henshawi) are currently limited in their distribution to a patchwork of small isolated populations, the result of habitat degradation and natural variation in landscape and in-stream conditions. The objectives of this study were to determine if landscape topography influences trout distribution, and if water temperatures control this response. The work was carried out in a sub-basin of the Quinn River system, McDermitt Creek, which drains the sagebrush desert of southeastern Oregon and northern Nevada. Headwater tributaries of this creek consist of alternating canyon-confined and valley bounded reaches. Trout within these systems are challenged by low discharge and high temperatures during the summer, and anchor ice during the winter. Contiguous whole stream surveys were used to look at trout distribution during the summer of 2003 and spring and fall of 2004. Our results suggested that topography can affect trout distribution. Trout numbers were highest in areas with greater numbers of nick-points (the transition zones between less confined and more confined valley segments) and greater valley confinement. Additionally, in the downstream portion of our headwater reaches, more trout were found in nick-points than expected based on the availability of this habitat type. Our data suggest that hyporheic inputs may be high in such areas, thus providing trout with shelter from warm water in the summer, anchor ice in the winter, and shallow stream depths during all seasons. Spatial occurrence of these areas of refugia can be taken into consideration when planning land use activities and restoration efforts. Further research is required to confirm that topography can affect the distribution of Lahontan cutthroat trout in other systems, and to better understand the mechanisms behind these patterns.

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Title
The Desert Fish Habitat Partnership: Striving for No More Extinctions

Abstract
Approximately half of U.S. threatened and endangered fishes occur in the arid western United States. State Wildlife Action Plans identify habitat loss as a primary factor threatening aquatic species in desert ecosystems. Conservation of aquatic resources is a fundamental and pervasive challenge facing people and fish sharing increasingly limited waters of the arid west. The Desert Fish Habitat Partnership is mobilizing to tackle this issue. In light of global climate change and enormous population growth in western states, our challenge is daunting. Yet our goals are clear: no species will go extinct and no species will be added to the TES list. Our objectives are simple: protect intact habitats by addressing threats and prioritize our efforts based on likelihood of success. We intend to meet these goals by integrating and implementing strategies and actions for desert fish identified in the State Wildlife Action Plans of Arizona, California, Colorado, Idaho, Nevada, New Mexico, Oregon, Texas, Utah and Wyoming. Partners are poised to work across jurisdictions to focus dollars, expertise, and efforts on protecting intact desert fish habitats and restoring degraded ones. Yet with all the partners and conservation efforts in place, we still need your help. We need partners that are currently working on desert fish species to share data we can use to evaluate species and habitat trends, provide additional opportunities for leveraging money to accomplish our ambitious goals, and offer innovative ideas to expedite progress. Time is of the essence. This presentation will provide details of the emerging Desert Fish Habitat Partnership and offer participants in this symposium the opportunity to join our efforts to protect and conserve desert fishes and their habitats.

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Title

Twelve years of monitoring the effects of flow regimes on salmonids in the Bridge River, BC- what have we learned?

Abstract

There remain relatively few cases where instream flow methodologies have been evaluated for their efficacy. Consequently adaptive experimental management has been promoted as a means to empirically test the relationship between alternative flow regimes and valued ecosystem components such as fish abundance. In 1996 a long-term (16 or more years) flow experiment was started to evaluate at least three different flow regimes in the Bridge River, a regulated tributary of the Fraser River, BC. An extensive monitoring program was initiated, primarily focused on juvenile salmon biomass, along with the secondary indicators of water quality, and primary and secondary productivity. We have currently completed the monitoring of two flow regimes and are considering options for the third. We have learned that the interpretation of our fish sampling data is complicated by both natural variability and a possible interaction between the flow levels and sampling efficiency. There is also evidence of a change in life history of Chinook salmon in the river that had rendered our sampling regime less effective for the evaluation of this population. Our other indicators may be relatively insensitive to the flow regime. Perhaps more importantly, there have been significant changes in the stakeholder composition and their values and desired outcomes during the 12 years since the inception of the experiment. A much broader suite of indicators than just juvenile salmon biomass will likely enter in the final decision about flow. We have also found that the limited capacity of the Regulatory Agencies and the Utility to make full use of the data that has been collected has hampered the execution of the experiment. These non-technical issues should be considered carefully when embarking on a large-scale, long-term, monitoring program.

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Title

The Status of McCloud River Redband Trout

Abstract

Abstract: Redband trout (Oncorhynchus mykiss ssp.) are found in small, isolated streams throughout the western US. The status and recent habitat restoration and fish passage projects of the McCloud River redband trout will be discussed. Recent genetic data support the distinctiveness of the Sheepheaven Creek redband and shed additional light on the evolution of McCloud redband within the context of other California redband populations. Surveys of McCloud redband trout habitat in the dry year of 2007 indicate that these trout persist in isolated pools along intermittent streams. These rare trout are vulnerable to hybridization and degraded habitat. Recent collaborative efforts by agencies, non-profit and timber companies in the upper McCloud watershed provide a model for successfully protecting and restoring this unique fish.

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Title

Streambank Trampling by Cattle: Monitoring Methods and Impacts on Streambank Integrity

Abstract

Streambank trampling by livestock potentially can degrade riparian ecosystems. Resource managers, particularly on public lands in the West, have responded by implementing streambank trampling guidelines for managing riparian livestock grazing, and streambank trampling measurements are often the trigger that initiates moving livestock to a new unit or off a grazing allotment. However, techniques for measuring streambank trampling are not well established and no research studies have quantified threshold levels of trampling that degrade streambank integrity. Responding to these needs, we conducted two studies on a foothill rangeland stream in west-central Montana. Study 1 compared streambank trampling measurements from 3 methods – the Beaverhead-Deer Lodge National Forest method commonly used in Montana for the past 10-15 years, and two recently unveiled methods, one each from the Northern Region of the U.S. Forest Service and the Bureau of Land Management in Idaho. All 3 techniques differ in how and where streambank trampling is measured. Six reaches were sampled in early fall 2005 and again in 2006. Reaches varied from moderate to very high levels of streambank trampling, and all measurements were made by a single observer. Study 2 evaluated the effects of 3 cattle trampling intensities (none, moderate, heavy) on streambank integrity. Cattle trampling treatments were applied in late summer-early fall of 2005 and 2006. Pre-treatment streambank measurements were made in late summer-early fall of 2005, and streambank response was measured in late summer-early fall of 2006 and 2007. Streambank response variables included bank cover, bank stability, bank height, bank angle, and bank undercut. Results from Study 1 indicate that the three sampling methods produce inconsistent estimates of streambank trampling. Study 2 results indicate that heavy trampling is not sustainable, but moderate trampling, perhaps combined with periodic rest in a rotational grazing system, appears to be sustainable on this foothill rangeland stream.

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Title

Ecological interactions between juvenile hatchery and wild salmonids in Eagle Creek and North Fork Eagle Creek, OR.

Abstract

I studied how hatchery reared winter steelhead released from Eagle Creek National Fish Hatchery interact with wild ESA-listed salmonids present in Eagle Creek, Oregon. I first determined if residual hatchery steelhead are present in Eagle Creek where the hatchery is present and/or North Fork Eagle Creek where there is no hatchery. Based on two phase snorkel surveys my preliminary analysis indicates that residual hatchery steelhead are present in Eagle Creek and not present in North Fork Eagle Creek. The second objective is to quantify populations of wild fish rearing in Eagle Creek and North Fork Eagle Creek and compare population abundance and densities between the streams. During first phase snorkel surveys I observed coho using riffle habitats in low numbers, yet while conducting second phase diver efficiency calibrations we documented populations more than 10 times the point estimates. This suggests that coho may be using interstitial spaces in complex fast water habitats more than previously thought. From these data it is unclear if residual hatchery steelhead are displacing wild salmonids from their preferred mesohabitat types, however, with hatchery and wild fish occupying the same habitats the potential for competition of microhabitat resources clearly exists. My third objective is to determine if residual hatchery fish are displacing wild salmonids from their preferred microhabitats. This will be accomplished in the summer of 2008 by constructing a microhabitat use model using logistic regression to determine if wild fish are selecting different microhabitats in the presence and absence of residual hatchery steelhead. Conclusions from this study will be available to make informed management decisions regarding hatchery release practices at Eagle Creek National Fish Hatchery in an effort to minimize negative effects to Endangered Species Act listed wild populations.

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Title

A review of the first 5 years of the CTUIR freshwater mussel project

Abstract

Freshwater mussels are culturally important to northwestern Native Americans and are vital components of intact salmonid ecosystems. In 2003 the CTUIR began its freshwater mussel project in order to better manage, restore and protect this valuable and enigmatic resource. The approach taken by the CTUIR was multi-pronged, and included distributional surveys, genetic and physiological analysis, habitat characterization at multiple scales, and host fish determination. The freshwater mussel project also began outreach efforts so that other Tribal members better understood the project's work. Most recently, CTUIR project employees have trained other researchers and organizations on how to conduct freshwater mussel surveys, including members of the Susanville Indian Rancheria in California. The objectives of this talk are to summarize the scientific findings of the first 5 years of research, and discuss some of the outreach and training efforts currently underway.

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Title

Idaho Power's Monitoring and Management of Juvenile Fall Chinook Entrapment in the Hells Canyon Reach of the Snake River

Abstract

Idaho Power Company (IPC), in coordination with NOAA fisheries, initiated a survey of entrapment pool areas in the upper Hells Canyon Reach of the Snake River in 2005 as part of compliance to an Interim Settlement Agreement relating to consultation for ESA species downstream of Hells Canyon Dam. These annual surveys have continued since 2005 and have focused on identifying entrapment pool areas and enumerating fish in and around these entrapment pools. Specifically, these surveys aim to document the extent of use by age-0 fall Chinook salmon (Oncorhynchus tshawytscha) in entrapment pool areas during the primary rearing period of March 15 through June 15. As of the 2007 season, 37 entrapment sites totaling 47 pools have been described in the upper Hells Canyon Reach. Of these documented sites, 24 areas totaling 33 pools are located at elevations affected by load following operations from the Hells Canyon Dam power plant (< 30 kcfs). As many as 26,000 (2005 rearing period) age-0 fall Chinook have been observed using these entrapment pools over the course of the rearing period. In order to manage fall Chinook use of these entrapment pools and provide the best level of protection under an operating environment, Idaho Power has developed a juvenile fall Chinook entrapment management plan for the Hells Canyon Reach. This plan calls for entrapment of juvenile fall Chinook salmon to be closely monitored with operational protocols utilized to reduce potential impacts of entrapment to juvenile fall Chinook salmon. This plan is adaptive and allows response to new information as more is learned through additional seasons of monitoring.

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Title
100th Meridian Initiative's Boater Survey Database

Abstract
Aquatic invasive species are often inadvertently transported between water bodies by trailered boats. The 100th Meridian Initiative, a cooperative effort between state, provincial, and federal agencies, was created to prevent westward spread of zebra mussels and other aquatic nuisance species in North America. This Initiative educates boaters about problems related to aquatic invasive species and incorporates voluntary boat inspections and boater surveys at launch sites and other locations. Since 1998 the 100th Meridian Initiative has performed and accumulated boater interviews designed to assess potential vectors of aquatic nuisance species spread. These data helped identify specific waters highly at risk for invasion. Data collection has increased progressively since the first surveys were conducted and currently includes information from all states west of the 100th Meridian except for Arizona and Utah, although plans for surveys in these states are in progress. All data obtained are stored in a centralized database and publicly available online at 100thmeridian.org. Analysis of 100th Meridian Initiative data indicates that a considerable amount of trailered boat traffic crosses state and provincial lines, highlights how specific waters are linked via common recreational boats, and underscores the necessity of public outreach and education efforts in preventing the spread of aquatic invasive species.

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Title
BLUE MOUNTAIN DIVERSION – CONSTRUCTION CHALLENGES

Abstract
The Blue Mountain Diversion is located on the Mainstem John Day River 1/4 mile west of Mount Vernon (RM238.3). The diversion is a privately owned concrete structure constructed in the 1960's. The diversion provides flood irrigation serving water rights totaling 20 CFS with priorities as early as 1871. The diversion site is located on private land accessible by permission only.
A site visit in the fall of 2006 revealed that the existing diversion created a total passage barrier during normal and low flow conditions. Head cutting below the structure created a 3.5 foot vertical drop and passage features across the structure were ineffective. Corrections were installed during the late summer of 2007 to correct the structural deficiencies and provide fish passage across the structure during all flow conditions at a total cost of approximately $230,000. The work was completed with Tribal,State and Federal funding. To accomplish this work in a 12 month window, it was necessary to overcome many challenges. Many times simultaneously. A brief overview of these challenges includes:
PRIVATE PROPERTY ENTRY, IRRIGATOR APPROVAL TO PERFORM WORK
IDENTIFY & SECURE PROJECT FUNDING, DESIGN – BOR/OWEB/CTWSRO
CONSTRUCTION – CTWSRO/US FISH/BPA, SITE SURVEY, DESIGN
CONSTRUCTION PLAN PREPARATION, PERMITTING, DSL/COE
ENVIRONMENTAL CLEARANCES, ARCHEOLOGICAL ODFW FISH PASSAGE TASK FORCE,
ESA CONSULTATIONS- USFWS/NOAA
CONSTRUCTION MATERIAL PROCUREMENT, CONTRACTOR SELECTION
CONSTRUCTION
BENEFITS OF CONSTRUCTION
•Restored the structural integrity of a concrete diversion with minimal disturbance to the riparian system.
•Established fish passage over the structure providing access to over 50 miles of prime spawning and rearing habitat under all flow conditions.
•Continued to develop private landowner/irrigator support and confidence in timely restoration work.
The Poster will include a project time line, expanded discussion of challenges, cost detail, construction detail, and before & after photos. Discussion of things that went well and the hard spots we experienced. Details of monitoring to be implemented by the CTWSRO.

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Title

Population status of seals and sea lions in the Pacific Northwest

Abstract

Since the implementation of the Marine Mammal Protection Act in 1972, many marine mammal species have recovered from relatively low population levels. In the Pacific Northwest this is perhaps best demonstrated by the substantial increases in the abundance of seals and sea lions (pinnipeds). Since the late 1970s, Pacific harbor seals on the Oregon and Washington coasts increased at 5-10%/year to reach a current abundance of approximately 20,000. Harbor seals appear to have reached equilibrium population levels within the current coastal marine ecosystem. The threatened Steller sea lion has increased at nearly 4%/yr over the same period to a minimum of 6,000 in the Oregon breeding population and continues to increase slowly. California sea lions have increased at approximately 6%/year since the late 1970s to an estimated population of 238,000 in 2005. As opportunistic predators of a wide variety of fish species, the interactions of pinnipeds with fisheries and fish resources have increased greatly. As a result, concern over the foraging habits of pinnipeds and their potential negative impacts on various regional fish stocks have grown.

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Title

Large-Scale Restoration Program Case Study: Clear Creek, California

Abstract

Restoration on Clear Creek resulted in a five-fold increase in fall Chinook, and re-establishment of threatened spring Chinook and steelhead populations. Beginning in 1848, Clear Creek was extensively damaged by gold and gravel mining, timber harvest, dams and diversions. Since 1995, over $30M, 1M acre feet of additional water, and $7M of land acquisition by the Bureau of Land Management have been invested in restoration efforts. The Central Valley Project Improvement Act (CVPIA) Clear Creek Fish Restoration Program and the CALFED Ecosystem Restoration Program funded restoration and monitoring activities, including increased stream flows, dam removal, spawning gravel supplementation, channel and floodplain restoration, revegetation, erosion control, and fuels management. CVPIA-funded efforts stressed actions that primarily benefit salmonids, while CALFED efforts were intended to have broader benefits for other species and ecosystem form and function. CALFED efforts stressed using good science, adaptive management, modeling, and transparent decision making. Restoration was accomplished with the support and participation of local landowners, agencies, and stakeholders including the water and power industries. Fall-Chinook escapement increased primarily due to increased stream flows which improved water temperatures, fish passage and the amount of spawning and rearing habitat. The flows came from 800,000 acre feet of water from Bureau of Reclamation projects, annually dedicated for management by the Fish and Wildlife Service under CVPIA. Re-establishment of threatened spring Chinook and steelhead populations was made possible by the removal of Saeltzer Dam. Physical habitat restoration, implemented primarily by the Western Shasta Resource Conservation District, has resulted in increased densities of spawning and rearing Chinook in restored areas. Riparian, wildlife and recreational values have also benefited. Long-term sustainability of the salmonid habitat improvements will probably depend upon obtaining a long-term spawning gravel supply and channel maintenance flows.

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Title

Channel Function and Form – Foundation for Managing Bovines and Waterways

Abstract

Louis Sullivan, recognized as America's first modern architect, is credited with coining the phrase "form follows function" - It is the pervading law of all things … that life is recognizable in its expression, that form ever follows function. This concept flows into the realm of river studies. As stated in A View of the River (Leopold 1994), The natural river channel is formed and maintained by the flow and its associated sediment. Therefore, in simple terms (although the study is far from simple) the function of a river or stream is to transport water and sediment provided by the watershed, and maintaining a balance of erosion and deposition processes. Values, including fish habitat and water quality, provided by the stream system are reliant on and subsequent to maintaining or restoring channel function and form. Maintenance of channel function and form often relies on vegetation for dissipating stream energy, resisting erosion and capturing sediment. Rosgen (1996) summarizes channel sensitivity to disturbance and the relative influence of vegetation, and demonstrates that not all stream types are equally reliant on riparian vegetation for maintaining channel function and form. Recognizing that the primary potential effect of livestock grazing along waterways is disturbance to riparian vegetation provides resource managers a focal point for managing bovines and waterways.

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Title

Global Climate Change and Potential Effects on Salmonids in Freshwater Ecosystems of Southeast Alaska

Abstract

General circulation models predict increases in temperatures from 1oC to 5oC as atmospheric CO2 continues to rise. Thermal regimes in freshwater ecosystems will change as air temperatures increase regionally. Changes in precipitation distribution and intensity will alter freshwater hydrology. As continental ice sheets melt, increasing sea-levels will flood low elevation floodplains and wetlands. Although anadromous salmonids exist over a wide range of climatic conditions along the Pacific coast, individual stocks have adapted life history strategies --time of emergence, run timing, and residence time in freshwater-- that are often unique to regions and watersheds. The response of anadromous salmonids will differ among species depending on their life cycle in freshwater. For pink salmon that migrate to the ocean shortly after they emerge from the gravel, higher temperatures during spawning and incubation may result in earlier entry into the ocean when food resources are low. Shifts in thermal regimes in lakes will affect juvenile sockeye salmon growth and survival, whereas, changes in seasonal precipitation distribution and intensity that alter stream flows will affect growth and survival of juvenile coho salmon. Rising sea-levels will inundate low elevation spawning areas for pink salmon and floodplain rearing habitats for juvenile coho salmon. Resulting changes in climatic conditions may not extirpate anadromous salmonids in the region, but it will impose greater stress on many stocks that are adapted to present climatic conditions. Survival of sustainable populations will depend on the existing genetic diversity within and among stocks, conservative harvest management, and habitat conservation.

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Title

Using PIT-tags to Analyze the Migratory Life-History of Pacific Salmonids: the ROSTER Model

Abstract

The extensive system of PIT-tag detectors in place in the juvenile bypass systems and fish ladders at hydroelectric dams on the Columbia and Snake rivers makes it possible to model the entire migratory life-history of anadromous salmonids through the hydrosystem, including both the juvenile and adult life stages. This makes it possible to estimate survival over multiple life stages and the effects of management strategies (e.g., smolt transportation) on survival in a single analysis. We briefly present the ROSTER (River-Ocean Survival and Transportation Effects Routine) model, a release-recapture model based on PIT-tag detection data to estimate survival and transportation effects of yearling Chinook salmon (Oncorhynchus tshawytscha) and steelhead (O. mykiss). We highlight results for spring and summer Chinook salmon released in the Snake River from 1996 to 2003, and discuss the advantages and limitations of basing analysis on PIT tags. Annual estimates of the smolt-to-adult return ratio (SAR) from Lower Granite Dam back to Lower Granite averaged 0.71% with a standard error (SE) of 0.18% for spring Chinook salmon, and averaged 1.15% (SE=0.31%) for summer Chinook salmon. Annual estimates of the transport/inriver ratio (T/I) averaged 1.15 (SE=0.03) for spring Chinook salmon, and averaged 1.28 (SE=0.13) for summer Chinook salmon. Tag loss or tagging effects on survival will produce negatively biased estimates of SAR and survival, but should not affect estimates of T/I or ratios of survival. The ROSTER model may also be used with joint acoustic-PIT tag technology aimed at improving precision of juvenile parameter estimates, but the lower sample sizes will result in lower precision on ocean and adult parameter estimates.

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Title

Using mark-recovery data generated by PIT tags to inform stock assessments of black rockfish in Stock Synthesis II

Abstract

The Oregon Department of Fish and Wildlife's (ODFW) black rockfish PIT tag program was conceived as a tool to inform stock assessments of black rockfish, which is a relatively data-poor species compared with many other marine fish stocks. Since 2002, ODFW has used PIT tags to mark approximately 3,000 black rockfish per year off Newport, OR. Tags were then recovered from landings in the recreational fishery. Annual exploitation rates, survival rates, and associated confidence intervals were estimated using the Brownie mark-recovery model. Annual abundance estimates were then generated by applying exploitation rate estimates from the Brownie model to estimates of total landings. These abundance estimates were incorporated into the 2007 southern black rockfish stock assessment as an abundance survey, which necessitated the estimation of a "survey q". The estimation of a "survey q" was based on the proportion of the total available black rockfish habitat for the assessed area occurring inside the PIT tag study area.

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Title

Lost River and Shortnose Sucker Recovery: Where are We and Where do We Need to Go

Abstract

The Lost River (Deltistes luxatus) and shortnose suckers (Chasmistes brevirostris)are endemic to several natural lakes in the upper Klamath Basin, Oregon and California. They were federally listed as endangered in 1988 and a recovery plan completed in 1993. Because considerable new information has been developed for these two species since the recovery plan was completed, the US Fish and Wildlife Service is revising the plan. Many of the threats addressed in the 1993 recovery plan are still present but progress has been made to minimize them. Currently, both species show frequent recruitment and robust populations in part of their range. However, low water levels during prolonged droughts continue to be a serious threat in the Lost River watershed. Lost River and shortnose sucker populations in Upper Klamath Lake show little evidence of recent recruitment and are vulnerable to water quality-related die-offs. In this presentation we will focus on some of the recovery actions taken to date and discuss what additional ones are needed to address both short-term and long-term needs. Long-term needs are habitat and water quality improvements that will take time to implement and may be slow to develop. Short-term actions must make the species more resilient in the interim until the long-term restoration actions will take effect.

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Title

How will climate change affect fluvial geomorphology and associated salmonid habitat in mountain basins?

Abstract

Riverine habitat for salmonids is intimately linked to channel morphology and fluvial processes (streamflow and sediment transport) which are, in turn, controlled by watershed hydrology and erosional processes that input sediment and wood to the fluvial system. Climate change has the potential to alter the timing, magnitude, and style of sediment, water and wood inputs to mountain rivers. Channel response to these changes may range from small-scale adjustments of channel characteristics (width, depth, grain size, etc.) to larger-scale changes in channel type (e.g., metamorphosis from a pool-riffle channel to a plane-bed morphology). Effects of climate change on riparian vegetation may also influence channel morphology in terms of bank stability (root strength), floodplain roughness, and supply of in-channel wood. Changes in channel morphology and fluvial processes can affect a variety of physical factors important for bull trout, and salmonids in general (substrate, stream temperature, bed topography and channel units, undercut banks, side channels, velocity and scour regimes, and hyporheic exchange). Although these potential impacts are well recognized, there has been little quantification of the magnitude and spatial extent of expected changes in fluvial processes and associated salmonid habitat in response to climate change. Identifying which parts of the river network are relatively stable and which are likely to cross critical thresholds in response to climate change is important for predicting the persistence of salmonid populations. Toward this end, a framework is presented for assessing the relative degree of channel stability in different physiographic settings (different water and sediment regimes), and digital elevation models are used to explore the spatial distribution of these conditions and potential consequences for salmonid habitat across the landscape.

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Title

Restoring bull trout through successful management of invasive brook trout in Crater Lake National Park, Oregon.

Abstract

Whatever happened to Sun Creek - Were brook trout eradicated and bull trout recovered? Fifteen years ago bull trout in Sun Creek, Crater Lake National Park, were threatened with a high risk of extinction from hybridization and competition with introduced brook trout. Two fish immigration barriers were constructed and brook trout were removed with a combination of techniques including electrofishing, snorkeling, trap-netting, and the use of the piscicide Antimycin-A. Bull trout population response was slower than expected, however, abundance and distribution increased from approximately 150 fish occupying 2 km of stream in 1989 to approximately 2050 fish occupying 11 km of stream in 2007. No brook trout have been observed above the immigration barriers since 2005. In order to recover this bull trout population under the Endangered Species Act abundance and distribution must be increased and extended downstream to provide connectivity with other Klamath Basin bull trout populations and reduce the risk of extinction from a catastrophic event or genetic isolation. Alternatives for restoration of an additional 12 km of stream on State Forest and private ranchland are presented. These include non-native fish removal, fish immigration barriers, stream channel restoration, screening water diversions, and improving reliability and delivery of water for irrigators.

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Title

Innovative Technology: An Experimental Electric Field to Deter Marine Mammal Predation on Columbia Basin Fishery Resources

Abstract

Pinniped populations have increased exponentially since passage of the Marine Mammal Protection Act. Their predation on ESA-listed salmonids has complicated fish recovery planning in the Columbia River Basin and elsewhere, prompting managers to seek “lethal take” authority. A NMFS Report to Congress identified a pressing need for marine mammal deterrence technologies. We describe a new approach and a novel concept to control marine mammal predation, one that could provide new tools in concert with selective management options, and/or lessen the need for lethal removals. This new application of existing technologies combines sonar (to identify specific "targets") with an electric gradient (to deter marine mammals) in areas where anadromous fishes congregate. This passive deterrence system delivers brief, non-lethal electric pulses without injuring pinnipeds or nearby fish. Its low-voltage, DC gradient does not affect boats or boat traffic. Sonar cues operation of the electrode array after distinguishing pinnipeds based on their anatomy and swimming patterns. Non-lethal electric pulses occur only when seals or sea lions are detected. "Soft-start" design criteria include considerations for sturgeon and unimpeded fish passage (further tests will evaluate effects on California sea lions and assess effects on salmon, sturgeon and lamprey behavior). Research on captive seals (Vancouver Aquarium) and animals in-situ (Puntledge River, B.C., 2007) showed that marine mammals are extremely sensitive to mild, electric fields at levels that are 1/30th the power used during electrofishing surveys. These novel results suggest selective deterrence of marine mammals with underwater electrode arrays. A demonstration project is planned in the Columbia Basin where predation on salmon and sturgeon is substantial. If successful, this array will help co-managers resolve controversial resource conflicts with pinnipeds and will possibly lead to more effective, less expensive alternatives for marine mammal control.

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Title
Data handling, databases, and restoration monitoring

Abstract
Skills for data handling, storage, and analysis are a ubiquitous need in science. Unfortunately, scientists commonly overlook data handling procedures and database design until after the data have been collected. Some common consequences of this oversight are reduced efficiency of data collection, increased errors in data entry, and longer timelines for data analysis. Moreover, insufficient data planning can sometimes lead to reduced effectiveness of restoration efforts and an inability to measure success during restoration monitoring. There are two main database concepts applicable to restoration monitoring. First, data handling procedures and database design for individual projects can increase efficiency and accuracy of the monitoring project. An example would be automating data entry (e.g., through the use of a palm-sized computer) and the transfer of data from field settings to a database (e.g., through a wireless network). Since data collected during monitoring will likely be compared to data collected prior to the restoration action, having a pre-designed, structured database allows easy comparison between pre- and post-action conditions. Second, metadata collected for multiple projects can lead to a greater understanding of the effectiveness of various restoration actions and techniques. For example, the National Estuaries Restoration Inventory tracks restoration projects across the nation and can be used to summarize the types of restoration actions that are most effective. Recent efforts at collating information about restoration projects have highlighted the need and benefit of standardizing data collection, organization, and analysis. This sort of meta-analysis is necessary to not just to learn from our mistakes, but also from our successes.

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Title

Influence of hyporheic flow and geomorphology on temperature of a large, gravel-bed river, Clackamas River, Oregon

Abstract

The hyporheic zone serves as transient storage within a river channel, where solutes and heat in river water are retained for periods of time before being released back into the river. The residence time of water within the hyporheic zone can lead to a temporal phase shift between hyporheic and mainstem temperature, where cooler hyporheic water emerges back into a warmer mainstem and vice versa. This study investigates the sensitivity of a large, gravel bed river to the temperature buffering effects of hyporheic exchange and postulates how gravel augmentation could cool a river by increasing hyporheic exchange.

Hyporheic exchange was primarily identified on a 24-km stretch of the 6th-order Clackamas River in northwestern Oregon by temperature anomalies, which are patches of water that demonstrate at least a 1 deg C temperature difference from the mainstem. Forty hyporheic temperature anomalies were identified through field investigations and thermal-infrared-radiometry (TIR) in summer 2006. The location of the anomalies was intimately connected with geomorphic features on gravel bars (bar channels and heads) that focus flow along preferential pathways. Higher hyporheic discharges emerged from anomalies where bars demonstrated high hydraulic conductivity, which occurs in gravel that has been recently reworked. However, the cumulative anomaly discharge on the lower Clackamas, in comparison with the large mainstem discharge, is small. Estimates of overall river cooling reflect this, composing only a fraction of a degree rather than several degrees observed in smaller rivers.

Adding gravel to a river will form new bars and/or enhance older bars, which will increase the amount of hyporheic exchange occurring throughout the river. This can lead to the development of new temperature anomalies that buffer river temperature, which can serve as localized fish refugia.

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Title
From Russia with Salmon

Abstract
A partnership is being developed with resource managers in Sakhalin Island Russia, led by Region 6 of the USDA Forest Service, the Wild Salmon Center, and members of the Siuslaw Basin Partnership. Outcomes have included training of Russian resource professionals, partnerships with a local community/school on Sakhalin, and completion of projects on the ground to improve riparian forest and stream conditions. The major goal of the effort is to share fisheries conservation information that we have learned from our history of salmonid and watershed management to enable the Sakhalin Island specialists, administration, and newly forming watershed councils to learn from our successes and our failures. This may allow them to better conserve their resources for their people who since the fall of the USSR have been stuggling to just survive.

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Title

Monitoring Streams and Riparian Vegetation to Detect Effects of Grazing Management on Fish Habitat Using Multiple Indicators

Abstract

Numerous studies during the last 30 years have demonstrated the affects of livestock grazing on riparian and aquatic habitats and fish. The consensus among investigators has been that improper livestock grazing can degrade these habitats resulting in decreased fish productivity. Most have concentrated on grazing effects to streambanks which, when degraded affect stream temperature, channel erosion, sediment input, and hiding cover and suitable living space for fish. More recently research demonstrated that improper grazing resulted in half the riparian vegetation, half the terrestrial invertebrates recruited to streams and trout diets, and also half the trout abundance compared to properly grazed riparian areas. The complexity and diversity of grazing effects calls for a robust monitoring protocol. To be effective, the protocol must include techniques with enough precision and accuracy to detect changes through time, yet feasible and cost-efficient. After a thorough review, the University of Idaho's Stubble Height Review Team concluded that simple single indicators, such as stubble height, should not be used alone to assess the riparian management success of a grazing system. Because riparian grazing should achieve, or make measurable progress towards achieving the desired conditions fish, monitoring multiple indicators to evaluate both implementation success and management effectiveness is necessary. To implement such monitoring, the Idaho State Office of BLM and Region 4, Forest Service jointly developed and published the Multiple Indicator Monitoring (MIM) protocol - an Interagency Technical Bulletin, available on the WEB at: http://www.blm.gov/id/st/en/info/publications/technical_bulletins/tb_07-01.html. Because multiple techniques are brought together in one protocol, and all the observations are made at the same time and place, the approach improves efficiency, reduces costs and time to sample, and allows statistical comparisons between short- and long-term variables.

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Title

Derivation and Properties of the PNI Statistic, a Tool for Managing Integrated Hatchery Programs

Abstract

Salmon and steelhead hatcheries are typically sited on streams already containing naturally spawning populations. There is often opportunity for returning hatchery adults to spawn with natural-origin fish, and for natural-origin fish to be included in the hatchery broodstock. This genetic exchange is typically ignored in harvest augmentation programs. In supplementation programs, where the intent is to use hatchery fish to increase the number of natural-origin spawners, the genetic exchange is monitored and in some cases controlled, under the assumption that gene flow rates affect the rate and extent of domestication. Recent genetic models suggest that this is the case and provide guidance on how the rates can be regulated to achieve different levels of domestication, regardless of the intent of the hatchery program. The key statistic is called proportionate natural influence (PNI), defined as PNOB/(PNOB+PHOS), where PNOB is the proportion of natural-origin fish in the hatchery broodstock and PHOS is the proportion of hatchery-origin fish on the spawning grounds. This paper explores the derivation and properties of the PNI statistic. PNI is an estimator of zw*, the expected equilibrium value of a trait relative to a natural optimum. PNI is biased, underestimating zw*, with bias increasing as heritability and selection strength increases. PNI assumes equal heritabilities and selection strengths in the hatchery and natural environments, but is easily modified to accommodate other assumptions. Although it estimates an equilibrium point, PNI is a reliable indicator of short-term behavior as well. PNI is a simple statistic based on a single-trait mathematical model incorporating a number of simplifying assumptions, but because it is also consistent with another quite different model it is unlikely that future research will invalidate its usefulness.

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Title

Quantitative comparison of the viability models developed for ESA-listed salmonids

Abstract

Eight technical recovery teams (TRTs) were organized by the National Oceanic and Atmospheric Administration to develop viability models for Pacific Coast salmonids listed under the Endangered Species Act, with each team responsible for the assessment of listed salmonids in a large geographical area (e.g. Puget Sound). The models that the TRTs developed vary due to factors such as regional biology, data availability, and analysis style. Due to this variation, developing a comprehensive understanding of the viability of listed salmonids is problematic. We compared the TRTs' viability models by running data from 35 listed populations through all available models. Estimates of current abundance and productivity vary with model structure and the types of parameters built into the model. Forecasts of extinction risk vary for additional reasons such as the assignment of quasi-extinction thresholds. When each model was run using the parameter sets defined by its creators, viability estimates for most populations varied widely. Standardizing all possible parameters (e.g. quasi-extinction threshold) tightened the range of extinction estimates and better revealed how model structure influenced extinction risk estimates. Documenting that variation in viability estimates exists and identifying the reasons for it will help managers better understand the differences and similarities among the TRTs' analyses and clarify the status of listed salmonids.

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Title

21st Century Salmon and Steelhead Project: A New All-H Salmonid Management Framework

Abstract

From 2000-2005, Long Live the Kings (LLTK) was the project manager for the Puget Sound and Coastal Washington Hatchery Reform Project. The project's Hatchery Scientific Review Group (HSRG) concluded, as did the Puget Sound Chinook Technical Review Team, that decisions about hatcheries must be made in the larger context of the health of the ecosystem in which they reside.

The HSRG asserted that a new kind of salmonid management was needed: one in which decisions about all the "H's"—hatcheries, harvest, and habitat—should be made in concert, at multiple scales, with the twin goals of recovering wild populations and supporting sustainable fisheries.

At the Washington Department of Fish and Wildlife (WDFW), as at most natural resource agencies, hatchery, habitat, and harvest staff largely worked independently of one another, without shared goals or strategies.

In 2005, LLTK partnered with WDFW to build a new "All-H" management framework to support integrated decision-making. The 21st Century Salmon and Steelhead Project paired LLTK with an interdisciplinary WDFW team with expertise in habitat, harvest, hatcheries, science, enforcement, and legislative and public affairs. A draft management framework was completed in December 2007.

The framework sets out what is needed, across multiple disciplines, to meet the twin goals of recovery and sustainability; it assesses where WDFW is today in relation to those goals; and it identifies benchmarks against which to measure progress. It is already being used to guide decision-making, allocate resources, and inform staff changes. Specific benchmarks have been integrated into individual work-plans and will provide the bases for performance evaluations.

WDFW realized that improving hatchery production and rearing protocols was not enough to secure the recovery and sustainability of salmonids. The agency partnered with a non-profit to create the new "All-H" management framework necessary to meet the twin responsibilities of recovery and sustainability.

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Title

Four Inches to Ten Feet: Detection of a PIT Tag at the End of a 700-Foot Trawl

Abstract

Beginning in the 1980s, juvenile salmonids were implanted with passive integrated transponder (PIT) tags and released into the Columbia River basin, primarily for studies relying on stationary detection equipment at dams to monitor timing and survival. In 1995, we adapted a surface pair-trawl with mobile PIT-tag detection equipment and extended sampling into the Columbia River estuary. In 1998, using an adaptation of the trawl mobile technology, we sampled for PIT tags on piscivorous bird colonies in the basin. PIT tags and detection equipment have continued to evolve to date, primarily to allow for longer read ranges for tags. These changes allowed for the development of detection antennas with larger fish-passage openings, which were of particular importance in trawl sampling where the larger openings contribute to unencumbered fish passage by releasing more water from the trawl, allowing faster trawling, and presumably increasing the sample size of tagged fish. However, stronger tags and more powerful antennas come with a trade off associated with electronic collision of multiple codes. This can occur when two or more tags are within the same detection field and neither may be read. We will present methods developed to evaluate in situ performance of PIT-tag detection electronics in situations of both low and high PIT-tagged fish densities utilizing increasingly larger antennas. We will also discuss techniques used to de-tune detection electronics necessary on avian predator nesting colonies having extremely high concentrations of tags.

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Title
What is Hatchery Reform?

Abstract
Concerns regarding genetic and ecological risks of salmon hatcheries increased in the 1990's when Pacific salmon and steelhead were listed under the ESA. The Hatchery Scientific Review Group was formed in 2000 to propose solutions whereby hatcheries could support fisheries and contribute to conservation of natural populations. Three scientific principles emerged: (1) the need for well-defined harvest and conservation goals, (2) scientific defensibility of programs and methods, and (3) flexibility to respond to new information. Hatchery reform represents a paradigm shift from managing hatcheries like fish farms (i.e., for "production") to maximizing the biological viability (e.g., abundance, productivity, etc.) of both hatchery and natural populations for achieving sustainable harvest and long-term conservation goals. Under this shift, hatchery and natural populations are managed as complementary components of a biological resource that is maintained by both natural reproduction and artificial propagation. Hatchery reform emphasizes both the genetic management of broodstocks and the genetic viability of natural populations according to the principles of local adaptation. Gene flow models incorporating natural selection (Ford 2002) are used to assess benefits and risks of alternative hatchery management strategies. These models demonstrate the biological need to minimize the influence of hatchery environments on the genetic constitution of natural populations. A basic axiom of hatchery reform is that the biological principles used to manage natural populations need to be applied equally to the management of hatchery populations. Past practices such as "backfilling" egg shortages via transfers among facilities, or managing facilities for maximum production rather than managing "stocks" (hatchery and wild) for maximum viability, are inconsistent with the biological principles underlying hatchery reform.

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Title

Human Nature, Human Influences - Are The Last Frontier's Aquatic Resources Really That Different?

Abstract

By many people's standards, Alaska is quite different than the lower 48, especially considering its sparse population and abundant natural resources. However, fisheries around the world, including Alaska's fisheries, are under immense or increasing pressure from human activities. As resource managers we're expected to use adaptive management strategies, but unfortunately we're dealing with a relatively non-adaptive, or slow to adapt society. It appears that as the human population increases and encroachment expands there is a progression of events (and attitudes) that are the consequence of human nature which often result in pressures on natural resources. Given the influence of human beings, the lag time associated with "adaptive management", and environmental uncertainty one might ask if scientific knowledge and management can keep pace to ensure sustainability.

The intent of this presentation is to generate thought about the future of Alaska's natural resources and to reflect on how human influence may hinder long term sustainability of our resources.

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Title

Predicting the Natural Flow Regime: Models for Assessing Hydrological Alteration in Streams

Abstract

Ecological assessments of streams are incomplete without understanding whether the natural flow regime is intact. Assessing hydrologic alteration (i.e., condition) requires that we quantify the attributes of the flow regime that would be expected in the absence of anthropogenic disturbance. Our objective was to evaluate whether indicators of the natural flow regime could be predicted at regional and national spatial scales using geospatial data. We first selected 1,272 gaged river basins throughout the contiguous U.S. where the hydrologic regimes were either least disturbed or near pristine. Using the period of record for these sites, we calculated 13 hydrologic indicators of magnitude, frequency, duration, timing, and rate of change. We used a robust modeling approach to evaluate the precision with which each indicator could be predicted with a single national and several regional models. We compared the precision of predictive models to that of “null” models, where expected values of each indicator were constant across hydrologic regions and ecoregions. A single national predictive model produced the most precise estimates for most indicators. Error rates ranged from 15-40%, but were <=25% for most indicators. We selected three gaged, non-reference sites to illustrate how predictive models could be used to assess site-specific hydrologic condition. These examples show how the model accurately estimates pre-disturbance hydrology and how reservoir construction and urbanization can affect hydrologic condition.

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Title

Assessment of Steelhead Supplementation Success in the Umatilla River Basin

Abstract

The Umatilla River steelhead hatchery supplementation program is managed to enhance natural production and sustain fisheries while maintaining life history diversity and productivity of the natural population. The hatchery program began in the late 1980's and uses nearly 100% natural origin Umatilla River adults for broodstock. We are assessing the benefits and risks of the hatchery program by comparing life history characteristics of natural and hatchery origin adults over time. In addition, we compare time series trends in natural origin abundance and natural spawner productivity with unsupplemented reference populations in the John Day River subbasin to evaluate whether abundance or productivity have increased or decreased relative to what might have been expected without supplementation. We found that ocean residence time and adult return timing of hatchery and natural origin fish are no different. Hatchery fish return a higher proportion of males than the natural fish. Total spawner abundance, including hatchery and natural origin fish, has increased substantially with supplementation. This increase is a result of the 8 to 1 adult to adult survival advantage provided by the hatchery. Natural origin abundance is equal to that which would have occurred without supplementation, thus there has not been a negative or positive natural abundance response. Productivity, calculated as natural origin recruits per spawner, has decreased during the period of supplementation relative to unsupplemented populations. We are uncertain if the reduced productivity is a result of reduced reproductive success of hatchery fish, hatchery fish interaction effects, or increased density of total spawners, all which could contribute to reduced natural productivity. The hatchery program has allowed managers to maintain consumptive fisheries for hatchery origin steelhead throughout the period of supplementation.

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Title

Overview of shad in the Columbia Basin: History and Current Status

Abstract

American shad are the most numerous anadromous fish in the Columbia-Snake River basin, yet relatively little is known about their life history, behavior, ecological interactions, or ecosystem effects, including effects on native fishes. We provide a review the history of shad introductions to the west coast, describe historical population dynamics of the species in the Columbia Basin, provide a description of current commercial and recreational fisheries, and review recently published research. We conclude by outlining the speakers and topics for this symposium and provide guidance for the panel discussion to be held at end of the symposium.

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Title

Up and down and back again: adult biology of American shad in the Columbia basin

Abstract

Migration is the defining characteristic of anadromous fishes, yet relatively little is known about the mechanisms controlling migration behavior for many fishes. We examined the migration biology of American shad Alosa sapidissima in the Columbia and Snake Rivers during 2005-2007 when 2.58-5.36 million adults were counted at Bonneville Dam each year. The study aims were to characterize basic migration biology of the species and use shad as a model system to test general migration ecology hypotheses. We PIT tagged and released 2529 adults during the study period. We simultaneously determined length, mass, sex, age and spawning history (from scales) and energetic status (using a Fatmeter) for a subset of PIT tagged fish in an effort to relate individual traits to migration behavior. Collections of adults at Bonneville and Lower Granite dams and juveniles at six dams characterized seasonal and longitudinal patterns during upstream and downstream migration, respectively. Preliminary analyses demonstrate that individual adults return to the Columbia Basin spawn in multiple years, revealed that the adult population at Lower Granite Dam (rkm 695) was younger and male biased compared to adults at Bonneville Dam (rkm 235), that mean initial lipid content of adults detected at McNary Dam (rkm 470) was higher than for adults at Bonneville, and that juvenile growth rates were higher in upstream reaches, particularly in the Snake River reservoirs. Collectively, the results suggest that: 1) the ecological effects of shad on the ecology of reservoirs probably differs longitudinally; 2) that adult upstream migration behavior appears to be relatively flexible and dependent on initial condition of individuals; and, 3) that there may be a selective advantage conferred to the offspring of adults undertaking a relatively long upstream migration prior to spawning.

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Title
The Hells Canyon Complex – A look at the past.

Abstract
Over a period of approximately 70 years, anadromous fish above the present-day Hells Canyon Dam on the Snake River were gradually extirpated from their historical distribution range. This extirpation was caused by the construction of federal and private dams and by the degradation of fish habitats from various land uses. Major tributary basins including the Boise, Payette, Malheur, Owyhee, Bruneau and Salmon Falls Creek were no longer producing anadromous fish prior to construction of the Hells Canyon Complex. Swan Falls Dam, constructed in 1901, blocked major production areas for Snake River fall Chinook salmon, Oncorhynchus tschawytscha. Immediately before construction of the Hells Canyon Complex, only a few tributary basins upstream of the Complex still produced chinook salmon and steelhead (O. mykiss). Fall chinook salmon were limited to reaches below Swan Falls Dam. To sustain remaining salmon and steelhead runs after Brownlee Dam was completed, Idaho Power Company (IPC) attempted to provide fish passage, but passage of downstream migrants was unsuccessful. To sustain numbers of anadromous fish, a portion of the remaining spring chinook and steelhead stocks were transferred to mitigation hatcheries in the Snake and Salmon river basins. In 1980, a Settlement Agreement between IPC and several state and federal agencies defined the production requirements for mitigation salmon and steelhead hatcheries. Less is known about the historic (pre-project) abundance and distribution of the non-salmonid anadromous species, white sturgeon (Acipenser transmontanus) and Pacific lamprey (Lampetra tridentata). Even less to nothing is known regarding the effects that the Hells Canyon Complex and other developments in the upper Snake River basin had on historic levels of native resident fish abundance or fish assemblages.

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Title

The Hells Canyon Complex – A look to the future.

Abstract

Research associated with the relicensing of the Hells Canyon Complex has been in progress since 1991 encompassing all aspects of natural resources. A final license application was filed in 2003. Aspects of the license still pending include the 401 water quality certification and biological opinions for ESA listed species. Until these are completed, and a final license has been issued, the full range of aquatic measures will remain uncertain. The discussion and development of Protection, Mitigation and Enhancement (PME) measures for Aquatic Resources associated with a new license for the Hells Canyon Complex have focused on several major areas of aquatic resources. These measures broadly include water quality measures, protection and restoration of ESA species, protection of state species of special concern, and warm water resident species. These measures have evolved into several potential PME programs that include a broad spectrum of enhancements, research, and monitoring on a large temporal and geographic scale. These programs include water quality, white sturgeon, fall Chinook salmon, bull trout, hatcheries, fish passage, and reservoir fisheries. These programs will provide the opportunity for large-scale adaptive integration and enhancement and will provide a means of holistic monitoring of ecological metrics for developing long-term trends relative to the health and status of resources and habitats associated with the Snake River basin and the Hells Canyon Complex.

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Title

Klamath Hydroelectric Project (FERC Project No. 2082) Ecosystem Diagnosis and Treatment (EDT) Analysis – Modeled Fish Passage Scenarios and Production in the Klamath River for Fall Chinook and Current Fall Chinook Production at Iron Gate Hatchery

Abstract

PacifiCorp's Klamath Hydroelectric Project, located on the Klamath River in Oregon and California, is currently undergoing Federal relicensing. As part of the relicensing studies, PacifiCorp and interested stakeholders completed an assessment of anadromous salmonid habitat in areas of the Klamath River Basin using the Ecosystem Diagnosis and Treatment (EDT) model. The EDT model uses habitat attributes and literature based performance values to assess capacity and productivity for focal salmonid species. The completed model incorporated data from site specific surveys, data extrapolation, and other modeling outputs. Modeling was performed for various fish passage options including full volitional passage, trap and haul, and dam removal scenarios. The focus of this presentation is fall Chinook, the most important commercial, sport, and tribal anadromous fishery in the Klamath Basin. Additionally, EDT modeling is compared to actual fall Chinook returns in the mainstem Klamath River below Iron Gate dam. Current Iron Gate hatchery production, as it relates to total basin escapement, escapement goals, and contribution to harvest will be presented. Modeling data indicates that any dam removal scenario that eliminates the current fall Chinook production provided by Iron Gate hatchery may result in lower production in the basin.

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Title
Back to the Future; Freezing the Hells Canyon Complex of Dams in the 1950s--Forever

Abstract
Back to the Future; Freezing the Hells Canyon Complex of Dams in the 1950s–Forever.

In 1955 the Federal Power Commission issued Idaho Power Company a license to construct and operate the Hells Canyon Hydroelectric Project on the middle Snake River.

The controversial, high-risk, experimental fish passage system failed. The result was a disaster of epic proportions.

Two hundred eleven miles of main-stem Snake River habitat, and 1,000 miles of tributary habitat were inundated or blocked. National Marine Fisheries Service estimated the area produced 240,000–377,000 fall chinook per year at the time.

When the 1955 license expired, fish advocates seized the long-awaited opportunity to reintroduce salmon and steelhead. National Marine Fisheries Service had the duty and power to prescribe fish passage/reintroduction. NMFS didn’t just drop the ball, it ran from it.

Reintroducing salmon and steelhead in all suitable blocked tributaries would not reduce power production. The cost would have an imperceptible effect on rates during the 30 year term of a new license, during which the company and its ratepayers would glean many billions of dollars using the public’s water and land.

Those facts do not matter; FERC staff concluded reintroduction “would not be worth the cost” to Idaho Power Company.

The relicensing process is broken; corrupted by moral hazard. Original licenses are treated by the licensees and by FERC as if they conferred perpetual ownership of public resources to the power companies.

The game is not over yet.

There is a fleeting, 11th hour, opportunity–likely the very last opportunity ever–to reintroduce salmon and steelhead above Hells Canyon Dam and to free reproductively isolated bull trout and white sturgeon.

What fish advocates do within the coming months–months,not years–will determine if future generations will forever live with the disastrous consequences of fish passage mistakes made more than a half-century ago.

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Title

Salmonid Rivers Oberservatory Network: Understanding salmon productivity, management, and cliamte change

Abstract

The Salmonid Rivers Observatory Network is a long term research project which describes biodiversity and bioproductivity, as controlled by natural and cultural processes, of a suite of pristine Pacific Rim salmon river ecosystems. This project addresses two major questions about salmon rivers that are critical for salmon conservation.

1. Has riverine habitat quality, defined as intrinsic capacity for productivity, substantially declined due to lack of fertility associated with chronic over harvest of salmon spawners that import marine nutrients into river ecosystems?
2. How will salmon and salmon habitat respond to ongoing climate warming?

This project uses a multi-disciplinary approach, utilizing multi-spectral (satellite) remote sensing of water depth and velocity calibrated by on-the-ground measures to define and quantify salmon habitat. These habitat measures are combined with salmon productivity proxies (e.g., growth rates; genetic indicators of effective population size) and marine isotopes from decomposing spawners in food web components (benthic organic matter, macro-invertebrates, riparian vegetation) to classify habitat-specific productivity. Sampling is distributed across the full range of habitat variation (complex flood plains to constrained canyons) within and among Pacific Rim rivers. To formalize our interpretations, we are improving our existing floodplain-scale models of water, head and nutrient flux and linking them to a new model that formalizes habitat-specific salmon productivity and the flux and cycling of salmon-derived nutrients. In this presentation we will discuss preliminary results of habitat classifications and quantity as well as how that relates to salmon productivity across habitats and river types. The fully developed modeling framework will allow testing of “what-if” scenarios encompassing all the drivers that are thought to control salmon productivity, including human stressors such as harvest, food web change dams, pollution, floodplain encroachments, water abstractions and hatchery operations, all in context of ongoing climate warming.

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Title

End Creek Fish Habitat & Wetland Restoration Project, Willow Creek Watershed of the Grande Ronde Subbasin, 2007 Western Division, American Fisheries Society Riparian Challenge Award Recipient, Allen B

Abstract

The Grande Ronde Subbasin, a Snake River tributary in northeastern Oregon, historically supported viable salmonid and other native fish populations important to tribal cultures and economies. Population declines began in the late 1800's with extirpation of sockeye and coho and eventual ESA listing of salmon, steelhead, and bull trout in the 1990's. Historic land management practices have altered channel morphology, decreased floodplain connectivity and wetland/riparian habitat, increased erosion and water temperatures, and decreased groundwater storage. Research and recovery planning has provided a framework for managers to prioritize actions and address factors limiting fisheries recovery. The End Creek Project encompasses 776 acres of historic wetland and riparian habitat in the Grande Ronde Valley impacted by extensive channelization. Project initiation began with private landowners interested in returning agricultural land into productive and sustainable habitat. Project development utilized a natural channel design methodology along with historic aerial photos and land surveys, field surveys, and interdisciplinary coordination between project landowners and sponsors to develop project design criteria. Objectives include: 1) Improve channel morphology consistent with valley form, hydrology, and sediment, 2) Reconnect floodplain and enhance groundwater/hyporheic exchange, 3) Increase cold water refugia, 4) Restore emergent/shrub-scrub wetlands, 5) Increase suitable steelhead spawning habitat, 6) Increase juvenile steelhead survival/productivity by increasing habitat quantity and quality. During 2006, construction included 3.1 miles of fish bearing and 5.3 miles of spring fed tributary channels, 6 floodplain ponds (10 acres), installation of wood and rock structural elements, 4.1 miles of ditch reclamation and removal of culverts, and native seeding/planting. Protection of the project is provided through two perpetual conservation easements (676 acres) and a 30-year term easement on 100 acres. Funding was provided by Bonneville Power Administration/Grande Ronde Model Watershed, Oregon Watershed Enhancement Board, and Wetland Reserve Program.

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Title

Investigating competition among lineages of Tubifex tubifex and the potential for biological control of whirling disease

Abstract

Whirling disease research in recent years has focused on selective breeding of Myxobolus cerebralis resistant trout, but not all management situations are conducive to the use of resistant trout. Less attention has focused on resistance in the oligochaete host, Tubifex tubifex, but not all T. tubifex lineages are susceptible to infection and some actually ingest and inactivate spores of M. cerebralis. We are investigating resistant T. tubifex as a potential biological control of the parasite. Laboratory experiments and a field manipulation were used to assess the competitive ability of resistant lineage V T. tubifex against susceptible lineage III. Replacement series laboratory experiments consisted of 2-3 densities and 3-5 proportions of each lineage, both exposed and unexposed to M. cerebralis. Exposed lineage III worms tested 100 percent positive for M. cerebralis prior to assigning treatments. Myxobolus cerebralis exposure increased the competitive advantage of resistant lineage V worms over susceptible lineage III. We also introduced lineage V worms to Spring Creek, Gunnison County, Colorado. Post-introduction monitoring has been ongoing for two years to track establishment and movement of lineage V worms. Post-introduction, lineage V worms have been found at all four introduction sites and movement has been detected downstream at one site.

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Title

Experimental Use of a Freshwater Mussel (Family:Unionidae, Genus:Anodonta) to Assess Habitat Quality for Juvenile Anadromous Salmonids

Abstract

Owing to its relative simplicity and cost effectiveness, aquatic resource monitoring with caged bivalves is an increasingly common tool for assessing habitat condition. This study examines the potential use of an endemic mussel, Anodonta californiensis, for monitoring abiotic habitat variables important to juvenile anadromous salmonids. In an experiment from 1 June to 15 September, 2007, I measured monthly responsiveness of four mussel growth and condition metrics to the range of in situ temperature, dissolved oxygen (DO), and pH conditions present in three pools of a degraded stream used by salmonids for rearing. An anticipated difference in abiotic variables among pools was largely due to the presence or absence of summer surface flows. I also tested whether caged mussels performed differently than un-caged counterparts in two pools. Mean monthly instantaneous growth, based on whole body weight, ranged from 0.22%/day to 0.99%/day and was significantly different among pools (Repeated Measures ANOVA; $P < 0.0001$). Of the four response metrics, whole weight growth proved more sensitive to habitat variables than shell growth, a condition index, or differences in percent dry tissue weight. During the experiment, growth of caged mussels in one pool exceeded by 20% that of un-caged mussels, whereas growth increases were nearly identical in the other. Mussel growth was strongly correlated with water temperature ($R2 = 0.67$, $P = 0.002$), but only weakly and non-significantly correlated with other habitat variables. Moreover, growth was highest in a pool in which DO measurements routinely dropped below 3 mg/L. Therefore, monitoring A. californiensis as a single-species indicator of salmonid habitat quality may not be useful. However, this mussel may be appropriate in an integrative multi-species monitoring approach due to its rapid growth and tolerance to habitat degradation and caging.

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Title

Lower Wenatchee River Off-Channel Habitat Creation Project

Abstract

The Lower Wenatchee River Off-Channel Habitat Creation Project was constructed during fall 2007 to provide refuge and rearing habitat for juvenile steelhead and Chinook salmon. Located approximately 11 miles upstream of Wenatchee, Washington, this privately-owned site was prioritized based upon results of a reach-scale geomorphic assessment that included hydraulic and sediment transport modeling. Working with the U.S. Bureau of Reclamation and Chelan County Natural Resources Department, the CH2M HILL team designed and permitted the project from fall 2006 to spring 2007. Construction included approximately 4,900 cubic yards of excavation to deepen an existing pond and create a backchannel connection to the main river. Specific habitat improvement treatments included placement of 30 large woody debris (LWD) structures and 10 fruitwood bundles; planting of 40,000 live cuttings; and installation of fabric encapsulated soil lifts (FESL) and live fascine along approximately 275 feet of streambank. The project created approximately 2 acres of pond, backchannel, and riparian habitat. The county is continuing monitoring of shallow ground water elevations and has initiated fish distribution and abundance monitoring.

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Title

Yankee Fork Floodplain Restoration Project

Abstract

CH2M HILL and the Shoshone-Bannock Tribes are working together to restore a 6-mile reach of the Yankee Fork impacted by historic dredge mining. A tributary to the Salmon River in central Idaho, the Yankee Fork provides important rearing and spawning habitat for Chinook salmon, steelhead, and bull trout. Previous efforts to restore the Yankee Fork have been limited by a lack of physical site information and cost-benefit analyses of specific restoration alternatives. In fall 2007, the CH2M HILL team collected aerial photography, LiDAR, and a channel survey. We combined these products to develop a seamless digital terrain model (DTM) covering the full valley width along the 6-mile reach. We are using hydraulic modeling to quantify and compare the physical (and associated biological) benefits of multiple restoration alternatives including tributary reconnects, floodplain reconnects, and backchannel habitats. We are also using earthwork modeling to calculate excavation volumes associated with specific alternatives. Additionally, we are working with external stakeholders to define project success criteria. From this information, we are developing cost-benefit analyses and prioritizing restoration alternatives.

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Title

Comparison of Early and Late Acclimated Volitional Releases of Spring Chinook Salmon in the Lostine River, Oregon from 2003 to 2007

Abstract

The Nez Perce Tribe and the Oregon Department of Fish and Wildlife have used supplementation to help restore spring Chinook salmon (Oncorhynchus tshawytscha) in the Lostine River. Endemic hatchery smolts were acclimated and volitionally released into the Lostine River each year during two separate release periods from 2003 to 2007. Early spring releases occurred from March 10 to March 23 and late spring releases occurred from March 28 to April 17. Survival probabilities at Lower Granite Dam were compared between early and late release groups from 2003 to 2007 and cumulative arrival frequencies were compared to those of natural smolts at Lower Granite Dam to determine if differences existed. Early release groups had a lower percentage of volitionally departing fish, significantly lower rates of survival from release to Lower Granite Dam ($P < 0.05$) from 2004 to 2007, and longer travel times to Lower Granite Dam than late release groups. Average travel time to Lower Granite Dam from 1999 to 2007 explained 47.1% of the variation in survival of hatchery fish. Cumulative arrival frequencies of early and late release groups occurred earlier than spring-tagged natural Chinook salmon smolts in 2003, 2005, and 2006 and differed significantly ($P <0.05$). Due to this difference in cumulative arrival timing, early and late release groups were scheduled for release a week later in 2007. Cumulative arrival frequencies differed between early and late hatchery release groups and between both hatchery release groups and natural smolts in 2007. However, the late release group appeared to have better mimicked the cumulative arrival timing of natural smolts in 2007. Relatively later release dates for early hatchery release groups should be considered in the future to try and imitate the cumulative arrival timing of natural Chinook salmon at Lower Granite Dam.

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Title

Abundance, Survival, and Productivity of Spring Chinook Salmon in the Lostine River, Oregon, After Ten Years of Supplementation

Abstract

Efforts to rebuild Lostine River Chinook salmon Oncorhynchus tshawytscha in Oregon's Grande Ronde Basin using supplementation began in 1997 with the collection of adult broodstock. The Lostine River supplementation program utilized native broodstock to produce 11,738 to 250,251 smolts annually from 1999 to 2007. These smolts were acclimated and volitionally released during the spring. Hatchery Chinook salmon were monitored as smolts and returning adults using coded-wire tags, PIT tags, redd counts, and mark-recapture escapement estimates. We found that mortality immediately after release in an 18 km reach immediately below the release site ranged from 0% to 16.3%. Survival estimates for hatchery Chinook salmon smolts 18 km downstream of release to Lower Granite Dam ranged from 43.3% to 70.1%. Survival estimates for natural Chinook salmon smolts from 1999 to 2007 were higher than for hatchery Chinook salmon smolts in all years except 2002 and ranged from 51.5% to 76.5%. Survival estimates were significantly higher for natural than for hatchery Chinook salmon smolts in 1999, 2001, 2005, and 2006. The first female adults from the supplementation program returned in 2001 and the redd count trend in the Lostine River mirrored redd count trends in unsupplemented streams in the Grande Ronde Basin. Although total escapement of natural and hatchery Chinook salmon initially increased from a low of 100 adult returns in 1999 to a high of 1,555 adult returns in 2004, natural escapement never increased above 600 adult returns and natural progeny-to-parent ratios declined from brood year 1999 to brood year 2002. Use of supplementation as a tool for rebuilding populations of Chinook salmon remains an uncertain strategy that will require ongoing monitoring and evaluation.

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Title

Consequences of summertime thermal regimes on reproductive maturation of adult Pacific lamprey, Entosphenus tridentatus: Plasticity or pre-programmed synchronization in maturation timing?

Abstract

Status of Pacific lamprey is of huge concern, and so the need for knowledge about maturation timing in relation to temperature will be essential for management. We conducted two studies, one an experiment that tested the effects of high summertime temperatures on body size, maturation timing and mortality rates, and the second on monitoring of maturation times and characteristics of Pacific lamprey at Willamette Falls, OR. For the first study, we subjected lamprey to high summertime temperatures that mimicked thermal regimes in the Willamette River (20-24 ºC; i.e., treatment) and compared the survival, maturation timing and body size of these animals with lamprey held at cooler temperatures representing the mean annual temperatures in the Willamette River (12-14 ºC; i.e., control). Treatment fish: 1) exhibited statistically significant decreases in body weight in comparison with control fish, 2) exhibited 100% maturation vs. 53% maturation for control fish, and 3) had a 92% overall death rate vs. 61% for control fish. All mortalities were mature fish during the springtime following treatment. For the second study, we monitored maturation timing and characteristics of lamprey at Willamette Falls, OR. Maturation occurred before river temperatures exceeded 20 ºC. Fish collected after this period had gonadosomatic indexes more similar to recent migrants from the ocean. In summary, we have evidence that suggests that river temperatures > 20 ºC are associated with 1) significant decreases in body size and expedited maturation timing, and 2) reproductive immaturity of Pacific lamprey. Is the observed maturation timing in nature the result of freshwater thermal regimes influencing maturation timing, as suggested by our lab study (plasticity) or a pre-programmed run and maturation timing that is adapted to, and synchronized with, cool (< 20 ºC) freshwater thermal regimes?

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Title

Reintroduction of Pacific lamprey in the Upper Umatilla River, Oregon

Abstract

This study provided evidence that reintroduction is a viable tool for reestablishing locally extirpated aggregations of Pacific lamprey if the life-stage specific factors limiting natural production can be reduced or eliminated. Between 1999-2007, over 2600 adult Pacific lamprey were reintroduced to the Umatilla River, where they had been extirpated by poisoning, from nearby locations in the Columbia River. Reintroductions were consistent with IUCN guidelines. Reintroduced adult Pacific lampreys were able to find suitable spawning habitat, construct nests, and deposit viable eggs (81-93% mean egg viability per nest). Their larvae were able to feed and grow. Median lengths for age 0+, 1+, and 2+ larvae were 19 mm, 63 mm, and 109 mm, respectively. Mean density of larvae in survey plots increased over time from 0.08 to 6.56 larvae/m2 over time. Geographical distribution of larvae in the river increased downstream but larvae failed to become established in the lower Umatilla River, where water flows were regulated for irrigation. Annual abundances of trapped, recently metamorphosed, out-migrating larvae increased during the study from nearly zero to 180,000 but not in all years, which suggested that many might not be surviving migration to the Columbia River, possibly because of irrigation withdrawals. Abundances of trapped, returning adult lamprey also increased from 2003-2006, which corresponded with the period when adult lamprey that were the progeny of reintroduced lamprey were expected to return, but more monitoring is necessary to confirm it was the result of the reintroduction. Our results also demonstrated that even if the initial causes of extirpation are known and removed, monitoring is essential to track long-term trends and identify additional limiting factors that were unknown at the time of reintroduction.

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Title
ADULT FISH PASSAGE AT DAMS: HOW WE GOT HERE AND WHERE WE ARE GOING

Abstract
Since the construction of Bonneville Dam and the 1934 Fish and Wildlife Coordination Act, which required Federal agencies to consider fish losses resulting from dams, the Corps of Engineers has been making changes to structures and operations to help migratory adult fish move past hydroelectric projects in the Columbia Basin. In the 1950s the Fishery Engineering Research Lab was built at Bonneville Dam. In that facility, ladder water velocities, fish density effects, and other fundamental fish passage behavior were investigated and criteria determined. During the 90s and early 2000s, systemwide radiotelemetry studies of large numbers of adult salmon and steelhead were undertaken to understand the effects of dam passage on the fate of migrating fish. Improvements to operations and structures are continuing. Today, the needs of other species are also being considered; Pacific lamprey, white sturgeon, downstream moving steelhead kelts. As we move toward the future and broaden our perspectives on fish passage, the needs for one species or even different ageclasses of the same species conflict and optimizing performance will require ingenuity and clear prioritization.

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Title

Implementing Lamprey Improvements at Dams in a Salmon-centric World

Abstract

Since the mid 90s, Portland District Corps of Engineers has been studying lamprey passage at federal hydro-projects on the Columbia River. We have determined where lamprey pass, some of the problems they face, and many of the big differences in passage criteria lamprey need when compared to salmon. Figuring out how to modify structures and operations to not only improve passage for lamprey but to ensure we do not negatively affect salmon and steelhead is a major challenge. Conflicting criteria for velocities and screening, basic differences in upstream migratory motivation and behaviors, and limited understanding of many of the basic life cycle issues of the species, makes it difficult to make quick and wise changes. Never the less, we are making progress. We have developed and installed alternative lamprey passage systems (LPS)to move lamprey from dead end sections of the AWS system at Bonneville Dam, we are incorporating rounding of corners and contiguous smooth bottom contours to aid passage in the designs for improving the John Day dam north ladder exit section, and we are exploring new designs and operations to help lamprey get through one of the most problematic sections of the dams, ladder entrances.

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Title

Discovery of aquatic gilled mushrooms: Psathyrella fruiting in the Rogue River in southern Oregon

Abstract

Mushrooms with true gills have been observed fruiting underwater in the clear, cold, flowing waters of the upper Rogue River in Oregon. Fruiting bodies develop and mature in the main channel, constantly submerged, near aquatic vegetation, and were observed fruiting over 11 weeks. Morphological characters and ITS sequence data place this fungus in the genus Psathyrella. These appear to be truly underwater mushrooms and not mushrooms fruiting on wood recently washed into the river. Substrates include water-logged wood, gravel, and the silty river bed. Water constrains spore dispersal. Spores were observed as wedge-shaped rafts released into a gas pocket under the cap. Underwater gills and ballistospores indicate a recent adaptation to the stream environment. This particular river habitat combines the characteristics of spring-fed flows, clear, cold, aerated water with woody debris in shallow depths on a fine volcanic substrate. The presence of nitrogen-fixing cyanobacteria near fruiting body attachment sites suggests a source of nitrogen in an otherwise clear stream. This observation adds to the biodiversity of stream fungi that degrade woody substrates. This is a new habitat for gilled mushrooms.

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Title

Mechanical Removal of Nonnative fishes in the Colorado River within Grand Canyon

Abstract

Nonnative fish were experimentally removed from federally endangered humpback chub Gila cypha habitat in the Colorado River to better understand factors contributing to native fish recruitment dynamics. This effort was in response to a long-term decline in humpback chub abundance and focused on two objectives: (1) evaluating the efficacy of mechanical removal of nonnatives in a large segment of the Colorado River and (2) evaluating the relationship between nonnative fish and humpback chub population dynamics. During 2003-06, over 41,000 fish were captured. Of these, 62% were nonnative fishes dominated by rainbow trout (Oncorhynchus mykiss; 81%), fathead minnow (Pimephales promelas; 12%), and common carp (Cyprinus carpio; 4%). Persistent reductions in rainbow trout abundance over the study period suggest that this effort is effective in controlling cold-water nonnative fishes. However, warmer than normal water temperatures released from Glen Canyon Dam since 2003, and particularly during 2005, are temporally correlated with both mechanical removal efforts and with increased abundance of native fish and nonnative fathead minnows. Both nonnative removal efforts and warmer water releases have possibly influenced the vital rates of native species and may confound our ability to evaluate the effect of either factor singly.

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Title

Assessing thermal suitability of stream for establishment of native trout conservation populations in high-elevation streams

Abstract

Native cutthroat trout populations have declined since settlers arrived in the interior western United States due to various anthropogenic mechanisms. Today, three native cutthroat trout subspecies are subject to multi-agency management and conservation plans that seek to protect or restore their populations, and create new populations to reduce or eliminate the need for listing under the Endangered Species Act. New populations are usually translocated to barren stream segments, above barriers that are intended to prevent upstream migration and future invasions by nonnative salmonids. In Colorado, where three native cutthroat trout species remain threatened, translocations are typically feasible only in high-elevation streams on public lands. Previous research suggests that many of these streams are too cold to support self-sustaining populations due to limitations on recruitment of small juvenile fish. I will present a concept for a cost-effective approach using data from a combination of physical habitat surveys, spatially explicit temperature surveys, and temperature monitoring, to refine the process by which thermally suitable high-elevation streams are selected for cutthroat trout translocations.

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Title

Amphibian Use of Intermittent Agricultural Channels and Ponds in the Lowlands of the Calapooia Basin, Oregon and the Importance of Conservation in Grass Seed Producing Areas.

Abstract

Agriculture-related land uses have affected water quality and quantity in many ecosystems at multiple scales. Intermittent watercourses and temporary ponds in the grass seed producing fields of the Upper Willamette Basin are often drained to improve crop production. Such practice may boost production capacity, but alters the availability and characteristics of potentially important amphibian winter habitats. Federal conservation programs currently compensate participating farmers for wetland restoration, fish and wildlife habitat improvement, planting riparian buffers, and other practices that contribute to conservation of aquatic resources. However, conservation programs have not been widely available or used by western Oregon grass seed farmers until recent inclusion of the Conservation Title in the 2002 U.S.D.A. Farm Bill. Not much is known about the extent of use by native amphibians or their relationships with aquatic habitat in these highly altered agricultural systems. Past results from our previous sampling in these areas indicate that many native species of amphibians use these areas; however sampling techniques focused only on intermittent streams and targeted fish. In the fall through spring 2006-2007, we specifically sampled for adult, larval and egg forms of amphibians in 19 intermittent agricultural channels and 10 ponds draining tributaries of the Calapooia River in western Oregon. Four native species of amphibians and one exotic (Bullfrog) were using these seasonal habitats. Pacific treefrogs, long-toed salamanders were the dominant species found. Amphibians used both the intermittent stream and temporary pond habitats for reproduction. Our findings indicate that intermittent agricultural watercourses and temporary ponds are important to native amphibian species. Therefore, agricultural conservation programs that have the potential to provide benefits to farmers while maintaining aquatic biodiversity in these floodplain habitats need to be clearly identified and promoted.

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Title

: Examining population fragmentation among native Colorado River Basin fishes with the aid of PIT tag technology

Abstract

Sympatric populations of bluehead sucker Catostomus discobolus, flannelmouth sucker Catostomus latipinnis, and roundtail chub Gila robusta persist in Muddy Creek, Wyoming. Our goal was to assess the effects of human-made instream structures in three adjacent segments on movements and population dynamics of the three native species in the system. Fish were captured and implanted with passive integrated transponder (PIT) tags and movements over structures were evaluated using fixed locality monitoring stations that record tagged fish upon passage and by electrofishing throughout the stream system. Estimates of abundance of each of the three species in each segment were obtained using three-pass depletion. Recoveries of fish that were PIT-tagged in each segment indicated that instream structures prevent or severely limit upstream movements, but downstream movements over structures occurred to some extent. In the upstream segment, populations were small and composed of large fish with very low recruitment, the middle segment contained the largest populations with diverse lengths, and the downstream segment supported smaller populations. Native fish populations in the most upstream segment may be at risk of extirpation, but in the middle and downstream segments they do not appear to be at a similar risk. The spatial arrangement of life history habitat requirements may be fragmented from these structures and restricted upstream movements may be limiting access to spawning and recolonization areas.

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Title
Watershed and Habitat Restoration in the Klickitat Subbasin

Abstract
The Klickitat Watershed Enhancement Project (KWEP) enhances and restores watershed health in the Klickitat River subbasin. Project actions target stream reaches and watersheds that support steelhead (Oncorhynchus mykiss; ESA- listed as "Threatened") and/or spring Chinook (O. tshawytscha). Implemented by the Yakama Nation Fisheries Program (YNFP) and funded by Bonneville Power Administration, KWEP addresses Yakima-Klickitat Fisheries Project (YKFP) as well as Columbia Basin Fish & Wildlife Program habitat goals of the Northwest Power and Conservation Council.

Since 2000, over 18 KWEP projects have:
- corrected 3 fish barriers restoring access to over 11.5 miles of habitat
- enhanced over 7400' of stream including construction of 57 LWD jams
- installed at least 15,000 plantings along 8,000' of stream
- fenced over 10000' of stream
- created 3500 square-feet of wetland
- restored high-flow access to over 800 lineal feet of side channels
- monitored streamflow at 13 sites
- assessed over 74 miles of stream
- assessed of over 110 miles of road and railroad
- treated 10.5 miles of road for drainage improvements

KWEP has partnered with 13 different private, tribal, federal, state, and local entities on over 10 projects resulting in:
- conservation of over 1050 acres and 4 miles of fish-bearing streams and side channels
- correction of 4 fish passage barriers restoring access to 3.3 miles of habitat
- enhancement of over 3400' of stream
- installation of at least 9,000 plantings along 3,000' of stream
- design and development of relational databases to manage habitat, temperature, and sediment data
- implementation of no-till agricultural practices on several hundred acres of farmland

Current KWEP projects involve:
- replacement of 3 passage barriers that will restore access to over 5 miles of habitat
- treatment of over 2000 feet of road to restore access to 0.5 miles of side channels
- install over 7000 plantings along 5 riparian acres
- enhance over 5000 feet of active channel and restore access to over 4500 feet of side channels

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Title

Comparing efficiency of a PIT-tag interrogation system to an adult fish trap and a rotary screw trap

Abstract

Since 1992, adult Lower Columbia River steelhead have been counted at a trap in the fish ladder at Hemlock Dam on Trout Creek, a major tributary to the Wind River, WA. This trap captures all adult steelhead that access Trout Creek above the dam, allowing biologists to handle, measure, and PIT tag 100% of the run. The ability to count returning adults has been a crucial part of the effectiveness monitoring for extensive restoration efforts targeting the ESA-threatened steelhead run in the Trout Creek watershed. With Hemlock Dam and the associated adult fish trap scheduled for removal in September 2008, the ability to handle and count returning adults will be lost. A PIT-tag interrogation system (PTIS) was installed in Trout Creek in September 2007 in hopes that it would be an adequate replacement and long-term monitoring tool for adult steelhead returns to Trout Creek following the removal of Hemlock Dam. With both the PTIS and adult trap operating at the same time, a unique opportunity exists to assess detection efficiency of the PTIS for PIT-tagged adults. In addition, we are evaluating the detection efficiency of the PTIS for PIT-tagged smolt and parr steelhead emigrating from Trout Creek. In spring 2008, a rotary screw trap will be operating a short distance downstream, which will allow a comparison of detection efficiency between the PTIS and rotary screw trap. By May 2008, the majority of the 2008 brood year of adult steelhead and about half of the smolt emigration will have been completed. We will be presenting the results of our initial detection efficiency tests from this critical first year effort.

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Title
Children & Nature

Abstract
Ever since author Richard Louv described “nature deficit disorder” as affecting our children in his ground-breaking work, Last Child in the Woods, natural resource agencies have considered this a wake-up call for thinking about the future of conservation in America. The U.S. Fish and Wildlife Service has elevated the task of “connecting children and nature” as a top priority. The Pacific Region has responded with an innovative effort to connect children with nature. From salmon festivals to creating school yard wildlife habitats, employees are encouraged to do their part to make sure our children get the chance to experience nature. The opportunities afforded to our generation, and the experiences that led us to a career in resource management, are absent in today’s electronic dominated society. The effort of one federal agency to begin to engage children of today in the hope of creating conservationists of the future are highlighted.

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Title

Status and Management of Northern Pike in Box Canyon Reservoir, Pend Oreille River, Washington

Abstract

Non-native northern pike (Esox lucius) were first collected in Box Canyon Reservoir, Pend Oreille River, Washington in 2004 during a reservoir-wide warmwater fish survey. The Kalispel Tribe of Indians has been assessing the status of pike in the reservoir since 2005 by conducting studies of pike movement and habitat use with radiotelemetry, age, growth, and condition, diet, recruitment, and estimated the size of the adult population through mark-recapture techniques.

Although the size of the adult population is small and year class strength is highly variable, northern pike appear to have become established, experience exceptional growth rates, and provide an increasingly popular sport fishery. Habitat conditions of Box Canyon Reservoir are ideal for northern pike and the population will likely continue to expand in the future. The expanding pike population will likely provide additional angling opportunity, but the cost to native species and gamefish presently being managed by the Tribe and Washington Department of Fish and Wildlife (WDFW) is unknown.

In Washington State, northern pike are presently managed as an unregulated gamefish species with no size limitations, bag limit, or season closure. Prior to implementing more restrictive angling regulations or active management, the Tribe and WDFW will continue to monitor the population as well as spatial and temporal distribution of “species of concern” (e.g. mountain whitefish, westslope cutthroat trout, bull trout, largemouth bass) to better assess when and to what extent interactions between these species occur and if they are significant relative to population levels. The data collected through this project will aid biologists with the development and implementation of a northern pike management plan for the reservoir.

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Title

Conservation of genetic resources for the Russian River Coho Salmon Captive Broodstock Program

Abstract

The Russian River watershed is the largest basin within the Central California Coast ESU and is critical for coho salmon viability and recovery at the southern edge of the species' range. To prevent the impending extinction of coho salmon within the basin, the Russian River Coho Salmon Captive Broodstock Program (RRCSCBP) was initiated in 2001. Its goals are to preserve the genetic resources of the Russian River population and to introduce progeny of captive broodstock to locations within the watershed where coho salmon have been extirpated. Since its inception, the RRCSCBP has completed five spawning cycles and released nearly 150,000 juvenile salmon into the basin. However, with a limited number of founding individuals for the broodstock population and continuing declines in wild returns, genetic management of the program faces the challenge of producing enough fish to re-establish self-sustaining runs while minimizing a seemingly inevitable inbreeding problem. To this end, all broodstock are genotyped at 18 microsatellite markers in order to produce a breeding matrix that precludes the crossing of closely related individuals. In addition, survival of all full-sibling progeny groups is monitored through early life stages, revealing wide variation in broodstock fitness. The integration of monitoring and genetic data allows a fine-scale analysis of fitness and reproductive success across brood years and cohorts. In addition, we report on trends in reproduction, such as average relatedness and origin of broodstock (wild or captive). These data are used to guide genetic management of the RRCSCBP, including design and evaluation of broodstock breeding practices and juvenile release strategies.

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Title

Comparison of local versus aggregate population productivity for naturally produced spring/summer Chinook salmon in the Snake River basin

Abstract

Stock-recruit (SR) relationships are important to understanding forces influencing abundance, but it is critical to understand the processes that shape the relationship. Aggregate SR curves are the product of the life stages and spatial components that compose the stock. The aggregate freshwater productivity of naturally spawning spring/summer Chinook salmon in the Snake River (as measured at Lower Granite Dam) exhibited Beverton-Holt (BH) density dependence during brood years 1990-2004. Our objective was to compare and contrast the relationship described in aggregate to comparable data from the spawning areas of 14 selected component populations. Strength of density dependence varied widely among populations with model form including linear, Ricker, and BH. In general, local populations did not exhibit as much density-dependence as the aggregate, indicating that density-dependence occurs downstream from spawning areas. Intrinsic productivity predicted by the aggregate BH model was 474.5 smolts/female. Intrinsic productivity of local populations ranged from 18.5 to 739.6 smolts per redd (mean = 152.5) and from 307.6 to 1242.4 parr per redd (mean = 569.0). Relative to the aggregate, low local smolt productivities versus high parr productivity indicate the importance of juvenile life history diversity and ‘mid-stem’ rearing areas to population regulation. There was density-dependent survival from the natal stream to Lower Granite Dam in almost every population and life stage combination that we examined. We conclude that a focus on spring smolts alone ignores important components of population productivity. Further, local limitations will be different among populations, which should reduce population synchrony and increase resilience of the aggregate. We recommend that managers should recognize the importance of the ‘mid-stem’ black box because juvenile dispersal is important to population functioning and juvenile life histories should be considered in recovery plans.

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Title

Status of application by state fish and wildlife agencies for permission to lethally remove California sea lions below Bonneville Dam.

Abstract

In late 2006, fish managers in Oregon, Washington and Idaho jointly applied to the National Marine Fisheries Service for permission to use lethal means, if necessary, to remove individual California sea lions that prey on ESA listed chinook salmon and steelhead below Bonneville Dam.

The application was submitted under Section 120 of the Marine Mammal Protection Act, which allows lethal removal of individual pinnipeds that negatively impact federally listed stocks. Upper Columbia River spring chinook are listed as endangered; lower Columbia River chinook and steelhead, middle Columbia River steelhead, Snake River spring/summer chinook, and Snake River Basin steelhead are all listed as threatened under the ESA.

In January 2007 The Secretary of Commerce found that the states' application produced sufficient evidence to warrant establishing a Pinniped-Fishery Interaction Task Force. NOAA Fisheries Service solicited public comments on the application, other information related to sea lion predation on salmon and steelhead at Bonneville dam, and nominations for potential members of the task force.

In August 2007: NOAA announced establishment of a Pinniped – Fishery Interaction Task Force. The task force assignment is to recommend whether to approve the request by Oregon, Washington and Idaho for authority to lethally remove California sea lions that feed on ESA-listed salmon in the lower Columbia River.

In November 2007 the Task Force, by a vote of 17-1 recommended approval of the states request with a variety of terms and conditions.

In January 2008 NOAA published an Environmental Assessment for authority to lethally remove California sea lions that feed on ESA-listed salmon in the Columbia River Basin.for a 30 day public comment period. They received in excess of 3500 comments.

A final decision by NOAA is expected in late March 2008 and details of the decision will comprise a significant portion of this presentation.

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Title

Invasive species research: Activities of the USGS Columbia River Research Laboratory

Abstract

The USGS Western Fisheries Research Center's Columbia River Research Laboratory has initiated studies of Aquatic Nuisance Species in the mainstem Columbia River and its tributaries. Over the past several years we have conducted surveys of Eurasian watermilfoil in an impoundment of the Columbia River, initiated early detection monitoring of New Zealand mudsnails in the Klickitat River, have begun examining the recent discovery of the infestation of the Amur goby in the lower Columbia River, and are working through aspects of determining the potential for an Asian carp infestation in the Columbia River Basin. During this presentation, we will give an overview of these activities.

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Title

Simulation of temperature and flow effects on coho salmon in the Klamath River Basin

Abstract

We developed a coho life-cycle model that simulates the number of Klamath Basin coho alive at different life stages, dependent on the environmental circumstances they encounter in the mainstem Klamath River. Temperature and flow dependent coho production and survival relationships were developed and applied to spatial units (reaches) within the Basin. To run the life-cycle model daily values of temperature and flow were needed for the midpoint of each mainstem reach. Because temperature and flow were not measured at each of these points, a hydrodynamic temperature model was developed by Watercourse Engineering, Inc. to simulate temperature and flow conditions from Iron Gate Dam to the estuary for a wide range of flow releases across high, medium and low water year-types. Outputs from the hydrodynamic temperature model were used as inputs for the life-cycle model to simulate effects of variable flows on coho survival and production at various life stages. Combination of both the hydrodynamic temperature model and the life-cycle model provide a framework for evaluation of spatially and temporally explicit effects of flow management on salmonid populations.

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Title

Life History Attributes, Trends in Population Size, and Challenges to Recovery of Federally Listed Lake Ozette Sockeye Salmon

Abstract

Lake Ozette, located within Olympic National Park on the Olympic Peninsula, Washington, is home to a unique population of sockeye salmon. Ozette sockeye constitute one of seven sockeye ESUs in the Pacific Northwest, and were listed as threatened under ESA in 1999. Lake Ozette is the third largest natural lake in Washington and is drained by the Ozette River, which flows just 8 kilometers before entering the Pacific Ocean. Ozette sockeye are unique based upon life history attributes and genetic distinction from other sockeye in the Pacific Northwest. Ozette sockeye (primarily age four) migrate up the Ozette River from May through August, where they hold in the lake before spawning in November and December along the lake shore or in one of several tributaries. Juvenile fish rear in the lake for one summer, emigrating in their second spring. Historic run sizes were as high as 30,000 adults prior to 1950, but had declined to less than 1,000 adults by the 1970s, leading to their ESA listing. Key factors for decline are: over harvest, spawning habitat degradation, predation, and altered lake hydrology. As Lake Ozette and the Ozette River are located entirely within Olympic National Park, there has been an expectation that recovery planning and implementation of recovery actions would be a relatively simple matter. However, most of the watershed is held in private ownership and is managed for commercial timber. The approval of the Habitat Conservation Plan (HCP) for Washington State forest practices prior to completion of recovery planning for Ozette sockeye has presented several challenges. Watershed partners are trying to balance conservation needs of the sockeye while adhering to both the provisions of the forest practices HCP and the purposes for which Olympic National Park was established.

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Title

Can Increases in Flow Released From Dams Help Coho Just Like a Good Water Year?

Abstract

We used simulation modeling of available information in the Klamath Basin to determine whether manipulations of river flows could benefit coho population in the same way that wet years tend to result in higher survival and abundance of coho smolts. Evidence from streams throughout the West Coast shows that salmon and trout populations tend to increase in cool, wet, water years. This correlation often leads managers to expect that increasing flow in other year types will produce the same benefit. We were able to simulate these differing circumstances in the Klamath Basin by linking a coho life-cycle model to the stream flows and temperatures predicted with a hydrodynamic model of river flow and temperature. The life-cycle model accounted separately for coho production in each tributary and in multiple distinct reaches of the Klamath River below Iron Gate Dam, and included functions that linked flow and temperature to survival and carrying capacity of coho. We found that increasing main stem river flow below the dam over a wide range, while runoff and weather were held constant, produced less than a 10% change in smolt production. In contrast, if dam releases were held constant, but runoff and weather were changed from a typical drought year to an average year, production of coho increased over 60%. The scenario for increasing dam outflows was beneficial to coho in the main river near the dam, while the improved water year scenario improved coho production in tributaries throughout the basin. Coupling of life-history and stream temperature models produces a useful tool for distinguishing fish benefits produced by flow management from those produced by hydrology and weather differences.

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Title

The Rainbow x Steelhead Interaction: Strengthening Population Viability

Abstract

Federal fisheries agencies have chosen a policy to treat resident and anadromous O. mykiss within the same basin as distinct ESU's or DPS's under the Endangered Species Act. In spite of the policy, there is clear evidence that the two ecotypes often interbreed, and share the same stream networks to spawn and rear. Parentage and breeding studies indicate that the tendency for either anadromy or residency is an inherited trait among O. mykiss, and expression of the trait is also influenced by environmental circumstances. We used life-cycle modeling of resident rainbow and anadromous steelhead populations in the Yakima Basin, Washington to simulate how the interaction of one type with the other influenced the population viability of either type. The model included the response of inherited traits to natural selection by environmental factors that influenced carrying capacity, migration, and survival. Both resident and anadromous parents can produce offspring of either type, but the ability to survive in saltwater is greater for fish from anadromous parents. On the other hand, resident rainbow experience higher parr-to-adult survival, are less fecund, but have higher rates of repeat spawning. Consistent with observations in the Yakima Basin and elsewhere, the simulations showed residency will predominate in river reaches with cool, dependable flow through the summer, while anadromy will predominate in areas where summer carrying capacity is sharply reduced by low flow and high temperature. These population responses are adaptive, enabling O. mykiss to thrive in a wide range of habitats and environmental circumstances. Predicted viability of the population over the long term for either ecotype was much higher when the contributions of both ecotypes to each other were accounted for.

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Title

Volunteer Project Highlights of ODFW's North Coast Salmon-Trout Enhancement Program

Abstract

Since the legislative creation of the Salmon-Trout Enhancement Program in 1980, volunteers have been integral in the completion of hundreds of Oregon Department of Fish and Wildlife (ODFW) projects in the North Coast Watershed District. As staff time and funds become increasingly limited, volunteers become even more important in meeting fisheries management objectives in a timely manner. Currently, hundreds of volunteers donate thousands of hours annually, assisting ODFW staff with key projects on the North Coast. Volunteer needs and talents are varied, and include a wide range of activities such as habitat restoration, fish propagation, data collection, construction and maintenance, outreach and education. An overview of the North Coast Salmon-Trout Enhancement Program will be given, including highlights of recent and upcoming volunteer projects.

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Title

Potential effects of rising temperatures on salmon migration through the Columbia River: evidence for recent evolutionary shifts in migration timing

Abstract

Salmon migration success depends, in part, on thermal and flow conditions along the migration route. These conditions are changing due to climate change, which might cause either plastic or evolutionary changes in migration timing. I show that sockeye salmon now migrate up the Columbia River over 10 days earlier than they did earlier this century, and I compare the evidence for plastic and evolutionary mechanisms that could explain this shift. Based on a recent study of sockeye salmon migration success, I developed a model of mortality caused by thermal stress, and back-calculated historical selection pressures based on this model. I show that there has potentially been strong selection for earlier migration, and an evolutionary response is likely. Rising river temperatures are certain to continue due to climate change, so I discuss the implications of climate change for future sockeye salmon migration success.

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Title

Quantifying climate change impacts on population abundance and viability -- lessons from Snake River spring/summer Chinook salmon

Abstract

Salmon life histories are finely tuned to local environmental conditions, which are intimately linked to climate. I show how environmental conditions affect juvenile growth and survival in spring/summer Chinook salmon, based on results from a long-term PIT-TAG study in 18 populations in the Salmon River Basin. Because temperature and flow had strong effects on survival, we projected the effects of climate change on these physical factors by downscaling predictions from General Circulation Models to a locally-calibrated hydrological model. We incorporated this information into a population dynamic model to predict the consequences of climate change for population abundance and viability. We found that populations differed in their sensitivity to particular environmental changes, and thus will likely differ somewhat in climate change impacts. I discuss the implications of these results for future research on the effects of climate change for bull trout and potential implications for management.

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Title

Whose redd is it?: The Use of PIT Tags to Identify Where Female Spring Chinook Salmon Spawn

Abstract

Passive integrated transponder (PIT) tags are widely used to track individuals and estimate population parameters for anadromous fish. We evaluated whether a PIT tag implanted intraperitoneally into a gravid female would be expelled into the gravel along with the eggs as she spawned naturally, allowing us to identify which female built the redd. We tested this during August-September 2007 in Lookingglass Creek, a tributary to the Grande Ronde River in northeast Oregon. We implanted tags into 34 females and released them to spawn naturally. Redds and female carcass recovery locations were flagged and latitude-longitude coordinates of each redd were recorded during weekly surveys. Scans of all carcasses revealed that 3 of 13 (23%) females had not expelled their tag during spawning. At the completion of the spawning season, we scanned all redds for PIT tags and discovered that 10 of 32 (31%) redds contained a tag. It is clear that not all tags were deposited in redds and it is likely that we were unable to detect all tags that were deposited. Assigning a redd to an individual female could be used to examine microhabitat selection based on parameters such as size and origin of the female, and indicate spawning success and distribution of hatchery versus natural origin Chinook salmon. Additionally, genetic analysis might be used to determine if progeny will return to spawn near the redd from which they originated. We plan to test this method again, attempting to improve the likelihood of females depositing tags in redds and our ability to detect the tags.

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Title

Perils of Pike in California: Lessons Learned at Lake Davis

Abstract

In September 2007 the California Department of Fish and Game in partnership with the U.S. Forest Service treated Lake Davis and tributary streams with rotenone to eradicate the illegally introduced, non-native and invasive northern pike (Esox lucius). Northern pike had severely impacted the reservoir's popular rainbow trout fishery. Because the reservoir is connected to the Sacramento-San Joaquin River system, downstream salmonid and other fish species were also at risk. Potential movment of pike to other waters by humans was also of concern.

Lake Davis pike had been targeted by a rotenone eradication project of similar scale in 1997 amid protests and controversy in part due to the reservoir's use as a drinking water supply. The 2007 treatment, while undergoing considerable public questioning and scrutiny, was not as controversial. Implementation was carried out efficiently and methodically.

Many factors led to the smooth implementation of the 2007 project. The project enjoyed strong support from agency leadership. It had solid funding through CalFed (a joint state-federal agency charged with protecting the Sacramento-San Joaquin Delta). The very ambitious timeline nevertheless included careful technical preparation and field reconnaissance. Staff counsel was involved at all stages. Extensive outreach included professionally-facilitated public information sessions and widely-distributed newsletters. Project philosophy emphasized dialogue, questioning, and information sharing – within and between agencies, up and down agency command structure, and with the community at large.

The jury is still out on the technical success of the project. Operations managers are confident that meticulous field reconnaissance, contingency planning, and methodical implementation have resulted in pike eradication. Nevertheless, two years of field monitoring – including gill nets, backpack electrofishing, trap nets and boat electrofishing – will be carried out before the project can be declared an official "success."

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Title

Sharing Field Data with the Community: Lake Davis Pike Removal and Eradication

Abstract

The California Department of Fish and Game (Department) has conducted a series of northern pike (Esox lucius) eradication and removal efforts in the Sierra Nevada mountains in northeastern California. Pike, illegal in California, threatened the local trout fishery, salmonids and other fish species (including State- and Federally- listed) in the Sacramento-San Joaquin Delta and aquatic ecosystems throughout the state.

After a controversial rotenone treatment of Lake Davis in 1997, pike reappeared eighteen months later. The Department subsequently undertook a pike control and containment effort at the recommendation of a local citizen group, the Lake Davis Steering Committee (Committee). The group did not support rotenone use. It recommended intensive mechanical removal of pike, public outreach and regular reports to the Committee. The latter recommendations were key in improving public understanding of the ecological situation. Reporting to the Committee opened a valuable dialogue between the Department and the community.

Information flow to the public occurred in stages over eight years. First, results of mechanical removal efforts were reported to the Committee. These showed the pike population increasing despite control efforts, culminating in the Committee requesting that the Department again investigate eradication methods. This investigation resulted in a joint proposal by the Department and the U.S. Forest Service to eradicate the pike using rotenone.

During environmental review and planning, information flow continued through many public project meetings on specific topics, newsletters, and a website. During the month-long treatment phase, project tours, email updates, newspaper columns and a telephone information line were implemented. After treatment, updates on water quality, project results, and restocking continued.

By working cooperatively with the community and the Committee early on, an open line of communication was maintained during all phases the Lake Davis project.

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Title

AFLP Assessment of Genetic Diversity of Pacific Lamprey

Abstract

This study is the first to document genetic differences among Pacific lamprey across much of their range. We examined collections of migrating adult Pacific lamprey from Naka River, Japan; Moose River, Alaska; and six locations in the Pacific Northwest: the Toutle River, Willamette River, Deschutes River, John Day River, Rogue River, and Klamath River based on variation at 180 polymorphic loci of the 556 loci generated by amplified-fragment length-polymorphism (AFLP)primers. Despite the large geographical distances separating the samples, the different collections were characterized by a high proportion of shared bands, which indicated significant levels of historical gene flow across the range of the species. Analysis of molecular variance across three geographical regions—the Pacific Northwest, Alaska, and Japan—showed divergence among samples, however, with FST = 0.106 (P<0.001) and significant differences among regions (FRT = 0.014, P<0.001), among collections within the Pacific Northwest (FSR = 0.092; P<0.001), and within collections. Over this extent of the species' range, genetic divergence tended to follow a pattern of isolation by distance, which suggested that allelic diversity may have been maintained by stepping stone patterns of dispersal. This pattern did not occur within the Pacific Northwest. Among the six collections in this region, all pairwise FST comparisons were statistically significant and ranged from 0.037-0.182 but the differences corresponded to no obvious geographical patterns.

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Title

Variations in annual adult timing and smolt production in a hatchery-influenced coho salmon (Oncorhynchus kisutch) population: associations with hatchery stocks, brood-cycles, and early fall flow fluctuations.

Abstract

The Nehalem hatchery on the North Fork Nehalem River, Oregon, has two stocks of coho salmon (Oncorhynchus kisutch) that do not receive wild inputs. The Fishhawk stock, founded in 1978-1984 using wild fish from an up-river Nehalem River tributary unlikely to have had previous hatchery influence, is released in one of the three semi-independently spawning brood-cycles of the predominant coho salmon life-history. The NF Nehalem stock has hatchery lineage back to 1926, last received wild inputs in the early 1960's, and is released in two brood-cycles. North Fork Nehalem River smolt production increased with later annual average return timing of wild and naturally-spawning hatchery adults (1998-2004 brood-years). Mean annual timing was significantly later for the Fishhawk stock-year associates than for the NF Nehalem stock-year associates. Mean annual natural smolt production (1996-2004 brood-years) was significantly greater for the Fishhawk stock-year associates. Whereas annual smolt production also differed among all three brood-cycles, annual adult timing did not differ between the two NF Nehalem brood-cycles. However, across all years, increased fluctuations in early fall (September 1 to October 13) migratory cue flows was associated with both earlier timing and lesser smolt production. Within only the two NF Nehalem associated brood-cycles, smolt production varied linearly with flow fluctuations during September 1 to October 2. This relationship was not significant for adult timing, but one outlier observation was responsible for almost all deviation from linearity. Overall, dependence of annual smolt production and adult timing on early fall flows and hatchery stock associations seemed clear, but dependence on brood-cycles was inconclusive.

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Title
Steelhead Recovery in the Okanogan Subbasin

Abstract
Historically, productivity in the Okanogan River was documented by established Tribal fishing camps (Spier, 1938). The Colville Tribes recognized a need to recover salmon and steelhead in the Okanogan before summer steelhead were federally listed as “endangered” in the upper Columbia. The development of a Watershed Plan/Environmental Assessment for Omak Creek in 1995, set the stage for removal of a complete passage barrier in the lower portion of the creek, opening access to 5.5 miles of spawning and rearing habitat. Natural reproduction of steelhead was confirmed in 2001, however, low abundance of returning adults provided an opportunity to develop a locally adapted broodstock effort.

As this project began to evolve, the need to monitor and evaluate our efforts lead to participation in a parental origin/reproductive success study in conjunction with the Columbia River Inter Tribal Fish Commission. Reconditioning steelhead kelts to reestablish iteoparity in the Okanogan basin will supplement natural reproduction, bolstering the genetic contribution of wild fish. Recovery efforts in Omak Creek are currently being expanded to include other tributaries both in the United States and Canada. The future for the recovery of summer steelhead in the Okanogan is so bright, “I gotta wear shades”.

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Title

Seasonal Variation in Denitrification in a Small Eutrophic Reservoir: Lacamas Lake, Camas, Washington

Abstract

In recent decades anthropogenic activities have more than doubled the rate of terrestrial nitrogen (N) fixation, leading to increased N inputs to freshwater and coastal systems and associated increases in eutrophication, harmful algal blooms, fish kills, and community composition shifts. Denitrification (DNF), the microbially mediated process whereby biologically available nitrate is reduced to N2 gas, is a primary pathway by which N is removed from aquatic ecosystems. DNF is thought to occur under anoxic conditions where there is adequate dissolved organic carbon, nitrate, and phosphorous. Despite a body of research identifying factors that can influence DNF rates, the spatial and temporal dynamics of DNF are poorly understood. In particular, DNF is understudied in reservoir systems. Lacamas Lake, a small (1.3 km2) monomictic reservoir draining to the Columbia River, was sampled monthly from June 2007 to February 2008 at 1m intervals along a vertical transect in the deepest part of the lake (17m). A membrane-inlet mass spectrometer was used to determine dissolved N2 and Ar concentrations. Expected relative concentrations of N2 and Ar were compared to measured ratios in order to ascertain supersaturation of N2, a proxy for DNF rates. The reservoir was supersaturated with N2 throughout the sampling period and supersaturation was significantly higher in June than in any other month (one-tailed t-test $p<0.05$) averaging 129% in June (n=12) and 105% (n=55) over the other months. These results indicate that DNF plays an important role in reservoir N removal. Higher DNF rates in June correspond to the time when the lake is stratifying suggesting that this period may be particularly important with regard to reservoir N removal. These findings are particularly relevant when considering the impact of dam management strategies on downstream nutrient loading and the associated impact on fish populations.

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Title

Using Full Parental Genotyping to Determine the Efficacy of Steelhead Streamside Incubators in Yankee Fork Salmon River, Idaho.

Abstract

The Shoshone-Bannock Tribes operate the steelhead streamside incubation program in the Yankee Fork Salmon River, Idaho. Our objective is to determine if targets for hatchery contributions are being achieved and can be improved using DNA parentage analysis. Approximately 214,750 eggs were outplanted in 2006 resulting in 155,908 fry seeded. We completed three-pass electrofishing to estimate density and distribution and adult and juvenile tissue samples for parentage analysis and genetic diversity/structure. Observed sample densities in 2006 and 2007 were 0.041 fish/m2 and 0.059 fish/m2. Tissue samples collected from BY06-0+ (n=349) and BY06-1+ (n=123) age O. mykiss resulted in 61 total parentage assignments. We estimated 17,850 (± 2207) total age-0+ juveniles in 2006, of which an estimated 4,268 (± 1244) were hatchery-origin; 23.9% (95% C.I. = 19.3 – 27.5%). Survival of hatchery-origin fry to age-0+ parr is estimated at 2.7%, however, fish maybe leaving the system before sampling or low sample size bias estimates. DNA analysis identified five hatchery-origin age-1+ juveniles representing 4.1% of the population. There is no significant difference in mean condition factor between hatchery and natural-origin juveniles in either year. Mismatches are commonly due to weakly amplified samples, or point errors traced back to data transcription errors. The final error rate assigned to the data set was 1.0%. Production (juvenile survival) among outplanted families is not equally distributed. Nineteen known mated broodstock pairs did not produce progeny. We observed high allelic polymorphism across 14 loci. Among 8 groups of O. mykiss evaluated, we observed Fst values ranging from 0.002 to 0.014 across loci. The overall estimate of 0.009 indicates significant among-group variability (99% C.I. = 0.007 – 0.011). The high proportion of HWE deviations observed likely indicates the presence of multiple spawning populations (e.g. juveniles of resident, natural-origin, and other hatchery-origin).

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Title

Metro's Natural Areas Program -- protecting water quality and fish and wildlife habitat through land acquisition

Abstract

With more than a million more people expected in the Portland metropolitan area in the next two decades, the region's need to protect water quality and wildlife habitat and save the places where people can connect with nature is more important than ever. Metro voters approved the region's first major land acquisition program in 1995. With these funds, Metro protected more than 8,000 acres and 74 miles of stream and river frontage. With s second measure, approved in 2006, Metro will add another 4,000 acres to the region's system of parks, natural areas, trails and greenways.

Metro's acquisition programs fund two key elements:

· protecting the region's most biologically significant -- and vulnerable -- natural areas as identified by the region's science community, and

· funding local projects to improve parks and natural areas, preserve wildlife habitat and provide greater access to nature for people all over the region.

Managing the 12,000+ acres of nature parks and natural areas in Metro's portfolio is no small task. Metro's science team is working to bring back many of the native plants, rare habitats and associated wildlife that once thrived in this region. Metro works with the help and support of thousands of volunteers and dozens of partners from across the region along with state and federal agencies.

One of the most significant of Metro's restoration projects was one to rebuild side channel habitat along the Clackamas River. The $1.2 million project, the largest of its kind in Oregon, is helping juvenile coho, Chinook, steelhead and trout. Other projects of similar scale are also being led by Metro including recreating a 135-acre oak woodland near Wilsonville and a 300-acre wetland restoration project at Multnomah Channel to benefit fish and wildlife such as Northern red-legged frogs.

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Title

Development of Regionally Protective Instream Flow Recommendations for Adult Anadromous Salmonid Upstream Passage and Spawning During the Winter Diversion Season

Abstract

In response to the needs for regulating instream flows and protecting ESA listed salmon and steelhead in northern California, a method was developed for making regionally protective winter instream flow recommendations for adult salmon and steelhead upstream passage and spawning in streams where site specific study results are not available. To be protective for a wide range of streams, the approach accounted for variation in instream flow (1) relations across variable channel sizes and hydrology, (2) needs among channels of similar size and hydrology, and (3) habitat suitability criteria and thresholds. In addition, the approach recognized the lack of biological and physical criteria and challenges related to defining acceptable levels of uncertainty, and the need to be as simple and understandable as possible for potential application in an instream flow policy context. The approach was founded within an adaptive management construct, whereby recommended flow levels were regionally protective (i.e. risk averse) in the absence of site specific study results. An upper envelope defining instream flow needs for spawning was also determined to be protective of general upstream passage needs at riffles. This paper describes the general steps used in developing the approach and provides examples of its application.

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Title
An optimistic overview of what is next in the Klamath Basin

Abstract
The Klamath River Basin in southern Oregon and northern California has sustained farming communities, provided habitat for the majority of waterfowl that migrate over the Pacific flyway, and was once the third largest salmon-producing watershed on the west coast, supporting large anadromous fish runs including Chinook salmon, coho salmon, steelhead, sturgeon, and lamprey, which supported significant commercial, recreational, and tribal harvests. Each year since 2001 the federal government has managed to make water deliveries to the irrigation project and to meet requirements for threatened and endangered fish, despite below average hydrologic conditions. But we are still not seeing juvenile suckers reaching adulthood in Upper Klamath Lake, or consistent returns of adult salmon in the Klamath River, and in 2006 the government was forced to limit commercial and recreational fishing, such limits are possible again this year. Can we move beyond year-to-year management to a sustainable and healthy watershed for wildlife and people to enjoy for many generations to come? Is there hope for the Klamath River?

There are important reasons for optimism. The conclusions of the National Academy of Sciences' National Research Council in 2004 and 2007 have been taken to heart, and we are now all engaged in seeking a systematic and coordinated basinwide approach to ecological restoration and management. Federal and state governments are funding initial recovery actions, scientists are working to reduce our uncertainties, and, most importantly, the residents of the basin have committed to working together to their mutual benefit.

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Title

Columbia River Treaty Harvest: Past, Present, and Future

Abstract

Despite some differences in language and cultural practices, the Columbia River Tribes have always shared the foundation of a regional economy based on salmon. To the extent the resource permits, tribal people continue to fish for ceremonial, subsistence, and commercial purposes employing – as they always have – a variety of technologies. Tribal people fish from wooden scaffolds and from boats, use set nets, spears, dip nets, and poles and lines. Fisheries occur throughout the year targeting a variety of species from the mouth of the Columbia River, upriver to smaller tributaries such as the Icicle River in the Wenatchee system, with the main fisheries occurring between Bonneville and McNary Dams. This presentation will summarize the historical, cultural and economic importance of these fisheries to the tribes; describe monitoring and evaluation methods for these fisheries; and present some strategies the tribes are considering as we look to the future.

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Title
Unintended Consequences of Hatchery Reform

Abstract
The Fish and Wildlife Service's Pacific Northwest Region operates the largest group of anadromous fish hatcheries in the National Fish Hatchery System. In response to our internal desire to operate these hatcheries based on the best scientific knowledge available, consistent with threatened and endangered species conservation, and consistent with defined management purposes, we began formal scientific hatchery reform reviews in 1999. These reviews should be completed in 2008. The underpinning of these reviews has been the creation of multidisciplinary, independent teams of scientists who conducted the reviews and made hatchery and species specific recommendations to fishery management agencies on hatchery reform needs. While primarily a process of scientific review, the hatchery reform processes the FWS has been involved in have resulted in many additional positive results that I term "unintended consequences of hatchery reform". Included in these are development of new models facilitating decision-making in hatchery management decisions, development of strengthened and new partnerships with other state and tribal fishery managers, better public understanding of the role of fish hatcheries in modern hatchery management, better opportunities for public input on state, tribal, and federal fish hatchery management, and involvement of state and federal legislatures in assisting in the implementation of hatchery reform through legislation and funding. This talk will describe these many unintended consequences.

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Title

Initial response to quagga mussels on the Lower Colorado River.

Abstract

Quagga mussels (Dreissena rostriformis burgensis), closely related to zebra mussels, were first discovered at Lake Mead National Recreation Area on January 6, 2007, the first detection of this species in the western United States. These invasive freshwater mussels are expected to cause major impacts to
biological resources, submerged cultural resources, marinas, water intakes, boats and recreational use in the Lower Colorado River System and, if spread, pose similar threats to other western waters. The National Park Service led a three month interagency initial response effort focused on assessment, containment, treatment, and long-term management of the quagga mussel
infestation in Lakes Mead and Mohave. While the scope of the infestation was well beyond containment or eradication, and indeed the species has now been found in other waters of the southwestern United States, there are lessons to be learned from the experience that may yet protect other western waters from quagga mussels and perhaps other aquatic invasive species. The National Park Service has captured those lessons in a comprehensive "Quagga/Zebra Mussel Infestation Prevention and Response Planning Guide" designed to help other park units and land managers analyze their risk of invasion and take proactive steps to prevent it, detect it, and respond rapidly if necessary. The document is available at: www.nature.nps.gov/biology/Quagga/index.cfm. Sandee Dingman, the Interagency Initial Response Coordinator for Lake Mead, will candidly share the Lake Mead initial response experience: what worked, what didn't work, and what others can learn to be better prepared to deal with the challenges presented by aquatic invasive species.

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Title
Hatchery Reform: Implications for salmon homing and straying

Abstract
A major uncertainty associated with hatchery reform and the conservation of wild salmon populations is the causes and consequences of straying between and within populations. To appropriately manage salmon populations it is important to understand how hatchery practices (e.g., transport, hatchery rearing and release procedures) affect natal stream imprinting and homing fidelity. For segregated hatchery programs, reform goals have focused on measures to exclude hatchery strays from interacting with wild populations. In the case of integrated supplementation hatcheries, a basic premise is that artificially produced fish will increase natural production by establishing self-sustaining spawning populations in habitat that is underutilized. If hatchery fish simply replace or interfere with wild fish on the same spawning grounds, supplementation will be unsuccessful. To minimize negative interactions between wild and hatchery fish and establish spawning in underutilized habitat, a number of hatchery programs use satellite acclimation and imprinting facilities to reestablish self-sustaining natural spawning. However, the ultimate choice of spawning location within a watershed involves complex tradeoffs between homing to the natal or release site, spawning habitat selection and mate choice. I will review potential hatchery reform measures that may help minimize negative effects of straying by hatchery fish. In addition, I will describe ongoing studies examining the homing and spawning site selection patterns of spring Chinook salmon released as part of the Yakima/Klickitat Fisheries Project (YKFP) supplementation program. Our results suggest that release location strongly influences homing patterns but environmental factors and habitat availability also affect ultimate spawning site selection.

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Title

Climate Change on Columbia Basin Treaty-Tribal Lands: Past-Present-Future

Abstract

Trends in climate (i.e., temperature and precipitation) and streamflow are summarized for the last 100 years for select watersheds co-managed by the Columbia Basin Treaty Tribes (Warm Springs, Umatilla, Nez Perce, & Yakama)— the Deschutes, John Day, Umatilla, and Imnaha Basins of Oregon; Clearwater and Salmon Basins of Idaho; Walla Walla, White Salmon, Wenatchee, Methow, and Okanogan Basins of Washington. Timing of the freshet (i.e., spring snow-melt cycle) has moved from 2 to 14 days earlier in the last 100 years. The spring-summer runoff has shifted to autumn-winter by 2 to 24%. Current climate change is accelerating as evidenced with more extremes in the weather each year. Future climate change suggests a warmer and wetter Columbia Basin, less snow and summer flow. A key indicator to our future climate may be locked up in glaciers of Greenland. Mr. Dittmer went to Copenhagen, Denmark, and interviewed government climate researchers. He will share insights from the Danish scientists on the direction of our 21st century climate. New data suggests that our time to act may be shorter than expected. Policy implications and mitigative strategies will be offered.

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Title
Caspian Tern Nesting Habitat Management by the Corps of Engineers

Abstract
The management of Caspian tern nesting habitat in the Columbia River estuary has been a focal point of the Corps efforts to lessen their predation on juvenile salmonids. As indicated by Dr. Dan Roby and his research associates, losses of juvenile salmonids to Caspian terns in the Columbia River estuary were in excess of 12 million fish annually in 1997 and 1998. These reported losses stimulated an effort by various Federal and State government agencies plus non-governmental entities, to come up with management prescriptions to address these losses. The initial management prescription called for moving the Caspian tern colony from Rice Island to East Sand Island, approximately 15 miles downstream to diversify their diet and lessen juvenile salmonid losses. Habitat development at East Sand Island was completed in 1999. Social facilitation measures, decoys and sound systems, were also installed. By 2001, the entire Columbia River estuary Caspian tern colony (~9000 pairs) were nesting at East Sand Island. The colony has been maintained at that location since then. Juvenile salmonid consumption averaged 4.72 million fish annually from 2001-2005. The Corps is now implementing further dispersal of the East Sand Island tern colony to other locations in Oregon and California through development of alternative habitat and social facilitation with an objective of reducing the East Sand Island Caspian tern colony to 3500 – 4125 pairs.

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Title

Use and utility of large scale watershed assessment for salmonid improvement projects in California

Abstract

In order to better focus watershed and salmonid improvement efforts, the California Department of Fish and Game (CDFG) encourages Fishery Restoration Grants Program (FRGP) applicants to address limiting factors for salmon and steelhead that have been identified in existing watershed assessments and planning documents. A number of watershed assessments specific to northern California are available on the CDFG's Coastal Watershed Planning and Assessment Program (CWPAP) website at http://coastalwatersheds.ca.gov. The Big, Albion, Gualala, Mattole and Salt rivers, and Redwood Creek (near Orick, Humboldt County) assessment reports are available. Review draft assessments are also available for Lower Eel River, Outlet Creek (Eel River subbasin). Partial information is available for works in progress including Van Duzen River, San Luis Rey River, SF Eel River, Noyo River, and Russian River. These products include watershed assessment reports with background information, findings, limiting factor analysis, and improvement recommendations that should provide additional guidance to restoration project proposal applicants. Current assessments for 2008 include the Van Duzen, South Fork Eel, and coastal Mendocino streams and will be added to the site as they progress.

These assessments are also useful for projects requiring various construction or timber harvest permits. Since 2004, in excess of ten million dollars in watershed and fishery improvement projects have been, or are in progress based on these assessments. Check the web site under the "Watersheds" tab to see past, current and proposed assessment areas. For more information, contact Scott Downie at sdownie@dfg.ca.gov or (707) 725-1070.

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Title
Yukon River Chinook Salmon Age Consistency Study

Abstract
During the years that the Alaska Department of Fish and Game (ADF&G) has collected scales from Yukon River Chinook salmon Oncorhynchus tshawytscha; many different readers have interpreted scale growth patterns and assigned ages. Appropriate age estimation is an inherent assumption of historical age trend analysis. The objective of this study was to assess the level of temporal consistency by ADF&G in estimating Chinook salmon ages from scales. A subset of aged Chinook salmon scale impressions were selected from the Yukon River database and scale archives over a 43-year span (1964-2006). These scale impressions were aged by three independent scale readers. Age estimates by ADF&G were compared to the readers' estimates for consistency in age composition, systematic differences (bias), and agreement (precision). Results from these analyses suggest that ADF&G has consistently aged Chinook salmon over the past 43 years. No significant differences were found in the estimates of age composition among ADF&G and the readers. In general, the differences in age estimates were negligible and agreement was high. More importantly, age-specific differences and the levels of agreement were temporally consistent. Differences were identified in age-2 freshwater and age-5 saltwater estimates. In Yukon River Chinook salmon, these ages frequently occur with older-aged fish. Anecdotal information and recent studies have suggested a decline in the proportion of older-aged fish over the past several decades. Differences in estimating these ages may be affecting the estimated proportions of older-aged fish in Yukon River Chinook salmon populations.

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Title

Network dynamics and the resilience of native fishes

Abstract

Our view of river ecosystems and resilience of stream-living fishes (e.g., salmon) in the Pacific Northwest has been transformed by a new understanding of how stream network structure influences the dynamics of physical processes and biological responses. Concepts from landscape ecology have played an important role in this thinking. To illustrate, we address six of the major themes in landscape ecology and highlight recent work showing how they apply to the dynamics of stream networks, and to resilience of fishes. A dynamic stream network perspective provides an essential spatial and temporal context for the relatively shorter-term and smaller spatial scales at which humans attempt to regulate and restore habitats and fish populations. It also provides a context for viewing resilience of native fishes and stream networks in the face of future changes from human impacts to river ecosystems.

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Title

Analysis of biochronologies from western pearlshell mussel, Margaritifera falcata, in the Pacific Northwest

Abstract

Our objectives are to develop and validate methods for building freshwater mussel growth increment chronologies and relating those chronologies to the physical environment. Over the past two years we have been working to thin-section >400 valves from western pearlshells (Margaritifera falcata) collected from sites representative of diverse environmental conditions across Oregon, Washington, and Idaho. From two sites in Oregon we have multi-decadal time series of stream discharge and water temperatures for comparison against growth increments of mussels. In one of these locations, we address the following questions: 1) how well do growth increments in mussel valves relate to local stream discharge and temperature?, 2) are patterns of growth variable among sites in the same watershed? Results of this work will have important implications for understanding the value of mussels as indicators of environmental conditions in streams and also to contribute some basic information on age and growth of the species across the region. The latter should be useful for understanding the conservation status of mussels and for understanding basic processes influencing life histories and populations.

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Title

Bull trout habitat requirements and factors most at risk from climate change

Abstract

Bull trout is among the most stenothermal of all freshwater fishes in North America, and will certainly face increasing threats if water temperatures warm substantially in the face of climate change. Large areas or “patches” of cold water are necessary to support local breeding populations. Connectivity is also important because bull trout move extensively through stream networks. Connectivity within networks depends not only on the ability of fishes to move freely, but also on the relative locations of important habitats, and their seasonal thermal suitability. Considerably less attention has been focused on the latter in terms of the development of migratory life histories in bull trout. For example, where spawning locations are chronically cold, bull trout may be more likely to adopt a migratory lifestyle to exploit thermal environments more suitable for growth of juveniles and adults. In a fish assemblage context, evidence suggests that bull trout may be more vulnerable to impacts from nonnative species such as brook trout when water temperatures are warmer. Recovery activities to increase the chances that bull trout will persist in the face of climate change can benefit from a realization that thermal requirements of this species are diverse and involve different life stages, locations, and species interactions.

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Title

Habitat Restoration and Research in the lower Columbia River and Estuary

Abstract

Presently 13 Evolutional Significant Units (ESUs) are listed under the Endangered Species Act (ESA) within the Columbia River Basin. All 13 of these ESA listed salmon and steelhead uses the lower Columbia River and estuary to some extent. The U.S. Army Corps of Engineers have several authorities to conduct habitat and ecosystem restoration actions and are working with regional federal, state, Tribal, and non-governmental entities to restore shallow water habitats in an effort to assist recovery of these ESA listed salmonids. However, existing authorities for habitat and ecosystem restoration have limited abilities to conduct post restoration monitoring. The lack of post restoration monitoring makes applying sound adaptive management to the planning process difficult or non-existent. The Portland District as part of an AFEP funded research program evaluating cumulative response to multiple habitat restoration actions have developed an Adaptive Management Plan specifically for the lower Columbia River and estuary. While this plan is necessarily Corps centric, it has been designed to become transparent and allow the combining of regional state, federal, Tribal, and non-governmental entities activities. As restoration actions continue and associated effectiveness research is conducted it is our desire to have a truly regional habitat and ecosystem restoration adaptive management plan to assist and support all regional efforts. Three presentations following are examples of the some of the work the Corps is funding.

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Title

Assessing patterns of fish demographics and habitat in stream networks

Abstract

Effective habitat restoration planning requires correctly anticipating demographic responses to altered habitats. New applications of Passive Integrated Transponder (PIT) tag technology to fish-habitat research have provided critical insights into fish movement, growth, and survival. Syntheses of demographic data gleaned from PIT tags can now better inform and help prioritize restoration activities. Using habitat-specific growth, survival and movement data from PIT-tagged coho salmon (Oncorhynchus kisutch), we illustrate the potential benefits of spatially-explicit habitat restoration scenarios in an Oregon, USA coastal basin. Use of in-stream antenna arrays, remote scanning of PIT-tagged fish, and multiple recapture efforts allowed us to document seasonal movement, growth and survival throughout a 67 km2 basin over 4 years. We used hierarchical linear models to evaluate habitat-specific growth and survival rates, which we then incorporated into a stream network simulation model to estimate population sensitivity to specific habitat restoration scenarios. We found that under present conditions, survival and growth are greater in tributary habitats compared to downstream mainstem habitats. Intermittent tributaries are particularly important as seasonal refugia and provide valuable spawning and foraging habitats. Under potential restoration scenarios, the greatest benefits, in terms of sensitivity of juvenile coho salmon population abundances, are likely to be observed in the mainstem. These findings highlight the value of habitat-specific demographic data to restoration planning, and the utility of PIT-tag approaches for fish population monitoring at whole-basin scales.

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Title

Timing of adult and juvenile Pacific lamprey movements in the upper Eel River, Mendocino County, CA

Abstract

The upper Eel River supports a run of Pacific lamprey that migrate over 270 km from the mouth near Ferndale, CA to the upper tributaries in Mendocino and Lake counties. Pacific Gas and Electric Company owns and operates the Potter Valley Hydroelectric Project on the mainstem Eel River. During a long-term monitoring study (1985-1994), information was collected on Pacific lamprey. The lamprey data is analyzed and presented here with a focus on the timing of adult and juvenile movement.

Between 1986 and 1989, adult lamprey were captured in the Eel River above Outlet Creek (river kilometer 203; RK 203) and in Tomki Creek (RK 246) between mid-March and early June. Movement may have occurred before March but high flows limited trapping. At Cape Horn Dam (RK 252) between 1992 and 1995, adult lamprey were caught in low numbers through April, with higher numbers arriving in late May through early July. Trapping at this site is not flow limited and lamprey use the existing fish ladder, sometimes in large numbers.

Year-round trapping captured macrophalmia (a.k.a. juvenile) in low numbers in all months. Downstream movement was concentrated in late winter and spring. In most years there were two pulses of movement. The first occurred between mid-December and early February. The second pulse occurred in mid-February to late May. More lamprey moved on the second pulse. Although movement continued after the second pulse, numbers were greatly reduced. Pulses of movement were almost always coincident with pulses in streamflow.

Ammocoete (a.k.a. larval) pulses were similar to macrophalmia pulses, although fewer ammocoetes moved on the flow events that seemed to trigger large-scale macrophalmia movement. In years with concurrent trapping, fewer ammocoetes were captured further downstream, suggesting that ammocoetes may be locally dispersing to take up residence in new locations.

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Comparison of Natural- and Hatchery-Origin Female Broodstock from a Long-Term Chinook Salmon Supplementation Program: Age Matters

Abstract

The Imnaha River Chinook Salmon Supplementation Program has been in operation since 1982, with a goal of producing hatchery salmon with the same genetic and life history characteristics as natural salmon. Supplementation programs are used to augment natural populations in danger of extirpation. However, supplementation may have deleterious effects by changing the natural population, or by hatchery and natural fish diverging so much, over time, that they become two disparate populations. We examined physical and life history characteristics of Imnaha River Chinook salmon female broodstock to determine whether differences exist between hatchery- and natural-origin salmon, and whether changes have occurred over time.

Age structure differed by origin, with 52% of natural females maturing at age 5, and 76% of hatchery females maturing at age 4. We found that natural females were also larger, heavier and produced both more and larger eggs than their younger, hatchery-origin counterparts. Age 5 females spawned earlier in the year than age 4 females, regardless of origin.

We found that mean fecundity of hatchery females is decreasing, while mean length is increasing. Minimum eyed egg weights of both hatchery and natural females have decreased over time, and age 4 hatchery fish have higher mean fecundity than age 4 natural fish. Natural females have experienced a decrease in mean egg size, and their mean spawn time has shifted almost one week later into the year.

Overall, most differences between natural and hatchery females are attributable to differences in age. Returning a greater proportion of age 5 adults should produce hatchery fish which more closely mimic natural fish. We have initiated work with Genetic Analysis of Pacific Salmonids standardized loci to determine if natural and hatchery fish differ genetically.

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Title

Exploring Methods to Improve Fertilization Success with Cryopreserved Chinook Salmon Sperm

Abstract

Cryopreserved sperm is an important tool for conservation hatcheries and has been frequently used, with mixed results, in the Grande Ronde Basin Spring Chinook Salmon Captive Broodstock Program. Cryopreservation techniques used in the Captive Broodstock Program were adopted from protocols largely developed for rainbow trout sperm and have yielded poor fertilization rates (37 % average) when used with Chinook salmon. Literature reviews of cryopreservation techniques used in teleosts report varying levels of success using a variety of cryoprotective extenders, freezing, and thawing protocols. In an effort to improve fertilization rates, we examined three parameters: 1) ratio of cryopreserved sperm to eggs, 2) comparison of four freezing (extender) recipes, and 3) ratio of sperm to extender solutions. Because Captive Broodstock Chinook salmon are listed under the Endangered Species Act, two non-listed hatchery stocks, Bonneville fall Chinook salmon and Wallowa summer steelhead, were utilized as surrogates for these experiments. For experiments 1 and 3, fall Chinook salmon and the standard freezing recipe (DMSO + glucose) were used. Fertilization rates were low, 30.8% and 28.6%, respectively; however increasing cryopreserved sperm to egg ratios increased fertility at a rate of 2.4% per additional straw used for a given number of eggs and the standard ratio of 1:3 (sperm to extender) yielded the best fertilization rate. Summer steelhead were used in experiment 2 and, of the four extender recipes compared, the standard recipe yielded the highest mean fertility rate of 71%. The wide range in fertilization success for steelhead versus Chinook salmon using the same freezing protocol suggests that a species specific component may have contributed to the low fertilities for Chinook salmon in these experiments and in the Captive Broodstock Program. Additional experiments to explore new methods of freezing and/or thawing Chinook salmon sperm and improve fertilization rates are planned.

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Title

Development of a Comprehensive Steelhead Monitoring Plan for California's Central Valley

Abstract

Central Valley steelhead were listed as threatened under the Endangered Species Act (ESA) in March 1998. As a result of the decline, considerable efforts have been initiated to bring about recovery of anadromous fishes and their habitat. While these restoration and recovery efforts have been initiated, our ability to measure their success at improving the status of Central Valley steelhead has been hampered by sparse information regarding their distribution, abundance and population trends. The objective of this project is to develop a comprehensive monitoring plan for Central Valley steelhead that when implemented, will provide the data necessary to assess the progress towards restoration and recovery goals. The plan will aid resource managers in identifying the spatial and temporal scales necessary for assessing population trends, developing a web based user friendly database, addressing knowledge gaps, consolidation of baseline information on species abundance and habitat, and gauge the effects of recovery actions. The presentation will cover process, lessons learned to date, and request feed back from the attendees.

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Title

Livestock Grazing Management Systems for Riparian-Wetland Areas

Abstract

Livestock grazing management in riparian areas is one of the most pervasive issues facing land managers. Most public and private rangeland is grazed, and even though riparian areas constitute only about 8 percent of the total public land acreage, and less than 1 percent of the public land in many of the more arid Western states, most grazing allotments, including some desert allotments, contain some riparian acreage (Wyman et al.2006).

Livestock grazing can be a compatible use in riparian areas when managed in harmony with land management objectives, and when the function, capability, and potential of the site and the needs of the riparian vegetation guide the development of the grazing management prescription. Regardless of other differences in management objectives, grazing must be compatible with achieving or maintaining “proper functioning condition” to be considered sustainable (Wyman et al.2006).

No single grazing management system has resulted in consistent recovery of degraded riparian areas. Many combinations of sites, resource conditions, and impacts, as well as human perspectives, are involved. The grazing management system for an area should be tailored to the conditions, problems, potential, economics, and livestock management considerations on a site-specific basis. There is no set formula for identifying the type of grazing system or management plan that will be best for any livestock operation or allotment. Water quality impacts are closely related to concentration of livestock. The grazing system must be designed on the basis of soil and vegetation capabilities, water quality considerations, and livestock and wildlife requirements (Moore et al. 1979).

As long as there is control of livestock distribution and grazing intensity, the specific grazing system employed may not be important (Clary and Webster 1989).

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Title

Factors affecting the distribution, abundance and population dynamics of mountain whitefish in Idaho

Abstract

Mountain whitefish Prosopium williamsoni are one of four native resident salmonids in the upper Snake River basin in Idaho, but comparatively little is know about population characteristics. We electrofished 2,043 study sites to assess whether physiochemical stream conditions affected their distibution, abundance and population dynamics. Whitefish were captured at only 106 (5.2%) sites and in only 11 of the 20 major river drainages within the study area. They were present in only 2% of the sites where width was less than 10m, but 88% of the study sites where width was greater than 15m. We estimated that, within the upper Snake River basin, there were approximately 5.7 million +/- 1.9 million whitefish, mostly in fifth- to seventh-order streams. They were present in only 3% of the total stream kilometers but constitued 67% of the total game fish abundance where present. Mean annual temperature was positively correlated and site elevation was negatively correlated with mean length at age, and these variables explained 67% of the variation in the mean length at age-0. Mountain whtefish are long-lived, with 18 of the 20 pooulations containing fish estimated to be >10 years old. The oldest fish captured was an estimated 24 years old. Estimates of total annual survival rate averaged 0.76 (range 0.59-0.87). Whitefish transitioned from immature to mature at about 250mm and about age-2. Males matured at a smaller size than females but not at a youger age. Using logistic regression analyses, fish length alone explained 82% of the variation in the length at maturity. Fish age alone explained 79% of the variation in the age at maturity models for both genders. Addition of other variables added little to the strength of the maturity models.

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Title

The Chilkat River Coho Salmon Stock Assessment Program (Southeast Alaska)

Abstract

Since 1999, the Alaska Department of Fish and Game (ADFG) has monitored smolt abundance, fishery harvests, and spawner abundance of wild Chilkat River coho salmon. The Chilkat River, which flows into Chilkat Inlet near the northern terminus of Lynn Canal, is considered the third largest producer of coho salmon in Southeast Alaska. Annual estimates of total run size have ranged between 60,000 and 300,000 adults with exploitation rates from 30 – 65% in recent years. Information from this program was used to establish the first biological escapement goal of 30,000 – 70,000 for this stock in 2006. We present an overview of the stock assessment program and describe how this information was used in the escapement goal analysis.

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Title

Combining new technologies with traditional mark-recapture methods to estimate the number of green sturgeon that spawn in the Rogue River, Oregon

Abstract

Green sturgeon are anadromous and range from the Bering Sea to Ensenada, Mexico. Even though this species is known to spawn in only three river systems along the West coast of North America (Sacramento, Klamath, and Rogue systems), little has been done to estimate or monitor the abundance of spawning adults. A monitoring program should be implemented within spawning systems to ensure sustainability and/or recovery for this species.

We provide abundance estimates and confidence intervals for adult green sturgeon that spawn in the Rogue River, Oregon, using traditional mark-recapture methods. More than 300 adult green sturgeon were caught and marked (PIT tags and scute removal) in the river between 2000 and 2005. In 2007, 85 adults were caught by gill net to provide our estimate of abundance. In addition to estimating absolute-abundance for green sturgeon spawning in the Rogue River, we describe steps taken to provide the most accurate estimate possible. Estimates were improved by studies to (a) understand the behavior of green sturgeon using sonic and radio telemetry (e.g., determining spawning periodicity, time of entry and departure, and summer/fall holding sites), (b) estimate the total possible number of summer/fall holding sites throughout the river based upon known-holding sites and using a GIS framework, and (c) verify the presence and positions of green sturgeon at potential holding sites using a DIDSON camera before setting gillnets in order to maximize capture rates. Because we now understand the behavior of green sturgeon, and because more than 400 adults are tagged, little effort (< 3 weeks per year) is now needed for acquiring annual abundance estimates for Rogue River green sturgeon, which will be a significant asset to management. Our methods could be used as a template to develop sturgeon-monitoring programs for important spawning rivers throughout the world.

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Title

Prospects and Problems for Bull Trout Restoration in Hells Canyon

Abstract

Bull trout (Salvelinus confluentus) are a threatened specie under the Endangered Species Act. In Hells Canyon bull trout are confronted with a suite of biotic and abiotic problems that continue to threaten their persistence and may preclude their restoration in this remote area on the Oregon-Idaho border. Migration barriers, loss of marine derived nutrients, competition from brook trout (Salvelinus fontinalis) and other non-native fishes, mainstem Snake River and tributary habitat modifications and losses, and water quality degradation all present significant life history problems for this species. Past anthropomorphic activities that began over 100 years ago in this semi arid part of the Snake River Basin have resulted in isolated and fragmented bull trout populations whose long term viability is very much in doubt. Bull trout that occur downstream of Hells Canyon Dam are doing much better than those residing in Hells Canyon Complex tributaries and upstream of Brownlee Reservoir to the Malheur River confluence. Re-establishing migratory pathways, water quality improvements, reduced competition from brook trout, and possible marine nutrient supplementation are keys to bull trout recovery in the Hells Canyon area. Relicensing of the Hells Canyon Project in the last 10 years has opened several pathways to start bull trout recovery actions which are discussed in this presentation. Re-connecting some bull trout populations in headwater streams in southwestern Idaho may not be possible. Recent information on global climate change and how it might affect recovery actions for bull trout over the term of the next Hells Canyon Project license are also discussed in the context of future adaptive management actions and strategies. Elevation of the Snake River at Hells Canyon dam appears to be a key consideration in how this specie will be affected by global warming over the next 50 to 100 years.

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Title

The use of a resistivity fish counter to passively enumerate adult A run Héeyey (steelhead) in Lightning Creek, Imnaha River tributary, Oregon

Abstract

Snake River basin A-run steelhead (Oncorhynchus mykiss; Héeyey in Nez Perce) frequently spawn in small streams and determining run-timing and abundance is nearly impossible due to high water flows and low visibility typical of the spring spawning season. In this study, we evaluated the performance of a Logie 2100C resistivity fish counter to estimate run timing and steelhead abundance in Lightning Creek, a small, high gradient tributary of the Imnaha River. The resistivity counter detects the passage of fish by analyzing the change in resistance across three electrodes and records the time, direction of movement and the peak signal strength. Fish are identified by a unique resistivity pattern, allowing size and direction to be determined. Data generated by the resistivity weir were verified using a bi-directional adult picket weir installed various distances above the resistivity weir from 2005-2007. Years 1 and 3 the resistivity weir was installed approximately 300 meters below the picket weir. In year 2 the resistivity weir was installed approximately 30 meters below the picket weir. Movement patterns and the large number of up and down events measured by the resistivity counter in year 2 suggested that the picket weir delayed upstream steelhead migration and this cycling of fish across the resistivity counter made escapement estimates difficult. Results from years 1 and 3 indicated that although the resistivity weir was good at estimating run timing, abundance estimates were difficult due to a variety of physical issues such as an unreliable solar power source and debris from high water events. In spite of this, we feel that the resistivity counter can provide a reliable estimate of run-timing and may provide a good estimate of adult steelhead abundance given a reliable power source and suitable installation site.

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Title
Maggie Creek Watershed Restoration Project

Abstract
As mitigation for a major gold mine, Newmont Mining Corporation, in conjunction with the Elko Bureau of Land Management (BLM), Elko Land and Livestock Company (TS Ranch), and other partners, developed the Maggie Creek Watershed Restoration Project (MCWRP) to improve streams, riparian habitats, and watershed conditions within the Maggie Creek Basin, located in Northeastern Nevada. The MCWRP was designed to enhance 1,982 acres of riparian habitat, over 40,000 acres of uplands, and more than 82 miles of stream. The Maggie Creek Basin supports some of the most important habitat in Nevada for Lahontan cutthroat trout, a federally listed threatened species. The primary means of habitat restoration in the Basin is through the application of prescriptive livestock grazing, although other measures including exclosure fencing, water developments, use of conservation easements, riparian plantings, and removal of fish barriers are also part of the overall management effort. An extensive monitoring program initiated in 1993 includes measurements of fisheries and riparian habitat conditions, trout distribution and abundance, water quality and quantity, and livestock grazing impacts. Results to date show an elevated water table; increased sinuosity; increases in riparian vegetation; extensive sediment capture; increased depth at the shorewater interface; development of quality pool habitat; narrowing and deepening of the stream channel; and, an increase in the number and distribution of Lahontan cutthroat trout. Because of the nature and extent of the data available in the Basin, the MCWRP is also being used to develop innovative monitoring protocols at the watershed level.

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Title

Evaluating the impact of avian predators on juvenile salmonids from the Columbia River through the recovery and analysis of PIT tags

Abstract

Each spring millions of downstream migrating juvenile salmonids from the Columbia River basin are tagged with Passive Integrated Transponder (PIT) tags to gather information on their survival and behavior. Each year, thousands of these PIT-tagged fish are consumed by colonial waterbirds and subsequently deposited on avian colonies throughout the Columbia River basin. The recovery of PIT tags on bird colonies has been used as a direct measure of predation rates on salmonid species listed under the Endangered Species Act (ESA) and these data can be used to assess the relative vulnerability of various salmonid species, stocks, and rearing types to avian predators.

Previous estimates of predation rates based on PIT tag recoveries, however, were considered minimums because not all tags consumed by birds are deposited on the nesting colony and not all tags deposited on the colony are detected. More accurate predation rate estimates can be generated by (1) physically removing tags from avian colonies, where PIT tag collision (interference) reduces detection efficiency; (2) systematically sowing test PIT tags with known tag codes on bird colonies in order to directly measure PIT tag detection efficiencies; and (3) conducting experiments to measure on-colony deposition rates of PIT tags ingested by avian predators. Results of these experiments indicate predation rate estimates are influenced to varying degrees by both the species of avian predator and the location of the avian colony. Data collected to address these sources of bias were used to develop more reliable estimates of predation rate in order to evaluate the relative impact of piscivorous waterbird colonies on survival of salmonids smolts from the Columbia Basin during 2004-2007 and are presented here.

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Title

Radio Telemetry Studies of Juvenile Salmonids at Bonneville Dam's Corner Collector in 2004 and 2005

Abstract

To increase non-turbine passage and survival of juvenile salmonids, the U.S. Army Corps of Engineers completed construction of the Bonneville Dam Second Powerhouse Corner Collector (B2CC) in early 2004. To create the B2CC, the existing ice-trash sluice chute was modified to ensure safe fish passage and a 2,800-foot long transportation channel, 500-foot long outfall channel, and a plunge pool were constructed. We conducted two years of post-construction evaluation of the B2CC using radio telemetry to estimate passage and survival of juvenile salmonids passing through the B2CC. In 2004, we radio-tagged and released 6,716 yearling Chinook salmon (Oncorhynchus tshawytcha), 4,399 yearling steelhead (O. mykiss), and 11,683 subyearling Chinook salmon. In 2005, we radio-tagged and released 5,820 yearling Chinook salmon, 4,278 yearling steelhead, and 6,525 subyearling Chinook salmon. Overall, 30-37% of yearling Chinook salmon, 66-74% of steelhead, and 37-40% of subyearling Chinook salmon passing the second powerhouse went through the corner collector, depending on the year of study. Passage through the B2CC was significantly higher during the day than during the night for all species. The effectiveness of the B2CC, or the proportion of fish that passed through the B2CC relative to the proportion of discharge at the second powerhouse, ranged between 5.6 and 14.2, depending on species and year; relatively high compared to spillway effectiveness of about 1.0. Route-specific survival estimates for the B2CC were higher than for any other passage route and ranged from 0.990-1.028 for yearling Chinook salmon, 1.01-1.03 for steelhead, and 0.95-1.01 for subyearling Chinook salmon, depending on the year of study.

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Title

Lahontan Cutthroat Trout Habitat Improvement in Response to Prescriptive Livestock Grazing Practices

Abstract

As part of the Maggie Creek Watershed Restoration Project (MCWRP), a prescriptive grazing program was employed by the TS Ranch in cooperation with the Bureau of Land Management (BLM) and Newmont Mining Corporation on approximately 40,000 acres of mixed public and private lands in the Maggie Creek Basin in Northeastern Nevada. Streams in the Maggie Creek Basin support Lahontan cutthroat trout (LCT), a federally listed threatened species. Historically, habitat conditions were poor as a result of season-long grazing by livestock. Beginning in 1993, changes in the time and timing of grazing as well as application of livestock husbandry practices were initiated for the purpose of improving stream and riparian habitat conditions for LCT and other species. Permanent stream survey stations were established in the Maggie Creek Basin beginning in 1977. As part of the MCWRP, an intensive stream monitoring program was established to evaluate changes in LCT habitat conditions over time and to monitor the effectiveness of the livestock grazing plan. Monitoring shows improvement in many habitat parameters important to LCT as a result of prescriptive livestock grazing practices. Coyote, Little Jack and Maggie creeks show increases in pool quality, depth at the shorewater interface, and in the amount of woody riparian vegetation overhanging the water column. In addition all three streams have become narrower and deeper. Extensive beaver dam complexes are forming along Maggie Creek, while pastures supporting a mixture of upland and riparian habitats are becoming increasingly mesic. As habitat conditions continue to improve, opportunities exist to adapt grazing protocols to a more robust riparian environment and to explore increasing grazing use of uplands.

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Title

Potential causes of size trends in Yukon River Chinook salmon populations.

Abstract

Concerns regarding the size and sex composition of Yukon River Chinook salmon Oncorhynchus tshawytscha have been expressed in public meetings for over a decade. However, reports of small size and low numbers of females have become increasingly common in recent years, and apprehension over the long-term health of the stock has grown within the drainage. In response to these reports, the Salmon Size Subcommittee of the US/Canada Yukon River Joint Technical Committee was formed and charged with advising the Committee, and thereby the US/Canada Yukon River Panel, with respect to changes in Chinook salmon age, sex, and size composition. This report, which summarizes the findings of prior investigations and the scientific literature on factors that influence salmon morphology, represents the first product of the subcommittee. Overall, evidence that the morphology of Yukon River Chinook salmon has been altered over time is limited, but suggestive. Existing analyses document a decrease in the mean weight of commercial harvests, a reduction in the prevalence of the largest fish, and the apparent near disappearance of age-8 fish. However, other important metrics, such as mean length-at-age, do not appear to have changed substantially. Whether the changes observed within Yukon River Chinook salmon have resulted from environmental or fishery-induced selective pressures, or a combination of both, is difficult to determine with certainty. In any case, the morphology of Yukon River Chinook salmon may be slowly changing. Expanded monitoring of age, sex, and size is warranted, as is directed research to identify causes and consequences.

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Title
Taking the LABOR out of Collaboration

Abstract
Collaborations, partnerships, teams, task forces, advisory committees are all attempts to initiate a “conservation conversation” with all parties who need to be involved in managing natural resources these days. Going it alone is neither wise nor possible in this age of “partnering”. A sound, logical, framework for public/agency interactions has been developed that provide guidelines for conducting multi-partner collaborative efforts.

The fundamental concepts of “Ethics, Momentum and Closure” are applied to a collaboration process that produces results! Fundamental concepts of an ethical approach are described as being ”fair, open, and honest” – if you can positively affirm that you have met those three standards of ethical behavior, then your project has a chance!

A collaborative framework that includes key components of: the right players; striving for consent; a solid deadline for completion; always seeking closure; a constant focus of reducing rather than expanding the scope of a project; and finally, utilizing a skilled facilitator, are defined as essential elements of a successful collaborative effort.

By sharing their successful approach to multi-party collaboration efforts the authors provide a pathway to natural resource issue resolution that can be applied to contemporary fisheries management challenges.

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Title
"Wicked Problems" and How to Solve Them

Abstract
Problems are never easy to solve – that's why they are a problem! Lawrence J. Peter contends that "some problems are so complex that you have to be highly intelligent and well informed just to be undecided about them." That sounds like any fisheries issue we have dealt with in the past 20years!

A traditional linear approach to problem solving, i.e. Gather data…Analyze Data…Formulate Solution …Implement Solution…often falls short of problem resolution due to the complexity inherent in multi-stakeholder efforts.

We are now in an age where collaboration is the often used technique to deal with complex social/resource issues. When people arrive at a collaborative process, they really aren't seeking a solution so much as seeking to convince others of their solution to a problem. Multiple parties mean multiple and often conflicting solutions. The recent use of the term "Wicked Problems" to describe todays socially and scientifically complex problems is appropriate. The solution therefore, requires a "re-think" of the way in which we strive for a solution. Dr. Jeff Conklin contends that "problem understanding can only come from creating possible solutions and considering how they might work." Thinking in a group process characteristically follows a path of sorting solutions rather than crafting one, with the problem often becoming re-defined in the process.

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Title
Why the Hells Canyon Not - Fish Passage into Oregon Tributaries

Abstract
Idaho Power's Hells Canyon Hydroelectric Project blocks access and upstream movement of salmon and steelhead into historic spawning and rearing areas of the Snake River above river mile 247. Immediately following Project construction, passage above Brownlee Dam was attempted and then abandoned in favor of hatchery production. Idaho Power proposes to continue operating four hatchery facilities in lieu of fish passage for the next license term.

Oregon laws and management plans, however, require safe upstream and downstream fish passage in all waters of the state in which native migratory fish are currently or have historically been present. Relicensing of Idaho Power's Hells Canyon Hydroelectric Project provides an opportunity to reintroduce anadromous fish to important Snake River production areas blocked for 50 years by the Project's dams. Sufficient habitat and water quality exists to warrant reintroduction into several Oregon tributaries, including Pine Creek. In addition, a viable means of collecting upstream migrants for trap-and-haul operations is already available with the trap at Hells Canyon Dam. Collection of downstream migrants for transport will be possible once a proposed monitoring weir for bull trout begins operating permanently at the mouth of Pine Creek. Because suitable habitat exists and practical means are available for passing fish, the Oregon Department of Fish and Wildlife recommends a license article requiring Idaho Power to develop and implement a Fish Passage Plan for reintroduction of spring Chinook salmon and summer steelhead to Oregon tributaries above Hells Canyon Dam. Initial efforts should focus on reintroduction into Pine Creek.

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Title

Correlations of depth and substrate variables with Willamette River fish assemblage metrics

Abstract

Several different IBI metrics used to assess Willamette River fishes have neglected investigating depth and substrate measures as predictors of variation in guild and taxonomic metrics. Studies comparing correlation strength of these physical habitat variables to assemblage metrics are required. To address this gap, data collected from the mainstem Willamette River were analyzed. Twenty sites in a reach from river kilometer 291-35 were surveyed during the summer of 2006. Over 50 taxonomic, habitat and trophic guild metrics were investigated for correlation strengths with 22 predictive measures of depth and substrate. Data were analyzed by Hyperniche and Excel. Significant correlations were detected between 6 predictors and 20 response metrics (R-values 0.3-0.7). Thirty percent of response metrics displayed strong correlations with 29% of predictors (p-values >0.05). The strongest predictor, percent subdominant fines and sand in the littoral zone, correlated with 80% of the response metrics. Invertivore metrics were the most commonly correlated response metrics. These results suggest the potential for developing predictive models for fish metrics. They also highlight the importance of addressing and investigating depth and substrate conditions prior to rehabilitation plans for mainstem large rivers where alteration or maintenance of local fish assemblages are goals.

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Title

Spatial patterns of Yakima River Spring Chinook spawning before and after supplementation

Abstract

In the Columbia River basin a number of hatchery supplementation programs have been developed to bolster wild salmon populations. One goal of these programs is to expand populations into habitat that is underutilized without negatively impacting established wild salmon. In particular, many programs utilize satellite acclimation/imprinting facilities to reestablish natural spawning in historically productive stream reaches. To examine the effectiveness of one such program, we studied the spatial distribution of spawning spring Chinook salmon released from the Yakima-Klickitat Fishery Project (YKFP) supplementation program into the upper Yakima River . Specifically, we mapped and compared the spatial patterns of spawning before and after initiation of the YKFP program. In addition, we compared these patterns to spawning patterns over the same time period in a similar unsupplemented spring Chinook population (Naches River, WA). The density of spawners in the upper Yakima River increased and their distribution changed after initiation of supplementation. However, the distribution of redds also changed in the unsupplemented control population during this time period suggesting that the spatial changes we observed may also partly reflect natural shifts in spawning distribution. One area specifically targeted for supplementation, the Teanaway River, demonstrated dramatic increases in the number of salmon spawning over pre-supplementation periods.

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Title

Results From an Integrated Spring Chinook Hatchery in the Yakima Subbasin

Abstract

The Cle Elum Supplementation and Research Facility (CESRF) was designed to test the hypothesis that hatchery produced Spring Chinook (Oncorhynchus tshawytscha)salmon could be utilized to increase natural production and harvest while minimizing genetic and ecological risks to target and non-target populations in the Yakima River. The project began in 1997 with the collection of adults at Roza Dam on the Upper Yakima River. Genetic guidelines include using only naturally produced broodstock, collected throughout the adult migration timing, leaving at least half the returning adults to spawn naturally, and a factorial mating design. Experiments were conducted over a five year period to include variable environmenal factors such as stream flow and ocean conditions. The first experiment tested whether Semi-Natural rearing Treatment (SNT: camoflauge-painted raceways, surface and underwater structures, and underwater feeders) increased survival of outmigrating smolts and returning adults over the Optimum Conventional Treatment (OCT: concrete rceways and surface feeding). Passive Integrated Transponder(PIT), coded-wire (CWT), and visual implant elastomer (VIE) tags were used to evaluate survival. We found insufficient evidence to conclude that the SNT treatment resulted in higher survival indices than did the OCT control. We monitored the homing fidelity of fish released from three acclimation sites. Reproductive success of supplementation versus naturally produced adults was evaluated in a spawning channel. Recent research efforts focused on evaluation of different juvenile growth profiles on production of precocial males versus smolt outmigration survival. Another recent research project included development of a Hatchery Line (returning hatchery adults as broodstock) to evaluate the effects of multiple generations of hatchery rearing on incidence of domestication, and inclusion of a control population (Naches River). This allows us to track the long-term trends of the supplementation, hatchery, and control populations. A DNA parentage analysis is also being conducted.

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Title

Remote sensing techniques for mapping aquatic habitat: River channel morphology and thermal heterogeneity

Abstract

Watershed Sciences has collected airborne thermal infrared (TIR) imagery of streams and rivers in the Pacific Northwest for almost a decade. While project specifics have varied, the general goal has been to better understand stream temperature dynamics by mapping spatial patterns of temperature along the stream gradient, with a common derived product being a longitudinal temperature profile. In many cases, TIR imagery has been collected on the same streams in multiple years and under different flow conditions, allowing direct temporal comparison of longitudinal temperature profiles in a given watershed. Results of these analysis have revealed that spatial temperature patterns correspond in predictable ways with stream gradient and valley morphology. In addition, for multi-year studies, we have observed that while absolute temperatures vary, thermal spatial patterns are remarkably consistent among years. Results hold a number of implications for the monitoring of thermal habitats and stream temperatures.

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Title

Does our scale of observation affect our perception of which habitat types are important for Pacific salmon?

Abstract

In order to explore the influence of spatial “scale” on the apparent relationship between habitat and animal populations, we examined the correlation between GIS-based habitat data and various ESA (Endangered Species Act) listed anadromous Pacific salmon (Oncorhynchus spp.) populations in three subbasins of the Columbia River basin, USA.

We characterized habitat and ran our models at three different spatial extents: local (~15 km2), intermediate (~250 km2), and landscape (> 500 km2). Salmon population data were derived from annual redd count surveys, collected for many decades by various state agencies. The “habitat” geospatial data included land use and land cover, geology, terrain, precipitation, temperature, dams, diversions, mining hazards, and livestock grazing allotments. We used mixed statistical models to explore the relationships between redd density and candidate explanatory variables, and we used the Bayesian Information Criterion (BIC) to select the most appropriate covariance structure, as well as to compare models. We created models for each of the three aforementioned extents, and we also created multi-extent models that combined the best habitat variables from the three different extents of analysis.

Overall, redd densities were most often correlated with land use variables, while land cover, structure and geology were also correlated, but not as frequently. Climate variables were not included in any of the final models. Certain categories of variables were better correlated with salmon redd density at a particular extent. However, our intermediate-extent models usually provided poor predictive power compared with our local- and landscape-extent models, and r2 values for these models were higher as well.

Based on these results, we conclude that our perception of which habitat attributes are important is clearly a function of our extent of observation, and that restoration efforts should focus on different habitat characteristics depending on the “scale” of the restoration effort.

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Title

Baker Sockeye Recovery: When Opportunity Met Effort

Abstract

In an analysis of Baker River sockeye salmon adult return data conducted in 1978, population numbers were trending downward with a predicted extinction within three generations. By 1986, the end of the second generation, the stock had declined to 99 total adults and in 1998 was officially proposed for listing under the Endangered Species Act. A series of baseline habitat and passage studies conducted beginning in 1981 and continuing to date permitted the Baker River Committee, an ad hoc group of resource agency, tribal and utility biologists, to formulate and implement a successful recovery process. Recovery elements included supplementation programs, improved spawning conditions, disease containment and management protocols, and modified passage facilities and programs. Beginning with the remnant population of 99 adults in 1986, efforts by the group resulted in a population rebound to a historic high return of 15,991 in 1994, followed by a return of 13,187 in 1998. As a result, the stock was removed from listing consideration in 1999 and experienced another record high return of 20,225 adults in 2003. Eight of the top 10 years on record have occurred during the recovery period. The recovery represents a significant benchmark for collaborative problem solving.

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Title

TRANSFER OF A WESTERN PEARLSHELL MUSSEL (Margaritifera falcata) POPULATION TO THE WILLAPA NATIONAL WILDLIFE REFUGE, WASHINGTON

Abstract

In September 2007 the Willapa National Wildlife Refuge, located in southwestern Washington, transferred 100 Western Pearlshell Mussels (Margaritifera falcata) to three refuge streams. Mussels were collected from the nearby Bear River, which contained a healthy population of Western Pearlshell Mussels, and transferred to several sites on the three small streams. These destination streams contained no mussels but exhibited suitable habitat and the presence of host fish.

An explanation of the process including objectives, donor surveys, permitting, and collection, transfer and relocation techniques will be presented as well as to-date results of monitoring. All transferred mussels were individually tagged and original orientation, burial depth, length, width and weight were recorded. The long-term monitoring program consists of documenting: 1) overall mussel survival, 2) growth, 3) reproduction, 4) recruitment and survival of new juveniles.

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Title

Utilization of Similar Stream and Floodplain Restoration Techniques in Forested Arid and Temperate Rainforest Environments

Abstract

Forest land management in the western USA has led to stream and riparian systems lacking large downed wood, reducing coldwater fisheries habitat quality. Large wood plays a significant role in habitat quality and quantity in both arid New Mexico and temperate Oregon rainforest watersheds. Habitat restoration projects using similar design concepts were implemented to reintroduce this important habitat element. Although natural levels of downed wood in both watersheds were quite different, the role large wood played in channel formation, maintenance, and fish habitat creation was similar. Both watersheds are located wholly or partially on National Forest system lands, and have been actively managed for over 100 years. Historical impacts leading to downed wood reduction in both watersheds were similar, including grazing, timber harvest, and road building. The New Mexico stream flows through alluvial fans and debris cones, and is flashy with two peak flow periods: spring snowmelt and summer monsoons. The Oregon stream lies within a U-shaped glacial trough, is spring-fed with stable base flows, and experiences peak flows from spring snowmelt.

Restoration goals were similar for both streams, centered on increasing channel and floodplain roughness and fish habitat complexity, but treatment intensity differed greatly. About 300 pieces of wood were added to a 3.2 km stream reach and floodplain in New Mexico, whereas over 1200 logs were added to a 1.6 km stream reach and floodplain in Oregon. Size, amount and type of wood added into project areas depended on adjacent forest type, stream size, flow regime, proximity to infrastructure, and material availability. Woody debris was not anchored at most sites in Oregon, but was anchored in the New Mexico stream reach. Preliminary monitoring indicates both streams are responding favorably to the increased roughness.

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Title

The Physiological Effects of Whirling Disease in Resistant and Susceptible Crosses of Rainbow Trout

Abstract

Laboratory experiments have determined that a German strain (GR) of rainbow trout is more resistant to Myxobolus cerebralis than other strains of rainbow trout. Experiments have also shown that crosses of GR and Colorado River rainbow (CRR) trout acquire resistance to the parasite. Three hybrid crosses and pure GR and CRR strains were evaluated for their resistance to the whirling disease parasite. Growth and swimming characteristics were also measured to evaluate the physiological effects of whirling disease. Individual families (single male/female matings) were used as replicates, with 25 fish per family. Ten pure GR and ten CRR families, and 20 families of the hybrid crosses were evaluated in this experiment. For the growth study, fish were fed four percent of the tank batch weight for four months. Infection did not influence growth rate during the experiment. Infected GR fish weighed significantly less that their controls, although this difference may be attributable to causes other than infection. For all other crosses, control and infected treatments did not differ. There were significant growth differences among the strains tested. We tested a total of 735 fish, consisting of fish from each group, at four time periods over six months to estimate swimming performance. Swimming performance was not significantly influenced by infection but there were significant differences among the strains. In general, the CRR group had better swimming performance than the GR group and the hybrids were intermediate.

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Title

Determining the Effects of Water Management Actions on Suitable Habitat and Abundance of a Critically Imperiled Estuarine Fish (Delta Smelt Hypomesus transpacificus)

Abstract

Anthropogenic modification represents a major worldwide factor affecting estuarine ecosystems. Greater understanding of the mechanisms of how anthropogenic modifications affect aquatic organisms dependent upon estuarine habitats is essential to balance services provided to humans and ecosystems. Based on over 40 years of data, we defined suitable physical habitat for delta smelt with a generalized additive model. Delta smelt is an annual euryhaline osmerid endemic to the San Francisco Estuary which is on the verge of extinction. We found that the amount of suitable habitat for delta smelt has a significant positive relationship with estuarine inflow. The amount of suitable habitat, in turn, accounts for a significant amount of variability in the stock-recruit relationship. Estuarine inflow provides a better fit to the stock-recruit model than habitat area, suggesting that inflow captures both abiotic and biotic processes in the population dynamics of delta smelt. We developed a forecast model to evaluate the likely affects of different management strategies for estuarine inflow on the abundance of delta smelt. Simulations suggest that a strategy which maintains high inflows can enhance both the habitat and abundance of delta smelt.

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Title

Abiotic Factors Structure Native Fish Assemblages in an Urban Stream

Abstract

In recent years, efforts to determine variables that shape fish assemblages in the South Platte River in the Denver metropolitan area have met with limited success. Because many plains fishes are resistant to a wide range of environmental stressors, it is often difficult to determine the effects of individual stressors on the fish assemblage. Fishes in this urbanized portion of the South Platte River are affected by stressors such as modified flows from reservoir releases and water withdrawals, input of municipal wastewater effluent, fragmentation, channelization, and storm water runoff. Species richness and abundance throughout this 49-mile reach demonstrate fluctuations of varying direction and magnitude between sampling sites. We investigated the factors that structure the fish assemblage of this reach of the South Platte River. Some widely-distributed, common species native to the drainage were absent from the entire reach. Although these species tolerate a wide range of environmental conditions, they are intolerant of organic enrichment, suggesting that species richness is influenced throughout the reach by large-scale stressors such as water management practices and nutrient enrichment. On a smaller scale, local fish assemblages appear to be controlled by reach-scale habitat features. Severe fragmentation has forced fish populations to persist at a small spatial scale, reinforcing the local nature of assemblage structuring. Canonical correspondence analysis (CCA) has been used in other streams to determine factors affecting fish community composition. The results of a CCA for the South Platte River in the Denver metropolitan area suggest that local physical habitat features such as channel morphology are an important factor in controlling fish species richness and abundance. Our observations and analysis results suggest that local fish assemblages in the urbanized portion of the South Platte are controlled by abiotic factors operating at multiple scales.

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Title

Mechanical Removal Effectiveness of Northern Pike in the Upper Yampa River, Colorado, 2004-2007

Abstract

Northern pike (Esox lucius) were introduced to the Colorado River drainage for sportfishing purposes and are heavily impacting threatened and endangered fishes. Northern pike were removed from a 38-mile stretch of the Yampa River, Colorado in the spring of 2004-2007. Methods employed included fyke nets set in localized areas and reach-wide DC electrofishing. In all years on the first pass we tagged and released all pike and removed all pike in subsequent passes (n=6). Objectives of the study were to reduce numbers of the adult northern pike population in the study reach, determine northern pike abundance and size structure in the study reach and the subsequent changes in the abundance and structure after removal, and determine if sampling (removal) concentration areas is effective. High capture probabilities (0.07 – 0.18) allowed for precise estimates of abundance and high removal rates (46%-63% annually). Adult northern pike abundance estimates declined after a total of 2267 northern pike were removed from the river. Catch rates also declined within all years although no significant trends were detected. Mean length of northern pike captured varied by year and pass. Management implications and recommendations both within the study reach and basin wide are to develop a concise control strategy and to expand efforts into other areas.

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Title

The good data paradox: Lessons in landscape modeling for coho salmon in western Oregon

Abstract

High resolution, spatially extensive data on populations and habitats are necessary to understand and manage widely distributed salmon species. Collecting field data over large areas is prohibitively expensive and time consuming; therefore, such data are generally lacking. To fill this gap, statistical relationships have been developed that can predict site-specific conditions from landscape characteristics. In this study, we develop and evaluate statistical models to predict densities of coho salmon spawners from digital landscape data on climate, topography, land ownership, land use, and land cover. This study provides a rare opportunity to compare models developed using coho salmon spawner densities from index survey reaches (N=44) and from spatially-balanced randomly selected reaches (N=100). We used index data that were collected from 1981-1997 and random data from 1998 – 2006. Both datasets were distributed across the Oregon Coastal Province (20,305 km2). We found that predictive power was generally greater for the models developed with the index data than for those developed with the random data. The random data contained numerous reaches for which coho salmon spawner densities were estimated as zero in some years. In a two-step modeling approach with the random data, logistic regression was unable to accurately identify years when specific reaches had no spawners. Results suggest that numerous factors, including many not assessed in this study, determine whether or not an area is used for spawning. However, landscape characteristics can effectively predict relative spawner densities in spawning reaches. Results of the study allow us to identify: 1) reaches expected to support higher densities of coho salmon spawners among years, 2) landscape characteristics that may influence fish production, and 3) testable hypotheses regarding relationships between salmon abundance and landscape characteristics.

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Title
Habitat Rehabilitation in the Okanogan Sub-basin

Abstract
The Okanogan River is the uppermost tributary of the Columbia River supporting anadromous salmonids. The Okanogan River sub-basin encompasses an area of nearly 9,000 square miles of forested, shrub-steppe landscape of which approximately 70% lies in British Columbia, Canada. Many tributaries of the Okanogan River have been diverted or otherwise reduced in flow by primarily irrigation diversions to support agricultural production. Stream-type Chinook salmon and summer steelhead which require e cold-water habitat are considered extirpated or are recognized as “endangered”. Since the mid-1990’s, the Colville Tribes have put forth a diligent effort to rehabilitate habitat in the Okanogan River basin to support anadromous salmonids. Rehabilitation efforts have included providing passage at dams, augmenting stream flow and culvert replacement, The results of these efforts have reconnected in excess of 20 miles of tributary and nearly 7 miles of mainstem habitat. Limited resources and information have resulted in opportunistic habitat rehabilitation efforts but with additional resources dedicated to project development and implementation, we anticipate dramatic increases in abundance, productivity, and diversity to occur within the Okanogan River over the next decade.

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Title

Stock Structure and Mixed-Stock Analysis of Yukon River Chum Salmon

Abstract

The management of Yukon River chum salmon fisheries is difficult because of the need to address a variety of complex issues, such as meeting escapements, while still providing harvest opportunities in a mixed-stock and mixed-species fishery. Yukon River chum salmon were assayed for genetic variation at 22 microsatellite loci to establish a baseline for mixed-stock analysis (MSA) applications to assist in addressing these issues. Yukon River chum salmon exhibited a relatively low degree of genetic divergence (GST = 0.0157) that was structured by seasonal race and geographic region. Using the 12 most informative loci, accuracies in MSA simulations for 14 of 17 reporting groups exceeded 90%, with a range of 80 – 98%. Stock composition estimates were within 10% of the actual proportions in a known mixture analysis. Stock specific abundance estimates, derived from combining the estimates of genetic stock composition with Pilot Station sonar abundance estimates, were concordant with upriver escapement data, after accounting for harvest. The combination of genetic MSA estimates from the baseline developed in this study and Pilot Station sonar abundance estimates provides a viable tool for assessing stock strength and assisting managers in regulating fisheries to maintain the productivity and evolutionary potential of Yukon River chum salmon.

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Title

Use of PIT tags to examine migration patterns of resident rainbow trout and hatchery steelhead crosses in the Grande Ronde River Basin, Northeast Oregon

Abstract

Oncorhynchus mykiss exhibit both anadromous (steelhead) and resident (rainbow) life history strategies. Progeny from crosses of rainbow and steelhead trout can exhibit seawater adaptability and have been used to develop seawater culture programs. However, it is not clear whether progeny from rainbow trout will complete all aspects of smoltification. This experiment used adult steelhead returning from a hatchery program and adult rainbow trout collected from their natural spawning grounds. We crossed steelhead females with steelhead males (SFxSM), steelhead females with rainbow males (SFxRM), rainbow females with steelhead males (RFxSM), and rainbow females with rainbow males (RFxRM). Progeny from these crosses were reared in a hatchery steelhead program and released in their first spring as smolts. We used a 6-year PIT-tag study to assess the migratory history of smolts from various crosses. Between 88 and 2,151 juveniles of each progeny were PIT tagged in the fall, and following their release, we monitored detections at downstream sites to determine migration numbers, timing, survival, and subsequently the number of returning adults. Based on PIT-tag detections, median arrival at Lower Granite Dam was early June for steelhead progeny, late June to early July for steelhead crossed with rainbow, and mid-July for rainbow crosses. At Bonneville Dam, the median arrival for all crosses was mid to late June, however, not all crosses were detected from every release year. Average survival estimates to Lower Granite Dam were highest for steelhead crosses (SFxSM = 48.8%), intermediate when steelhead were crossed with rainbow (SFxRM = 35.4%, RFxSM = 27.9%), and lowest for rainbow-only crosses (RFxRM = 7.7%). Results suggest that progeny from all crosses will migrate as smolts, although at different rates and histories.

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Title

Multiple Spatial Scales in an Analysis of Two Life History Stages of Coho Salmon

Abstract

Life history diversity over broad spatial extents characterizes populations of anadromous salmonids in the Pacific Northwest. The life history of coho salmon, Oncorhynchus kisutch, is a complex example of adaptation in response to diverse habitats in a dynamic environment. It is possible that ecological processes acting at different spatial scales influence the abundance and distribution of coho salmon. Adult distribution reflects dispersal patterns adapted to maintain salmonid populations as large scale disturbances render entire basins suitable or unsuitable over time. Meanwhile, juvenile distribution reflects adaptation to local conditions as individuals seek habitats for a year of freshwater occupancy. The usefulness of incorporating multiple spatial scales in models of abundance for each life history stage was explored in this study. Hierarchical modeling of two spatial scales for each life history stage was completed using Bayesian methods. Results indicated that adult coho salmon abundance could be explained using two-level hierarchical models that incorporated the subbasin variable, percent large trees in a 100-m riparian buffer, modeled with the basin scale variable, mean annual precipitation. This contrasts with juvenile distributions that were adequately represented by a two-level hierarchical model that included three site scale variables, percent sand, stream order, and network distance to spawning habitat, hierarchically linked to non-specific subbasin scale variation. This suggests that effective recovery strategies for endangered salmonids may require targeting habitat features at different spatial scales that are relevant to individual life history stages.

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Title

A review on setting appropriate reach length for biological assessment of boatable rivers

Abstract

Researchers working on boatable rivers are presented with the task of selecting an appropriate stream length, or reach length, from which data will be collected. Ideally, the sampling effort applied is the minimum that will allow stated objectives to be addressed as required by a study. Comparisons based on insufficient sampling effort estimates can be confounded because real differences in assemblage structure may be indistinguishable from method error. In general, long reaches (e.g., multiple kilometers) are advantageous for describing the mean condition of a large river section as they minimize the influence of small scale conditions and localized impairments. This advantage, however, can also be a disadvantage because long reach lengths may mask small scale habitat conditions and impairments. They may also decrease the sensitivity of indicators to detect linkages between local river conditions and drivers of conditions. Conversely, short reach lengths (e.g., < 1 km) can be criticized for being too sensitive to local conditions and thus provide a biased reading of the overall system condition. Alternatively, reach lengths can be set by evaluating the biological parameter responses (e.g., species accumulation curves, assemblage metrics; IBI scores), as a function of geomorphology (e.g. channel widths, meander wavelengths, riffle-pool sequences), or a combination of the two. In short, what is deemed an appropriate reach length should be a balance between data collection intensity for a particular event, and the number of events that can be sampled; all of which is further tempered by careful consideration of the question(s) being addressed, the data quality (in part, the precision, accuracy, and sensitivity) required to address the question, the statistical approach that will be used to analyze any resulting data, and present and future resource availability. This presentation will review issues related to appropriate sample unit definition, or sampling reach, for rivers, with examples

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Title
Synopsis of Klamath River Salmon Disease Issues

Abstract
The California – Nevada Fish Health Center, in cooperation with state, tribal, university, and federal fisheries groups, has conducted diagnostic surveys of both juvenile and adult Chinook salmon in the Trinity and Klamath Rivers since 1991. Early work helped describe the range of parasites, bacteria, and viral agents in this population. Two myxosporean parasites, Ceratomyxa shasta and Parvicapsula minibicornis, are quite prevalent in juvenile Chinook salmon that rear or migrate through the Klamath River. Ceratomyxa shasta infection has been detected in >20 % of the out-migrant Chinook smolts and often results in lethal enteritis. The kidney parasite, Parvicapsula minibicornis, infects over 90% of the juvenile Chinook and is associated with glomerulonephritis and overt kidney swelling. The reduction in smolt survival, due to disease, is a likely factor in the low abundance of Klamath River salmon and yet has not had the notoriety of the 2002 adult salmon kill in the Lower Klamath River.

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Title

Differences in annual growth and annual survival of ‘T-bar’ anchor and PIT tagged mountain whitefish, rainbow trout, and walleye in the Lower Columbia River, Canada

Abstract

In 2001, BC Hydro recognized the need to define impacts of the operation of their dams and reservoirs on fish populations and ensure that operations are managed for both environmental and economic sustainability. A sampling program, initiated in 2001 and ongoing, was designed to monitor changes in fish population dynamics in the Lower Columbia River study area. This area spans from Hugh L. Keenleyside Dam downstream to the Canada-US border. Between 2005 and 2006, 1126 mountain whitefish, 1139 rainbow trout, and 791 walleye were marked with ‘T bar’ anchor tags and 1398 mountain whitefish, 1200 rainbow trout, and 813 walleye were marked with Passive Integrated Transponder (PIT) tags. Measurements in mountain whitefish and rainbow trout annual growth rates between the two tag types were based on inter-year recapture data and differences were tested using a modified von Bertalanffy growth model and a paired comparison maximum likelihood ratio test. Differences in annual survival between the two tag types for all species were analyzed using a robust design model in Program MARK. The average annual growth rate was lower for mountain whitefish marked with ‘T bar’ anchor tags than for mountain whitefish marked with PIT tags ($p < 0.001$). For rainbow trout, growth rates were similar between the two tag types. For all three species, annual survival was lower for fish marked with ‘T-bar’ anchor tags (mountain whitefish = 0.375, rainbow trout = 0.350, and walleye = 0.429) than for fish marked with PIT tags (mountain whitefish = 0.554, rainbow trout = 0.429, and walleye = 0.495), though confidence intervals for the two estimates did overlap for all three species. Based on these results, only PIT tags were deployed during the 2007 portion of the program.

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Title

Evaluation of an Electrical Gradient to Deter Seal Predation on Salmon caught in Gillnet Test Fisheries

Abstract

In 2007, the Pacific Salmon Commission (PSC) and Smith-Root Inc. installed and tested an electrical deterrent system as a humane, effective and practical method to deter Pacific harbour seals Phoca vitulina richardsi and their predation on sockeye Oncorhynchus nerka and pink salmon Oncorhynchus gorbuscha caught in Fraser River gillnet test fisheries. Results from this study demonstrate that seals can be deterred from foraging by using a pulsed, low voltage DC electrical gradient, resulting in increased sample sizes and reduced variability and uncertainty in the test fishery data. Catches and CPUE were significantly greater for the electrified portion of the gillnet compared with the non-electrified control section of the gillnet. This non-lethal technology demonstrated a potential to reduce marine mammal predation on Pacific salmon in gillnet test fisheries, with meaningful implications for management agencies that rely on gillnet test fishery data in areas frequented by pinnipeds.

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Title
Creating a Career That Makes a Difference

Abstract
This poster is based on my recent book, Intelligent Courage—Natural Resource Careers That Make a Difference. The book features the real-world career stories of eight natural resource professionals who created careers of meaning, purpose and conservation accomplishment. Their stories range from saving golden trout in California to halting oil exploration in the Rocky Mountain Front Range. Personal commitment, personal excellence, and personal satisfaction in a career are all covered to reveal how professionals can create the career they want. This poster features a summary of the lessons learned from the people interviewed by presenting:

- the keystone issues most professionals will encounter in their career,
- career success attributes, or the personal characteristics and skills, that allowed the people interviewed to effectively manage the keystone issues, and
- the premises for a career of meaning and purpose.

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Title

Long-term Monitoring of Fish, Stream Temperature, and Channel Characteristics Following the 1980 Eruption of Mt St Helens

Abstract

The eruption of Mt. St. Helens in 1980 severely impacted aquatic habitats across an area covering more than 250 square miles. After the eruption a monitoring program was initiated on three streams exposed to different impacts from the eruption. Fish populations, water temperature, and channel characteristics were assessed annually. Schultz Creek lies closest to the mountain, flowing though an area where nearly all vegetation was obliterated by the force and heat of the eruption. Hoffstadt Creek lies near the margin of the blast zone, and was impacted primarily by heat-kill of riparian vegetation followed by a large debris torrent that scoured the channel to bedrock and boulder. Herrington Creek lies outside of the blast zone, flowing across a large mudflow deposit within the South Fork Toutle River valley. Resident cutthroat trout survived the eruption in all three drainages. Due to a variety of stocking and adult transport practices, fish communities present in each stream have varied over the past 25 years making interpretation of population trends difficult. Juvenile fish showed a surprising resiliency in severely impacted habitats, thriving in spite of warm stream temperatures, minimal woody debris, and low pool availability. Anadromous steelhead and coho introduced above natural barriers suppressed native resident cutthroat trout populations, which persist in relatively low numbers where juvenile steelhead and coho are abundant. Re-establishment of riparian vegetation varied among sites, influenced by factors such as the proximity of a seed source and/or the persistence of live willow roots along channel margins. Stream temperatures decreased as overhead canopy cover was re-established. Changes in channel character through time varied with underlying substrate composition. Long-term monitoring projects like this provide unique opportunities to understand recovery processes following catastrophic disturbance.

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Title

Salmonid Gamete Preservation in the Snake River Basin:Management Goals for Preserving Pacific Salmon and Steelhead Diversity

Abstract

In 1992 the Nez Perce Tribe initiated a gene bank program with the mission of preserving the genetic diversity of Snake River basin spring/summer Chinook salmon and steelhead evolutionary significant units (ESUs). Significant declines in population sizes over the previous 50 years has resulted in a significant loss of genetic diversity and put these populations at risk of extinction. We present a management plan detailing the history and current status of the program as well as providing an overview of the goals and strategies used to prioritize populations for collection and gene banking. The collection strategy involved cryogenically preserving milt from at least 500 gamete samples from multiple populations within each major population group, thus ensuring that a representative level of diversity was preserved for each species' ESU. To date, 2793 gamete samples representing 15 Chinook salmon populations and 1390 gamete samples representing 13 steelhead populations have been preserved in the gene bank. The efficacy of the collection was evaluated using intra- and inter-population genetic and demographic analysis and the preservation of unique life histories and results demonstrated that preservation goals have not been met for most major population groups. Providing clear goals will help managers evaluate the program and prioritize future collection efforts, ensuring successful genetic diversity preservation of critically threatened Snake River salmon and steelhead populations. Given the success of the project over the last sixteen years, these goals and objectives will continue to build a successful regional repository, provide a better understanding of the genetic and demographic components of Snake River Basin salmonids and provide a blueprint for initiating gene banks programs for other threatened or endangered aquatic species.

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Title

Genetic assignment of fish origin aids in Columbia Basin stray rate estimates

Abstract

Straying, or migration of anadromous salmonids terminating in a spawning area other than the fish's natal one, is a natural component of anadromous life history and evolution. However, negative aspects of this behavior can be exacerbated in impounded and manipulated systems such as the Columbia River Basin. Therefore, evaluation of stray rates is critical to the conservation of ESA-listed Chinook salmon. Radiotelemetry techniques provide a means to track adult fish movement and migration to spawning grounds, but analyses of straying have traditionally been constrained to individuals that were PIT-tagged as juveniles, as these represent the only population component whose origin is known. While availability of known-source fish for some runs is relatively high, many populations are not PIT tagged at all. As such, the sample used to assess straying has been restricted and potentially biased. Recent development of a genetic baseline for West Coast salmon populations provides a method of assigning run-of-river fish an origin, thus increasing the available population for straying analyses to include all fish radiotagged and tracked in the system. A genetic component was added to an ongoing, large-scale radiotelemetry study in 2004 and 2006. We employed individual assignment analysis using microsatellite loci to assign fish of unknown origin to an ESU, and retained only those fish with a 90% or greater assignment accuracy (70% of spring/summer Chinook and 58% of fall Chinook salmon). Estimated stray rates differed among ESUs, with mid-Columbia River spring/summer Chinook salmon most likely to stray. Snake River drainage fish showed the highest ESU-level site fidelity. Where sample sizes allowed relevant comparisons between genetically assigned and PIT-tagged groups, stray rate estimates were similar. The two approaches are complimentary and can help us converge on representative estimates of stray rates for a diverse group of fish, such as those not PIT tagged as juveniles.

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Title

The effects of a surgically implanted miniature acoustic tag on growth, survival, behavior and predation risk on sub-yearling fall chinook salmon

Abstract

Implantable acoustic tags are often used to assess salmonid smolt behavior, survival, habitat use and predation risk. However, the relatively large size of most acoustic tags limits their use in juvenile fish. A miniature implantable acoustic tag prototype was evaluated for impacts on 1) growth and survival, 2) behavioral differences and 3) predation risk in Chinook salmon Oncorhynchus tshawytscha smolts. Growth rate over a 30-day period was significantly affected by the tag, but survival was not affected. Partial to complete tag expulsion was noted in 37% of the tagged fish in the growth evaluation group. Implantation of an active miniature prototype acoustic tag did not significantly affect predation risk or behavior involving activity level and position in the water column. The small sample sizes of the predation and behavior evaluations suggested trends toward an affect by either the tag or the surgical procedure. This study showed a tendency for growth and tag retention to affect the overall successful use of this type of tag. These evaluations led to physical size modifications of the tag for improving biological acceptance within the organism.

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Title

Past and present impact of dam passage (or lack thereof) on Columbia Basin sockeye salmon

Abstract

Columbia Basin sockeye salmon abundance has declined by over 95% since white settlers arrived in the region. Much of this decline can be attributed to the impact of dams. Dams built prior to the 1930's were commonly built without fish ladders, blocking salmon passage. Later dams, although built with fish passage, still have a negative impact on Columbia Basin sockeye salmon and are likely the primary reason for the low smolt to adult survival for this population. Much of the mortality likely occurs on the downstream migration, where the remaining sockeye stocks must pass through seven to nine mainstem dams. High rates of descaling are one mortality source as, at dam juvenile bypass systems, sockeye salmon smolt are 2.5 to 5 times more likely to be descaled than are Chinook salmon smolt, and the mortality rate for sockeye salmon smolt is 1.2 to 2.7 times higher than that for Chinook salmon smolt.

PIT tag studies estimated a survival rate on the adult upstream migration from Bonneville Dam to Rock Island Dam of 81.1% in 2006 and 73.4% in 2007. Early migrating fish survive at a higher rate than later migrating fish. Among the two remaining significant sockeye salmon stocks, in both 2006 and 2007 Wenatchee sockeye migration timing was earlier than Okanogan sockeye migration timing which likely means a higher survival rate on the upstream migration for the Wenatchee stock.

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Title

PIT tagging adult salmon at Bonneville Dam to estimate migration timing, survival, stock composition, and escapement

Abstract

In 2006 and 2007, we PIT tagged adult sockeye and (primarily summer run) Chinook salmon sampled at the Bonneville Dam Adult Fish Facility as part of separate age and stock composition studies. These fish were subsequently detected as they passed fish ladders at upstream dams with PIT tag detection. From these detections, we estimated distribution, survival, and travel rates. Based on PIT tag recoveries, in 2006 4.5% of summer Chinook salmon at Bonneville Dam passed upstream of Ice Harbor Dam, while 69.9% passed into Priest Rapids Dam. In 2007, 16.6% of summer Chinook passed Ice Harbor Dam, while 58.0% passed Priest Rapids Dam. Between Bonneville and McNary dams, summer Chinook salmon averaged 37.4 km/day in 2006 and 39.8 km/day in 2007.

We estimated a sockeye salmon survival rate from Bonneville to Rock Island Dam of 81.1% in 2006 and 73.4% in 2007. The stock composition at Bonneville Dam was estimated to be 72.8% and 85.3% Okanogan in 2006 and 2007, respectively, with the remainder of Wenatchee stock. Median migration speed between Bonneville and Rock Island Dam was 34.9 km/day in 2006 and 35.1 km/day in 2007.

Mark-recapture techniques were used to estimate 2006 and 2007 sockeye and summer Chinook salmon abundance at upstream dams. These techniques estimated between 32.1% fewer and 17.8% more sockeye salmon at upstream dams than those made by visual fish counts. Summer Chinook PIT tag estimates of summer Chinook abundance were between 21.9% fewer and 44.8% more than those by visual fish counts.

PIT tags provide an easier, cheaper, and less intrusive method of monitoring upstream migration than do radio tags. This will become even more so as PIT tag detection antennas are installed at additional sites.

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Title

Latent Mortality of Transported Fish – Where Are We Now?

Abstract

Recent evidence suggests that the extent of delayed mortality of outmigrant salmon may be substantial in the estuary and near-shore ocean environment. Causes of delayed mortality may include, but are not limited to: (a) unintended consequences of management actions targeted at reducing the incidence of direct mortality in the FCRPS, (b) contaminant exposure, (c) size of smolts and timing of estuary and ocean entry, and (d) selected hatchery practices. In 2006, we found barged hatchery-reared Snake River spring/summer Chinook salmon were less susceptible to infectious diseases than fish with an in-river outmigration life-history, suggesting that the FCRPS imposes a level of stress that adversely impacts the health of in-river smolts, and barging mitigates that stress. Physical, chemical, and biological characteristics of the smolts were evaluated to provide an ecological context within which to evaluate underlying mechanisms associated with disease susceptibility. Trends in whole-body lipid and chemical concentrations supported the differential disease susceptibility between barged and in-river fish. In addition, we found that the hatchery of origin affected disease susceptibility, with significant differences observed between hatcheries in the disease susceptibility of barged fish but not fish with an in-river life-history. We hypothesize that the less fit in-river fish were culled prior to reaching Bonneville Dam, thereby eliminating differences in disease susceptibility between hatcheries within in-river fish, whereas barged fish are likely culled in the estuary after release. The collective results suggest that barging may help to mitigate the adverse health effects of the FCRPS on Snake River spring/summer Chinook salmon, but the fate of barged fish in the estuary and ocean may depend on their health status shortly after entering the river system (e.g., prior to barging).

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Title
The NAS database and Alert System

Abstract
The Nonindigenous Aquatic Species (NAS) database (http://nas.er.usgs.gov) maintained by the U.S. Geological Survey in Gainesville, Florida, serves as a repository for spatial occurrence data on introduced aquatic species nationwide. The NAS program is a publicly accessible system designed to assist state and federal agencies and non-governmental organizations in understanding and managing non-native species in their jurisdictions.

While the NAS database focuses mainly on freshwater species, we work closely with the Smithsonian Environmental Research Center, who focuses mainly on marine species. We also work in partnership with Portland State University who maintains the aquatic plant portion of the database.

The NAS system is highly integrated and has many capabilities. Species are all tied to collection data, fact sheets, images, references, pathways data, an alert system, and interactive, real-time maps. Currently the system provides mapping by hydrologic unit codes; however, the capability to provide point distribution maps and maps by population status is being developed.

The NAS Alert System is activated whenever a species is entered from a locality (state, county, or drainage) where it has not been recorded before in the database. The alert is reviewed for relevance before being sent out. Users may register to receive alerts via e-mail or can browse and search the archive on the site.

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Title

Estimating habitat conditions and salmonid population responses in the Lewis River watershed

Abstract

Restoring freshwater ecosystems requires a holistic approach that incorporates the delivery of wood, water, and sediment over the entire watershed as well as an understanding of how these natural processes interact with human activity to shape aquatic habitat conditions over large spatial scales. Effective management for threatened or endangered Pacific salmonids and their habitats must therefore be conducted over large spatial extents. We developed a multi-metric decision support tool to help decision-makers review possible effects of management choices on fish and fish habitats in the Lewis River watershed (southwestern WA). We modeled key physical processes in the watershed to predict historical and current in-stream habitat conditions (e.g, fine sediment deposition, bed scour, and habitat suitability), and species-specific fish responses (e.g., spatial distribution, spawner capacity and egg-to-fry survival). Using the same models, we were able to also evaluate a variety of alternate futures resulting from human activities. We predicted how habitat and fish might respond to major changes on the landscape (e.g., passage through migration barriers, urbanization, and riparian conservation), and how restoration strategies can complement these expected changes. Results suggest that dam passage will provide access to large amounts of high quality habitat that will benefit fish populations. Conservation of existing riparian areas, if implemented according to existing policies, has the potential to greatly improve habitat conditions, despite expected urban growth. The choice of which restoration strategy fared best was fairly robust to assumptions about other trends in the watershed but differed among output metrics analyzed. Given that we cannot physically evaluate the effect of most restoration actions for decades, scenario-planning allows us to forecast likely outcomes in a way that incorporates uncertainty in our estimates. Results predicted by the multiple models in our approach provide valuable information for evaluating management strategies intended to reverse or slow salmonid population declines.

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Title

Monitoring watershed condition under the Northwest Forest Plan: Evolution of a broad-scale monitoring program

Abstract

Since the Aquatic and Riparian Effectiveness Monitoring Program was implemented in 2002, data have been collected at more than 1300 sites in nearly 200 watersheds. Upslope road and vegetation data have been analyzed in more than 500 watersheds. In the next year, roads and vegetation data will be analyzed in the remaining 1100 watersheds with federal land in the Northwest Forest Plan area. In addition, the monitoring program has developed a region-wide model to estimate landslide frequency and developed tools for watershed condition assessment. The use of these tools has expanded beyond the Northwest Forest Plan area as we apply them to determine watershed condition across Washington and Oregon and begin using them in the Forest Planning process, specifically to identify areas of high quality habitat that may serve as refugia and to evaluate the sustainability of aquatic and riparian species.

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Title
Yankee Fork Floodplain Restoration Project: Background and Vision

Abstract
Yankee Fork Floodplain Restoration Project
Shoshone Bannock Tribes
Presenter: Evelyn Galloway, Program Manager
Co-author: Steve Clayton, CH2M HILL

The Yankee Fork is located in central Idaho and is one of the larger watersheds within the Upper Salmon River Basin. The river lies in the Salmon-Challis National Forest east of Stanley, Idaho. The Yankee Fork contributes to the Upper Salmon River with diverse habitats, low gradient stream channel reaches, aquatic productivity, and a remnant spawning and rearing population of resident and anadromous fish, including, Chinook, Steelhead and other native species within this system.

Dredge mining in the early-mid 1900s severely impacted 10 kilometers of the stream, eliminating the natural meander pattern and associated in stream habitat as well as riparian vegetation and the values it provided. The existing stream-floodplain complex consists of unconsolidated and unvegetated dredge tailings that offer little habitat for aquatic and terrestrial species. The impacted floodplain has reduced natural and nutritional fluxes.

The goal of the Yankee Fork Floodplain Restoration Project is to restore natural river channel characteristics, floodplain function, hydraulic and sediment regimes, and aquatic habitat within the dredged reach, so that the system will be self sustaining. We are currently in the process of evaluating restoration alternatives that would reconnect tributaries, floodplains, and disconnected ponds left by the dredging. Restoring the river to less disturbed conditions will create a healthier, functioning riparian community that will benefit fish and wildlife and help restore cultural significance.

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Title

Estimation or Prediction in Stream Networks: The Role of Spatial Autocorrelation

Abstract

Spatial autocorrelation, the tendency for neighboring observations to be similar, reduces the precision of the estimate of an effect. But spatial autocorrelation is helpful when attempting to predict the occurrence of a response in space. In fact, perceiving patterns of similar response over space is a fundamental task in ecology. Connectedness and patchiness in a habitat or landscape is part of the definition of such a system. But connectedness and spatial autocorrelation are more complex in stream networks. Modeling the autocorrelation structure of data from an intensely sampled stream is the subject of current research in statistics. We present a number of new models and describe their implementation and consequences for stream research.. We extend the idea of patches in a landscape to stream networks and describe results for a set of forty stream networks from western Oregon.

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Title

Stable isotope analyses of otoliths in identification of hatchery origin of Atlantic salmon (Salmo salar) in Maine

Abstract

We conducted stable oxygen and carbon isotope analyses for otoliths of Atlantic salmon (Salmo salar), in an attempt to develop a reference database on isotopic variability among private and federal hatcheries in Maine State which currently support the salmon aquaculture industry and recovery of endangered populations. During the first phase of our study, we collected 40-50 sagittal otoliths of juvenile Atlantic salmon from each of the five hatcheries and analyzed for stable oxygen and carbon isotope ratios (18O/16O or d18O, and 13C/12C or d13C). Combination of d18O and d13C signatures in otoliths showed that the five hatcheries can be clearly separated and chemically distinguished. By identifying stable isotope variations of otoliths from different hatchery settings, we were able to establish some isotopic criteria or standards to assign a likelihood that an individual Atlantic salmon came from a specific hatchery within the reference database. If successful, a diagnostic tool that can provide definitive information on identification of the hatchery salmon origin could serve as a novel marking technique, and the chemical method may provide a more effective alternative to DNA analysis for mixed stocks. Overall our isotopic data from otoliths support the hypothesis that there are detectable differences between the five hatcheries, and multiple statistical analyses indicated that we can correctly distinguish individual Atlantic salmon into a hatchery with high confidence.

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Title

Using Fishing Permit Sales to Aid in Fisheries Management Actions, www.tribalpermit.com

Abstract

In late 2007, the Confederated Tribes of Warm Springs launched www.tribalpermit.com. The website is designed to provide informaton to the public regarding fishing and camping opportunities on the Warm Springs Reservation and allows visitors to purchase permits online. The data that is generated from the site will help Warm Springs fisheries managers better understand which areas and stocks are receiving the most fishing pressue. We intend to use the data to aid in fisheries management decisions, direct enforcment efforts, and to identifiy issues that impact the fishing experience.

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Title

Comparison of Two Macrolide Antibiotics and Drug Injection Site to Reduce Prespawn Mortality due to Bacterial Kidney Disease in Maturing Chinook Salmon

Abstract

Maturing spring Chinook salmon Oncorhynchus tshawytscha in the Grande Ronde Basin Captive Broodstock Program experience significant mortality due to bacterial kidney disease (BKD), which is caused by Renibacterium salmoninarum. We investigated two methods to increase survival to spawning without reducing fecundity.

We evaluated the effectiveness of intraperitoneal injection of azithromycin or erythromycin to reduce pre-spawning mortality. We gave an initial injection at the first sign of maturation (April or May), and a second injection prior to spawning (August). Blood was collected at the first injection for detection of R. salmoninarum DNA using qPCR. In the spring, few fish had detectable levels of bacterial DNA in peripheral blood. We collected kidney tissue at spawning for analysis of drug activity by disk diffusion assay and for detection of R. salmoninarum antigens by enzyme-linked immunosorbent assay (ELISA). Preliminary results show that azithromycin remains in the kidney longer and at a higher concentration than erythromycin. We will look for a relationship between antibiotic concentrations and ELISA values.

We compared dorsal sinus and intraperitoneal antibiotic injections in maturing females. Intraperitoneal injection has been reported to reduce fecundity, but the bioavailability of antibiotic delivered by dorsal sinus injection has not been demonstrated. Females received injections of erythromycin at early sign of maturation (April or May) and prior to spawning (August), and the same injection site was used for both administrations. At spawning, we collected kidney samples for analysis of drug activity and the number of undeveloped eggs were quantified.

These studies will help evaluate which antibiotic and which injection site provide the most effective treatment regime against BKD. This will allow us to increase production in the Captive Broodstock and other hatchery programs and reduce the number of broodstock that must be collected from nature.

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Title

Effects of Total Dissolved Gas on Chum Salmon Fry Incubating in the Lower Columbia River

Abstract

The effects of total dissolved gas (TDG) exposure on larval salmonids are not well understood. Chum salmon sac-fry are present in the gravel below Bonneville Dam at the time spill occurs, and exposure to greater than 103% TDG may affect their development. The objective of this study was to characterize effects of TDG on incubating chum salmon fry in the lower Columbia River. Depth-compensated TDG monitored in the hyporheic zone was less than 103% TDG at Ives Island and Multnomah Falls, two spawning areas in the Columbia River below Bonneville Dam. However, not all redds were located in areas where water depth could compensate for elevated TDG, and risk models suggested about half the redds constructed at Ives Island were exposed to depth-compensated levels greater than 103% TDG for 50-100 h in 2007; this was substantially higher than the estimated 10 h for 2006. In the laboratory, levels ranging up to 113% TDG did not influence direct mortality of chum salmon fry. However, moderate to severe microscopic damage to gill epithelium was measurable at levels of 108% and 113% TDG, but was not associated with morbidity or mortality. Fry exposed to the 113% TDG level emerged about four days earlier than those of the control group. No external signs of gas bubble disease were seen in fry sampled from redds at Ives Island. However, a few fish had inflated swim bladders and bubbles in the intestinal tract. Collectively these results suggest redds in the Ives Island area could be exposed to TDG levels that exceed physiological thresholds. Although acute mortality did not occur in the laboratory, the presence of sub-lethal physiological effects is suggestive of a chronic impact if TDG below Bonneville Dam is high at low tailwater elevations.

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Title

Response of Lamprey Ammocoetes (Lampreta sp.) to Four Types of Water Diversion Screens

Abstract

Lamprey (Lampreta sp.) populations have been gradually declining in the Columbia River Basin for many decades due in a large part to unsuccessful passage at hydroelectric dams and other water diversion structures. Due to the potential loss of fish resources from watersheds at water diversion structures, state and federal law requires any diversion of water from streams, rivers, lakes, reservoirs and tidal areas to be screened to protect fish. The objective of this study was to evaluate whether existing screen criteria, based on tests using juvenile salmonids, are effective for the protection of lamprey ammocoetes from being impinged or entrained at water diversion structures in the Columbia River Basin. Lamprey ammocoetes were exposed to four screens currently approved by the National Oceanic and Atmospheric Administration (NOAA Fisheries) and the Washington Department of Fish and Wildlife (WDFW). Lamprey ammocoetes (median total length= 134) were tested in groups of 5 at water temperatures between 11.9o-14.7oC for 11.5 h (1900-0630 h) in a specially designed study tank. Lamprey ammocoetes came in contact with the screens on many occasions and were regularly impinged, but escaped impingement and survived at least 24 h after the experiments. Under the experimental conditions in the present study, lamprey ammocoetes are unlikely to be entrained or mortally injured when impinged using the NOAA Fisheries and WDFW approved screen criteria.

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Title

Underwater Imaging Tools and Techniques to Monitor Fish

Abstract

Fisheries researchers and resource managers face many challenges in their efforts to collect accurate and repeatable data about fish presence and absence, escapement enumeration, timing of fish migrations, and species composition. In some cases, water turbidity, discharge, site logistics, or study objectives preclude the use of traditional field methods like visual foot or snorkel surveys. Thanks to recent advances in imaging, recording, and post-processing technologies, new tools are now available for these and other fisheries applications. We present an overview and synthesis of some of the imaging tools that are available, including underwater video, imaging sonar, digital image identification systems, and resistivity counters. Specifically, we describe how the tools work, their relative costs, strengths and limitations, and examples of current and potential applications of these imaging tools and technologies in the field of habitat restoration monitoring.

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Title

Morphological diversity among Pacific lamprey ammocoetes (Petromyzontidae)

Abstract

The Pacific coast of North America is home to a diverse yet cryptic assemblage of native lampreys from three genera: Entosphenus, Lampetra and Lethenteron. Observations of declining populations from many sources have raised concern over the long term persistence of several of these Pacific coast lamprey species. This conservation concern was brought to the attention of the USFWS in 2003 with a petition to list four species under the Endangered Species Act. Although the petition was declined in a 90 day review, little quantitative evidence exists regarding their distribution and population dynamics. One factor limiting the study of these species is the lack of clear identification characteristics, particularly in the ammocoete stage. In this study we attempted to identify morphological characters able to consistently distinguish among genera of Pacific coast ammocoetes. We evaluated several variable morphological characters in ammocoetes from 16 collection localities distributed from central California to Alaska. Morphological identifications were then compared to identifications based on mitochondrial DNA sequence analysis and restriction fragment length polymorphism (RFLP) assays. Our analyses explore the relationships among the morphological characters, genetic identification, and geographic patterns.

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Title
Changing Views on Invasive Species - One Mind at a Time

Abstract

Invasive species offer an interesting study in the human response to natural resource issues. First, the average person rarely even realizes that a species in their local pond is invasive. Then, once they do learn the truth, they can often become impassioned champions of eradication and control. But sometimes as they learn more and more about the shear volume of invasive species and their numerous implications people can become overwhelmed to the point of disillusionment or confused inaction. If this happens, you can often end up with an indifferent public that will respond even less favorably than your previously uneducated public. Therefore it is critical to control, tailor and target your message to generate the long-term response you want.

In this talk, Jim Gores, the Invasive Species Coordinator for the Oregon Department of Fish and Wildlife will discuss his experiences in trying to bring invasive species into the consciences of the general public, what worked, what didn't and how to bring people to action through a personalized and realistic message.

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Title

Aquatic Invasive Species in Oregon: Emerging Issues and the Search for Solutions

Abstract

With quagga and zebra mussels on their borders, nutria spreading north and south, unknown numbers of non-native crayfish in its waters and the availability of infinite new species on the internet, Oregon is facing more and more new threats and management challenges. In this talk, Jim Gores, the Invasive Species and Wildlife Integrity Coordinator for the Oregon Department of Fish and Wildlife will discuss Oregon's current priorities and concerns and the educational and regulatory approaches they are exploring to deal with these new threats.

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Title

Community Constraints In Urban Ecosystem Rehabilitation

Abstract

Urban streams and wetlands in the Pacific Northwest are becoming increasingly important to the quality of the urban experience and to the recovery of federally listed species. This is especially true in the Portland, Oregon metropolitan area, which is located at the confluence of the Columbia and the Willamette Rivers. One of the most significant streams within the City limits is Johnson Creek.

Johnson Creek is 26 miles long and drains a watershed area of 52 square miles. Most of Johnson Creek's stream miles and watershed area are within the highly developed cities of Portland and Gresham, Oregon. They are the first and fourth largest cities in the state respectively with a combined population of 668,000 in 2007.

Endangered Species Act (ESA) listed species in the watershed include steelhead trout, Chinook salmon, and coho salmon. Habitat for listed species of fish within Johnson Creek has been heavily impacted by agricultural and urban land use activities. Habitat impacts include frequent high flow events, excess sediment loading, low and warm summer flows, and poor water quality.

In the early 1990's the City of Portland began working to restore natural functions to Johnson Creek. One of the earlier projects was the Brookside Wetland and Stream Enhancement Project.

The Brookside project had a set of design constraints that went well beyond the normal technical constraints associated with stream and wetland enhancement due to its location within the urban environment near residential and commercial development. The community was extremely interested in the project and its potential to both harm and enhance their living space. Members of the community were both the greatest critics and strongest advocates for the project. The Brookside project was able to address most of the competing design constraints in a manner that balanced the benefits to community and the ecosystem.

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Title

Assessing dam impacts on Pacific salmon using stream network analyses and a North Pacific inventory of hydro-georeferenced dams

Abstract

The construction of dams in the 20th century has fragmented migration routes and significantly altered habitat for anadromous fishes to varying degrees across their ranges. The State of the Salmon program – a joint program of Ecotrust and the Wild Salmon Center – has been building range-wide data sets describing patterns of abundance for North Pacific salmonids and, as part of this effort, has also been building range-wide data sets of anthropogenic factors that may help explain those patterns. A key data set in this effort has been a North Pacific-wide database of dams integrated from multiple sources and georeferenced to regional hydrogaphies. Georeferencing dams accurately to hydrographies has permitted stream network analyses, such as the modeling of cumulative impedance to fish passage as fish move up stream networks and estimations of the proportion of stream networks above impassable dams. Network analyses are also being developed for an index of downstream dam impacts. Indices of dam impacts have been aggregated to the scale of catchments. Such indices can be used to relate patterns of salmon abundance or catchment conservation value with dam impacts.

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Title

A Comparison of Escapement Estimate Methods Plus Escapement-Recruitment Relationships for Coho Salmon and Chinook Salmon in a Coastal Stream

Abstract

This study compares methods of escapement estimation of Coho salmon (Oncorhynchus mykiss) and Chinook salmon (Oncorhynchus tschawytcha) in a coastal stream without a counting fence or weir. Relationships between escapement estimates and juvenile recruitment were also analyzed. A six-year data set, collected from Prairie Creek, California, during 1998-2004, was used for this project. Five methods of escapement estimation were considered: area-under-the-curve of live spawner observations, carcass mark-recapture using a modified Jolly-Seber method, carcass mark-recapture using the Peterson method, a redd count based estimate assuming one redd per female, and a redd count based estimate using a redd-area method. A logistic regression model to distinguish Coho salmon redds from Chinook salmon redds for those redds which do not have a known species associated with it was constructed. The model was able to predict species with 93.3% concordance with the known data set when time (water year day) was the only available parameter and 99.7% concordance when time, pot area, and substrate data were available. Coho salmon AUC escapement estimates were linearly correlated with one redd per female (R-sq = 0.7492) and redd area estimates (R-sq = 0.6922) for the study area. Chinook salmon AUC and one redd per female escapement estimates yielded varying degrees of relatedness (R-sq = 0.4789 to 0.9145), depending on the portion of the study area included. Carcass estimates were inconsistent with AUC and redd-based estimates. Age 0+ Coho salmon population estimates and age 0+ Chinook salmon outmigrant catch were used for evaluating spawner-recruitment relationships. Linear regression analysis of AUC estimates and juvenile recruitment yielded R-sq values of 0.7308, 0.6513, and 0.6832 for Coho salmon in Boyes Creek, Streelow Creek, and upper Prairie Creek, respectively, and 0.8658 for Chinook salmon in mainstem Prairie Creek.

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Abstract

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Title

Lower Deschutes River Fall Chinook Escapement: A Validation Study

Abstract

Deschutes River fall chinook salmon (Oncorhynchus tshawytscha) are one of three naturally spawning runs within the Columbia River upriver bright (URB) stock. Deschutes River fall Chinook salmon have been identified as an indicator stock for URB by the United States Chinook Technical Committee under the Pacific Salmon Commission. Since 1977, fall chinook escapement has been monitored by the Oregon Department of Fish and Wildlife (ODFW) through the combination of a mark-recapture study at Sherars Falls (Rkm 70.8) and aerial redd counts throughout the entire lower 161 Rkms. In 2001, the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) began a gill net mark-recapture project, at Rkm 32.2, to validate the ODFW escapement estimate. From 2001 – 2005, CTWSRO generated escapement estimates within 30% of its true value, ranging from 10,274 to 19,646. However, in 2006 and 2007, CTWSRO whole river estimates had relative precisions greater than 60%. Low numbers of marked and recaptured fish as well as high dip-in rates may explain the estimate's poor precision. Based on 2006 and 2007 results, it appears the CTWSRO current methodology is not feasible in years of relatively low abundance. In most years the CTWSRO estimate has been higher than the ODFW estimate. The differences among estimates have ranged from 9% to 39%. Water visibility during redd counts below Sherars Falls may partially explain the degree of divergence between the two estimates.

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Title

Juvenile Bull Trout Monitoring in the Warm Springs River, Oregon

Abstract

Distribution of juvenile bull trout (Salvelinus confluentus) in the Warm Springs River, (Deschutes River Subbasin, OR) is confined to a 3.6 rkm headwater section. Of this stream section, access is limited to 2.4 rkm. Starting in 1999, relative densities and habitat use of juvenile bull trout and sympatric brook trout were estimated in the 2.4 km study area through night snorkeling. Another objective was to determine if snorkeling four (approximately 100 m long) index reaches could provide comparable abundance data to the 2.4 km study area; therefore providing a more cost and time effective monitoring protocol. From 1999 to present, relative bull trout density in the study area ranged from 3.3 – 14.3 fish/1,000 m2. Bull trout densities have been stable or increasing since 2003. Densities in 2007, were the highest observed since project inception. Brook trout densities have also remained relatively stable in the 2.4 rkm study are averaging 2.6 fish/1,000 m2. Our data suggests the number of available pools and glides, as well as, interspecies competition may be limiting factors for bull trout. In all years, bull trout preferred pool and glide habitats, which made up the smallest proportion of available habitat, averaging 9% and 4%, respectively. In 2005, a model was developed to determine the potential for using index reaches as a predictor of bull trout density within the study area. The model suggests index reaches can be used to predict bull trout density in the study area (SE = 0.537; df = 2; r2= 0.97; adjusted r2 = 0.92). A final model, incorporating 2006 and 2007 juvenile densities, is in development.

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Title

Geological framework for interpreting streamflow and temperature regimes under climate warming

Abstract

Spatial patterns of summer streamflow in the Oregon Cascades vary dramatically between the geologically distinct High and Western Cascade regions. A key control on streamflow response between these two regions is the partitioning of water input between fast-draining shallow subsurface flow networks (Western Cascades) versus a slow-draining deeper groundwater system (High Cascades). These differences result from extremely high contrasts in rock permeability, porosity, and drainage density, and produce distinctly different patterns in magnitude, timing and temperature of streamflow.

We consider how these geologically-based differences in groundwater storage capacity can significantly alter streamflow response to projected climatic warming. Climate warming in the Cascades will likely result in a higher proportion of precipitation falling as rain, rather than snow, resulting in diminished snowpacks that melt earlier. Shifts to earlier winter recharge in the High Cascades will result in an earlier summer streamflow recession, and less cold, late summer sustaining streamflow. In the Western Cascades, where there is already virtually no groundwater storage, and very warm and low summer streamflows, permanent streams may become intermittent or ephemeral.

Taken together, these results imply that current models linking climate and streamflow changes need to account for differences in groundwater storage as a first-order control. Differences in sensitivity to climate change between areas with and without large groundwater reserves have major implications for water resources management, but are not well-integrated into current plans. In particular, the sustained cold stream temperatures necessary for bull trout and other aquatic species are a direct consequence of the underlying geology. The geologic framework of the Oregon Cascades must be integrated into any future assessment of bull trout habitat.

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Title
Hells Canyon Complex Operations for Fall Chinook Salmon

Abstract
The National Marine Fisheries Service (NMFS) listed Snake River fall Chinook salmon as “threatened” under the Endangered Species Act in 1992 and designated critical habitat for this species in 1993. Fall Chinook salmon spawn, incubate, and rear in the 160 km reach of the Snake River downstream of Hells Canyon Dam (the lowermost of the Hells Canyon Complex dams). Protective operations were adopted by Idaho Power Company (IPC) in 1991 to protect redds and incubating eggs (stable outflows during spawning and minimum flows through emergence). After participating in the relicencing process and in settlement negotiations, NMFS issued its recommended terms and conditions to the Federal Energy Regulatory Commission (FERC) in January 2006. These recommendations include continuation of IPC’s fall and winter operations to protect redds from dewatering; new spring operations (and studies) to minimize the potential for significant juvenile mortalities caused by load-following operations (entrapment and stranding); and operations to enhance migration conditions (flows) for migrating juveniles in May, June, and July. With the exception of its recommended spring operations, FERC adopted NMFS’ recommended operations measures in the Final Environmental Impact Statement for the Hells Canyon Complex. Together with other actions, Hells Canyon operations should maintain and enhance the productivity, and assist the recovery of, Snake River fall Chinook Salmon.

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Title

Students and Volunteers Help Achieve the Fish Management Goals of the Coos-Coquille-Tenmile Fish District

Abstract

Volunteers have been an integral part of fish management programs for the Oregon Department of Fish and Wildlife (ODFW) for decades, but increasingly so since the development of the Salmon and Trout Enhancement Program (STEP)in 1981. Volunteer and youth/student involvement in fish and wildlife programs helps to engage those sectors of the public toward ODFW's Mission "...to protect and enhance Oregon's fish and wildlife and their habitats for use and enjoyment by present and future generations." Fish management has become increasingly complex due to societal pressures, while funding has not increased accordingly. Enlisting the aid of volunteers and students has greatly expanded the resources available to ODFW's Coos-Coquille-Tenmile Fish District to meet fish management goals. The Millicoma Interpretive Center (MIC)is a fish production facility in the Coos River watershed, designed for hands-on, youth educational activities related to hatchery production, native salmonid life cycles, and watershed ecology. From October to May, weekly field trips from Oregon schools visit the MIC and participate in the sorting and spawning of hatchery broodstock, fin marking of salmon and steelhead smolts, and learning about the ecology of coastal watersheds. Adult volunteers from local STEP "associations" guide students in fish production tasks, watershed education, and riparian/instream habitat restoration projects. Student interns from local high schools spend a summer working with District biologists on a wide range of fish management activities. A recent five-year STEP project review identified the need for intensified monitoring and evaluation of the District's STEP propagation projects toward meeting harvest augmentation goals while protecting native fish resources. Volunteer and student involvement has allowed ODFW to implement this increased program evaluation without the ability to increase staff.

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Title

Effects of river discharge on size and survival in Chinook salmon: a tale of two tributaries

Abstract

River discharge is a primary driver of processes which form and maintain freshwater habitat conditions necessary to meet the biological needs of fish and other aquatic species. In the interior Columbia River, water withdrawals for agriculture and hydropower have altered seasonal hydrographs, and we examined the extent to which such changes have impacted Chinook salmon over their entire life cycle. We compared survival and body size of PIT-tagged juvenile fish in nine cohorts from two tributaries of the Salmon River: the Lemhi River, a system subject to water withdrawals, and Marsh Creek, a reference site. In both systems, we correlated dependent variables with mean monthly flow in May, the period which sets flow conditions for the year, and the month of maximum difference between systems. We found strong differences between sites in tributary survival and length, and a strong correlation with flow in the Lemhi River. We could also detect this correlation with tributary flow in survival downstream, after fish had migrated from the Lemhi River. Within the Lemhi River, the difference in survival between years of higher and lower discharge increased from 300% within tributaries, to 400% through the Salmon River, to 700% through the hydropower system and 1000% to adult return, a potential consequence of the delayed effect of tributary discharge on body size. We also found that return rate increased above replacement levels only when discharge was above 100% mean monthly average. Hence, these findings strongly implicate low flows in the decline of salmon populations in systems subject to water withdrawals, and provide a straightforward metric to help manage for ecologically sustainable flow levels.

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Title

Identifying Thermal Refuges for Coldwater Fishes in the Willamette River: Implications for Conservation and Restoration

Abstract

We mapped spatial distribution of cold water habitats in the upper Willamette River between Albany and Eugene, Oregon in 2005-06. Approximately 80-150 temperature dataloggers were deployed on the bottom of the river for 2-km reaches. We then created thermal maps of the reach by krigging the observed maximum temperature. We completed reach surveys for approximately 40% of the upper river. We developed a typology of thermal reach types based on associations of thermal characteristics and channel morphology and floodplain vegetation. Based on these typologies, we developed spatially explicit representations of likely thermal patterns of the upper Willamette River. We also developed a simulation model of hyporheic exchange for three sites and evaluated the major determinants of water temperature. Length of time in the hyporheic flowpath was the major determinant of the temperature of the water and extent of the thermal refuge. These typologies and analysis of the major hyporheic processes were used to project priorities for future floodplain restoration in response to land use changes, human population increase, and regional climate change. This floodplain framework for thermal refuges is being used with regional decision makers to create options to meet the requirements of the Clean Water Act Total Maximum Daily Load (TMDL) for elevated temperature and federal Endangered Species Act concerns for listed salmonids and other native riverine species. This framework also is being used to develop a thermal credit trading framework for the Willamette River and to design restoration efforts in the mainstem Willamette River.

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Title

Conserving and restoring native trout in the face of climate change, invasive species, and development.

Abstract

Evidence suggests that factors such as climate change and a century of fire suppression are altering fire regimes in some vegetation types of the western USA, and the probability of large stand-replacing fires has increased in those areas. For example, over 100 million acres have been burned by wildfire in the West during the last 20 years. It appears, however, that even in the case of extensive, high-severity fires, local extirpation of fishes is patchy, and recolonization is often rapid. Lasting detrimental effects on fish populations have been limited to areas where native populations have declined and become increasingly isolated because of anthropogenic activities. Unfortunately, this situation is exacerbated by decreasing water availability at a time when demand is increasing. Furthermore, the potential of invasive species to expand under these altered habitat conditions is poorly understood. Despite incomplete knowledge of the effects of climate change in aquatic systems, it is apparent that managers must begin to develop a broad-based management strategy that focuses on protecting remaining native fish populations and associated habitat from further anthropogenic degradation and restoring degraded habitat and connectivity. Such a strategy will require a watershed-scale approach than integrates conservation and restoration activities throughout the stream network.

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Title

Growth and survival of endangered Snake River sockeye salmon Oncorhynchus nerka in three Sawtooth Valley lakes, Idaho

Abstract

In November 1991, Snake River sockeye salmon Oncorhynchus nerka were listed as endangered (56 FR 58619). As a result of the listing, the Redfish Lake sockeye salmon project was initiated to conserve and rebuild sockeye salmon populations in Sawtooth Valley lakes designated as critical habitat.

In this paper we evaluate the growth and survival of Snake River sockeye salmon parr stocked from 1998 to 2006. We used passive integrated transponder tag interrogation data from smolt traps in outlet streams of three Sawtooth Valley lakes (Redfish, Pettit, and Alturas) to estimate specific growth rates and lower Snake River interrogations to estimate cumulative survival to Lower Granite dam. We used hydroacoustic surveys and limnological data to estimate whole lake O. nerka densities and zooplankton biomass. Densities in nursery lakes were negatively correlated ($p = 0.0450$) with zooplankton biomass. Growth of yearling sockeye salmon was variable and positively correlated ($p = 0.0005$) with total zooplankton biomass. The percent of hatchery parr that successfully emigrated was inversely related ($p = 0.0002$) to specific growth, evidence that sockeye salmon residualized when zooplankton biomass and growth rates were relatively high. Survival of sockeye salmon parr from nursery lake stocking to interrogation at lower Snake River dams was not related ($p = 0.8342$) to growth. Survival from smolt traps to Lower Granite dam did not correlate with growth in Redfish ($p = 0.7286$) and Pettit lakes ($p = 0.9976$), but was significant in Alturas Lake ($p = 0.0193$) where fish experienced low growth rates and frequently lost weight during the winter. These data suggest that a threshold growth rate is required for survival to lower Granite dam on the Snake River.

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Title

Protecting, Mitigating and Enhancing Fish and Wildlife in the Columbia River Basin

Abstract

The Columbia River basin is 258,500 square miles in area. With flows of almost 200 million acre-feet it has nearly 10 times the flow of the Colorado. The river and its' tributaries provide habitat to many species of anadromous salmon, steelhead and resident fish. A substantial anthropomorphic presence has been superimposed on the basin beginning 12,000 to 15,000 years BCE, with rapidly increasing effects from the mid 1800's. Hydroelectric projects on the river produce nearly 70 percent of the region's electric power, irrigation waters millions of acres and a 465-mile navigation channel extends to Lewiston, Idaho. Vast areas of anadromous fish habitat were destroyed, extirpating many populations of salmon and steelhead, while threatening or endangering others. Some populations of sturgeon, a species that has survived for 250 million years, are nearly extinct. Many other resident fish are under severe pressure. A century ago, attempts began with the hatcheries to reverse the rapid decline of fish numbers. This effort picked up with the passage of the 1980 Northwest Power Act, and with ESA listings of anadromous fish in the 1990s. Today, nearly a billion dollars a year in economic resources go to mitigate for the human effects on the Columbia Basin ecosystem, mostly for fish. Conservatively, $150 million goes into efforts to protect and restore habitat, support hatcheries, refine fish passage and transport mechanisms, measure results and conduct needed research. Success is not yet at hand, and many legal, policy and scientific questions remain. Dozens of jurisdictions at all levels with overlapping authorities complicate the effort. Significant threats loom such as climate change, human population growth and invasive species effects. The stakes are high and outcomes uncertain, but thousands of people are engaged at all levels throughout the basin in the effort to restore the fish to healthy and harvestable levels.

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Title

Snake River Fall Chinook Salmon: An Overview of Research Pre- and Post-Relicensing

Abstract

Issues relative to fall Chinook salmon (Oncorhynchus tshawytscha) focused on relationships of the Hells Canyon Complex (HCC) with flow and spawning habitat availability and habitat suitability as it related to geomorphic and water quality processes. The potential for reintroduction of these fish upstream of the dams was also explored. In 1991 a protective flow program was initiated which provides a stable discharge (around 9500 cfs) from Hells Canyon Dam during the spawning season, and then adopts that flow as the minimum discharge throughout the incubation period. A model of spawning habitat availability demonstrates that spawning habitat increases moderately between 8,000 to 13,000 cfs, remains stable from 13,000 to 15,000 cfs, and decreases rapidly at discharges >15000 cfs. We estimate a redd capacity of the mainstem Snake River to be between approximately 3,450 and 3,750 redds (? 1,217). Since 1991 redd counts within the Snake River have increased from a low of 46 (1991) to a high of 1,709 (2004). An investigation of the quality of the spawning/incubation habitat revealed that the particle size distribution of the gravels, and the horizontal sub-surface water velocity within both contemporary and historic (upstream of the HCC) spawning areas should not limit redd construction or embryo incubation. However, in situ incubation survival experiments using freshly fertilized eggs resulted in average survivals of 42% and 0% in contemporary and historic spawning areas, respectively. Reduced dissolved oxygen and the presence of hydrogen sulfide within the shallow hyporheic of the historic habitat are the primary cause of significant embryo mortality in the historic area. Finally, in examining potential effects of delayed fall cooling below the HCC, laboratory tests have revealed that when embryos are provided a naturally descending thermal regime, initial water temperatures during incubation can be as high as approximately 16°C without significantly reducing embryo survival.

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Title

Density-dependence is a driver of life history variation in Chinook salmon rearing in Marsh Creek, Idaho

Abstract

A common theme of life history theory is that life history variation is driven in part by density-dependence. We tested these ideas using mark-recapture data from a ten-year PIT-tagging effort of Chinook salmon rearing in Marsh Creek (127 km2), a tributary of the Salmon River, and correlated population density with the frequency of life history types, survival and body-size. Survival and body-size were measured at out-migrant traps and at the first dam out-migrants encounter (Lower Granite Dam). Additionally, out-migrants were categorized into life history types—early sub-yearlings, late sub-yearlings, and yearlings—based on length, timing at traps and season of migration. We hypothesized that body size, survival, and the frequency of life history types should differ as functions of density in Marsh Creek. We found that differences in the frequency of life history types were strongly density-dependent and our results indicate that as population density increases in Marsh Creek, the frequency of fish migrating as early sub-yearlings also increases. We also found that body size decreases with density, which is likely a result of shorter residency. Downstream of the trap, population size remained an important predictor of survival, indicating that the effects of density-dependence in tributaries on factors such as growth could continue to impact salmon in later stages of their life cycle. Survival of different life history types and its relationship with population size differed during downstream migration. These results suggest that tributary resources are limited in the Marsh Creek system and additionally, these results indicate that life cycle models incorporating density-dependent growth and residency may be much more accurate than models that focus on single life history types.

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Title

A species-specific molecular marker for determination of glochidia/host relationships among unionacean mussels and Pacific salmonids

Abstract

Unionacean mussels were, and in some areas still are, an important component of freshwater-salmonid ecosystems throughout the Pacific Northwest. Glochidia larvae of unionacean mussels are temporary obligate parasites on the gills or fins of fishes, including juvenile Pacific salmonids, and this parasitic larval stage is the main means of dispersal for mussels. In turn, mussel beds provide habitat for juvenile salmonids and the benthic organisms they feed upon, and filter-feeding adult mussels may maintain water quality, reduce suspended particles, and control nutrient and plankton levels in lakes and rivers. Therefore, understanding glochidia/host fish relationships is vital to mussel, and potentially salmonid, conservation efforts. To aid in ecological studies of natural glochidia/host fish relationships, we developed a molecular-identification tool for species-specific identification of mussel glochidia. We found diagnostic differences in the nucleotide sequences of a 710-bp fragment of the mitochondrial cytochrome c oxidase subunit I gene (COI) from five unionacean freshwater mussels native to the Pacific Northwest. Digestion of polymerase chain reaction products for the COI gene with the restriction endonuclease AluI produced species-specific differences in size and number of mitochondrial DNA fragments. These DNA fragment patterns were diagnostic for glochidia that were sampled from the gills of juvenile Pacific salmon. We anticipate that future uses of our molecular key to mussel species will include evaluation of species-specific parasite-host relationships in hatchery salmonids experiencing glochidiosis, as well as descriptions of natural parasite/host relationships among unionacean mussels and juvenile Pacific salmonids and other fishes in the Pacific Northwest.

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Title

Travel times of juvenile yearling Chinook and steelhead through the lower Snake River and their associations with environmental variables

Abstract

As part of the multi-agency Comparative Survival Study (CSS), we monitored juvenile wild yearling Chinook, hatchery yearling Chinook, and combined hatchery and wild steelhead travel time between Lower Granite Dam and McNary Dam on the lower Snake River during 1998-2007. We used information-theoretic methods to develop models characterizing the associations between median fish travel time and the environmental indices. Across the three groups analyzed, we found consistent responses of reductions in median fish travel times associated with decreasing water transit times (increased water velocity) and increasing percentage spilled. The effectiveness of water transit time and percentage spill for reducing fish travel time varied over the migration season. Hatchery and wild yearling Chinook demonstrated similar travel times over the migration season, suggesting that rearing type had little effect on yearling Chinook travel times. The functional relationships that we developed provide useful management tools for predicting the effects of alternative hydrosystem operations on the outmigration rates of juvenile yearling Chinook and steelhead through the lower Snake River.

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Title

Instantaneous mortality rates of juvenile yearling Chinook and steelhead through the lower Snake River and their associations with environmental variables

Abstract

As part of the multi-agency Comparative Survival Study (CSS), we estimated the survival of weekly cohorts of juvenile wild yearling Chinook, hatchery yearling Chinook, and combined hatchery and wild steelhead between Lower Granite Dam and McNary Dam on the lower Snake River during 1998-2007. Combining these survival estimates with estimates of median fish travel time, we developed estimates of instantaneous mortality rates along with the uncertainty in those rates. We then developed indices characterizing the flow, water transit time, temperature, turbidity, and the percent spill experienced by these weekly cohorts during the juvenile outmigration. Using information theoretic methods, we developed models characterizing the associations between instantaneous mortality rates and the environmental indices. We found that instantaneous mortality rates generally increased over the migration season for both species and that instantaneous mortality rates of steelhead were roughly double those of yearling Chinook. For yearling Chinook, instantaneous mortality rates were best described by a model that included water transit time, Julian day, and an interaction between these two variables. For steelhead, instantaneous mortality rates were best described by a model that included water transit time, percentage spill, and Julian day. The functional relationships that we developed provide useful management tools for predicting the effects of alternative hydrosystem operations on the survival rates of juvenile yearling Chinook and steelhead through the lower Snake River.

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Title

Pacific Northwest Native Freshwater Mussel Workgroup

Abstract

Although freshwater mussels are considered to be one of the most endangered animal groups in North America, little attention has been given to the status of the seven native freshwater mussel species in the Pacific Northwest. A dent was made in this knowledge gap on February 19, 2003, when a workshop on native freshwater mussels of the Pacific Northwest was held in Vancouver, Washington. The purpose of the workshop was to initiate discussion on the regional population status of freshwater mussels. The workshop consisted of presented papers, a panel discussion and discussion of future activities. It was well attended by 91 participants of very diverse backgrounds. Out of this meeting the Pacific Northwest Native Freshwater Mussel Workgroup was founded. The goal of the Workgroup is to ”Ensure that freshwater mussel research, management, and educational activities are coordinated, prioritized and are consistent with identified information needs”. Towards achieving this goal, the Workgroup has developed nine objectives and meets at least four times a year. Major accomplishments of the Workgroup include construction of a website (http://www.fws.gov/columbiariver), hosting of three annual symposia, participation in two television educational segments on freshwater mussels, and publication of a regional mussel guide, "Mussels of the Pacific Northwest". In addition, several Workgroup members have given presentations on freshwater mussels at professional society meetings, university classes and other natural resource groups. Currently the Workgroup is developing a “critical needs” document that will offer guidance for mussel research. The Workgroup intends to raise the awareness of the status of native freshwater mussels in the Pacific Northwest and ensure that the knowledge base about these mollusks continues to build.

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Title

Hydrologic Implications of Climate Change in the Western U.S.

Abstract

Climate change, and particularly rapid temperature changes which are projected with the greatest certainty, will result in significant hydrologic changes in the Western U.S. in the 21st century including reduced natural storage as mountain snowpack, increased river flow in winter, reduced flow in summer, and increased water temperature. Changes in hydrologic extremes (droughts and floods) are likely to occur. Widespread loss of glacial storage will likely reduce late summer flows in low flow years in sensitive areas. Hydrologic impacts will not be equally distributed, and areas near freezing in mid winter will be the most sensitive to warming related losses of snowpack and resultant streamflow timing shifts. A large number of impact pathways related to engineering design, water resources management, water quality, and ecosystem function are likely to be activated by these hydrologic changes. As a result there is a wide-spread need to incorporate expected changes in climate into long range planning activities related to water at all levels of governance. Achieving this goal will require the development and use of model-based scenarios to replace historic records of important variables such as streamflow, and will also require more sophisticated and flexible approaches to ecosystem protection and restoration, water planning, and engineering design problems related to water.

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Title

Does Spawning Distribution of Outplanted Adult Hatchery Spring Chinook Salmon Influence Reproductive Success in a Natural Stream?

Abstract

Adult hatchery spring Chinook salmon were outplanted into Shitike Creek, a tributary of the Deschutes River (OR), in an attempt to accelerate re-colonization of the stream after the removal of a passage barrier. Outplants were released at five locations in the lower 40 river kilometers of the stream. We used genetic parentage analysis of outmigrating juveniles sampled near the mouth of the stream to estimate the reproductive success of the outplants. A sub-set of the adult outplants were also radio-tagged and monitored after release. The median distance travelled by tagged fish was 1.5 river kilometers (range of 0-10) from their release location, with spawning occurring in three distinct reaches of the stream. Reproductive success of the outplants was variable, with outplants in the upper reaches of the stream producing more migratory juveniles than outplants in the lower reach. Progeny from the lower stream reach migrated predominately in the fall at age 0 while progeny from the upper reach migrated predominately in the spring at age 1, although in all reaches individual family groups had a mix of fall and spring migrants. The presence of non-outplanted spring Chinook adults in the lower reaches, along with differences in habitat conditions, may explain the variable reproductive success of the hatchery outplants as well as the migratory behavior of their progeny.

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Title
Human Population Growth in the Columbia River Basin:

Abstract
The operating assumption of actions taken to protect and restore fish habitat in the Columbia River Basin is that external conditions will be stable over time. However, it is clear that human population growth is a major source of change in the Basin. Population is growing in ways that alter the quantity and quality of fish habitat, thereby affecting the success and permanence of habitat improvements. This paper presents the major findings of the Independent Science Advisory Board's 2007 review of human population impacts on fish and wildlife in the Columbia River Basin. First, Basin population trends and projections are described. Next, the major vectors of population effects on fish habitat are summarized. Outside-basin population impacts on fish habitat are also presented. Planning processes to incorporate the uncertainty caused by population growth are reviewed. The paper concludes with recommendations regarding planning processes, tools and coordination to incorporate population growth into fish habitat protection and restoration.

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Title

Monitoring Fish Passage Through Culverts in Western Oregon

Abstract

Full channel PIT tag antennas were installed upstream of culverts in the West Fork Smith River basin to monitor fish movement through culverts. All of the culverts in this study passed juvenile coho salmon and cutthroat at a wide range of flows. There appear to be patterns in the timing, frequency, and magnitude of upstream and downstream presmolt movement. The upstream movement of both juvenile coho salmon and cutthroat trout in the West Fork of Smith River appeared to be triggered by the first fall freshets and tapered off through the rest of the year. Downstream movement was spread throughout the year. Virtually all of the upstream movement occured during flows at or below the 2% exceedance level with the vast majority happening at or below the 10% exceedance. Determining the timing and magnitude of flows when fish move could help to refine the design criteria for crossings. While these findings might be used to justify less than stream simulation sized crossings many other factors need to be considered as crossings are sized and designed. However, stream simulation crossings provide for many more benefits and functions than just fish passage. Maintenance of stream channel processes, ecological function and delivery of materials downstream are of equal or greater importance and should be considered in culvert design.

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Title

Distribution of Native and Invasive Crayfishes in Oregon's Willamette Valley: Exploring Synergy Between Invasive Crayfish and Bullfrogs

Abstract

Oregon's Willamette Valley is an agriculturally dominated region inhabited by native Signal crayfish (Pacifastacus leniusculus) and invasive Red Swamp crayfish (Procambarus clarkii). This agricultural landscape is inhabited by several other predatory invasive species, such as the American Bullfrog (Rana catesbeiana), that may be facilitating crayfish invasion through artificial trophic structures. Due to similarities in behavior and physiological plasticity, and dissimilarity in size, Red Swamp crayfish should not be capable of competitively excluding native Signal crayfish unless another factor is present. Invasive Red Swamp crayfish and native Signal crayfish share similar behavioral traits (e.g., aggression, dispersal, plasticity – typical of invasives) and life histories (keystone species, wide abiotic tolerances, refuge requirements) and both occur as invasive species outside of their native ranges. Signal crayfish are native to the Pacific Northwest and occur as invasive species throughout Northern Europe, while Red Swamp crayfish are native to the lower Mississippi River and have worldwide distribution as an invasive species. Bullfrogs are sympatric with Red Swamp crayfish, and also share worldwide distribution as invasive species. Bullfrogs are voracious predators, and are known to prey upon crayfish. To address this hypothesis, we will survey lentic and lotic water bodies to determine the success of Red Swamp crayfish invasion within the Willamette Valley. This will be complemented by laboratory behavioral assays and mesocosm experiments to determine inter- and intraspecific relationships in this species assemblage. We will then compare species assemblages of sample sites to determine whether invasive Bullfrog presence influences crayfish occupancy.

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Title
Navigability and Public Access

Abstract

Human Population Growth and Fisheries: The Western Challenge
Abstract for the American Fisheries Society

Navigability and Public Access
Michael Hanson, Senior Trooper
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Several major watersheds within the Portland Metropolitan Area are utilized by many different river users. As the population has increased, so has the use of these rivers often conflicting with private landowners who reside along these metropolitan streams. Many of these conflicts concern the public right to use the beds and banks of navigable streams with the rights of private land owners who live beside these streams.

Although, federal law states that “all the navigable waters of (the) State, shall be common highways and forever be free, as well as to the inhabitants of said State as to all other citizens of the United States…” it is the Oregon State Land Board that determines which waterways or portions are navigable.

This has caused conflict with river users, private land owners and law enforcement who are often called upon to sort out these issues. Navigability issues are found on numerous streams throughout the State but we will limit our discussion to the Portland Metropolitan Area.

Please join us for a discussion on cases worked and how law enforcement deals with these conflicts on navigability.

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Title

Comparative Life History Traits of Natural and Hatchery Lostine River Spring Chinook Salmon (Oncorhynchus tshawytscha) after Ten Years of Supplementation

Abstract

Chinook salmon Oncorhynchus tshawytscha serve as a powerful cultural and social symbol for tribal and non-tribal people of the Pacific Northwest. Yet despite the significance of this icon, there have been widespread and dramatic declines in Chinook salmon populations over the last century. These declines were also witnessed in the salmon populations of northeast Oregon. In response, co-managers of this resource have used several management strategies to help reverse the decline, including the use of supplementation. The Nez Perce Tribe and Oregon Department of Fish and Wildlife believe that supplementation may be capable of increasing natural production, but the recovery benefits of supplementation are not universal and can be highly uncertain. Therefore, monitoring and evaluation are integral in managing the risks associated with supplementation and are the mechanisms whereby managers and policy makers are informed of results.

Supplementation activities began in 1997 in the Lostine River to assist an ESA listed population of spring Chinook salmon. Our objectives are to increase abundance and productivity of the population without altering the life history traits that are adapted to the local environment. Performance measures associated with life history were assessed during the 10 years of supplementation, comparing natural and hatchery origin salmon.

Natural and hatchery Chinook salmon had similar adult migration timing, sex ratios, length-at-maturity, fecundity and distribution on the spawning grounds. Juvenile hatchery fish did not mimic the emigration patterns of natural juveniles and arrived at Lower Granite Dam earlier than their natural counterparts. Hatchery Chinook salmon also displayed a different cohort age structure than natural cohorts with hatchery males maturing at an earlier age. Monitoring and evaluation efforts will continue to coincide with supplementation activities in the Lostine River to address the uncertainty specific to this project and add to society’s knowledge regarding supplementation in general.

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Title

Public Involvement: How Information and Education Professionals Can Help (A Case Study from the Fish Food Crisis of 2007)

Abstract

Public Involvement: How Information and Education Professionals Can Help (A Case Study from the Fish Food Crisis of 2007)

How do you convince an already skeptical public that the trout they are catching in a local pond or lake are not contaminated and are safe to eat? In the aftermath of the pet food scare, which may have caused as many as 4,000 animal deaths, this is the issue the Oregon Department of Fish and Wildlife (ODFW) faced when fishery managers found out that more than 30 of their fish hatcheries were potentially exposed to melamine-contaminated fish feed in Spring 2007.

Public involvement is critical to ensure that issues and concerns are understood and addressed. This is true especially during low trust, high risk scenarios. Information and Education (I&E) professionals are a valuable resource and should be brought in early when there is a potential controversial issue that could impact the public. For example, when the fish food crisis developed, I&E was included in the initial response team and strongly encouraged that state and federal agencies fully disclose the initial findings. This action was critical in forming the steps for the public involvement relating to the issue.

Through a combination of public involvement approaches—media outreach, informational campaigns, and face-to-face discussions—ODFW was successful in quickly restoring the public's confidence, lessening and eliminating fears of any significant human-health risk associated with eating the fish. Although there is a paradox that sometimes frustrates the public involvement process--agency personnel know they need meaningful citizen involvement in their management decisions, but they also want citizens to trust their scientific expertise--as public stewards, natural resource managers need to practice responsive leadership by involving the public in their decision-making processes.

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Title

Distribution, Abundance and Habitat Preference of the Lake Lamprey, Lampetra macrostoma, in the Cowichan Lake System, British Columbia

Abstract

The Vancouver lamprey, Lampetra macrostoma, is endemic to the Cowichan Lake system on Vancouver Island, and is protected under a variety of status designations, warranted in part by its extremely limited distribution. Additionally, as it was only recently described as a new species, general information on the biology, ecology and evolution is lacking; information that is vital for proper conservation status designation and subsequent management and protection. As a result, a multi-year project was initiated with the intent of resolving some of these unknowns. The preliminary research, initiated in 2007, was undertaken to provide insight on the distribution, abundance and general habitat use of L. macrostoma. To facilitate this, electro-fishing was employed in a system wide assessment to capture ammocoetes. In total, 309 ammocoetes were captured in Cowichan, Mesachie and Bear lakes from 16 geographically distinct locations, suggesting that L. macrostoma is widely distributed in this system and that the abundance of this species is greater than previously assumed. Furthermore, qualitative observations made at ammocoete capture locations suggest that larval lampreys of this species prefer habitats where sediments are composed of medium-fine or fine substrates in areas where there is also an element of organic debris. Although preliminary in nature, our field surveys provided some important insights into the distribution, abundance and habitat preference of L. macrostoma. Future work, such as quantifying important specific habitat characteristics, laboratory experiments and molecular analyses to test its distinctiveness from parapatric Pacific lamprey, Lampetra tridentata, will promote a better understanding the life history, ecology, and evolution of this freshwater parasitic lamprey.

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Title
Measuring the response of spawning chum salmon to elevated flows in the Columbia River

Abstract

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Title

Measuring the Response of Spawning Chum Salmon to Elevated Flows in the Columbia River using an Acoustic Telemetry Array

Abstract

Chum salmon (Onchorhynchus keta) spawn in main-stem habitats near Ives Island below Bonneville Dam on the Columbia River. The spawning habitat is sensitive to water level fluctuations resulting from hydropower generation at Bonneville Dam. To provide stable spawning conditions, fishery managers attempt to maintain a tailwater elevation of 11.5 ft below Bonneville Dam during the spawning and incubation period, but are sometimes forced to pass excess water at night when flows are high. We examined the response of spawning chum salmon to experimental increases in tailwater elevation (i.e., increased flows) in 8-h tests. We used acoustic telemetry to determine if tagged fish were 1) unaffected, 2) temporarily displaced from their redds, 3) moved and spawned elsewhere, or 4) did not complete spawning. Redd digging behavior, time spent on redds, and incidence of spawning were documented using a dual-frequency identification sonar (DIDSON). Most chum salmon movement from redds was associated with tailwater elevations exceeding 14.7 ft, and fish generally moved into slow velocities along shore and sometimes exited the study area for short periods. Redd digging activity by female chum salmon generally declined with increasing tailwater elevation. The least digging occurred at a tailwater elevation of 15.5 ft when water velocities increased to 1 m/s. The effects of the elevated flow and tailwater elevations we tested appeared to be temporary as most fish returned to spawn after tests were completed and flows returned to base levels.

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Title
Oregon Conservation Strategy: Citizen Science Opportunities for Fish and Wildlife

Abstract
Every state and six territories have created State Wildlife Action Plans (SWAPs) as a big-picture framework for conservation. The Oregon Conservation Strategy (Strategy) is Oregon's SWAP. The Strategy uses the best available science to create a broad vision and conceptual framework for long-term conservation of Oregon's native fish and wildlife, and is intended to be a broad framework for all of Oregon. The Strategy identifies priority species, habitats, and areas on-the-ground for conservation action. The Strategy takes an adaptive management approach to incorporate new information; therefore, monitoring is an important component of the Strategy. To focus monitoring efforts, additional work has identified priority species for monitoring based on three criteria: (1) data needs; (2) representation of priority habitats; and/or (3) public appeal, including the potential for doing monitoring work on private lands and for doing work by citizen scientists. These monitoring priorities can provide guidance to citizen science groups, helping them to focus efforts to collect information where these efforts are most needed. Several web-based tools, in various stages of development, assist with tracking and reporting results over time. Our presentation describes how Strategy priorities are being tracked over time, and we discuss how the monitoring priorities can be utilized by a broad array of groups, including citizen scientists.

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Title

Overview of Management Tools used in Yukon River Fisheries

Abstract

The salmon fisheries of the Yukon River drainage are managed to achieve escapement goals in Alaska and the Canadian portion of the drainage, and, to provide for consumptive uses. Subsistence fishing opportunity has the highest priority. Management of the salmon fishery is difficult because of the complexity of the salmon populations, fisheries, geography, and jurisdiction. Due to the size and complexity of the drainage and the geographic distribution of its fisheries, management for individual stocks or populations is not possible. Salmon fisheries throughout the drainage harvest Canadian-bound stocks that are over a thousand miles from their spawning grounds. The fisheries are complex due to the gauntlet nature of the fishery with harvest of multiple stocks occurring at different times and locations throughout length of the drainage. Allocation issues exist between lower-river and upper-river fishers in Alaska. Lastly, important allocation and conservation issues exist between the governments of U.S.-Alaska and Canada-Yukon Territory. The commercial and subsistence salmon fisheries in the Yukon River are managed based upon perceived run strength and Alaska Board of Fisheries approved fishery management plans. During the fishing season, management is based upon in-season run strength assessment information. Pre-season information involves run forecasts based upon historic performance of parent spawning abundance and is generally expressed as runs that will be below average, average, or above average. In-season run assessment includes: (1) abundance indices from test fishing, (2) sonar counts of fish passage, (3) escapement assessment, (4) commercial and subsistence catch data, (5) catch per effort data from monitored fisheries, and (6) genetic mixed stock analysis.

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Title
Full Circle: Cashing In On A Lifetime of Experience

Abstract
Fish and Wildlife agencies are facing flat or declining revenues from the sale of fishing licenses. Traditional efforts to recruit new fishermen are not keeping pace with population growth, due in part to changing lifestyles of today's family units. Loss of revenue will very likely negatively impact agency budgets and work programs and could potentially reduce seasonal staff and impinge on the collection of survey and inventory data and other baseline field activities. The fastest growing segment of America's population is the "baby boomer" generation who are retiring and in many cases relocating to coastal and rural communities. These retirees are coming from the best educated generation in our nation's history and have gained a lifetime of work experience in a vast array of occupations. Retirees are more commonly financially secure and involved in leisure activities, making them ripe for recruitment into fishing activities and involvement with volunteer programs designed to assist fish and wildlife agencies in providing "value added" fisheries habitat, survey and inventory, educational and enhancement programs. Volunteer programs are not only a force multiplier for short staffed agencies, but these programs also develop core support groups who have a strong affinity for natural resources, are generally supportive of agency programs and personnel and who have independent funding resources.

The Oregon Department of Fish and Wildlife Salmon and Trout Enhancement Program (STEP) has been working for Oregon's fisheries resources for twenty six years and is a model for a successful volunteer effort. STEP volunteers work under the direction of ODFW biologists on projects that include: education and outreach, habitat improvement, inventory and monitoring, and fish culture. In 2006, STEP volunteers contributed 71,874 hours to STEP programs, the equivalent of 35 full time employees.

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Title

A comprehensive survey of the native fish fauna of the Goose Lake Basin

Abstract

The Goose Lake Basin is an arid watershed in south central Oregon and northeast California that supports nine native fishes, including the endemic Goose Lake redband trout (Oncorhynchus mykiss ssp.), Goose Lake lamprey (Lampetra tridentata ssp.), Goose Lake sucker (Catostomus occidentalis lacusanserinus), and Goose Lake tui chub (Gila bicolor thalassina). The last survey of fishes from the Goose Lake Basin was preformed in 1994 and was largely restricted to public land. In the summer of 2007, we conducted a statistically-based survey to determine the distribution and abundance of the watershed's native fishes. Sample sites were randomly chosen using the Environmental Protection Agency's Environmental Monitoring and Assessment Program (EMAP) protocol which selects representative sample sites from known fish distributions across a broad array of stream habitat and land ownership. At each sample site we used a variety of sampling methods to collect relative abundances and length distributions from all species encountered. Additionally, abundance of redband trout was estimated using multiple-pass removal electrofishing. Sampling began amid a severe drought resulting in many dry or puddled streams and water temperatures exceeding 30oC. Despite these conditions, all nine native fish species, including six non-native species, were captured across 140 sample sites. We will describe distribution and abundance patterns of the nine native fish species and compare results to prior surveys.

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Title

The 100th Meridian Initiative: Finding Relevance in a Post-Quagga West

Abstract

The 100th Meridian Initiative – named for the imaginary line dividing western and eastern North America - is a national partnership dedicated to preventing the westward spread of zebra mussels (Dreissena polymorpha) and other aquatic nuisance species. This program serves as a catalyst and coordination mechanism for activities ranging from boater outreach to rapid response planning. But its context shifted dramatically in January 2007 when quagga mussels – a congener of the zebra mussel – were discovered growing in Lake Mead; further surveys have revealed a distribution extending into central Arizona and southern California. Things went from bad to worse in early 2008 when adult zebra mussels were confirmed living in San Justo Reservoir in California's central valley, and in Lake Pueblo in Colorado. Strictly speaking, dreissenid mussels have breached the 100th Meridian, and some might argue the 100th Meridian Initiative therefore has become irrelevant. However, closer examination demonstrates the exact opposite. The strategies employed by this program to prevent mussels from crossing the 100th Meridian can be effective in minimizing spread within the West. Moreover, boats from the eastern United States continue to represent as likely a source of zebra mussels to regions like the Columbia Basin as the more recently infested waters to the south. There are also many other invaders east of the 100th Meridian, such as Asian carp, where exclusion from the West remains possible. If anything, the recent quagga and zebra mussel invasions have galvanized interest and investment in the 100th Meridian Initiative. Although the geographic aspect of its name now may be less intuitive, its relevance to the overall national effort to minimize aquatic invasive species impacts continues to expand.

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Title
Trinity River salmon: work, results, and trends

Abstract
The Trinity River Restoration Program in Northern California is rehabilitating the river channel and restoring flows after 40 years of channel simplification to restore sustainable fisheries. Although the Trinity River Hatchery maintains production, natural fall Chinook continue to decline. Since the Program currently manages flow we are interested in whether increases in flow are beneficial to Chinook and coho. We used a long term set (1978 -2006) and a subset (1991-2006) separated into brood years. We separated out variation in both natural and hatchery runs due to ocean or climatic factors from variation due to flow management using adult run size estimates and cohorts. Fall run Chinook long term data indicate that ocean conditions as well as in river conditions during outmigration were important. Long term data on coho indicate that natural escapement responded positively to changes in river flow since 1977. Natural two year old coho response is much more complex, requiring incorporation of ocean conditions as covariates. Brood year specific data for hatchery coho indicates an influence of both in-river and ocean conditions. Natural coho show a stronger influence of river conditions in their first year and during outmigration. How do Trinity River runs compare to the Klamath as a whole? When we look at hatchery fall Chinook, Trinity River Hatchery fish survive well in comparison to Iron Gate Hatchery Fish. Although both chinook and coho are influenced by ocean conditions, both seem to respond positively to moderate in-river flows provided year round within the Trinity Basin.

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Title

Larval sucker response to wetlands restoration at the Williamson River Delta, Oregon

Abstract

The mouth of the Williamson River historically flowed through ~2,200 hectares of contiguous emergent marsh wetlands that were bisected by the Williamson River and connected to Upper Klamath (UKL) and Agency Lake. Larval Lost River and shortnose suckers historically inhabited the wetlands prior to entering UKL. Beginning in the 1940's, levees were built and the wetlands were drained and converted to cropland, and the Williamson River flowed directly to Upper Klamath Lake with no access to floodplain or delta wetlands. The Nature Conservancy is restoring the wetlands by removing levees to hydrologically reconnect the delta to the Williamson River and UKL. Two pilot projects, completed in 2000 and 2003, restored approximately 100 HA of wetlands. Monitoring there has shown that larval suckers have been using the restored habitats, and larval suckers caught in restoration wetlands are bigger, older, and better fed than suckers caught in the Williamson River and existing shoreline habitats of Upper Klamath Lake. It appears that wetlands act to retain fish and also provide them with rearing opportunities that may enhance fitness and survival of young suckers. Non-native fish also utilize these restoration wetlands, although interspecific interactions are unknown. In October 2007, an additional 1000 hectares of wetland habitat was restored at the Williamson River Delta, with an additional ~ 1000 HA planned for restoration early 2008. Restoration is expected to improve early survival of suckers, leading to increased recruitment to adult spawning stages and the eventual downlisting of both species, and could be used as a model for future restoration projects in the area.

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Title

The use of adult and juvenile salmon abundances to measure reintroduction success in the Tilton River Basin.

Abstract

Population growth in the Pacific Northwest region in the 21st century has included the construction of dams for hydroelectric power which has affected access to important rearing and spawning habitats for anadromous salmonids. The Cowlitz River, a tributary to the Columbia River in Southwest Washington, is an example of this with the construction of the Mayfield and Mossyrock dams in the 1960s and the Cowlitz Falls Dam in the 1990s. Effort to reintroduce salmonids upstream of these dams has included a truck and haul program and the use of juvenile collection facilities at two of the dams, Mayfield and Cowlitz Falls Dam, to capture outmigrants. The Mayfield Dam collection facility is downstream of the Tilton Basin and captures juvenile fish migrating from the Tilton River. In the Tilton Basin since 2001, the focus has been on reintroducing adults rather than planting juvenile fish. From 2000-2006, over 86,000 adult coho have been transported and released into the Tilton to spawn and provide harvest opportunities for sport fishermen. During that same timeframe, large numbers of juvenile coho and Chinook have migrated out of the Tilton and are enumerated and tagged at the Mayfield Dam facility. This presentation will give details of the fish management efforts in the Tilton River including juvenile run timings, techniques used to differentiate Tilton and Upper Cowlitz Basin stocks, and adult salmon escapement information related to the reintroduction efforts.

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Title

Using PIT technology to assess movement and residence time of juvenile Chinook salmon in an intertidal salt marsh of the Salmon River estuary, Oregon.

Abstract

Understanding of juvenile salmon behavior in estuarine wetlands is based almost entirely on conventional capture methods, which are not readily adapted to studies of fine-scale movements by individual fish. We operated a stationary Passive Integrated Transponder (PIT) detection system within a small intertidal channel of the Salmon River estuary and passively monitored movement into and out of the channel by individually tagged age-0 Chinook salmon (FL =60mm) during two summer rearing seasons in 2004 and 2005. Frequency of tag detection peaked between one and two hours before high slack tides and between three and four hours after high slack tides, corresponding with movement of fish into the tidal channel on flooding tides and out of the channel on ebbing tides. Although most detected fish moved with the tidal currents, several individuals entered the channel against the ebbing tide. Few fish were detected when water depth was less than 0.4 meters, and no fish remained in the channel during low slack tide. Median residence time of individuals within the study channel was 4.9 hours per tidal cycle, and individual salmon were detected using the study channel over periods up to 109 days. Some individuals used the channel on multiple successive tidal cycles, and detections of other individuals were separated by several weeks. Our findings demonstrate that PIT interrogation can be an effective tool for monitoring small tidal channels in Pacific Northwest estuaries. Stationary antennas detected 12mm full-duplex tags in salinities as high as 30 psu. This novel application of PIT technology allowed us to describe volitional movements of individual subyearling salmon into and out of tidally flooded salt marsh habitat and may facilitate understanding of estuarine rearing by fishes too small to be tracked by conventional radio or acoustic telemetry.

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Title

Emergence of Ichthyophonus hoferi in the Columbia River via American Shad

Abstract

Ichthyophonus hoferi, a protozoan parasite that has repeatedly caused massive epizootics among wild clupeids throughout the world, currently infects 72% (n = 202) of adult, pre-spawn American shad in the lower Columbia River. Infection prevalence decreased to 58% (n = 60) at the Snake River Lower Granite Dam, indicating that some of the infected cohorts either died from the resulting disease or were unable to complete the upriver migration. Infections were likely established after exposure in the marine environment because 0% (n = 120) of the age - 0 shad out-migrants in the Columbia River were positive, but 60% (n = 10) of sub-adult shad were positive in the marine / estuarine waters of Puget Sound. Among other Columbia River fishes, Ichthyophonus was also detected in 4% of adult spring Chinook salmon (n = 90), but it was not detected in smallmouth bass (n = 14), northern pikeminnow (n = 73), white sturgeon (n = 12), or adult fall Chinook salmon (n = 101). Considering the high infection prevalence in adult American shad, the recent increase in shad population size, and the low host specificity of Ichthyophonus, a high potential exists for future geographic and host range expansion of the parasite throughout the Columbia River watershed.

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Title

Snake River Fall Chinook Salmon Productivity and Hatchery Production

Abstract

Snake River fall Chinook salmon abundance and productivity have been and continue to be influenced by construction and operation of hydroelectric dams, among other natural and management factors. We summarize here four areas related to productivity; (1) adult abundance, (2) hatchery programs, (3) management actions, and (4) remaining critical uncertainties.

Historical abundance of fall Chinook salmon in the Snake River Basin was 500,000 fish annually. However, from the mid 70’s to late 90’s return levels have averaged less than 1,000 and were as low as 100 natural-origin fish. Much of this decline was directly attributable to blocked access or inundation of spawning habitat. Hatchery programs were developed in the past 20 years to mitigate for some of this lost productivity. Hatchery programs were modified and expanded in the mid 90's to incorporate supplementation objectives (release of hatchery juveniles in natural production areas) as a result of litigation by the Columbia River treaty tribes. Recent returns, including hatchery origin fish, have been 10,000 to 15,000 (~2,500 natural origin adults). Distribution of spawners within the accessible habitat has started to re-colonize areas in the Salmon River, Imnaha River, Grande Ronde subbasin, and South Fork Clearwater River, but much of the historic habitat remains block or unutilized.

Harvest of Snake River fall Chinook salmon still occurs in ocean and mainstem Columbia River fisheries, however, substantial reductions in state and tribal fisheries were implemented in 1993 and continue today. Several critical uncertainties still exists relative to the short-term and long-term productivity of Snake River fall Chinook salmon, including: relative reproductive success of supplementation and natural origin adults; long-term persistence of an ESU with a single extant population spatial structure and diversity; estimates of juvenile abundance/production; factors influencing and magnitude of carrying capacity.

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Title

Assessing distribution and relative reproductive success of hatchery origin adults in target and non-target interior Columbia River Basin stream-type Chinook salmon populations

Abstract

The Collaborative System-wide Monitoring and Evaluation Project hatchery subgroup was charged with the development of study designs to evaluate the “effectiveness” of Columbia River Basin hatchery programs. The highest priority question to be addressed at the regional scale was identified as: “what is the distribution and relative reproductive success of hatchery origin adults in target and non-target Columbia River Basin populations?” Addressing this question requires two types of information: (1) estimates of the relative abundance of strays in a “representative” group of Columbia River Basin populations (stray ratio design) and (2) estimates of the reproductive success of hatchery origin adults relative to natural origin adults in target and non-target populations (relative reproductive success (RSS) design). Although the two types of information are most informative when utilized simultaneously, it was found that sampling challenges precluded the formulation of a single design to generate representative estimates for both. We developed low, medium, and high level designs separately for each type of information. For each design alternative, we examined the qualitative inferential ability, cost, and statistical reliability. The process used in design selection recognized scientific "certainty" can really only be achieved when a design

process starts with appropriate precision guidance and designs can achieve significant cost-savings by capitalizing on existing monitoring efforts. We concluded the medium level stray ratio design would provide adequate estimates for all populations and enable evaluation of precision and bias. We also determined that the medium level RRS design sufficiently represents the range of hatchery management and yields information on RRS of strays with some assumptions. If there are reasons to suspect that the reproductive success of naturally spawning hatchery origin fish might change in the presence of greater numbers of hatchery origin adults, it would be prudent to implement the high level design.

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Title
Strategic Analysis Worksheet

Abstract

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Abstract: Strategic Analysis Worksheet

Too often, managers and executives see only the crisis in an emerging issue. Focusing on an immediate response often leads to solving the wrong problem, overlooking key players, unanticipated consequences, or other unsatisfactory results. Responding in a crisis mode also precludes any search for the opportunity that may be hidden within the crisis.
With today's emphasis on partnerships and collaborative decision making, it is imperative that agencies accurately articulate the parameters of issues to be resolved, the meaningful decision space, and the role played by various partners in the decision making process. These important details, and many others, are often ignored in the rush to "deal with" an emerging issue.
Luckily, a straightforward analytical tool is available to planners, managers and decision makers faced with an emerging crisis. Developed and refined by the staff of the Cispus Communications Workshop, the Strategic Analysis Worksheet (SAW) asks 13 critical questions that lead beyond the surface of an emerging issue. These questions not only help define the issue, they also identify information gaps, outreach opportunities, potential constraints and a realistic timeline.
Deceptively simple in appearance, the SAW can be used for a quick and dirty initial assessment, as an analytical tool to identify information needs or planning shortfalls, and as a planning and monitoring tool by the decision maker and their staff.

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Title

Integration of ecological functions into greenway development along Yreka and Greenhorn Creeks, California

Abstract

Yreka and Greenhorn Creeks are urban anadramous streams tributary to the Shasta River in the Klamath River Basin. Both creeks have been extensively dredged for gold. Yreka Creek has lost floodplain access due to downcutting and adjacent urban development. Greenhorn Creek retains some floodplain access, but is constrained by tailings piles and a reservoir that blocks anadromous fish. The City of Yreka has prepared master plans for a greenway along Yreka Creek and a regional park along Greenhorn Creek. State and federal grant funding was recently obtained to flesh out and begin implementation of these master plans. Design components for Yreka Creek Greenway implementation include: (1) restoring floodplain function by lowering surrounding grade to proximity of downcut channel; (2) disposing of spoils on adjacent commercial properties to minimize hauling costs and enhance adjacent commercial development; (3) intercepting nearby urban runoff with vegetated swales, sediment basins, and floodplain overflow channels to induce infiltration and filtering of runoff prior to reaching Yreka Creek; (4)routing of trails within new floodplain to maximize available floodplain; and (5) revegetating site with native riparian species to maximize wildlife and fishery habitat values. Design components for 1 mile of Greenhorn Creek and Reservoir include: (1) restoring floodplain function by removing tailings piles; (2) disposing of spoils on adjacent upland park property to facilitate future park development; (3) Intercepting urban runoff as above; (4) routing of trails along edges of restored floodplain; (5) revegetating site as above; and (6) retro-fitting the reservoir to serve as stormwater attenuation basin and restore fish passage. Construction of the Yreka Creek portion was completed last fall, and construction of the Greenhorn Creek portion is currently underway. Important lessons have been learned regarding master planning, land tenure, and construction methods.

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Title

An Evaluation of Supplementing Natural Production Using Adult Hatchery-Origin Spring Chinook Salmon (O. tshawytscha) in Shitike Creek, Oregon

Abstract

Shitike Creek is the first major tributary to the Deschutes River downstream of the Pelton Round Butte Hydroelectric Facility. The entire watershed is located on the Warm Springs Reservation of Oregon and supports a naturally spawning population of spring Chinook salmon (Oncorhynchus tshawytscha). Despite habitat improvements in the watershed via passage barrier removal in 1983 and protection of riparian areas, the productivity of natural populations did not appear to increase. In 2000, the Confederated Tribes of Warm Springs and the U.S. Fish and Wildlife Service initiated an outplanting evaluation project using surplus adult hatchery-origin spring Chinook salmon returning to the Warm Springs National Fish Hatchery to supplement natural production in Shitike Creek. From 2000 to 2007, adult hatchery-origin spring Chinook salmon were outplanted each year in as many as 5 release locations throughout the drainage. Sub-samples of the outplanted fish were radio tagged from 2002 to 2005. Starting in 2002, genetic samples were obtained from outplanted hatchery spring Chinook, returning wild adults, and outmigrating juveniles to establish pedigree. Pedigree analysis for brood year 2003 showed that 80% of the juveniles sampled at the rotary screw trap were progeny of at least one outplanted parent. Overall since project inception in 2000, there has been a documented increase in redd production and juvenile densities compared to pre-supplementation.

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Title

Validation of mark-recapture and depletion electrofishing models for redband trout in Central Oregon streams

Abstract

Accurate redband trout population estimates are necessary to evaluate the potential effect of reintroducing steelhead trout into the upper Deschutes watershed. Depletion and mark recapture electrofishing are commonly used methods for estimating stream trout populations. We evaluated the underlying assumptions of these two models, and the bias and precision of the results. Field electrofishing surveys were conducted during low-water conditions in eleven, 100 m blocknetted sites in Ochoco, McKay and Whychus creeks. Fish were marked with a caudal fin clip and recaptured in one to three subsequent passes. Additional blocknets were installed above and below sites to evaluate the assumption of a closed population. Independent population estimates of redband trout >60 mm were conducted using the Zippen model (2-3 passes), generalized removal model (4 passes) and Peterson mark-recapture models. Blocknets were successful in limiting emigration of fish (only 1 of 667 marked redband was detected outside of its original section). Despite significant effort to standardize electrofishing passes, measured capture efficiencies were not equal among passes or size class. These significant differences were not detected by the tests of homogeneity performed by the generalized removal model (Program CAPTURE). In addition, capture efficiencies estimated by the removal model were significantly greater than the capture efficiencies measured in the field (p=0.002). The removal model overestimated capture efficiencies by an average of 17.7% in 19 of 23 habitat units electrofished. This created significant negative bias in the population estimates generated by the depletion model. The average precision of mark-recapture estimates was 38% (range 20-58%). The protocol developed allowed us to complete one sample site per day, evaluate underlying model assumptions and generate relatively precise, unbiased population estimates for redband trout in Central Oregon streams.

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Title

Ecological conditions in the Missouri, Mississippi and Ohio Rivers: from microbes to fish

Abstract

The US EPA’s EMAP assessment of Great Rivers collected chemistry, habitat, and biological samples from 447 main channel sites on the Upper Mississippi, Missouri and Ohio Rivers in 2004-2006. We paired these data with landscape and hydrological attributes. River chemistry was distinctly different among rivers, with the Mississippi having the highest nutrient concentrations. Physical habitat variables, particularly the extent of human disturbance in the riparian zone channel complexity, and a diversity of substrate sizes were significantly different among rivers. Likewise, landscape scale attributes, such as the percent row crop agriculture in the watershed, or the weighted-proximity of human disturbances, showed differences among rivers. Using these physico-chemical attributes, we created a multi-metric stressor gradient against which we compared the biological responses within and among rivers. Organic matter processing by sediment microbial assemblages was largely governed by nutrient availability and stoichiometry. Algal assemblages were diverse and significantly different among rivers, and exhibited strong responses to nutrient gradients in the rivers. Macroinvertebrate assemblages collected from the surfaces of main-channel snags varied considerably within rivers and reaches, but were correlated with distance from the first upriver dam, river velocity, and dominant river substrate. Fish assemblages within the three rivers exhibited little inter-annual variation within river, and ordination of the fish assemblage data revealed significant differences among the three rivers. Overall, biology was significantly different between rivers, and was correlated with chemistry, habitat, landscape attributes and the overall stressor gradient. By characterizing these biological responses we are developing tools that can track pollution and quantify the impacts that upland stressors are having on water quality.

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Title

Challenges for fish passage and migration in the North Fork Toutle River

Abstract

The North Fork Toutle River drains the northwest face of Mount St Helens to the Cowlitz River, a major tributary of the Columbia River in southwestern Washington. In response to the 1980 eruption of Mount St Helens, the U.S. Army Corps of Engineers constructed a Sediment Retention Structure (SRS) in the North Fork Toutle River watershed to reduce the transport of fine sediment to the lower Cowlitz and Columbia River systems. The SRS was built without fish passage facilities and currently presents a significant barrier to volitionally migrating adult salmonids. To facilitate passage of coho salmon Onchorynchus kisutch and steelhead trout Onchorynchus mykiss to the upper watershed, a Fish Collection Facility (FCF) was constructed 1.5 km downstream of the SRS. Trapped fish are transported upstream by truck across minimally improved logging roads and randomly released into two North Fork Toutle River tributaries, Alder and Hoffstadt creeks, without consideration of their stream of origin. Spawning success of released adults and the subsequent success of rearing and outmigrating juveniles is not well understood. Radio telemetry research is underway to evaluate trapping efficiency of the FCF and adult fish passage limitations of the SRS and forebay sediment plain. Results of these evaluations will provide fishery managers and fish passage engineers with valuable data to prioritize fish passage and habitat restoration alternatives. Successful selection and implementation of preferred alternatives will lead to self-sustaining fish populations in the upper watershed. Existing challenges for fish passage and migration will be presented as well as the goals and implications of existing collaborative research within the watershed.

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Title

The Imnaha River Chinook Salmon Supplementation Program After Twenty-five Years: A Model Program in Need of Reform?

Abstract

The Chinook salmon Oncorhynchus tshawytscha of the Imnaha River of northeast Oregon are an unique spring/summer race that migrates and matures later than other Snake River populations in Oregon. The Imnaha River Chinook Salmon population has been supplemented since 1982 and annual means of 148 adults have been spawned, 241,554 smolts released, and 1,117 adults returned. We examined similarities and differences in characteristics between hatchery and natural Imnaha River Chinook salmon to determine whether the program has been successful in accomplishing its life history goals. We also compared abundance and productivity of Chinook salmon in the Imnaha River with similar but unsupplemented Snake River Basin populations to evaluate whether abundance and productivity of the Imnaha River have increased above that which might have been expected if the river was never supplemented. We found that hatchery smolts are larger than natural smolts and return at a younger age than natural adults. Hatchery adults also return and spawn later than natural adults and hatchery adults tend to spawn lower in the system and near that acclimation site, whereas natural salmon spawn further upstream. The program has increased total abundance, with the hatchery recruit:spawner ratio being 7 times that of natural salmon, but has not achieved other goals, particularly those related to enhancing abundance of natural origin salmon and maintaining productivity. Natural abundance has not increased, despite an increase in total spawners (hatchery and natural) spawning in nature. Since the initiation of supplementation, mean recruit:spawner ratio for natural salmon has exceeded replacement for only 4 of 20 brood years and productivity of the Imnaha population relative to unsupplemented populations has declined. It may be time to substantially modify this program, with changes in weir management, broodstock collection and management, hatchery rearing, and smolt releases.

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Title

Migration Behavior of Introduced American Shad in the Columbia and Snake River System in Relation to Recent Growth History

Abstract

The migratory ecology of Columbia River American shad (Alosa sapidissima)is poorly understood. Compared to most native salmonids, shad are iteroparous and appear to enter migration with a greater range of individual energetic stores. In this study we examined the relationship between variation in energy stores and Recent Relative Growth (RRG) to explain individual differences in migration distance. We collected and PIT tagged fish captured at the Bonneville Dam Adult Fish Facility during peak of the 2006 spawning migration. Body length was measured and sex was determined by gently expressing gametes. Scales were collected for age and growth analyses (RRG), and energetic state was estimated using a low energy microwave probe (Distell Fatmeter). There was a positive correlation between RRG and body lipid content of adults in their second migration, and these fish had a higher probability of detection 235 river km upstream at McNary Dam. Fish with higher RRG values in their first spawning migration (2006) had greater probability of returning for second migration (2007), illustrating that RRG influences survival and migration behavior, but these effects appear to depend on life stage. First time migrants appear to allocate more RRG resources for reproductive development and survival, while second time migrants appear to allocate more resources for migratory preparation (energetic lipid storage). These results suggest recent growth history prior to freshwater migration may affect energetic status, individual migration "decisions", and rates of repeat spawning in some migratory fishes.

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Title

The Endangered Mohave tui chub: Partnering to Achieve Recovery, Education, and Community Outreach

Abstract

The endangered Mohave tui chub (Siphateles bicolor mohavensis) is the only fish endemic to the Mojave River in Southern California. Extirpated from its historic habitat, it now occurs at 3 small sites, two of which are man-made. A fourth location, at the Lewis Center for Educational Research (a public charter school in Apple Valley, California), is being constructed. Through a community effort with the U.S. Fish and Wildlife Service, California Department of Fish and Game, Mojave Water Agency, and other community partners, the staff and students at the Lewis Center are designing, creating, and plan to manage habitat for establishment of a two new chub populations. Although the focus is on managing chubs, the students will be managing this pond as a biotic community. They will be learning about the needs of the Mohave tui chub, and through experiential learning, they will ask questions and collect data to discover new insights related to population status and trends, population health, reproduction, habitat preferences, water quality changes, and managing non-native aquatic predators. The students will be applying the scientific process, exercising principles of natural resource stewardship, the interaction of biotic and abiotic processes in an aquatic environment, and helping to recover an endangered species. Through an existing web site, proposed web camera, and agreement with other schools, they will be sharing their experiences with other members of the community.

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Title

Fish Welfare: Implications for Management, Research, and Industry

Abstract

Herein we review various aspects of fish welfare that have increasingly gained the attention of the scientific community and society over the last decades, outcomes of significant research, controversies, legislation, and subsequent modifications of activities in recreation, research, management, and industry. Humans use fish for food, recreation, and research. The welfare of fish used in each of these arenas has become a high profile issue, gaining attention in society, science, and politics. Research has demonstrated that fish, similar to mammals and birds, possess sense organs that detect stimuli, sensory pathways for processing stimuli, and brain mechanisms that process stimuli and generate physiological and behavioral responses. Although there are immense variations in defining acceptable animal welfare conditions, it is generally agreed that animals should be spared unnecessary suffering throughout their life cycle. In light of this, government veterinary institutions of many countries have developed guidelines for raising, handling, transporting, and killing of animals. Debate over ethical and moral responsibilities and the outcomes of scientific research influence legislation and (subsequently) activities in recreational and commercial fishing, aquaculture, and research studying fish.

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Title
History and the Mystery

Abstract
Significant historical preservation of agency records, photographs, and equipment at Idaho Fish and Game began on a small scale at the Mackay State Fish Hatchery ten years ago. Potential artifacts were sought at other installations and the urgency of preservation became apparent. Combined with enlarged historical photographs of agency activities, obsolete items were first put on exhibit in 2000, eliciting positive public interest and feedback. The exhibitions continued through 2002 at state and county fairs and sportsmen's shows, illustrating state fish hatchery history. A 1957 hatchery truck was restored by a high school vocational program as a community project. Since 2006, the expanded collection was invited to the three largest museums in the state, culminating in 2007 with the "A Century of State Fish Hatcheries" exhibit still currently on display. These museum exhibits lead to the creation of a department policy to assure the preservation of its history for its employees and a public archive. Agency presence is expected at fairs and sportsmen's shows by the public, however the exhibit topic is not. The reaction is one of curiosity, generating specific questions to better understand past activities. The historical photographs drew in the public that would not have otherwise entered fair booths. The public however did not expect agency presence in the museums. In seven months with over 20,000 visitors to one museum, there were no negative comments and an unexplained increase in fishing license sales was observed in that area when license sales are normally decreasing. An agency's historical exhibit lends credibility to its actions and gives ownership to the public viewer on a personal level. History used as an outreach program can engage public interest through partnerships, and can create a dimension of support previously unseen for fisheries management as well as other agency programs.

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Title

Strategies for Improving Fisheries Habitat in a Columbia River Tributary; a one year perspective and illustration of diverse techniques used to address habitat deficiencies in the Umatilla River Subba

Abstract

Degraded and disconnected habitat conditions in the Umatilla River Subbasin have contributed to a decline in salmonid abundance. It is the challenging duty of the Umatilla Tribal Fish Habitat Program to restore and sustain habitat conditions essential to salmonid populations, to satisfy needs of the Umatilla Tribal community.

A variety of habitat monitoring techniques and habitat assessments were used to determine existing conditions and identify factors limiting salmonid abundance. Flow quantity, passage, and in-stream channel complexity were identified as key limiting factors. Aquatic habitat inventories completed on 150 miles of stream channel determined that habitat quality was poor in 85% of the area surveyed and fair in the remaining 15%. Additional information showed channel migration, floodplain connectivity, and riverine wetlands were reduced from historic levels; primarily due to levees located along significant portions of the stream network, resulting in simplified aquatic habitat and degraded water quality. Survey data also showed that elevated summer stream temperatures and sediment concentrations have created poor water quality conditions for spawning and rearing salmonids.

During 2006 and 2007, implementation was completed on ten high priority projects in the Umatilla Subbasin to improve habitat. The most influential limiting factors were considered for prioritizing restoration actions. Key migration barriers and irrigation diversions were identified for project development. Areas of high stream temperature and sediment were linked with stream reaches important to specific salmonid life stages to prioritize locations for land management changes and restoration. Specific restoration actions included passage restoration at 6 sites, incorporation of 220 whole trees into stream channels, planting 1,200 saplings, construction of 2 miles of riparian fence, and the development of 8 water gaps and 2 off-channel solar powered watering areas for livestock. Landowner coordination was an important determinant of technique selection. Technique applicability, proper implementation, and effective monitoring ultimately determined project success.

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Title

Functional Role of Freshwater Mussels in the Benthic Environment

Abstract

Freshwater mussels are the dominant consumer biomass in many fluvial systems. As filter feeding grazers, mussels can remove large amounts of particulate matter from the water column and transfer these resources to the substrate as biodeposits (agglutinated mussel faeces and pseudofaeces). Mussel biodeposits are a nutrient rich and easily assimilated food source and therefore may have significant relevance to benthic community structure. This study examines the functional role of Margaritifera falcata in the South Fork Eel River, California. We addressed two main questions: (i) Do mussels increase benthic resources in this system? (ii) If so, does this alter macroinvertebrate community structure?

Measurements and enclosure experiments in the South Fork Eel River show that mussels can play a significant role in local food webs by increasing available fine particulate matter (both organic and inorganic) on the substrate. We document increased benthic macroinvertebrate biomass for predators and collectors (Leptophlebidae) in the presence of mussels, but only in late summer.

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Title
Connecting Water, Wildlife and People through Creeks and Kids

Abstract
Connecting kids with creeks and watersheds takes knowledge and skills, of course, but most importantly, it takes confidence to use a local stream as a learning site. The Creeks & Kids Educator Workshop Program provides all of that, and much more, to K-12 educators in Oregon. First held in the late 1980s, the workshops have successfully helped educators create comprehensive watershed experiences for their students. The workshops balance activities from Stream Scene: Watersheds, Wildlife and People, Project WET (Water Education for Teachers) and Aquatic Project WILD, with field experiences. Participants leave the workshop with everything they need to make big changes in their teaching methodology. And something else – a renewed excitement and confidence about teaching science.

Educators are taken from basic concepts such as water cycle and watershed through watershed function, mapping, macroinvertebrates, fish sampling, water quality, wildlife inventory and related topics. Field work includes a complete stream survey. Teachers become immersed in work in groups to take measure of a stream and apply what they discover to stream and watershed health, and to restoration and enhancement efforts by resource agencies, such as the Oregon Plan for Salmon & Watersheds. They also learn how to engage resource agencies and community partners in their students' efforts to improve their home watershed.

The Creeks and Kids Educator Workshop Program is time-tested and is increasingly relevant to schools and students in our post-"Last Child in the Woods" world. Educators and schools who get their students involved in watershed education and restoration involve the entire community in the effort, and have built close relationships with state and federal resource agencies as a result. Oregon K-12 teachers and students have most definitely found a valuable niche for themselves in restoring the state's watersheds and fish resources

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Title

Use of hydrodynamic and habitat models to assess anadromous fish benefits in the Yakima River, WA.

Abstract

The Yakima River basin in Eastern Washington (confluence at RM 335) is a major center of irrigated agriculture. The existing regulated hydrograph is characterized by reduced spring flows, reduced flow variability, and mean monthly flows that differ significantly from the unregulated hydrograph. A feasibility study was initiated in 2003 to assess the anadromous fisheries benefits of four water storage alternatives intended to move the hydrograph toward a more normative state. Flow-induced changes in the types and amounts of fish habitat were examined for the five largest floodplain reaches.

The Ecosystem, Diagnosis and Treatment (EDT) model was used to estimate fish abundance under each storage alternative. Two-dimensional hydrodynamic models (River2D and Sediment & River Hydraulic-Watershed) were used to estimate changes in habitat type and quantity as a function of the mean daily flows expected under each alternative. Flow/habitat relationships generated by the 2-dimensional models were used as input for the EDT habitat attributes, providing the EDT model with a new dynamic habitat feature. EDT output was used as input to the All H Analyzer (AHA) model, which was used to estimate the impact on both natural and hatchery production.

We estimated spring and fall Chinook, coho and steelhead population equilibrium abundance, capacity, productivity and life history diversity under the four alternatives. The percent increase in fish abundance over the four alternatives ranged from 2 to 29% for spring Chinook, 0 to 89% for fall Chinook, 24 to 65% for coho and 5 to 39% for steelhead. Much of the increase in population abundance was attributed to decreased smolt passage through diversion dam bypasses and a consequent decrease in mortalities assumed to be associated with predation at bypass outfalls.

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Title

Longitudinal Variability in PNW Rivers: Implications for Survey Design

Abstract

We evaluated the number of sites that would yield precise estimates of physical, chemical, and biological condition for six raftable rivers 100-200 km long and 20-120 m wide. We used a probability design to select 20 sites on each of two rivers in Washington and four in Oregon. The rivers included those draining cold deserts, dry and wet forests, and agricultural plains. All sites were sampled by a four person crew from two rafts. Crews collected physical and chemical habitat and fish, algae and macroinvertebrate assemblage data at each site through use of USEPA's EMAP-West methods. The reach length for each site was 50 times the mean wetted width of the channel, totaling 1000 channel widths per river. The data indicate considerable longitudinal ecological change in some rivers but little in others, as well as local variability in biological assemblages associated with local changes in macrohabitat types. Based on preliminary analyses on these rivers, our data suggest considerable spatial autocorrelation between sites that are < 10-40 km apart, and we observed no marked changes between sites within this distance range. This autocorrelation needs to be considered in designing regional or river monitoring surveys and research projects.

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Title

The eastern banded killifish, a “non-native transplant” in the Willamette River.

Abstract

The eastern banded killifish, Fundulus diaphanus diaphanus, is an introduced species in the Columbia River Basin. I review the temporal and spatial establishment and expansion of this killifish. Historical and contemporary data are used to create a physiologically based and spatially explicit model of the habitat constraints on this fish in Oregon. The potential ecological influences of the fish on the trophic dynamics of the Willamette River biotic community are considered.

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Title

Linking cold-water refuges into a biologically effective network in the southern Willamette River floodplain: outlining key locations and knowledge gaps

Abstract

Providing ecosystem services is emerging as a motivating purpose for environmental management. With the recognition that ecosystem services are valuable, questions arise about the comparative value of such services. Recent research indicates the opportunity to simultaneously derive multiple ecosystem services from single restorative acts: water temperature reductions, terrestrial and aquatic habitat enhancements, increased recreation and improved non-structural flood storage all are possible from individual on-the-ground restoration projects.

In the Willamette River Basin, efforts are underway to create WillamEx, an ecosystem marketplace exchange where credits for multiple ecosystem services will be bought and sold. Initially, entities that discharge heated effluent into the river from point sources such as municipal sewage treatment facilities may buy credits for any combination of three approaches aimed at creating cold water refuges: floodplain restoration projects, increased shade along streams or augmented water flow in the main river channel. Studies indicate that salmonids gather in coldwater microhabitats and may use them as stepping stones to move through reaches that exceed their thermal tolerances. These studies have led to questions about using floodplain restoration to provide cold water refuges for native biota, particularly where refuges could provide multiple benefits.

Using a three-part approach, this study sampled river bottom water temperatures at select locations between Eugene and Albany, mapped observed and expected cold water areas and compared their spacing to literature-based estimates of effective travel distances for two native fish species. Findings indicate that there are four contiguous river reaches in the study area that lack any observed or expected cold water over a distance far exceeding even the most generous estimate of adult cutthroat trout and adult steelhead effective travel distance. Based on temperature patterns and key biophysical and socio-cultural factors, one kilometer sections of the floodplain were then prioritized for their suitability as floodplain restoration sites.

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Title

Conditions Affecting the Reintroduction of Anadromous Fish to the Upper Klamath Basin

Abstract

Hydropower dams constructed on the mainstem Klamath River without effective fish passage facilities have blocked runs of anadromous fish from Oregon's portion of the Klamath Basin since the early 1900s. Prior to completion of the first such dam, Copco, a relatively short distance downstream of the California border, multiple anadromous species returned to streams in Oregon's portion of the basin and unique populations of chinook salmon supported tribal fisheries above Upper Klamath Lake. Today, with aquatic conditions in large portions of the basin substantially different than those that once supported the historic fish runs, the Klamath Tribes and others have been considering the potential for reintroducing anadromous fish to historically blocked areas. In this presentation we will review aquatic conditions both in the Upper Klamath Basin and along the mainstem Klamath River downstream, identify opportunities and constraints affecting a potential fish reintroduction effort, and suggest a meaningful, adaptive approach to restoring at least a portion of the lost runs.

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Title

Salmonids and Altered Thermal Patterns Below Artificial Reservoirs on Three Northwest Rivers

Abstract

Available physical models can provide reasonably accurate estimates of the effects of artificial reservoirs on the thermal conditions found in rivers below dams. However, translating model-based estimates of these physical changes into reliable predictions of biological effects on salmonid populations can be a more difficult proposition. Spatio-temporal patterns of variation in river temperatures are likely to be influential, thermal effects on specific lifestages must be considered, and ecological shifts and/or altered fish behavior may affect the consequences of a given change in temperature. In this paper we describe some of the thermal changes seen below dams on three Northwest rivers (the Clackamas [OR], Deschutes [OR], and Klamath [OR,CA]) and examine how the influence of these changes on specific salmonid lifestages might be modeled.

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Title

Protecting Habitat in an Environment of Change: New Strategies and

Abstract

A recent study produced by the Northwest Power and Conservation Council's (NPCC) Independent Economic Advisory Board assessed various approaches to restoring fish and wildlife habitats in the Columbia Basin. It focused on 5 questions: (1) Can the Fish and Wildlife Program (FWP) work with federal, state and non-profit conservation programs to acquire habitat, improve habitat quality or reduce costs? (2) Could the FWP participate, as a buyer or as a seller, in the emerging markets for environmental attributes associated with habitat units? (3) What problems and opportunities exist when habitat acquisition occurs in more developed regions such as the Willamette Valley? (4) How might land acquisitions respond to fluctuations and uncertainties in land values, and how should the program work with federal and state agencies and non-profits to manage risk? (5) What strengths and weaknesses of the strategies be identified and described? The report finds that market-based and collaborative approaches to protecting and restoring habitat are promising. In both rural and more densely populated regions, these approaches promise more stakeholder commitment and more cost-effectiveness than common regulatory approaches. This presentation will review the state of habitat mitigation under the Fish and Wildlife Program, and will then review water trusts, land trusts, and easements as mechanisms for implementing habitat protection and improvement. Further opportunities for collaboration by NPPC and Bonneville Power Administration with NGOs, local governments, and the Federal government are described. Finally, a few recommendations drawn from the IEAB study will be summarized.

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Title

Adaptive Fish-Adaptive Fish Management: Chewaucan River Redband Trout

Abstract

Historically, the Chewaucan River was an ideal ecosystem for Redband trout (Onchorynchus mykiss spp.). Adfluvial Redband trout migrated as juveniles from the headwaters of the Chewaucan River to the Chewaucan marsh. Settlement of the Chewaucan River Valley resulted in draining of the marsh and diking of the river corridor. By 1946, the marsh and lower river habitat had disappeared, and consequently so did the expression of Redband trout adfluvial life history.

Brook trout were introduced into the headwaters in the 1950's. Oregon Department of Fish and Wildlife stocked the Chewaucan River with coastal, Rainbow trout from 1925-1998. Harvest regulations for this period allowed five fish per day, and the use of bait.

In 1992, Rivers End Reservoir was built on a private ranch at the end of the Chewaucan River. The Rivers End Reservoir roughly mimics the marsh condition, and provides downstream migrants with rearing habitat. In 1996, adfluvial Redband trout were observed at the Narrows irrigation diversion. A collaborative effort between private landowners and natural resource management agencies resulted in retrofitting all diversion structures blocking passage in the lower river by 2006. Following the direction of the Native Fish Conservation Policy, stocking of non-native trout in the Chewaucan River was ended in 1999, including stocking the Chewaucan River. Currently, the Chewaucan River fishery is driven by native Redband trout. Harvest regulations were passed in 2000 to protect wild trout. Regulations reduced bag limits to two fish per day, flies and lures only. The migration corridor to Rivers End Reservoir is closed to angling October through May, providing additional protection to adfluvial Redband trout.

In 2007, a fly-fishing tournament was held on the Chewaucan River, called the Chewaucan Challenge. The tournament was a unique fishing opportunity, designed around a catch-and-release points system targeting native, Redband trout.

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Title

Impacts of Alternative Development Patterns on Aquatic Ecosystems: Evidence from the Puget Sound Lowland Sub-basins

Abstract

One of the most influential factors in human-induced global change over the last two hundred years has been the transformation of land and resource use associated with population growth and urbanization. Landscape change with urbanization poses major challenges to aquatic ecosystems. Urban development fragments, isolates, and degrades natural habitats, simplifies and homogenizes species composition, disrupts hydrological systems, and modifies energy flow and nutrient cycling. Extensive studies have shown that the composition of land cover within a watershed can account for much of the variability in water quality and stream ecological conditions. We present findings of a recent study developed by an interdisciplinary team at the Urban Ecology Research Lab indicating significant statistical relationships between urban landscape patterns—both amount and configuration of impervious area and forest land—and biotic integrity of Puget Sound lowland watersheds. We propose that future patterns of urban development matter to aquatic ecosystems. In planning for future changes in the Columbia River Basin, human and ecosystem functions can not be considered separately given that socio-economic and ecological systems interact and have critical interdependencies.

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Title

THE OKANAGAN FISH-WATER MANAGEMENT (OKFWM) TOOL: BALANCING WATER OBJECTIVES TO PROMOTE SOCKEYE SALMON PRODUCTION GAINS

Abstract

Water levels on Okanagan Lake are managed to provide a balance between fisheries, flooding, and other interests. Water levels must provide sufficient water to meet target flows for Okanagan Lake kokanee and downstream sockeye salmon populations, and minimize flooding of both lakeshore and downstream properties. Owing to a variety of factors, Okanagan River sockeye are the only significant remnant stock of more than a dozen anadromous salmon stocks that historically returned to Canada through the US portions of the Columbia River. The Okanagan Basin Technical Working Group (OBTWG) identified improvements to Okanagan River flow management practices as one means of achieving significant sockeye production gains. With this goal, the OBTWG oversaw the development of OKFWM, an Internet-accessible software application as the central tool for defining these improved water management practices. OKFWM enables water managers and fisheries scientists to combine best science subsystem models and integrate real time data to make daily/weekly decisions regarding Okanagan Lake Dam water releases. Using this tool, a comprehensive retrospective analysis was performed for the 1974 to 2003 period. Results showed routine use of OKFWM may yield an average annual increase in Okanagan sockeye smolt abundance by as much as 55% without significantly increasing socio-economic losses associated with other water use interests. This encouraging result owes to improved understanding of fundamental ecological processes controlling juvenile production, the application of real-time data to inform physical and biological parameters, and a heightened awareness of trade-offs – all features seamlessly captured within the OKFWM tool.

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Title

The Eastside Experience: Bull Trout and Climate Change within the Interior Columbia

Abstract

Past declines in bull trout populations related to harvest, habitat degradation, and invasive species resulted in ESA listing in 1998. The potential effects of a warming climate were not considered in the original listing, but recognition that environmental changes associated with this phenomenon may exacerbate or exceed previous threats is growing. Bull trout could be especially vulnerable to a warming climate, given a strong dependence on cold water temperatures, fragmented population structures, and confinement to headwater streams that are vulnerable to periodic disturbance. We are engaged in several projects to understand the effects of climate on bull trout within the Interior Columbia Basin. In recently published work, a strong correlation between spatial trends in mean annual air temperature and contemporary bull trout distributions was documented. Model projections based on this relationship suggest substantial and spatially heterogeneous habitat losses (40 – 60%) by mid-century. Other work describing trends in stream temperatures indicate losses of thermal habitat may already be occurring. From 1993 - 2006, we estimate that average summer stream temperatures increased by 1.4°C within a 6th-order central Idaho watershed and the stream length of suitable summer habitat decreased by 45% in response to recent climate trends. If trends continue, bull trout populations should begin to contract and work has begun to monitor distributions. Results from initial resurveys of streams originally sampled in 1997 revealed no detectible shift, but biological responses could lag environmental trends due to interannual climate variability and intergenerational constrains on extinction/colonization dynamics. Bull trout within the face an uncertain future and more research is needed to understand how distributions may change, which environmental features are most important, and how conservation resources are best allocated. Until more is known, enhancing the adaptability and flexibility of existing populations by maintaining diverse, large, and well-connected habitats should remain a priority.

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Title

Stream temperature modeling within the context of a warming climate and bull trout recovery planning

Abstract

Bull trout have thermal requirements that are among the lowest for salmonids in North America and their distributions are strongly linked to the availability of coldwater habitats. A warming climate is driving environmental trends in air temperatures, hydrology, and conversion of terrestrial and riparian vegetation, which are generally expected to warm stream temperatures. Stream temperature response to these forcings will be spatially heterogeneous—resulting from local interactions among geomorphology, hydrology, disturbance, and biology. Models capable of accommodating this spatial complexity and accurately predicting stream temperatures will be needed to forecast distributions of thermally suitable habitats and advance conservation goals. We briefly review temperature metrics previously used to describe bull trout habitat, then contrast mechanistic and statistical approaches to modeling stream temperatures through application of several examples. Mechanistic models are based on physical processes, can capture nonlinear behaviors, and provide generalizeable results, but are data intensive and questions remain about modeling of some processes. Statistical models link empirical temperature measurements from commonly available thermograph data to variables representing surrogates of physical processes, which can often be quantified from a GIS. Statistical approaches are relatively easy to calibrate and apply across broad areas, but assume linear responses and results are less generalizeable. No temperature modeling approach offers a panacea and selection of a “best” modeling strategy will depend on the spatiotemporal scale at which predictions are needed, availability of pre-existing data, and resources available to solve the problem. Furthermore, different approaches can be complementary, and it would be useful at the outset of any effort to consider the relative merits of each in the context of desired outcomes. Accordingly, it may be useful to employ several different modeling strategies to address the complex problem of climate change, stream temperatures, and impacts on bull trout.

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Title
Implementation Challenges for the Columbia River Fish and Wildlife Program

Abstract
Implementation challenges for the Columbia River Basin Fish and Wildlife Program (Program) stem from the broad mission "to protect, mitigate and enhance fish and wildlife, including related spawning grounds and habitat, on the Columbia River and its tributaries." The Program is a product of the Northwest Power Act which strives to provide an equitable balance between hydroelectric development and protection and mitigation of the river's fish and wildlife resources. The Program describes actions that address hydroelectric project operational and structural modifications, habitat protection and restoration, and hatchery construction and operation. One could argue that the usual challenges for large recovery programs like explicit obligations, actionable work plans, or adequate funding are NOT limiting the implementation of the Program. In fact, the size and complexity of the Program creates the greatest challenges for implementation. The Program consists of 57 subbasins; addresses resident fish, anadromous fish and wildlife activities; and identifies significant "off-site" actions to compensate for on-site mortality caused by the hydroelectric facilities. When the Northwest Power Act was adopted in 1980, total annual spending by Bonneville Power Administration on fish and wildlife was approximately $41.3 million; in 2006 that total was estimated to be $851.7 million. As the Program has increased in size, it has drawn increased scrutiny and calls for accountability. Challenges include how to establish appropriate and stable funding levels for the Program, how to allocate those funds geographically and by species, how to get the greatest benefits on the ground, and how to assure adequate monitoring and evaluation that can support adaptive learning. A well defined science-policy framework is needed to guide implementation and evaluation in order to justify the significant investment necessary to protect, mitigate and enhance fish and wildlife populations in the Columbia River Basin.

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Title

Examining 80 year old scales to determine if Columbia River kokanee are reservoirs of extinct sockeye salmon genetic diversity

Abstract

Sockeye salmon on the Columbia River have declined from a peak of approximately 4 million fish in the late 1800's to an current average (last 4 years) of approximately 50,000 fish through a combination of habitat loss, harvest and dam construction. Although much of the damage had already been done by the 1920's, sockeye salmon numbers remained relatively high with much of the Upper Columbia River habitat remaining accessible. The recent discovery of well preserved sockeye salmon scales from the 1920's allowed the recovery of sufficient amounts of DNA to genotype individual sockeye salmon that were collected at fish wheels on the Lower Columbia River. The genetic profiles of approximately 800 sockeye salmon collected in 1924 were compared to 21 extant populations of O. nerka from the Columbia Basin in an attempt to determine their population of origin. Genetic analysis at 12 microsatellite loci revealed that some genetic diversity has been lost (~25% of the alleles from 1924 are no longer seen today) and that three large genetic groups of sockeye salmon likely existed in 1924, including one that shares little life history or genetic resemblance to the two current Columbia River sockeye salmon populations. This unique group does, however, share some genetic attributes of current Upper Columbia River kokanee populations and may represent sockeye salmon that were destined for the Upper Columbia River.

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Title
Instream Flow Restoration in the Umatilla and Walla Walla Basins

Abstract
Human population growth and irrigated agriculture resulted in loss of instream flows and salmon runs in the Umatilla and Walla Walla Basins in the early 1900's. Recent visionary efforts of tribes and irrigators have shown that difficult conflicts over water can be resolved cooperatively. In what have been recognized as models for peaceful resolution of water rights disputes, projects in the Umatilla and Walla Walla Basins are successfully restoring instream flows for fish while protecting the stability of the local irrigation economy. After a near century of absence, salmon runs are now returning to these basins and agricultural operations are actually more secure!

The federal government and states, in promising the same water to the irrigators which it had a responsibility to protect for the tribes, had pitted the tribes and irrigators against one another. Instead of devoting time and resources fighting, the two decided to join forces. Basic principles to the success story include: 1) commit to negotiate rather than litigate; 2) develop a creative approach for "new" water to keep both fish and agricultural interests "whole"; 3) seek unified support for government funding of water projects; 4) implement a comprehensive fish restoration program (including habitat enhancement and hatchery actions) that compliments and provides cost share for the flow enhancement portion; 5) commit to monitoring of results and adaptive management to inform improvements.

The Umatilla Basin Project is a water exchange that delivers Columbia River water to irrigators who in turn leave Umatilla River water instream for fish. Fish flows are gained through exchange of surface and reservoir-stored water rights. The Walla Walla Flow Enhancement Feasibility Study has identified the same type solution as well as possible off-channel storage which would be delivered to irrigators in exchange for leaving flows instream for fish.

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Title

Unique Physical Conditions and Resulting Novel Life Histories of Shasta River Salmonids.

Abstract

Historically, the Shasta River had arguably the largest salmon population density in California, with early counts of over 80,000 Chinook salmon returning to a river with a baseflow of only 200cfs. The Shasta River's unique geology, hydrology and several anthropogenic impacts have resulted in unique life history strategies and potential "ecological traps" for salmonids. Coho salmon have different habitat requirement and limitations compared to other salmonids in the Shasta River. This combination of habitat requirements and physiological limitations is the basis for the conceptual model of an ecological trap for coho salmon in the Shasta River. An ecological trap is a scenario that occurs when an animal preferentially chooses a habitat that ultimately reduces its survivability or reproductive success over a habitat of apparent similar quality where survivability and reproductive success are much higher. Coho salmon, where juveniles rear for a year in freshwater, are more likely to parish prior to seaward migration due to anthropogenic alteration of the landscape than other salmon species that leave freshwater during their first year. Despite warm water temperatures, productivity in the Shasta River is exceptionally high. Fish able to tolerate warmer temperatures or find thermal refugia exhibit grow rates very rarely observed in natural populations. For example, juvenile Chinook grow so rapidly that a small percentage remain in the Shasta throughout the summer, sexually mature, and spawn with returning adults approximately 10 months after initial emergence. It is unknown how mature parr may contribute to the population, but this life history strategy may help the population hedge bets against poor migratory conditions downstream. High productivity and potential coldwater sources may help explain the unique life history strategies adopted by Shasta River salmonids, and present potential for future restoration within the watershed.

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Title

Non-lethal Options for Reducing Seal and Sea Lion Predation on Salmonids

Abstract

Individuals and resource managers throughout the world have attempted to use a variety of non-lethal techniques to reduce marine mammal interactions with fisheries. On the U.S. west coast as populations of harbor seals, California sea lions and Steller sea lions have increased, so have interactions with commercial, sport and tribal fisheries. In the Columbia River in particular, California sea lion predation on endangered salmonid runs and white sturgeon at spawning grounds near Bonneville Dam has added a relatively new source of mortality that requires management attention along with other traditionally recognized management actions addressing salmonid recovery ie harvest, hydro operations, hatchery practices, and habitat degradation. Since the passage the Marine Mammal Protection Act, the Washington Department of Fish and Wildlife and Oregon Department of Fish and Wildlife have been working with National Marine Fisheries Service and NOAA-Fisheries to develop and test a variety of non-lethal approaches to reduce predation (website link at: http://www.nwr.noaa.gov/Marine-Mammals/Seals-and-Sea-Lions/Deterring-Pinnipeds.cfm) including use of rubber bullets, seal bombs, crackershells, capture and relocation of offending animals, capture and holding offending animals, net barriers, acoustic barriers, and barrier gates at fishways. Most techniques are generally ineffective although some techniques may have limited success on naïve animals, which have not yet developed a food-driven attraction to a location such as fishways at dams or on spawning grounds. Non-lethal techniques and other management options for dealing with this issue will be discussed.

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Title

A decision support tool for assessing dual frequency identification sonar (DIDSON) steelhead (Oncorhynchus mykiss) escapement data

Abstract

Dual frequency identification sonar (DIDSON) has been used to estimate chinook and sockeye salmon escapements in Alaska with great success. DIDSON is a multi-beam sonar that produces near video quality images in turbid water or low light conditions, allowing the user to determine fish passage, size, and direction of travel. The previous studies in Alaska involved estimating escapement for relatively large populations (n>5000), where a certain amount of error was acceptable. However, when applying this technology to small populations (n<100) of ESA-listed steelhead (Oncorhynchus mykiss) in coastal streams of California, it is extremely important to have precise escapement estimates. Differentiating between juvenile and adult fish and between fish that are migrating versus those which are simply milling is critical when estimating overall escapement. We have developed a decision support tool to help standardize the process of assigning status to the size of fish and their movement upstream or downstream. Utilizing fish size, elapsed time, and distinctive behavioral characteristics, the tool allows the user to compare upstream and downstream migrants and assign migratory status to individual fish. The support tool was applied to eight days of DIDSON data collected in 2006 from the San Lorenzo River near Santa Cruz, California. The DIDSON data were then compared to counts from a fish trap located 180m upstream. The decision support tool yielded 46 upstream migrating steelhead compared to 46 caught in the trap.

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Title
Yakima WATERS and Stable Isotopes

Abstract
The Yakima WATERS project is an NSF funded regional program administered through Central Washington University (CWU) to engage K-12 students in interdisciplinary watershed research. The WATERS (Watershed Activities to Enhance Research in Schools) project is designed to have research teams involve K-12 students in actual research rather than learning about research that others are conducting. The research teams include a CWU graduate student fellow, faculty advisor and a lead K-12 teacher, who work collaboratively to develop a project concerning an aspect of studying the Yakima River watershed in central Washington. Each graduate fellow incorporates their research into the public school curriculum by working alongside a teacher in the classroom. CWU has partnered with A.C. Davis H.S., located in Yakima, WA., to integrate salmon ecology and other watershed themes to enhance the relevancy of biological sciences in the 9th, 10th, and 11th grade biology classes. This integrative theme of Yakima watershed science provides a real world context for inquiry based learning in the high school. Our team's research focus is to investigate the relative importance of aquatic invertebrates and terrestrial invertebrates in salmonid diets using stable isotopes. We are using carbon and nitrogen isotopes to describe the dynamics of food webs, and the importance of trophic pathways that shift seasonally between microhabitats and river reaches in the upper Yakima River. Gut analysis, which only provides "snapshots" of an organism's diet, does not capture spatial and temporal differences in dietary shifts. The high school students are investigating the diets of juvenile chinook salmon and resident rainbow trout using carbon and nitrogen stable isotopes to determine the relative importance of riparian production and aquatic production to the salmonid populations of the Yakima River.

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Title

A quantitative model for risk-assessment and management of invasive yellow perch in Shuswap Lake, British Columbia

Abstract

Recent introductions of yellow perch (Perca flavescens) in British Columbia are causing concern over the potential impact on several major salmon stocks. Yellow perch are known to be aggressive invaders, and although their effects on salmon are not well understood, it is believed that they will compete with (and possibly prey upon) juvenile salmon. Such large uncertainties, as well as the large potential biological and economic losses from important harvested salmon populations, create a need for a risk assessment. Bayesian decision analysis will be used as a conceptual framework for evaluating the effectiveness of different management scenarios for the control of yellow perch in Shuswap Lake. This analysis will involve the development of a stochastic model that will simulate the dynamics of a yellow perch invasion and determine the ecological consequences of that invasion (i.e. the impacts on salmon stocks) under different management scenarios. The effectiveness of various management actions at different stages of the invasion process will be evaluated. The results of this project will help managers choose the most appropriate and cost effective control method. This quantitative risk-assessment model will be a management tool adaptable to other freshwater systems where native fish are at risk from aquatic invasive species.

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Title

Asotin Creek Watershed Restoration – small steps lead to big results

Abstract

The Asotin Creek Model Watershed Plan (Plan) was Bonneville's (BPA) first watershed scale habitat restoration project for salmonids in Washington. With the distinction of Model Watershed based on Northwest Power and Conservation Council's (NPCC) Fish and Wildlife Program.

This was significant for this 325 square mile watershed, home to ESA listed steelhead, spring and fall Chinook, and bull trout. Prior to BPA funding, Washington Conservation Commission (WSCC) was the primary cost-share available for projects. After Plan completion, funding from BPA, WSCC, WA Governor's Salmon Office, Salmon Recovery Funding Board and Department of Ecology was secured.

The ability to leverage BPA funding with State funding wouldn't have been attainable without NPCC Fish and Wildlife Program, trust and credibility gained from grass-roots Plan, Early Action Funding and a unique collaborative approach for salmonid restoration by technical agencies and landowners, who implemented prioritized projects.

The NPCC Fish and Wildlife Program initiated a comprehensive watershed effort and provided recommendation for BPA funding. Large scale recovery of resource issues wouldn't have been addressed without dedicated funding and partnerships developed at local level. Asotin County Conservation District worked with landowners and agencies responsible for protecting ESA listed salmonids, Washington Department of Fish and Wildlife, Department of Ecology,National Marine Fisheries Service and U.S. Fish and Wildlife Service.

The Plan was BPA's first coordinated total watershed restoration program. A Ridge-Top-to-Ridge-Top approach for salmonid restoration. Validated during Subbasin Planning and Ecosystem Diagnosis and Treatment (EDT) processes. Early on we were criticized for using a shot-gun approach or taking low hanging fruit. EDT was run and projects were mapped, most completed and identified were in high priority reaches. The grass-roots Plan resulted in local support, a high degree of implementation certainty and partnerships.

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Title

Juvenile salmonid use of slough habitat in the lower Columbia River: The influence of tidegates.

Abstract

Restoring tidally influenced wetlands to improve conditions for juvenile anadromous salmonids is an important component of many recovery and management plans and regulatory requirements. Although restoring tidal wetlands and improving fish access to them are major components of recovery strategies for anadromous salmonids, considerable uncertainty exists concerning appropriate restoration actions. Information on specific habitat requirements and restoration needs of juvenile salmonids in these areas is lacking. The U.S Army Corps of Engineers has proposed such restoration actions in Julia Butler Hansen National Wildlife Refuge. As a component of these actions, replacement of traditional top-hinge tide gates with new designed tide gates has been proposed. These new tide gates are designed to provide habitat and fish passage benefits when compared to traditional tide gates. The U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office has begun to monitor biological and physical attributes of sloughs on Tenasillahe Island and Welch Islands in association with tide-gate replacement. Comparisons were conducted among sloughs on Tenasillahe Island (treatment site), before construction associated with the USACOE restoration project, and sloughs on Welch Island (reference site), which is not influenced by dikes and tide gates. Comparisons post construction will begin in 2008. Specific objectives addressed were to assess frequency, and duration that existing tide gates are likely conducive to passage by juvenile salmonids, characterize habitats at the sloughs on Tenasillahe Island and compare to that observed at Welch Island sloughs, and describe the fish community inhabiting Tenasillahe Island sloughs and compare to that observed at Welch Island sloughs.

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Title

Reintroduction of Sockeye Salmon to Wallowa Lake in Northeast Oregon

Abstract

Prior to 1900, an estimated 24,000 to 30,000 sockeye salmon (Oncorhychus nerka) returned to Wallowa Lake, within the Grande Ronde River Subbasin in northeast Oregon. Overharvest, unscreened irrigation diversions, and misguided attempts at fish culture resulted in extirpation of sockeye returning to Wallowa Lake by 1904. Restablishment of sockeye has been prevented by Wallowa Lake Dam, which was constructed at the lake outlet in 1916.

For decades, the Nez Perce Tribe has desired to reintroduce and reestablish a sockeye salmon run to Wallowa Lake. There are substantial challenges with a reintroduction program; availability of an appropriate donor stock(s), a long 792 mile migration from the Pacific Ocean to Wallowa Lake, juvenile and adult mortality at mainstem Columbia and Snake River dams, juvenile and adult passage over 36 ft Wallowa Lake Dam, and the changing zooplankton and fish community in Wallowa Lake. However, a feasibility study has determined that reintroduction is not impossible.

The only existing population of sockeye in the Snake River, returning to the Stanley Basin in the Salmon River, was listed as endangered under the Endangered Species Act in 1991. This population is currently in a captive broodstock program which has been successful in returning only a handful of adults to the Snake Basin. A successful reintroduction of sockeye to Wallowa Lake would greatly enhance the probability of long-term persistence of Snake River sockeye salmon.

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Title

Restoring Sockeye Salmon to the Yakima River Basin

Abstract

Returns of sockeye salmon to the upper Columbia Basin have numbered 50,000 or fewer in 14 of the past 22 years. Dam counts indicate that sockeye are declining by an average of 830 fish per year. Of the historic sockeye nursery lake habitat in the Upper Columbia, only about 4% is presently utilized with only two (Wenatchee and Osoyoos) of 12 historic nursery lakes presently producing fish. Four nursery lakes in the Yakima River Basin, which historically produced an estimated annual return of about 200,000 sockeye, were removed from production in the early 1900s when irrigation storage dams were constructed without passage. Work conducted by the National Marine Fisheries Service from 1987 to 1993 in Lake Cle Elum returned from 4 to 20 sockeye adults to the base of Cle Elum Dam demonstrating that sockeye restoration was feasible with sufficient passage modifications. In 1994 the Yakima River Basin Water Enhancement Project Act was passed providing for increased storage capacity in Cle Elum reservoir including provisions for developing fish passage alternatives. The Yakama Nation is now working with the Bureau of Reclamation to conduct additional feasibility work using a temporary juvenile passage flume and coho salmon as surrogates. Over 25% of the smolts released into Lake Cle Elum in 2006-2007 successfully migrated using the flume and 1.5% of the known 2006 outmigrants returned as adults to Prosser Dam in 2007. Based on the results of this prior work, the Yakama Nation is working to resolve logistical issues so that sockeye fry plants can begin in Lake Cle Elum in 2009.

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Title

Human dimensions: The role of coordination, planning, meetings and personalities in the design and implementation of large-scale monitoring programs

Abstract

The design and implementation of large-scale monitoring and evaluation programs for salmon recovery across the Pacific Northwest involves stakeholders from fish, land and water resource management agencies, industry, private landowner groups, and conservation and recreation interests. Monitoring programs must be designed to answer questions of accountability; accountability that public fiscal resources are being used in a cost effective and efficient manner and public natural resources are managed in a responsible fashion. These monitoring programs must be designed and implemented to support management decisions consistently across multiple jurisdictional boundaries and on a time horizon much longer than the traditional agency attention span. To address these requirements, resource co-managers have devoted significant effort to research the statistical tools to support sampling design and data analysis, the field methods that maximize information content, and the data management approaches that efficiently store and share monitoring data. Yet, while work has been and is being done to refine monitoring and evaluation methods, the implementation of a robust regional program remains elusive because we lack the methods for including people -- not people as the source of anthropogenic impacts, but people as possessors of opinions, egos and personalities and as members of communities. We have not tried to capture the human dimension of this process. We have no working models of public participation in the development and implementation of new monitoring programs and no framework for accepting the learning and experience from existing programs. Every watershed is not different and everyone is not an expert, but everyone's opinion counts and needs to be heard; how do we do this and still make constructive progress?

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Title

Life history diversity in Oncorhynchus mykiss: Monitoring population productivity of ESA listed steelhead in the interior Columbia River basin.

Abstract

Throughout much of its natural range in the Pacific Northwest United States, declines in indigenous anadromous rainbow trout (Oncorhynchus mykiss), or “steelhead” have prompted federal management agencies to provide protection under the U.S. Endangered Species Act. One reason for this listing involves uncertainties regarding relationships between steelhead and freshwater resident rainbow trout and the factors that determine the expression of these life history strategies. O. mykiss exhibits a diversity of life history strategies that range from extensive marine migrators to non-migratory individuals in maturing freshwater. Often there is evidence of gene flow between forms and evidence that any one form can produce the full range of life history variants. Thus, monitoring and management approaches for steelhead must include the processes that underlie the expression of the full range of life history strategies exhibited by these fish. Monitoring metrics for steelhead production monitoring/management should capture, in a spatially and temporally explicit manner, the expression of these traits. Total life-cycle productivity metrics will not be sufficient to explain trends in steelhead populations, nor to develop cause-and-effect management strategies. Instead, seasonal movement based metrics and individual fish condition metrics (lipid levels, gonadal development, growth rate) as indicators of life history diversity expression will be more relevant. The management implications of understanding the origin of life history diversity are clear. To influence production of anadromous juveniles or smolts, management actions should focus on locations where the proportion of anadromous juveniles is relatively high through habitat conservation or restoration efforts. However, if management actions can change the expression of anadromy, then a process-based approach is more viable. For example, through targeted restoration actions it may be possible to shift life history expression to a higher per capita proportion of steelhead in a given watershed.

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Title
Legal Landscape Regarding Tribes' Treaty Reserved Rights.

Abstract
Legal Landscape Regarding Tribes' Treaty Reserved Rights. Laurie Jordan, Policy Analyst II, Columbia River Inter-Tribal Fish Commission. Ms. Jordan provides a synopsis of the legal principles regarding Federal Indian Law and a summary of major treaty fishing rights' cases.

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Title

Evidence of density- and size-dependent mortality in hatchery-reared juvenile white sturgeon (Acipenser transmontanus) in the Kootenai River.

Abstract

Our objectives were to determine if increased stocking levels and declining size-at-release influenced survival rates of hatchery-reared juvenile white sturgeon in the Kootenai River. Survival rates for PIT-tagged juvenile sturgeon were estimated using Cormack-Jolly-Seber and related models implemented in Program MARK. We developed a set of capture-recapture models to test various assumptions about the influence of release year, age, and length-at-release on survival, and selected the best fitting model or models using Akaike's Information Criterion (AIC). We released a total of 119,768 age 1–4 fish from 1992 to 2006, of which 2,938 fish were subsequently recaptured. According to the best fitting non-covariate model, annual survival rates for both age classes varied across years, ranging from 0.01–0.86 (mean = 0.40) during the first year at large and from 0.74–1.0 (mean = 0.94) in subsequent years. Average first-year survival rates declined substantially in recent years, concurrent with dramatic increases in hatchery releases. A simple linear regression model with total estimated juvenile abundance as the independent variable explained approximately 72% of the variation in first-year survival (P = 0.002). Addition of a length covariate greatly improved the model fit, suggesting that fish length-at-release explained a substantial proportion of the variation in survival during the first year at large. These results provide convincing evidence for density- and size-dependent mortality in hatchery-reared juvenile white sturgeon in the Kootenai River and suggest that management actions which prioritize the release of fewer, larger-sized fish will likely improve first-year survival rates and subsequent recruitment to the spawning-age population.

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Title
Overview of the Upper Colorado River Endangered Fish Recovery Program

Abstract
The Upper Colorado River Endangered Fish Recovery Program (Recovery Program) is a long-term, collaborative effort to recover four endangered fish species in the upper Colorado River basin in Colorado, Utah, and Wyoming. The humpback chub (Gila cypha), bonytail (Gila elegans), Colorado pikeminnow (Ptychocheilus lucius), and razorback sucker (Xyrauchen texanus) are large, long-lived, warmwater fishes endemic to the Colorado River Basin where they are believe to have thrived for 3 – 5 million years. These fishes are endangered due to human-induced changes to their habitat, including dams, water depletion, and introduction of more than 70 nonnative fish species. In 1988, a landmark partnership of public and private organizations was established to recover the endangered fish while water use and development proceed in compliance with state water law, the Endangered Species Act (ESA), and interstate water compacts. The Recovery Program is considered a national model demonstrating that public/private partnerships can work to recover endangered species and resolve ESA-related conflicts. Recovery Program partners include state and federal agencies, environmental groups, and water and power users. This partnership is implementing recovery actions far beyond the abilities of any one partner acting independently, demonstrating tangible, on-the-ground success in providing river flows, restoring habitat, constructing and operating fish ladders and screens, producing and stocking endangered fish, and monitoring the results of these recovery actions.

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Title

Physical Habitat in the National Wadeable Streams Assessment.

Abstract

Effective environmental policy decisions require stream habitat information that is accurate, precise, and relevant. The recent National Wadeable Streams Assessment (NWSA) carried out by the U.S. EPA required physical habitat information sufficiently comprehensive to facilitate interpreting biotic data, and to address habitat concerns in their own right. The assessment characterized the major habitat features that may operate as controls or limiting factors on biotic assemblage composition under natural or anthropogenically disturbed circumstances. Within sample reaches, the field approach employed a randomized, systematic design, locating habitat observations on reaches with lengths 40 times their low flow wetted width. Two-person crews typically completed NWSA habitat measurements in 1.5 to 3.5 hours of field time. The resultant field measurements quantified major dimensions of channel morphology and stream habitat, allowing calculation of measures or indices of stream size and gradient, substrate size and stability, habitat complexity and cover, riparian vegetation cover and structure, anthropogenic disturbances, and channel-riparian interaction. We reduce the complexity of the raw field data by calculating metrics to summarize stream reach habitat characteristics. Beyond simple descriptions, the national assessment evaluated associations that implicate channel responses to basin-riparian disturbances, or biotic responses to habitat alteration. In large regions, human land use disturbances typically overlay wide ranges of natural geomorphic factors that control both habitat characteristics and biotic assemblages. We discuss a variety of approaches for estimating the degree to which streams deviate from “natural” or “reference” conditions, including use of historical information, best professional judgment, reference sites, impairment criteria, and the use of process-based or empirical models to estimate reference condition. The survey produced descriptions of habitat adequate for regional assessments of habitat condition, establishing benchmarks for assessing future change, assessing likely causes of habitat alteration, and evaluating relative risk for biotic impairment.

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Title

Evaluating the impacts of salmon and steelhead hatchery releases on wild, ESA listed fish populations in a tributary to the lower Clackamas River, Oregon

Abstract

Eagle Creek National Fish Hatchery spawns and raises juvenile coho salmon (Oncorhynchus kisutch) and juvenile steelhead trout (Oncorhynchus mykiss) that are released into Eagle Creek within the Clackamas River basin, Oregon. The purpose of the program is to mitigate for fish losses in the Columbia River Basin caused by hydro-power dams, to provide commercial, sport, and tribal harvest, and to support tribal restoration programs. The hatchery also operates within the confines of the Endangered Species Act, however limited information exists on the ecology and biology of wild ESA listed fish in Eagle Creek. To better understand the ecological interactions between hatchery and wild coho and steelhead populations in Eagle Creek, we are evaluating the impacts of hatchery management practices on wild fish. Starting in 2002 we began collecting additional information to study 1) the distribution, migration timing, and relative abundance of juvenile and adult winter steelhead and coho, 2) the migration rate, movement, and residualism of juvenile steelhead and coho post volitional release from the hatchery, 3) the benefits and risks of alternative rearing densities and release numbers from the hatchery, 4) the genetic contribution of hatchery and wild fish to natural production in Eagle Creek, and 5) health and pathology of hatchery and wild fish through investigations performed by the USFWS Lower Columbia River Fish Health Center.

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Title

ITEROPARITY IN COLUMBIA RIVER SUMMER STEELHEAD: A MULTI-YEAR SUMMARY OF KELT SURVIVAL AND TRANSPORTATION STUDIES

Abstract

We used ultrasound imaging and a series of tagging programs to assess maturation status, postspawn migration behaviors, and iteroparity patterns in summer-run steelhead (Oncorhynchus mykiss) of the interior Columbia River basin. Over four years, 13,193 adult steelhead were examined in fish bypass systems at three Columbia and Snake River dams. Of these, 89% were postspawn kelts. Kelts were disproportionately female (>80%) and majorities were of wild origin, unlike prespawn steelhead at these sites. For kelts that outmigrated in-river, annual iteroparity estimates varied from 2.9–9.0% for fish PIT-tagged at lower Columbia River dams (n = 2,542) and from 0.5–1.2% for those tagged in the Snake River (n =3,762). Iteroparity differences between Columbia and Snake River groups reflected greater outmigration distance and additional dam passage hazards for Snake River kelts. Across samples, there was strong evidence for condition-dependent mortality, with iteroparity rates an order of magnitude higher for good- versus poor-condition kelts. Proportionately more females than males and more wild than hatchery fish also returned, providing potentially valuable genetic and demographic benefits for the Columbia's threatened steelhead populations. Iteroparity rates for Snake River kelts transported downstream in barges were ~2.3 times higher than those for in-river migrants, with the largest transport benefits for good condition wild females. Overall, the iteroparity data from these studies are among the most comprehensive ever collected for interior, summer-run steelhead. Results provide important baseline data for evaluating Columbia River kelt mortality mitigation efforts and basic life history information for steelhead conservation planning.

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Title
Policy and Regulatory Context for Cold Water Refugia.

Abstract
In 2000 EPA undertook a major project to develop guidance for the development of a water quality standard for temperature to protect the native salmonids of the Pacific Northwest. The goal of the project was to develop a water quality standard that would be protective of native salmonids, would recognize the natural temperature potential and limitations of streams and rivers, could be effectively incorporated by states and tribes in water quality standards programs.

The resulting standard reflects, as best as possible, the biological requirements of salmonids in terms of temperature, and the natural thermal variation of streams and rivers of the Pacific Northwest.

The project and resulting standard is not without controversy or challenges. One criterion in particular has presented challenges in terms of implementation. The criterion,
Salmon and Trout Migration - 20°C 7DADM plus a provision to protect and, where feasible, restore the natural thermal regime, is designed to protect salmonids that migrate and or rear in large, low elevation rivers during the warmest times of the year.

Water temperatures of 20°C are known to cause harm to migrating and rearing salmon.
Yet rivers such as the lower Columbia and lower Willamette in Oregon, most likely were naturally warm during the summers months. Therefore, the provision to protect and restore cold water refugia, becomes critical to making this criterion protective of salmon. To fully implement this criterion, states, tribes and EPA need tools for identifying and protecting existing cold water refugia as well as tools for identifying and restoring cold water refugia where it once existed but has been lost through the many alterations made to these large rivers overtime. This is the challenge I bring to this panel and symposia today.

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Title

The Prevalence of Wild Juvenile Chinook Salmon from Lake Creek, Idaho that Rear a Second Year in Freshwater

Abstract

Several distinct migration strategies were identified from wild juvenile Chinook salmon (Oncorhynchus tshawytscha) captured in Lake Creek, a headwater tributary of the Secesh River, located in central Idaho. From 1997 through the spring of 2007, a rotary screw trap was operated in Lake Creek to monitor migration and survival of juvenile Chinook salmon to Lower Granite Reservoir. Analyses of fish marked with PIT-tags detected through the Columbia River systems showed migration occurred for age 1+ and 2+ age smolts. Further analysis confirmed the presence of multiple age classes of fish in the natal stream, verified through scale analysis and length frequency distributions, providing evidence that two life history strategies occur within each brood year. There is the normal migration group (NMG) and a delayed migration group (DMG). The NMG initiates the smoltification process at age 1+. The DMG contains fish that rear an additional year in freshwater. Two variations of the DMG exist; one is precocial males that are sexually mature and may become smolts the following spring at age 2+, and the second is individuals that are not sexually mature but also become smolts at age 2+. Variables analyzed for the DMG were location of rearing (natal stream or downstream) and evidence of precocity. Ecologically, the presence of the DMG life history strategy spreads genetic risk across multiple migration years and potentially guards against the negative effects of small adult returns. Measurable proportions of the DMG life history strategy within a brood year can affect certain results such as, incorrect brood year production and survival estimates, underestimates of smolts reaching the ocean, and biased estimates of smolt to adult ratios. Utilizing these biased results could inhibit the ability to make sound management decisions.

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Title

Using PCR as a Tool for Quagga/Zebra Mussel Early Detection and Monitoring

Abstract

A key issue for the management of quagga (Dreissena bugensis) and zebra (Dreissena polymorpha) mussels is an ongoing vigilant monitoring program with accurate and early detection. With early detection, preventative or accommodating measures for the protection of water delivery systems may be implemented in a timely fashion and the prevention of their spread to other neighboring water bodies may be accomplished. A polymerase chain reaction (PCR) assay has been used in some monitoring programs as a means to detect quagga and zebra mussel larvae (veligers) in plankton tow water samples collected from western water delivery systems. The assay utilizes an 18s rRNA targeted oligonucleotide PCR primer specific for Dreissena spp. Until now, resource managers have relied on artificial substrates which may be slow to show reliable results, and microscopic examination of plankton to locate veligers is often difficult and uncertain due to their small size and paucity of distinguishing morphological features. Due to its targeted amplification of the 18s rRNA gene, PCR is a sensitive and unambiguous method of detection, making it possible to detect veligers years earlier and at lower numbers than with previous monitoring methods alone. The results of a side-by-side study involving microscopic examination and PCR will be shared. Ongoing research is focused on designing additional primers for the amplification of other targeted DNA regions and for quantitative PCR, as well as improving field plankton tow sampling.

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Title

Long term fishery selection on age and size at maturity of Bristol Bay, Alaska sockeye salmon

Abstract

Life history traits of wild animals can be strongly influenced, both phenotypically and evolutionarily, by anthropogenic exploitation, including hunting and fishing. Fishing gear selectively removes individuals based on size, and thus provides selective pressure on life history traits such as size and age at maturity. We used 57 years of catch and escapement data to document the magnitude and trends in gillnet selection on age and size at maturity of a commercially important and biologically diverse sockeye salmon stock from Bristol Bay, Alaska. Overall the fishery has caught larger fish than have escaped to spawn, but selection has varied over time, becoming weaker and less consistent recently. Selection patterns were strongly affected by fish age and sex, in addition to extrinsic factors including run size, mesh size regulations, and fish length variability. These results reveal a more complex and changing pattern of selective harvest than the simple “larger is more vulnerable” model, emphasizing the need for quantified, multi-year studies before conclusions can be drawn about potential evolutionary effects of fishery selection. Our findings should be considered by fisheries managers, especially when considering long term population sustainability.

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Title

An overview of otolith microchemistry: its application and potential for addressing regional issues in fish restoration and management

Abstract

Otolith microchemistry is now regularly employed in fisheries sciences to address questions about the movements, natal origins and life history variation of fish. Despite the increased use and expanding utility of otolith microchemistry, the applicability of this approach is not universal and varies depending upon the questions being asked. In order to use the chemical signatures in otoliths to answer questions about fish movements and origins, one must consider issues of environmental variability, the temporal and spatial scale of variation, and the limitations on the confidence of spatial classification. In this talk, I will discuss preliminary data from several projects addressing varied fisheries restoration and management issues in the Pacific Northwest. With collaborators from across the region, we are working on projects that address the migrational timing and source habitats for salmon. By way of these projects, I will provide an overview of the questions that are being addressed with otolith microchemistry and the general strengths and limitations of this approach in the restoration and management of freshwater systems. I will compare the spatial variability and discriminatory ability of our regional studies to comparable datasets in the Great Lakes, the Colorado River, the Connecticut River and Trondheimsfjord, Norway in which I have attempted to apply otolith microchemistry to distinguish among source populations. For each of these studies, I have sampled water and resident fish otoliths at multiple spatial scales, and have quantified both elemental concentrations and Sr isotope ratios in source material. My results describe the geologic conditions that drive variations in freshwater geochemistry and the predictability with which this determines variability in otolith microchemistry. Finally, I compare how these results compare different elemental and isotopic systems.

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Title

Impacts of parasites on coho salmon from coastal Oregon watersheds

Abstract

Parasites have long been recognized in anadromous salmon in Oregon, but only recently have they been considered to possibly impact coho populations. To address this question, we are determining the identification and distribution of parasites in coho parr and smolts (Oncorhynchus kisutch) in various coastal watersheds in Oregon. We are also assessing the association of parasite abundance with condition factor. To date, parr from certain rivers have shown heavy infections by metacercariae of Nanophyetus, Apophallus sp., and black spot (neascus). Two myxozoans were common in the muscle; Myxobolus insidious in myocytes and a new Myxobolus sp. infecting muscle nerves. The West Fork Smith River has been a focus of our research. We found exceptionally heavy infections of Apophallus in parr from the main-stem (avg. 1,350 metacercariae/g), and much fewer parasites in parr from the tributaries of this river. About 50 times fewer metacercariae were found in outmigrating smolts from this river. This difference could be explained by 1) selected overwinter mortality in heavily infected fish, 2) fish eliminating encysted parasites, or 3) smolts were from the tributary populations. We are addressing the duration of metacercariae infections in a captive fish study, where infected parr were collected September 2007 and being held at OSU. We will compare infections at smoltification (April 2008) with fish examined in Sept 2007. Other studies have shown that coho parr from this the main-stem of this river have reduced overwinter survival compared to coho from tributaries, suggesting that our smolt samples may be overrepresented by fish from the tributaries (which are lightly infected). It has been suggested that abiotic characters of the main-stem may not be favorable for overwinter survival of coho salmon, and our studies to date suggest that parasites might also be a contributing factor.

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Title
The Potential of Maintsem Surface Passage

Abstract
This paper will present information indicating the potential for Mainstem Surface Passage to improve adult return rates for Snake River anadromous fish. Information will be presented for all Snake River anadromous fish, but will focus on stream type (spring/summer) chinook salmon and steelhead trout.

Stream type chinook salmon spawning ground survey data from the Middle Fork Salmon River will be used to show that the primary human cause of the current perilous status of anadromous fish in the Snake River is in all probability due to the existence and past operation of the large hydroelectric dams in the mainstem. The Middle Fork Salmon River is contained mostly within the Frank Church River of No Return Wilderness. Anadromous fish from the Middle Fork Salmon River have had very little hatchery influence. Estimated overall human harvest of wild Snake River stream type chinook has been very low to low since the late 1970's.

Past mainstem efforts to improve smolt-to-adult return rates for Snake River anadromous fish has consisted primarily of smolt transportation. Ocean productivity has varied greatly for Columbia River anadromous fish since transportation of Snake River smolts began. Adult return data indicates that smolt transportation will be inadequate to recover Snake River anadromous fish with the likely future variations in ocean productivity. Information will be presented that clearly indicates that transported Snake River smolts consistently return at the lower end of the potential range for a given ocean productivity.

The surface passage concept, current technologies, and recent research results indicating surface passage has the potential to significantly improve overall Snake River anadromous adult return rates will be presented. The recent research results presented will focus on the species that transportation benefits the most when compared to past in-river migration conditions, Snake River steelhead trout.

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Title

Creating a Mitigative Solution in a Transboundary Context

Abstract

Fisheries agencies and tribes in Washington State worked with Public Utility District No. 1 of Douglas County to develop a mitigation solution to impacts to migrating sockeye salmon (Onchorhynchus nerka) at Wells Dam on the Columbia River. The fisheries parties developed a plan in the US portion of the Okanogan River, which was outside the native spawning and nursery area of the transboundary population. Douglas County PUD initiated discussions with Provincial and Federal fisheries agencies and First Nations in Canada to propose a mitigative solution in British Columbia. After several years of discussions and review of various options, fisheries parties from both the US and Canada supported a measure proposed by fisheries and water resource agencies represented by Fisheries and Oceans Canada, British Columbia Ministry of Environment and the Okanagan Nation Alliance Fisheries Department. The implementation of this mitigative solution has gained International attention as a model in watershed management.

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Title
Second Chances in Relicensing - Oregon's Perspective

Abstract
We have entered into a period of second chances to lessen and mitigate, or even ameliorate, the harm caused to our environmental, cultural, and recreational resources by the first licensing of hydropower projects throughout the Pacific Northwest. The past 50 years or so of altered lotic environments and landscapes have demonstrated damage not foreseen and provided lessons now learned. In Oregon, FERC relicensing proceedings are viewed as an opportunity to achieve balance, ensure public benefit, and effect positive outcomes for managed and natural resources and energy supply in the state, particularly through successful settlements with utilities and in partnership with federal agencies, tribes, and conservation groups.

The State invested in interagency teams, the Hydroelectric Application Review Teams, led by the Governor's office, to participate in project-specific proceedings. Oregon has successfully secured valuable protections, restorations, and mitigations for its resources in settlements associated with hydropower projects on the Clackamas (PGE), Sandy (PGE), Deschutes (PGE), Hood, (PGE), McKenzie (EWEB), Willamette (PGE), and Umpqua (PacifiCorp) rivers. Settlement discussions and/or FERC administrative proceedings are ongoing for the Klamath Project (PacifiCorp) and the Snake River Hells Canyon Complex (Idaho Power Company). Relicensing of the Hells Canyon Complex has been especially difficult, teasing us with its possibilities and testing us with its realities, particularly regarding anadromous fish reintroduction. A settlement (or completed FERC proceeding) for the Klamath Project offers greater hope.

All of these relicense (or decommission) proceedings have demanded a substantial investment of State resources, time, and political will. In the end, the State will have wisely obtained the best outcomes it could for its resources and citizens, for another 50 years.

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Title

Spring and Groundwater Resources of the Mt. Shasta Region

Abstract

Mount Shasta is the largest Cascade volcano by volume and its glaciers and snowmelt feed hundreds of springs that feed the McCloud, Upper Sacramento and McCloud Rivers in northern California. These spring-fed rivers support a diverse array of cold-water dependant aquatic species. The springs surrounding Mount Shasta are coveted by the fast growing water bottling industry. Coca-Cola and Crystal Geyser currently operate large water bottling plants at the base of Mt. Shasta and Nestle is proposing to build the world's largest water bottling plant at the headwaters of the McCloud River. Our knowledge of Mount Shasta's spring and groundwater resources is limited. California Trout has initiated data collection and monitoring of 20 plus springs around Mount Shasta. General water chemistry is being collected to help determine aquifer relationships and isotopes analyses are being done to identify recharge areas. This information is needed to make sound resource-management decisions, especially due to the increased threat of impacts related to spring and groundwater extraction from the water bottling industry.

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Title

The Western native Trout Initiative - A New Approach for conserving 15 Native Trout Species

Abstract

With few exceptions, native trout populations have declined across the West, usually due to two general factors: habitat alteration and introduced non-native fish. Remaining native trout populations are often isolated from one another and exposed to increased predation, competition, and hybridization. The Western Native Trout Initiative (WNTI) provides a new perspective and impetus to improve the return on investment of the time, money and manpower dedicated to native trout conservation over the next decade.The 15 native trout impacted by the Initiative have long been considered as biologically, recreationally and culturally important.

Through an intensive planning effort supported by Western Association of Fish and Wildlife Agencies (WAFWA) and Federal Partners, the Initiative developed a Plan for Strategic Actions with the following goals designed to achieve success by building upon existing strengths of ongoing efforts: 1) Protect, enhance, or restore western native trout populations and measure success in improving the status of western native trout; 2)Protect intact watersheds, and enhance or restore habitats that have been impacted by human activities or catastrophic natural events; 3)Develop collaborative approaches and partnerships among agencies and stakeholders that emphasize cooperation and shared effort, and increase funding to implement high priority projects for the protection, conservation and enhancement of western native trout; and 4)Develop and implement effective communication, education and outreach programs as a tool to increase public awareness and encourage partnerships that benefit western native trout.

The Initiative will operate as a function of the Western Association of Fish and Wildlife Agencies, with guidance from the State Directors, reporting accomplishments annually to partners and the public.The Initiative will leverage the efforts of partners to increase project funding as it becomes available to fulfill the initiative’s objectives.

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Title

The Western native Trout Initiative - Is there really a Truckload of Money on the Horizon?

Abstract

With few exceptions, native trout populations have declined across the West, usually due to two general factors: habitat alteration and introduced non-native fish. Remaining native trout populations are often isolated from one another and exposed to increased predation, competition, and hybridization. The Western Native Trout Initiative, developed by a mix of western state fish managers, presents an opportunity for increaseed emphasis on the time, money and manpower dedicated to native trout conservation over the next decade.

The National Fish Habitat Action Plan, developed simultaneously with the Western Native Trout Initiative has spurred an effort to increase the funding available to fish habitat projects. In February 2008, the Western Native Trout Initiative was recognized as a "National Fish Habitat Partnership", ensuring the access to future project dollars. The national effort seeks congressional appropriations at a scope similar to the North American Waterfowl Management Act.

The Initiative, in its Plan for Strategic Actions, has two specivic Goals with designed to improve the status of western native trout and qualify for future funding: 1) Protect, enhance, or restore western native trout populations and measure success in improving the status of western native trout; and 2)Protect intact watersheds, and enhance or restore habitats that have been impacted by human activities or catastrophic natural events.

In the first 2 years of existance, the Initiative has influenced over $2.4 million dollars of project funding form National Fish Habitat related ventures and Partners. The Initative will use several approaches: 1)Capitalize on opportunities for conservation of western native trout based on cooperative planning; 2)Participate as a partner in the National Fish Habitat Action Plan and 3) Capitalize on growing public and private interest to acquire additional funding to support conservation actions.

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Title

Short- and long-term impacts of PIT tags on survival estimates of hatchery Chinook salmon

Abstract

In two double-tag experiments, we examined the effects of PIT tags on survival estimates. In the first study, short term (<86 days) impacts of PIT tags were estimated on post-release survival of subyearling fall Chinook salmon from Bingham Creek Hatchery. We employed an Unhandled Control (UC) which was not disturbed and a Handled Control (HC) which experienced the same handling as tagged fish without being tagged. After approximately 90 days of rearing, fish were tagged. Two releases of each group were made separated by 9 days. After emigrating to a juvenile weir 21 kms downstream of the release site, PIT tag retention averaged 99% and post-release survival of HC groups did not differ significantly from UC groups, indicating fish had recovered from tagging stress prior to release. PIT tagged groups had significantly poorer survival than UC groups, averaging 24% lower survival (range 19-27%).

In the second study, we PIT and Coded wire (CW) snout tagged upper Yakima River hatchery spring Chinook salmon. PIT tags losses averaged 18.4% in adults returning 18 months to 4 years after release. PIT-tag smolt-to-adult recruit survival (SARS) was significantly lower than non-PIT-tagged, underestimating SARS by 24.6% on average. After correcting for tag losses, PIT-tag induced mortality averaged 11.3% and was significantly lower than non-PIT-tagged fish. Mean lengths and weights of PIT-tagged adults were also significantly smaller than non-PIT-tagged adults.

Both studies point out the need to assess the impacts of PIT tags before extrapolating results to the untagged fish. They also indicate that a significant portion of the differences observed between PIT-tagged and non-PIT-tagged Chinook salmon SARS in the Columbia River are due to a combination of PIT-tag loss and induced mortality.

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Title

The Latest “Bull” on Bull Trout and the Endangered Species Act

Abstract

Bull trout were listed under the Endangered Species Act (ESA) throughout their range in the coterminous United States in 1999. Since then the U.S. Fish and Wildlife Service (FWS) has completed draft recovery plans and designated critical habitat for bull trout. In 2004 the state of Idaho requested the FWS conduct a 5-year review of bull trout to determine whether an ESA listing was still warranted. The FWS is poised to complete this review in early 2008. This review may lead to a reclassification process designating multiple “Distinct Population Segments” of bull trout, each addressed separately under the ESA. In addition to the 5 year review and potential reclassification processes, the FWS also plans to complete recovery planning, and awaits the outcome of litigation over its designation of critical habitat, which could result in additional work. The FWS is working closely with states and interested Native American tribes to complete all four processes.

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Title

Restoration of salmon in the Cowlitz River Basin: historical perspectives, current status, and future plans

Abstract

The construction of Mayfield (rkm 96) and Mossyrock (rkm 114) dams on the Cowlitz River in the 1960s created fish passage barriers on a system that historically supported abundant runs of anadromous salmonids. The completion of Cowlitz Falls Dam (rkm 143) in 1996 presented an opportunity to restore anadromous salmonids to approximately 322 km of stream habitat in the upper basin by providing a downstream collection point for juvenile outmigrants. Reintroduction efforts rely on a trap-and-haul program in which adults are collected downstream of the lowermost dam (Mayfield Dam) and transported upstream of Cowlitz Falls Dam in trucks where they are released to migrate and select spawning locations. Juvenile outmigrants are collected at Cowlitz Falls Dam, transported downstream of Mayfield Dam, and released. However, reintroduction efforts have met some challenges, including low collection numbers at the juvenile collection facility. Research evaluations that provide data to fishery managers on various aspects of the reintroduction efforts are a critical link to ensure the long-term success of the reintroduction program. Our evaluations have focused on juvenile collection efforts at Cowlitz Falls Dam, adult migration patterns, spawning distributions in the upper basin, and overwinter behavior of juvenile coho salmon in Lake Scanewa, the impoundment created by Cowlitz Falls Dam. Results from these evaluations will be presented to provide a general understanding of the history and current status of the reintroduction efforts.

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Title

Snake River sockeye salmon Oncorynchus nerka: evidence of natural production in Redfish, Pettit, and Alturas lakes

Abstract

Snake River sockeye salmon Oncorynchus nerka were listed as endangered in November 1991 under the Endangered Species Act (56 FR 58619). The Snake River sockeye salmon Evolutionarily Significant Unit (ESU) consists of all anadromous and residual sockeye salmon from the Snake River Basin, Idaho: including artificially propagated sockeye salmon from the Redfish Lake Captive Broodstock Program (RLCBP). The NOAA Fisheries Draft Recovery Plan document states- “the ESU is entirely supported by adults produced through the RLCBP” and “no natural origin anadromous adults have returned since 1998.” Recent monitoring data suggest that natural production is not only occurring, but increasing. For the time period 1999-2007, approximately 132,236 unmarked O. nerka smolts migrated from three Sawtooth Valley lakes (Redfish, Pettit, and Alturas); and 29 unmarked adult sockeye salmon returned to the Sawtooth Valley, representing 8.2% of adult returns. The potential origin of these fish includes: production from residual sockeye salmon; eyed-egg plants from the RLCBP; pre-spawn adult releases from the RLCBP; and non-native kokanee salmon.

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Title

Upper Cowlitz River Salmon and Steelhead Reintroduction Program

Abstract

The upper Cowlitz River anadromous fish reintroduction program is reestablishing spring Chinook salmon, coho salmon, late winter steelhead trout, and sea run cutthroat trout into more than 240 river miles of habitat that had been isolated for nearly 40 years. This unique opportunity began when designs for the new Cowlitz Falls Dam included plans to integrate a fish facility and surface collection system for anadromous downstream migrants. The facilities include: flow baffles (for attraction), integrated fish flap gates and flume system, fish separator, holding tanks, raceways and facilities for biosampling and fish marking. The reintroduction program is based on a “trap and haul” trucking system around three Cowlitz River dams for both juvenile (downstream) and adult fish (upstream).

The Cowlitz Falls Project became commercially operable in 1994 and the fish facility interim smolt collection began in 1996 with full time operations in 1997. The planning that led to the construction of the Cowlitz Falls Fish Facility and the subsequent ESA listing of three species as “threatened” has resulted in an intensely monitored Project relative to most small hydroelectric projects.

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Title

The implementation of remote PIT tag detection stations to improve precision of annual survival rates of endangered suckers in the Upper Klamath Basin, Oregon.

Abstract

Annual survival estimates from a capture-recapture study are used to monitor population status and recovery efforts of endangered Lost River and shortnose suckers in Upper Klamath Lake, Oregon. Between 1995 and 2004, sampling relied entirely upon trammel netting, PIT tagging, and releasing suckers at pre-determined staging areas,lakeshore spawning areas, and in spawning tributaries. In spite of consistently increasing sampling effort and tagging large numbers of suckers between 1999 and 2004, recapture rates of previously tagged suckers remained low. Low recapture probabilities resulted in point estimates with poor precision and model selection methods based on parsimony led to oversimplified survival models. Efforts were made in 2005 to increase recapture probabilities by using fixed underwater PIT tag antennas at strategic locations. Detections on these antennas dramatically increased recapture probabilities of previously tagged fish. Between 2005 and 2006, 14,261 previously marked suckers were detected on remote antennas compared to 4,192 suckers recaptured using capture, handle and release methods. The use of remote systems resulted in a marked improvement in survival estimate precision and is leading to survival models that are more biologically realistic.

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Title
Columbia River Fish Mitigation Program Introduction

Abstract
The Columbia River Fish Mitigation Project (CRFM) was initiated in 1991 by the Corps of Engineers to address anadromous fish passage issues through lower Columbia and Snake River dams. In this same year several salmonid species in the basin were listed as threatened or endangered under the Endangered Species Act. The Corps has constructed and operates eight projects in these reaches primarily for the purposes of hydropower production and inland navigation. The program includes baseline research on passage efficiency and survival, feasibility studies, testing operational changes, development and testing of prototype passage improvements, and design and construction of new permanent facilities. A number of improvements have been accomplished over the past 16 years, but there are additional improvements yet to be made to meet performance goals. We anticipate that the program will potentially require another decade to complete and the current estimate through completion of the project is $1.6 billion.

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Title
Diversity of Icelandic “dwarf” charr

Abstract
Arctic charr (Salvelinus alpinus) in Iceland has been found to be very diverse in morphology, life history and behaviour. Commonly, more than one morph of charr can be found in the same location. These morphs show clear resource segregation and are often genetically distinct. Morph formation and resource specialization is, therefore, important for speciation. “Dwarf” charr are common in Iceland, especially in localities with a combination of lava and groundwater flow. These charr populations, although phenotypically similar, are far from identical and differ in important morphological and life history characters. In this presentation we will overview the diversity among Icelandic “Dwarf” charr and discuss what ecological characters may be important for the evolution of this diversity.

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Title

EFFECTS OF SUCTION DREDGE MINING ON THE SHORT-TERM SURVIVAL OF FRESHWATER MUSSELS IN THE SIMILKAMEEN RIVER, WASHINGTON.

Abstract

Freshwater mussels are among the most imperiled taxonomic groups in North America. However, causes of mussel imperilment are often difficult to identify. Physical disturbance by suction dredge mining can affect the survival of aquatic organisms. The Washington Department of Fish and Wildlife protects freshwater mussels from the impacts of hydraulic projects, including mineral prospecting activities, but little information describing the effects of dredging on freshwater mussels is available to guide management.

We quantified the effects of entrainment, exposure, and burial by suction dredging on the short-term (6 weeks) survival of Western Pearlshell (Margaritifera falcata) and Western Ridged (Gonidea angulata) mussels in the Similkameen River, Washington in 2006. We exposed and buried mussels that were subjected to entrainment by a dredge and compared their survival to exposed and buried non-entrained mussels and to a control group. Entrainment and exposure resulted in no mussel mortality. Burial killed between 6 and 13 % of Pearlshell and Ridged mussels, respectively, and prevented all mussels from reorienting at the substrate surface. We compare our results with those of a pilot study we conducted in Mill Creek, Washington and with results reported in the literature. We suggest that the effects of dredging on mussel survival vary among locations and that precautionary management of mussels in Washington is warranted.

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Title

Water supply planning and meeting Endangered Species Act and Clean Water Act obligations-how do you deal with water demand forecasting, fish needs, and climate change predictions?

Abstract

The City of Portland is preparing a habitat conservation plan (HCP) to address its impacts for operating the Bull Run water supply. The City is considering future water demand projections and potential climate change impacts to create a plan that would be protective of fish habitat. The City is relying on the input of approximately 15 state, federal, and non-governmental agency partners to complete the HCP. The HCP conservation measures are cost-effective actions that will benefit ESA-listed fish populations in the Sandy River Basin.

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Title

Use of Dual Frequency Identification Sonar to Determine Adult Salmon Escapement in the Secesh River, Idaho

Abstract

Dual frequency identification sonar (DIDSON) was experimentally tested in the Secesh River from 2004 to 2006 to monitor adult escapement in a wild chinook salmon (Oncorhynchus tshawytscha) population. DIDSON technology provided a non-invasive method that avoids incidental trapping and handling mortality and fish impedance related concerns. High frequency DIDSON sonar files that ensonified the entire water column were continuously collected in the Secesh River during the salmon migration period. DIDSON estimated salmon escapement at the Secesh River monitoring site, with 95% confidence intervals in parenthesis were: 914 salmon (± 194) in 2004, 336 salmon (± 59) in 2005, and 209 salmon (± 24) in 2006. To obtain accurate and precise escapement information it was crucial to adjust the raw daily salmon passage data. DIDSON generated salmon escapement estimates in 2005 and 2006 would have been positively biased by 53.3% and 20.6% without adjustment for DIDSON file reader error and CSOT processing error. Validation monitoring occurred over the three year period through use of underwater optical cameras to determine whether fish targets identified by the DIDSON technology were actually salmon. A subsample of days revealed that 1,470 optical camera recorded salmon passages were observed in the validation zone, and all of the passages were recorded as salmon during DIDSON file review.

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Title
Salmon Recovery in the Klamath River Basin

Abstract
Numerous salmon and steelhead populations historically occupied the Klamath River Basin. Historically viable populations were likely composed of several life history strategies, were wide ranging, locally abundant, and well adapted to a dynamic environment that included frequent disturbances. Under current conditions, these population traits are severely limited. Federal recovery planning for the Southern Oregon/Northern California Coast coho salmon Evolutionarily Significant Unit (ESU) encompasses nine historic coho salmon populations in the Klamath River Basin. A series of assessments creates a "road-map" to attaining specific recovery goals and objectives. First, knowledge of the historic population structure provides an understanding of how the species was distributed across the landscape and what roles individual watersheds may have played in the overall persistence of the species. This includes an understanding of what constitutes a viable population. Then, key ecological processes influencing coho salmon and their habitat are identified across their marine, estuarine and freshwater environments. This includes a detailed review of current conditions and the various stresses, or altered ecological processes, that have arisen. The sources of these stresses are then identified, along with the affected population viability parameters. Once this set of tools has been assembled across all of the populations, additional effort focuses on identifying a core set of populations that satisfies ESU-wide criteria for species resiliency, redundancy, connectivity and representation. Finally, an implementation plan describes the priorities, costs and timelines to achieve specific recovery goals and objectives. We conclude with a discussion on the status of the Federal recovery planning process for coho salmon and its relationship with the recent Klamath Basin Restoration Agreement.

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Title

Effects of a marine reserve on coral reef fishes

Abstract

Fishing pressures in coral reef habitats tend to selectively target large, top-level predators. Marine reserves protect against fishing pressures, and can directly replenish heavily fished species. However, the community-wide effects of reserves are less clear. We examined the effects of a large, fully protected marine reserve in the Bahamas on the local community of coral-reef fishes. Visual-transect surveys provided estimates and comparisons of the density and size of all fishes on reefs located both inside and outside of the reserve (n = 5 reefs each). Apex predators (e.g., sharks, large groupers) were found to be larger and more abundant inside the reserve, resulting in much greater biomass there. Mid-level trophic species (e.g., snappers, grunts) had higher biomass outside of the reserve, where the number of species and overall abundance of large predators was lower. Low-level trophic species (e.g., wrasses, damselfish) had higher biomass within the reserve. Although the community-wide effects of the reserve are complex, this general pattern is consistent with a trophic cascade resulting from changes at the top of the food web.

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Title

Knowles Creek (Siuslaw River, Oregon) Long-Term Monitoring Project; How has the climate affected the life-stage specific survival

Abstract

Knowles Creek, like many of the other Oregon Coast Range streams, once produced outstanding runs of salmon and steelhead, which have dwindled in recent years due to a variety of impacts, including splash dams, landslides, wood removal, overfishing, and ocean conditions. In the 1990's, representatives from an industrial timber organization, an environmental group, and the federal government embarked on a mission to see if they could work together to restore some of the function of this tributary and monitor those changes, which initiated the long-term monitoring project starting in 1992 with smolt production monitoring. Whole basin juvenile snorkel survey and adult spawning survey monitoring followed suit in Knowles Creek in 1993 and 2002, respectively, which enabled more in-depth analysis on life-stage specific survival rates. Our year-round precipitaion data spans from 1952 until today, providing site specific data for the drainage. Within the 1992-2007 timeframe, many events have occurred that have influenced the production of the Knowles Creek basin, including the flood of record in 1996, three drought periods, numerous instream restoration efforts, and continued timber management on the industrial timber lands. Last year, we reported preliminary analysis results, focusing mostly on annual run numbers, smolt survival - summer drought intensity, and smolt length and weight trends. In this presentation, the discussion will focus on 5 topics all in relationship to flow and temperature conditions: 1) Outmigration pattern/trends in relationship to multiple variables, including precipitation, stage level, temperature, moon cycles, and migration by other species; 2) Comparison of the results from #1 with other smolt trap data within the State of Oregon; 3) K-value analysis of the salmon and trout species; 4) Black spot disease on Coho salmon and water temperature; and 5) Life-stage specific Coho survival rates (adult->fry->smolt->adult).

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Title

THE ECOLOGICAL SIGNIFICANCE OF MOUNTAIN WHITEFISH (PROSOPIUM WILLIAMSONI) IN A CENTRAL IDAHO WILDERNESS STREAM

Abstract

Abstract. Mountain whitefish (Prosopium williamsoni) are among the most abundant native fishes in western North America, yet their ecological role is largely unknown because they have not been considered a valuable game fish. This study investigated the ecological significance of mountain whitefish in Big Creek, a wilderness watershed in central Idaho. Using underwater visual counts along with hook and line surveys we estimated whitefish distribution and abundance as well as total biomass, nutrient, and energy contributions within main stem Big Creek. We estimated that there are 1.25 metric tons of mountain whitefish tissue and 0.23 metric tons of tissue are produced each year. Using this data we then estimated whitefish uptake and standing crop mass of nutrients and energy within the Big Creek. Finally, we were able to compare these values to rough estimates of biomass for three other common fish species in the watershed: juvenile rainbow/steelhead trout (Oncorhynchus mykiss), juvenile Chinook salmon (Oncorhynchus tshawytscha), and westslope cutthroat trout (Oncorhynchus clarki lewisi).

Key words: Big Creek, Idaho; mountain whitefish; Prosopium williamsoni; biomass; production; nutrient and energy composition

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Title

How do we move forward? Making informed decisions in the face of uncertainty, conflict and competing resources

Abstract

Despite incomplete scientific knowledge, opposing stakeholder interests and limited resources, fisheries scientists and policy makers are faced with the challenge of making decisions and allocating funds to support population recovery. Such decisions involve a myriad of variables, data and models. The resulting complexity often obscures the transparency of findings and ultimately the decision making process. This can be avoided - even with the most complicated of scientific studies. We do not need to understand all aspects of a system to make informed choices, nor can we afford to. I will present useful fundamentals from the field of decision theory, including Value of Information (VOI) methods, and demonstrate practical applications for fisheries management. Following these strategies will support the integration of science and policy. I will also present a broad-based decision support system that can be tailored to the objectives and priorities for a given project or group. The system will demonstrate the integration of scientifically complex elements with qualitative ratings, human preferences and uncertainty.

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Title

Strategies for improving salmon and steelhead passage at dams: surface flow outlets, spillway survival improvements, turbine survival program, adult passage improvements.

Abstract

The Northwest Division Corps of Engineers (Corps) is pursuing multiple strategies to facilitate safe passage of juvenile and adult salmonids that migrate through the Federal Columbia River Power System (FCRPS) dams. To increase the survival of downstream migrating juvenile salmonids, the Corps is developing and installing surface flow outlets and behavioral guidance structures to pass juvenile fish around hydroturbines and reduce the amount of migration delay that occurs in the forebays of FCRPS dams. Also, structural and operational improvements to spillways and hydroturbines are being investigated and implemented to better protect juvenile fish that pass via those routes. To ensure safe and efficient passage for adult fish, the Corps is designing and constructing improvements to adult ladders and auxiliary water systems. Adult passage monitoring and evaluation occurs to ensure juvenile passage improvements do not adversely affect adult passage at dams. In addition, the Corps and its partners continue to develop state of the art research, monitoring, and evaluation tools such as passive integrated transponder (PIT) systems, to increase our understanding of adult and juvenile fish passage through the FCRPS.

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Title

Can spawning period operations of Priest Rapids Dam, under the Hanford Reach Fall Chinook Protection Program Agreement, be adapted to increase operational flexibility for hydroelectric power production while maintaining adequate protections for this highly valued population?

Abstract

As the human population of the Pacific Northwest continues to grow, so too will the demand for clean and reliable energy. Beginning in 1984, Priest Rapids Dam operations were restricted in an attempt to reduce impacts to fall Chinook by limiting high elevation spawning (i.e. greater than 70 kcfs). These operations, termed Reverse Load Factoring (RLF), limit daytime discharge during the spawning period and result in reduced flexibility for power production. Recent evidence indicates fall Chinook create redds during day and nighttime hours. Consequently, there is uncertainty about the assumed mechanism for the effectiveness of RLF. Thus, provisions were incorporated into the 2004 Hanford Reach Fall Chinook Protection Program Agreement (HRFCPPA) that provided for evaluation of alternative operations during the spawning periods of 2005 and 2006. Traditional load following operations in 2005 resulted in more high-elevation redds than previously observed under RLF operations. Operations in 2006 were similar to traditional load following but with shorter, sharper peaks and the resulting number of high elevation redds were in the top 10% of those observed under RLF operations. While the number of high-elevation redds identified during ground surveys is in the upper range of those observed under RLF, aerial photography indicate a clear break in the distribution of redds with 97.8% occurring below 40 kcfs elevation. Under RLF operations, Hanford Reach fall Chinook spawning escapement and mean November discharge appear to best predict whether protections will be established at low or high elevations (MLR, $r^2=0.80$). However, the number of high elevation redds is difficult to predict because of differences in the resolution of data collected. While RLF operations are effective at limiting high-elevation spawning, the distribution of redds on the Vernita Bar index site suggests that peaking operations similar to those conducted in 2006 can be effective at limiting high-elevation spawning.

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Title
MAINTAINING COWLITZ RIVER SALMONIDS WITH HYDROPOWER OPERATIONS AND MITIGATION

Abstract
The Cowlitz Hydroelectric Project is Tacoma Power's largest hydroelectric project, and consists of a three dam complex; the Barrier Dam at RM 50, Mayfield Dam at RM 52 and Mossyrock Dam at RM 66 on the Cowlitz River in western Washington State. Fisheries mitigation for the second license (2003) was based upon a multi-party settlement agreement that had an emphasis on restoration of natural-origin stocks to harvestable levels in the Cowlitz River basin. The anadromous fish mitigation program for the first license was based upon adult salmonid run sizes counted at the Mayfield Dam ladder from 1961-1963.

To fulfill the mitigation requirements, Tacoma Power implements an instream flow regime, protects key habitats, contributes to lower Cowlitz River habitat complexity, and constructed and funds the operation and maintenance of the largest hatchery complex in Washington State. The hatcheries are downstream of the dams on the Cowlitz River where the river flows unimpeded to the Columbia River mouth. Adult salmon returns to the Cowlitz hatcheries have been highly variable since accounting began in the early 1960s. In recent years the natural-origin adult returns have comprised about 10% of the run and are showing an increasing trend. The fisheries mitigation program includes separating the natural-origin and hatchery-origin adults at the Cowlitz Salmon Hatchery. Tacoma Power trucks the adult fish around the dams for release into the upper basin areas. Separating the adult salmonids at the hatchery allows for a continuation of the lower river hatchery program while supporting the upper basin salmonid restoration program.

A limiting factor to the success of the natural-origin population restoration effort is the survival of juveniles outmigrating past the dams on the Cowlitz River. Multi-agency efforts are underway to increase the current downstream collection survival rates to 95% of the juveniles entering the upper most reservoir.

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Title

Precocious Male Maturation in Salmonid Hatchery Programs.

Abstract

Over the past decade our research has revealed that approximately 10-50% (depending population and brood year) of male fish from several Columbia River hatchery programs mature precociously at age-2 (commonly referred to as minijacks) rather than the more typical age 3-5 for this species. Instead of migrating to the ocean for long-term rearing and growth, minijacks remain in headwater streams or undertake a short migration downstream, turn around, and attempt to migrate back upstream to complete the maturation process. Age of maturation in salmon is influenced by genetic, biotic, and abiotic factors including energy stores, size and/or growth rate at specific times of year. Studies in salmonids have shown that maturation for each age class is physiologically initiated approximately 10-12 months prior to spermiation and growth rate during this period significantly influences the physiological “decision” to mature in a given year. Hatchery growth profiles are not well matched to that of wild fish, suggesting that rearing practices are a key component of the altered life-history pattern. Changes in the life-history composition of salmon populations are undesirable in supplementation and production hatcheries, potentially resulting in loss of returning anadromous adults, biased gender ratios, and negative genetic and ecological impacts on native species. Laboratory and production scale experiments aimed at more closely matching growth profiles of wild fish have met with mixed success in that growth regimes that suppress early maturity often produce smaller fish at release. Release of smaller smolts typically results in lower rates of survival to adulthood. Future studies are aimed at reconciling the trade-offs between matching the “wild-like” phenotype, and the survival advantages gained through larger body size at release in salmon hatchery programs.

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Title

General sample surveys: a design for multiple objectives and scales in the Lower Columbia salmon recovery region

Abstract

Throughout the Pacific Northwest, many agencies are responsible for monitoring the condition of streams across their respective domains, some at broad regional scales, and others at local scales, with differing time horizons. These monitoring agencies generally design their stream surveys independently of other agencies' plans with several obvious implications. One is that resultant data are often difficult to aggregate, even if common protocols have been used for field measurements. Another is that there could be redundancy in the data collection process. Providing a mechanism for monitoring site selection that integrates across agency needs seems useful. We describe the concept of a master sample for stream networks: an approach to sampling design that provides the flexibility to integrate site selection across a variety of spatial and temporal scales. A master sample consists of a dense set of stream locations selected to meet important statistical criteria of randomization and spatial balance. A unique feature of the algorithm used to select a master sample is that subsets of sequentially ordered sites can be chosen that retain both randomization and spatial balance. This feature allows organizations to select sites that both cover broad spatial domains as well as "fill in" high interest areas with denser samples, such that the results can be combined in a statistically sound way. We illustrate how the concept can be used to explore various design possibilities in the Lower Columbia salmon recovery region where, for example, there are 5 federal agencies, 5 state agencies, and at least 12 local agencies with stream monitoring interests in the Washington part of region alone. Implementing a master sample might be an efficient way for organizations with overarching regional monitoring responsibilities to foster cooperation and collaboration among the range of participating agencies.

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Title

Monitoring to support salmonid recovery and effective land use policies in King County, Washington

Abstract

Understanding how fish and habitat respond to both land use change and restoration actions is vital to support recovery of threatened salmonids. King County monitoring efforts have greatly expanded in scope to reflect the emergence of salmonid recovery, improved management of flood risk, and restoration of Puget Sound as regional priorities. We use a variety of approaches to monitor outcomes from numerous project types, ranging from stormwater runoff management and acquisitions to levee setbacks and wood placements. Results are used to inform the design and implementation of watershed based conservation plans and to quantify project effectiveness and inform future project design. However, important knowledge gaps exist, including; the veracity of hypotheses underpinning conservation plans; the status of population viability metrics; and habitat conditions on private lands. The use of monitoring results in large-scale management decisions is constrained by our ability to match the scale of inference from monitoring studies to relevant scales of response (population) or regulation (parcel or county). Looking forward, we recognize that salmonid recovery may hinge on the ability of land use policies to buffer aquatic systems from increasing development pressures. We have proposed a monitoring framework to determine whether current land use policies in King County – which rank among the most protective in the nation – are sufficient to protect aquatic resources. Results will be useful in informing the 2012 regulatory review mandated by the Growth Management Act.

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Title

Large woody debris and pool habitats in the North Fork Sol Duc River, Olympic National Park

Abstract

I examined the effects of large woody debris on average residual pool depth and pool frequency within five similar-sized stream reaches surveyed in the North Fork Sol Duc River subwatershed within Olympic National Park, WA. A crew from the Aquatic and Riparian Effectiveness Monitoring Program surveyed stream segments in this watershed using a standard protocol during the summer of 2007. The crew measured the quantity, size and location of large woody debris greater or equal to 3 m in length and 0.3 m in diameter found within the bankfull channel of each 200-400 m reach. Pool habitats were counted and measured for residual depth. I found a significant positive correlation ($R^2 = 0.71$) between the number of qualifying wood pieces in a reach and pool frequency, but no significant correlations between the mean pool residual depth and any other wood metric. High stream power and relatively large mean substrate size within this high-rainfall watershed may account for the latter finding. We present large wood data for this semi-pristine stream network that may serve as a reference for researchers and those who manage watersheds on the Olympic Peninsula.

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Title

Early behaviour of Arctic charr (Salvelinus alpinus, L.) juveniles in relation to body size and social environment

Abstract

The early development of behaviour, as movement and foraging patterns, can determine food intake and growth rate with important consequences for life histories and later performance in fish. Shortly after first exogenous feeding, behavioural differences in mobility and foraging of Arctic charr, according to body size, and social environment (group contexts versus isolation since hatching or shortly before observations) were assessed.

Larger fish in group were more active, obtained food earlier and foraged more compared to smaller fish. Larger fish were preferentially foraging where the food was located either on the bottom, in the water column or in surface. Any significant aggressive interaction difference between mixed and homogenous groups was recorded although fishes held on mixed group were more mobile than fish kept in homogenous size group. Large and small fish displayed consistent mobility and foraging patterns regardless of previous social experiment. This result shows that foraging behaviour and mobility are mainly inherent i.e. genetically linked in Arctic charr at the onset of first exogenous feeding.

These findings are discussed in terms of aquaculture and ecological / evolutionary aspects in Arctic charr species. A model of behaviour development in early stages of fish is proposed.

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Title

Restoring the Sprague River, a Work in Progress

Abstract

The Klamath Tribes have been pursuing a collaborative approach to monitoring and restoring the Sprague River Basin. As the primary tributary to the Williamson River, the Sprague River is an important provider of spawning and rearing habitat for endangered shortnose (Chasmistes brevirostris) and Lost River (Deltistes luxatus) suckers as well as “redband” rainbow trout (Oncorhynchus mykiss sp.). Because the Sprague River flows through a large valley dominated by agricultural uses and has been heavily impacted by grazing and channel manipulation, it has experienced significant nutrient loading, water temperature increase, degraded riparian plant communities, and attendant impacts to river morphology and habitat. We will present how the results of our ongoing water quality monitoring, suspended sediment loading studies, and remote sensing efforts (including LiDAR and Thermal Infrared Radiometry) have shaped our view of present conditions, and restoration and research priorities in the Sprague River.

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Title

Barriers to upstream migration of prickly sculpin Cottus asper and coastrange sculpin Cottus aleuticus

Abstract

Fish passage criteria in Pacific Northwest streams have long been described for salmon and trout, yet little is known of passage requirements of other native migratory fish with different swimming abilities. Prickly sculpin and coastrange sculpin are weak swimming fish and are sensitive to barriers to upstream migration. This study identified distribution limits of two common sculpin species, prickly sculpin (Cottus asper) and coastrange sculpin (Cottus aleuticus), in 11 northern Puget Lowland streams. I observed that prickly sculpin and coastrange sculpin distribution limits corresponded with instream barriers and not stream habitat. Of the barriers impededing sculpin passage, most were fish ladders installed to improve salmon and trout passage. Perch height and velocity at crest of barrier were significant attributes of barriers to sculpin passage. Extirpation of a common and abundant forage fish, such as sculpin, from upstream reaches alters fish communities and food web dynamics in these upstream reaches.

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Title

White Sturgeon Conservation Plan: The Hells Canyon Reach of the Snake River

Abstract

White sturgeon, Acipenser transmontanus, in the Snake River are considered by the state of Idaho to be a species critically imperiled. Anthropogenic factors that have played a role in the decline of sturgeons in other river systems — hydropower development, water quantity and quality, habitat alterations, historical exploitation — have also contributed to the status of Snake River white sturgeon. Idaho Power Company (IPC) operates nine main-stem dams along the Snake River including the three dam Hells Canyon Complex (HCC). Below Hells Canyon Dam, structure of the white sturgeon population is balanced with high abundance of juveniles and sufficient numbers of larger broodstock-sized fish to ensure population viability. In contrast, HCC reaches between Hells Canyon and Swan Falls dams contain remnant levels of adult fish with little or no detectable recruitment. State and federal management agencies and Native American tribes participating in the relicensing process of IPC dams have expressed concern about the status and persistence of sturgeon within the HCC. Information collected over the last decade, including population and habitat assessments, limiting factors, and population viability modeling, formed the basis for development of the Snake River White Sturgeon Conservation Plan. This plan outlines an adaptive approach for implementing mitigation strategies intended to restore opportunity for beneficial use and long-term persistence of Snake River white sturgeon.

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Title

Applying Multiple Imputation with Geostatistical Models to Account for Item Nonresponse in Environmental Data

Abstract

Missing data arises in environmental surveys for a number of reasons. An entire observational unit, such as a sampling site, may be missing or one or a few variables for an observational unit may be missing. In order to account for the missing sites or for the missing variables within site, the researcher must deal with handling missing data. Methods proposed to solve the missing data problem in estimation procedures should consider the type of missing data (item or unit nonresponse), the missing data mechanism, the sampling design, and the availability of auxiliary variables correlated with the process of interest. In this paper, we discuss the use of geostatistical models with multiple imputation to handle missing data in environmental surveys. We apply this method to the analysis of data generated from a probability survey to estimate coho salmon abundance in streams located in western Oregon watersheds.

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Title

Traditional Ecological Knowledge insights into Pacific lamprey populations of the Lower Klamath Basin

Abstract

Until recently, Pacific lamprey (Lampetra tridentata) were generally considered insignificant and overlooked in West Coast fisheries management. Substantial population declines in the last two decades have triggered increased interest, yet current studies lack historical context. The Yurok and Karuk Tribes of the Klamath River in Northern California have long had a relationship with Pacific lamprey, utilizing its subsistence and cultural value for thousands of years. In this research, ethnographic methods were used to gather traditional ecological knowledge (TEK) of Pacific lamprey from Yurok and Karuk tribal community members. Native knowledge of this species is integrated in a complex understanding of natural systems. This system of knowledge can inform science of key insights regarding the life history, decline, and ecological significance of local lamprey populations. Historically, millions of lamprey were seen throughout the Lower Klamath River Basin. According to tribal lamprey fishers (eelers), lamprey populations began declining in the Klamath Basin more than 40 years ago, with average harvests dropping from 1000 to less than 15. Population decline factors have been attributed to the combined influences of logging practices, wetland delineation, dams, fire suppression, contamination, and predation. Harvest methods utilized by eelers provide insights into stream morphology and flows, as well as lamprey distribution and relative abundance. Tribal community members emphasize the significant role lamprey play in the river system, both as prey and essential contributors of marine-derived nutrients. Finally, the cultural significance of Pacific lamprey cannot be overlooked, particularly the social, spiritual, and health implications of a declining lamprey population.

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Title

Bull Trout Population Genetics in the Metolius River

Abstract

The Metolius River basin supports several populations of bull trout (Salvelinus confluentus), which are listened as Threatened under the Endangered Species Act. However, the number of populations and their structure has never been conclusively determined. In 2007 federal, tribal, state, and power company biologists collected 334 fin clips from Metolius River basin bull trout for genetic analysis. These fin clips came from seven separate spawning areas in the Metolius basin. The studies' objectives were to determine levels of genetic variation within and among the seven spawning locations, and to determine the number of distinct bull trout spawning aggregations within the Metolius system. Though the number of spawning bull trout in the Metolius fell to relatively low levels in the 1980's there was no evidence of any recent genetic bottleneck. Results suggest that while all seven spawning areas are genetically distinct, the spawning populations fall into three groups. These are: 1) Whitewater River; 2) Jefferson Creek and Candle Creek; and 3) Canyon Creek, Jack Creek, Spring Creek, and Heising Spring. Data on effective population size appears to be highest in populations where the largest numbers of redds have been observed, suggesting that there is a positive relationship between the number of redds and effective size. The information from this study will assist the U.S. Fish and Wildlife Service and basin managers in making decisions regarding Metolius basin bull trout. This may include using Metolius basin bull trout as donor stock to re-establish extirpated bull trout populations.

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Title
Study design and statistical tools for monitoring restoration effectiveness

Abstract
While the basic questions motivating restoration effectiveness monitoring are often simple, there are many interesting issues that arise when designing monitoring studies and analyzing the results. Questions that arise during study design include: what should the unit of replication be, what type and how many controls are necessary, how should the available effort be spread across time and space, and what do the results of a BACI tell you. While the basic question (was the restoration effective) is straight forward, with many different variables, and spatial and temporal scales, a bewildering number of specific hypotheses are often possible. In this talk I will briefly discuss issues specific to restoration monitoring design, and provide a overview of some statistical approaches to synthesizing the results.

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Title

Total lipid content and fatty acid signatures of common forage fish species off Oregon and Washington under variable oceanographic conditions

Abstract

We determined total lipid content and fatty acid signatures of four forage fish species, northern anchovy (Engraulis mordax), Pacific sardine (Sardinops sagax), Pacific herring (Clupea harengus pallasi), and whitebait smelt (Allosmerus elongatus), which are common in the California Current large marine ecosystem (CCLME). Sampling took place during periods of variable oceanographic conditions in the summers of 2005 and 2006. The summer of 2005 was anomalous because of delayed upwelling conditions that postponed primary productivity until mid-July. In contrast, 2006 was characterized by the early, albeit weak onset of upwelling in May. Strong upwelling-favorable winds blew from July through September, leading to a coast-wide hypoxic region along the Oregon shelf lasting through October. Forage fish densities were low in both years. We observed lowest lipid levels among all species in 2005, and highest lipid levels (tripling in Pacific sardine) in 2006. Essential fatty acids, such as docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA), are distinctive biomarkers that can only come from the diet and remain unaltered when deposited in adipose tissue. Using ratios of DHA to EPA, we detected a transition from a diet of primarily dinoflagellates in early 2005, to a diet of diatoms by late summer 2005. We also detected higher levels of macrozooplankton carnivory, identified from monounsaturated eicosenoic and erucic fatty acids, in Pacific herring and whitebait smelt in 2006 relative to 2005. For all fish, lipid levels were negatively correlated with DHA concentrations, and positively correlated with EPA, demonstrating that delayed upwelling along the eastern boundary of the CCLME can alter forage fish food web structures, and dramatically impact foraging efficiency at multiple trophic levels.

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Title

Spring Chinook Salmon in the Warm Springs River: Evaluating a 35+ year-old Data Set

Abstract

The Warm Springs River is a tributary to the lower Deschutes River, located on the Confederated Tribes of Warm Springs (CTWS) Indian Reservation in Central Oregon. This river and its tributaries support a spawning population of wild Spring Chinook salmon. Operations at the Warm Springs National Fish Hatchery (WSNFH), located at river mile 11, began in 1978. The WSNFH is funded and operated by the US Fish and Wildlife Service, and is co-managed by the USFWS and the CTWS. This hatchery is unique because it is located below all of the major spawning areas for spring Chinook, and all migrating fish can be stopped and enumerated at the hatchery weir. Therefore, hatchery fish can be kept from migrating upstream, resulting in a relatively pure wild strain of spring Chinook salmon. However, some hatchery - origin fish have been allowed to pass upstream in some years.

Data has been collected since the late 1970's and early 1980's on both wild and hatchery-origin adult migrations, redd counts, juvenile rearing, and juvenile outmigration in the Warm Springs River. This presentation will focus on the relationships among these variables, and will explore potential effects that hatchery-origin fish may have on the fitness of wild populations.

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Title

O. Nerka in the Deschutes River Basin: Kokanee Management and Sockeye Salmon Reintroduction

Abstract

After over a decade of studies, planning, and negotiation, efforts are underway to reestablish passage of anadromous fish through the Pelton-Round Butte Hydroelectric Project (PRB Project) on the Deschutes River in central Oregon. These efforts include construction of a selective water withdrawal facility in the forebay of the Lake Billy Chinook that will allow for collection and safe transport of downstream migrating juvenile fish, as well as plans for transporting upstream migrating fish. The PRB Project consists of three hydroelectric dams that create three reservoirs: Lake Billy Chinook, Lake Simtustus, and a reregulation reservoir.

Among species targeted for reintroduction is sockeye salmon (Oncorhynchus nerka). This sockeye population is proposed to be built from existing kokanee populations in the system. These kokanee support a popular sport fishery, and also provide the forage base for listed bull trout (Salvelinus confluentus). Recent investigations into kokanee spawning escapement from Lake Billy Chinook suggest that the population may be lower than estimates in from the late 1990's. Many questions exist about the ability of this population to maintain itself at its current level as well as provide enough individuals for establishment of a sockeye run.

Reintroduction of sockeye salmon in the Deschutes River Basin presents a range of complicated management issues and a variety of difficult decisions for fisheries managers.

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Title

Can bull trout predation regulate juvenile salmonid populations?

Abstract

Currently bull trout (Salvelinus confluentus) is listed as “Threatened” under the United States Endangered Species Act (1973) (ESA). The sensitive nature of these animals and ecosystems that support them often creates difficulties when researching this species. Because of this restriction, ecological modeling to analyze the function of biological systems containing listed species is desirable. The Skagit River in northwest Washington has a relatively large bull trout population which allows researchers to use methods currently restricted in other systems containing these fish. A survey of fluvial bull trout diets was initiated in spring 2006 to collect baseline data of their trophic ecology. A bioenergetics model was applied to bull trout diet, observed growth, and physical data from the Skagit River to determine seasonal consumption demand of identified food items. I estimate that bull trout require between 340-7,250 grams of food, dependent on size class, to achieve observed growth. Bull trout in the Skagit River are opportunistic feeders primarily consuming fishes, invertebrates, fish eggs, and carrion. This trophic plasticity allows bull trout to exploit a variety of food sources year round. Food supply and lack of migration barriers in the Skagit River likely contribute to this species success in this system. This is an ongoing project to determine ecological interactions between bull trout and the stream food web especially steelhead (Oncorhynchus mykiss) and stream type Chinook salmon (O. tshawytscha).

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Title

An integrated view of climate change and bull trout: the Boise River Basin over the last 50 years as a case history

Abstract

The fundamental changes occurring with climate change are increased air temperatures and altered precipitation regimes. Most obviously within stream systems, these trends translate to warmer stream temperatures and advances in median flow timing. Substantial uncertainty exists about how these changes will affect local habitat networks, which makes prioritization of restoration and conservation efforts difficult. Changing temperature and precipitation regimes will have broad ecological consequences that will manifest through a complexity of interactions and mechanisms. For example, there are numerous ecologically mediated physical processes, including interception of precipitation, evapotranspiration, and stream shading that will be affected by increased insect, drought, and fire mortality. Increased wildfire will also change soils and affect major stream disturbance processes. Some of these cascading and interacting effects will exacerbate initial effects, while others will mitigate. An important question is the relative contributions of processes to changes in streams and bull trout habitats. We present a case study of the Boise River basin examining interactions between multiple physical processes and the ecological outcomes. We discuss changes to streamflows, stream temperatures, and major disturbances through a retrospective of the last half-century and explore how feedbacks can be considered for a more holistic evaluation of climate change effects on bull trout habitats.

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Title

Eastern Oregon Salmon-Trout Enhancement Program: Volunteers STEP Up

Abstract

Volunteers lend a hand with fisheries projects in Eastern Oregon. The Oregon Department of Fish and Wildlife's Salmon-Trout Enhancement Program (STEP) facilitates partnerships between volunteers and ODFW staff to accomplish education, habitat and fish monitoring projects. This presentation will highlight volunteer projects such as invasive species control, redband trout monitoring, and fisheries education in elementary schools. Volunteers can provide expertise and skill as well as promote fisheries conservation. Volunteer activities increase public understanding and provide and avenue for involvement in fisheries management. An overview of the benefits of utilizing volunteers in fisheries work will be discussed.

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Title

Defining Trophic Relationships on the Shasta River: Variability in Space and Time

Abstract

The Shasta River, a highly sinuous alluvial river channel and primary tributary to the Lower Klamath River Basin, routinely experiences flow reductions due to seasonal agricultural irrigation diversions. These flow reductions create unfavorable thermal conditions for native salmonids and may alter food web interactions and trophic dynamics. The trophic system supporting salmonids on the Shasta River and the extent to which anthropogenic land use activity influences this system is not well understood. Naturally occurring stable isotopes of carbon (d13C) and nitrogen (d15N) are important elements in determining particular sources of organic matter and understanding the extent to which those sources are transferred through trophic pathways in an ecosystem. Preliminary isotopic data collection and analysis on the Shasta River suggest that 1) basal carbon sources fueling productivity are distinct, and thus, permit further data collection and analysis, and 2) that juvenile steelhead show a unique and isotopically depleted d13C signature, most likely of allochthonous origin. Additional data collection and analysis will determine specific contributions of identified carbon sources to higher trophic levels and the spatial and temporal variability of isotopic distributions throughout the Shasta River corridor. Spatiotemporal sampling of naturally occurring stable isotopes will provide valuable insight on watershed-level differences in food web dynamics, how juvenile steelhead feeding behavior changes through space and time, and the role of anthropogenic influence on trophic dynamics. Ultimately, this information may play an integral role in the development of viable restoration strategies for the Shasta River.

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Title
Larval metamorphosis in Pacific lamprey

Abstract
This study is one of the first to follow individual Pacific lamprey through the process of metamorphosis. Readily observable external changes were described for individual Pacific lamprey going through metamorphosis. Changes occurred to their mouth, eyes, and branchial region from July through at least November, and probably into December. During metamorphosis, Pacific lamprey also exhibited asymmetric growth, including an increase in snout depth, which had not been previously reported in the literature. The order of the morphological changes and patterns of asymmetric growth during metamorphosis in Pacific lamprey matched most closely with those reported for another Lampetra species, American brook lamprey, but exhibited unexpected variations from those reported in other species of lamprey. As has been reported for other lamprey species, ammocoete length, weight and condition factor could be used to predict the proportion of lamprey that would transform; however, such models were not very accurate in predicting which individuals would transform. Under captive rearing conditions, essentially 100% of the ammocoetes survived and maximum growth rates of 0.040-0.071 mm/d were within the range of those estimated for ammocoetes rearing naturally in stream environments. Supplemental feeding improved larval growth but did not influence the incidence of metamorphosis in captively-reared Pacific lamprey. To develop effective conservation strategies for Pacific lamprey in the Columbia River basin it would be prudent to consider that the phase of metamorphosis, a time when the animals are relatively vulnerable, may last from July through at least December.

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Title
Hatcheries, habitat and the conservation of Pacific salmon in Canada

Abstract
The goals of the Canadian Salmonid Enhancement Program (SEP) are to provide for harvest opportunities, mitigate for major habitat losses, rebuild depleted stocks, supplement weak stocks and re-establish extirpated stocks of Pacific salmon. Using hatcheries operated by federal employees, community groups and volunteers, the SEP has provided sizeable components of the Canadian production and catch of chinook, coho and chum salmon since the 1980s.

SEP has attempted to fully integrate hatchery production with natural production of endemic wild stocks of Pacific salmon. SEP facilities follow strict operational guidelines to minimize any potential detrimental ecological, genetic or disease effects from hatchery production. The high survival of fish in the hatchery is an important component in the strategy to minimize deterioration of fitness through genetic effects such as in-breeding depression, loss of locally adapted gene complexes, founder effect and domestication selection. Low survival is the greatest genetic danger to fish populations that are in a depressed condition.

Intensive hatchery production, including the rearing of broodstock for their entire lives, can be a valuable tool in reducing the extinction pressure on species at risk. At the other end of the spectrum, hatchery production of large quantities of juveniles during times of high natural survival can augment the harvest benefits that can be derived from salmon stocks. In addition, hatcheries can provide a long-term, reliable replacement for habitats lost from dam construction, urbanization or other modes of habitat degradation, conditions that can only get worse in the future, considering the encroachment of human impacts on the land and water resources of the northeast Pacific coast. The SEP combines habitat restoration and enhancement with its hatchery production to provide assured production of salmon with intact wild genotypes for generations to come.

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Title

Assessing Thermal Rearing Restrictions of Juvenile Coho Salmon using Thermal Infrared Imaging and In-stream Monitoring

Abstract

Historically, coho salmon were found throughout most of the 108-km-long mainstream of Redwood Creek. Currently, however, juvenile coho distribution is limited to the downstream-most 20 km of the mainstem and a few large low-gradient tributaries. Thermal infrared imaging (TIR) and in-stream monitoring were used to quantify trends in stream temperature, and temperature patterns were related to historical and present distributions of juvenile coho salmon. Water temperature increased from the headwaters to about 60 km downstream, then gradually decreased over the next 40 km, where the river flows through the coastal fog belt and has a riparian zone dominated by old-growth redwood trees. Widespread streamside landsliding, channel aggradation and harvest of riparian trees have resulted in elevated stream temperatures along a 50-km long reach of river in the middle basin. In this reach, maximum weekly maximum temperatures ranged from 23 to 27 degrees C, and these high temperatures may play an important role in restricting juvenile coho to one-fifth of their historical range. Cool water seeps, springs and back channels > 20 m2 within the warmer river channel were also identified through TIR imagery. These thermal refugia were most common in the downstream reach where the river flows through schist bedrock. Although TIR sensing can map surface water temperature, it cannot identify thermally stratified pools or small seeps along streambanks that are obscured by riparian vegetation. Consequently, small cool-water refugia may be more common than currently described, but more intensive field work is necessary to quantify the presence and use of such refugia.

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Title

Flood pulse trophic dynamics in a restored arid-land river-floodplain

Abstract

The Rio Grande has been identified as one of the most endangered rivers in the United States by American Rivers. Water impoundment, water extraction, and point-source pollution have likely contributed to the decline of the federally endangered Rio Grande silvery minnow (Hybognathus amarus). The overall goal of this study was to locate, identify, and characterize food resources for H. amarus and the ichthyofauna of the Middle Rio Grande (MRG). An extended flood-pulse release (~100 days) from Cochiti Reservoir allowed for the investigation of food resource usage during a flood event. Trophic interactions between fish, aquatic invertebrates, and periphyton were identified using stable isotope analyses (delta 13C and delta 15N) and paleolimnology techniques.

H. amarus has been classified by various investigators as an herbivore, detritivore, or carnivore. During low flow conditions H. amarus is primarily an algivore as indicated by stable isotope results. However, during flood conditions, hydrodynamic scouring eliminates or reduces the benthic algal food sources. The stable isotope data from the Los Lunas site on the Rio Grande are inconclusive with respect to either autochthonous or allochthonous carbon dependence as a food source for H. amarus. A mixture of autochthonous and allochthonous sources are indicated, but it is also unclear whether terrestrial C3 plants are an important food source in the absence of algae. The food web, however, appears to be supported by an unknown primary producer with a delta 13C value of approximately -26.5 to -24.5‰ and a delta 15N value of approximately 2-3.5‰. Stable isotope results indicate that H. amarus makes use of other locally abundant food sources, primarily chironimids and Odonate instars, during and immediately after floods. Results suggest that H. amarus is an opportunistic feeder and should be classified as an omnivore.

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Title

Spring Chinook Reintroduction in the Walla Walla Basin

Abstract

Spring Chinook salmon were extirpated from the Walla Walla River Basin more than eighty years ago. Watershed restoration efforts have focused on improving fish passage, instream flows, and habitat. Salmon restoration began in 2000 with the out-planting surplus hatchery adult spring Chinook into pristine spawning habitat in the South Fork Walla Walla River. A yearling hatchery program of 250,000/year began in 2005. This project conducts monitoring and evaluation actions specified by the Walla Walla Subbasin Plan by providing estimates of distribution, productivity, abundance, and survival of reintroduced spring Chinook (Oncorhynchus tshawytscha). Spring Chinook returning to the Walla Walla River and fish from CTUIR's adult outplanting program spawned within a 45 rkm reach of the upper mainstem and South Fork Walla Walla River (rkm 68.2 and 113.3) between mid-August and early October. Between 2000, and 2007, mean total expanded redds and adults per redd were 215.4(SD 110.6) and 2.0 (SD 0.4); respectively. Abundance estimates of natural and hatchery spring Chinook juveniles emigrating into the Columbia River from the lower Walla Walla screw trap (rkm 15.0) were 14,453 (SD 3,880) and 163,384 (SD 66,836); respectively. Survival estimates for hatchery spring Chinook indicated 92% (95% C.I. 0.52 - 2.01) of smolts (n=1,004) survived from the direct release in the South Fork Walla Walla River (rkm 93.9) downstream to Nursery Bridge Dam (rkm 71.9); 66 % (95% C.I. 0.23 - 1.09) survived to the lower mainstem rotary trap (rkm 15); and 23% (95% C.I. 0.19 – 0.29) survived to McNary Dam. Results suggest that both hatchery and natural origin adult Chinook successfully spawned and produced viable offspring that emerged, reared, and migrated to the ocean at similar sizes and times.

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Title

Steelhead Movement in the Walla Walla Subbasin

Abstract

We used radio telemetry to describe adult migration, fish ladder use (delay and percent passage), and spawning distribution of summer steelhead in the Walla Walla Subbasin. Upstream in-river detections accounted for roughly 82 % (n = 128) of the 156 steelhead radio-tagged in the lower Walla Walla River between 2001 and 2006. Based on radio-tag detections, steelhead distributed unequally among four stream drainages: 50.5% Touchet River; 39.2% Walla Walla mainstem and upper tributaries; 7.2 % Mill and Yellowhawk complex; and 3.1 % Dry Creek (Washington). Radio-tagged hatchery and wild steelhead were spatially and temporally mixed in the lower watershed. The mean number of days spent by radio-tagged hatchery and wild steelhead in the Walla Walla watershed was significantly different (z = 2.142; P = 0.322; df = 51). The median time spent in-basin by radio-tagged wild and hatchery females were 152 days (range 75-197 days) and 134 days (range 112-173 days); respectively. Telemetry suggested a general pattern of movement. Steelhead held in the lower Walla Walla River near Lake Wallula, often until sufficient flow and lower temperatures queued upstream movement (usually in November). Steelhead entered tributary streams between November and May; however, peak spawning escapement occurred in March and April. Spawning fish remained within tributary streams for a variable amount of time, ranging from a few days to weeks; while roughly half (54%) of radio-tagged steelhead returned downstream to the Columbia River as kelts (usually between March and May). Study results were applied towards fish barrier removal and adaptive management within the subbasin.

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Title

Estuarine Resident Juvenile Steelhead Mimic Half-Pounder Life History Traits in the Russian River, California

Abstract

Anglers in the Russian River, north of San Francisco, report catches of sub-adult steelhead during fall and liken these fish to “half-pounder” runs found farther north in California and southern Oregon. The term half-pounder describes steelhead that emigrate as smolts in spring, rear in the ocean for several months, migrate upstream in fall, overwinter in freshwater, and emigrate to the ocean again the following spring. Little information exists about the movement of these fish but rapid growth rate suggests the marine component to their life history. Unlike larger river systems to the north, the sand bar at the mouth of the Russian River estuary is artificially breached during the low flow season. Questions about the effects of breaching on rearing habitat led us to examine growth and movement of juvenile steelhead in the estuary during summer and fall 2005 and 2006. We hypothesized that fish captured during summer were late arriving smolts en route to the ocean and that anglers in fall caught fish returning from the ocean. To determine movement patterns, we implanted acoustic transmitters in 77 fish between 150 and 280 mm FL and tracked them for up to 140 days. To determine growth, we compared sizes of early summer and late fall catches and measured circuli spacing in scales from 164 individuals. Few fish entered the ocean and most resided in the estuary or migrated upriver in fall. Scale analysis indicated rapid and consistent growth in estuarine resident fish. High estuarine growth rate was confirmed by scale patterns from three recaptured acoustic tagged fish that were at large for more than 100 days. The growth and behavior of estuarine resident fish suggests that other half-pounder populations may forego the purported marine component of their life history.

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Title

Observed and Projected Climate Trends in the Pacific Northwest

Abstract

Historical climate observations for the Pacific Northwest region indicate that temperatures increased approximately 1 degree C in the 20th century, while trends in precipitation were less prominent than interannual and interdecadal variations. Additional evidence in support of the observed changes in temperatures includes widespread declines in the ice mass and length of PNW glaciers, declines in springtime snowpack at low elevations, and advanced runoff timing in snowfed rivers. Recent projections for climate change in the 21st century taken from the climate models used in the IPCC's Fourth Assessment Report of 2007 indicate that the average warming rate for PNW temperatures will be in the range of 0.1 to 0.6 deg C/decade, with a best estimate of 0.3 deg C/decade. For comparison, the observed PNW warming in the 2nd half of the 20th century was approximately 0.2 deg C/decade. In contrast, projected changes in annual average precipitation from most climate models are modest with respect to historical variations, ranging from a 10% decrease to as much as a 20% increase, but with an average of +4% by the late 21st century. On average, the climate models have winter precipitation increasing and summer precipitation decreasing.

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Title

Integrated Monitoring – the Holy Grail of Columbia River Basin M&E: Challenges, Examples and Lessons Learned from the Collaborative Systemwide Monitoring and Evaluation Project

Abstract

Monitoring and evaluation (M&E) involves consistent data collection and analysis to measure status of the resource, detect changes over time and test action effectiveness. Integrating this information is important to inform management decisions in the Columbia River Basin. But what do we really mean by “integrated M&E”? Full integration requires consideration of at least five dimensions: 1) Spatial integration, 2) Temporal integration, 3) Life history integration, 4) Species integration, and 5) Programmatic Integration. Important design issues include the need to address multiple objectives across agencies and the role of existing monitoring sites. EPA’s Data Quality Objectives (DQO) process can help ensure that M&E elements to be integrated are initially well designed by clarifying program objectives, defining appropriate types of data to collect/analyze and specifying the tolerable limits on potential decision errors. The Collaborative Systemwide Monitoring and Evaluation Project (CSMEP) has used DQOs and other systematic processes for developing alternative M&E designs to answer Status & Trends, Hydrosystem, Harvest, Hatchery, and Habitat Effectiveness monitoring questions, including an analysis of the potential for an integrated PIT-tagging program to address a range of monitoring questions across these five M&E domains. Integration of M&E depends ultimately on the policy and management priorities of each domain and its constituent questions. Consequently, there is no “optimal” design that will exactly suit the preferences of all agencies. There is also no monitoring “czar’ who can enforce a top-down integrated approach on agencies. Therefore, program managers will need to iteratively review and collaboratively revise integrative strategies and designs. To catalyze this process CSMEP developed analytical tools that allow managers and scientists to jointly explore alternative M&E designs and associated trade-offs (i.e., statistical power, costs, sampling effort, etc.).

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Title

Improving survival of fish passing through hydroturbines by developing new turbine designs and modifying operations for existing hydroturbines

Abstract

The U.S. Army Corps of Engineers' (COE) Turbine Survival Program (TSP) is part of the COE's multi-faceted Columbia River Fish Mitigation Program. The TSP was established to quantitatively evaluate juvenile fish passage through turbines with and emphasis on identifying turbine structures and operations responsible for fish injury. The first phase of this study included four main objectives; 1) Evaluate and recommend measures to improve survival of fish passing through the Kaplan turbines, 2) Identify biological design criteria for design of fish passage improvement modifications of existing turbine units, 3) Investigate modifications to the existing turbine designs that have potential to increase fish survival, and 4) Recommend a course of action for turbine rehabilitation or replacement that incorporates improvements for fish. It was soon realized there was a significant lack of understand of the turbine environment and the effect of that environment on fish. The phase I efforts were redirected to develop the necessary tools and studies to better evaluate the turbine environment and to determine the effect on fish. The results of this effort and the use of the TSP's study methods in meeting the TSP objectives will be presented.

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Title

ODFW & ODOT's Fish Passage Program: A Partnership Towards Native Migratory Fish Recovery

Abstract

The Oregon Department of Fish and Wildlife (ODFW) is charged with regulation of fish passage under the state fish passage laws: ORS 509.580 through 910 and in OAR 635, Division 412. The Oregon Department of Transportation (ODOT) is responsible for the safe and effective state and federal transportation system within Oregon. ODFW and ODOT are committed to the protection, conservation, and recovery of native migratory fish species in the state; including healthy populations and those listed as threatened and endangered under state and federal statutes. These commitments, memorialized in the 1999 Executive Order No. EO 99-01: THE OREGON PLAN FOR SALMON AND WATERSHEDS, defines state agency expectations as they relate to the Oregon Plan for Salmon and Healthy Watersheds (Oregon Plan). The purpose of the Oregon Plan, and reaffirmed in Executive Order 99-01, is to restore Oregon's wild salmon and native trout populations and fisheries to sustainable and productive levels that will provide substantial environmental, cultural, and economic benefits and to improve water quality. One of ODOT's Oregon Plan commitments was the establishment of a Fish Passage Program. The Program's primary goal is to replace or retrofit priority culverts for fish passage in the most aggressive, cost effective, and efficient means as practicable. To date, this Program has opened up over 400 miles of stream habitat to a wide variety of fish species. This poster provides an overview of the partnership between ODFW and ODOT's Fish Passage Program and the common goal of native migratory fish conservation and recovery.

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Title

Relationships among implementation monitoring, management and long-term trends in riparian and stream conditions on public grazing lands in the Interior Columbia River Basin

Abstract

Declines in salmonid populations throughout the Western U.S. have resulted in many stream and riparian management policy changes at local, regional and national levels. These policy changes include mandates to monitor stream and riparian areas on public grazing lands for both short-term impacts of annual grazing use (“implementation monitoring”) and long-term effectiveness of overall management direction (“effectiveness monitoring”). Standardized monitoring protocols such as the Multiple Indicators Method, Riparian Proper Functioning Condition Assessment provide good tools for rapidly and efficiently collecting data on stream and riparian conditions. These data may be used to identify trends in relation to plan implementation and guide land managers in adjusting management objectives and practices as needed to improve fish habitat on public grazing lands and watersheds downstream. This research focuses on USFS and BLM Designated Monitoring Areas (DMAs) in the interior Columbia River Basin. Ninety three DMA’s were monitored by the USFS PACFISH/INFISH Effectiveness Monitoring Program (PIBO EMP) in 2001 (n=43) and 2002 (n=50). Each of these DMAs was monitored again five years later (2006 and 2007) to provide a measure of change in stream and riparian attributes over that time. Thirty Five US forest Service and BLM field offices throughout the interior Columbia River Basin cooperated to provide implementation monitoring and management data for these 93 DMAs. These data are used to explore relations among grazing management, implementation monitoring, and long term trends in stream and riparian condition. Analyses from this study will be interpreted to provide land mangers with guidelines for choosing appropriate monitoring indicators given specific environmental and management constraints. Recommendations will provide focus to future data collection efforts to identify cause/effect relationships given limited personnel and resources available for monitoring.

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Title

Evaluating natural productivity and genetic interaction between a segregated hatchery stock and a wild population of steelhead trout (Oncorhynchus mykiss) in Eagle Creek, Oregon.

Abstract

Hatchery propagation of steelhead trout at Eagle Creek National Fish Hatchery (ECNFH) was implemented as mitigation for loss of fishery resources in the Columbia River basin. The original ECNFH winter-run broodstock was largely derived from out-of-basin Big Creek Hatchery stock from the Lower Columbia River with a component of local natural-origin (NOR) stocks. Hatchery-origin (HAT) steelhead return to Eagle Creek from December through March, whereas NOR late-run steelhead return to spawn in Eagle Creek from February to June. This temporal distinction has been viewed as advantageous because it allows for a targeted fishery on early returning HAT steelhead. Managers have assumed few matings occur between NOR and HAT fish because of distinct spawning locations and differences in spawning time. Redd counts indicate peak spawning for NOR steelhead occurs in May while the peak spawning of HAT fish at ECNFH occurs in February. The North Fork Eagle Creek is believed to be the major spawning area for NOR fish, while natural spawning of HAT fish is thought to occur primarily in the mainstem Eagle Creek. We conducted genetic structure analyses using 16 microsatellite loci to evaluate geneflow and relative productivity among naturally spawning HAT and NOR steelhead throughout the Eagle Creek watershed during return-years 2005-2007. Significant population heterogeneity (Fst = 0.018; CI 0.012-0.025) was observed between juveniles from the ECNFH raceways and NOR juvenile groups including North Fork Eagle Creek. We examine risks associated with observed levels of geneflow between NOR and HAT groups in the wild.

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Title

There and Back Again: Lessons in Global Freshwater Climate Adaptation

Abstract

Freshwater-dependent species are facing widespread threats from anthropogenic climate change, but new climate-aware approaches to freshwater conservation are only now emerging. In the developing world, these approaches face a particular challenge since freshwater ecosystems are typically embedded into vulnerable economies and livelihoods. These new approaches are based on a still-developing philosophy of climate change adaptation and resilience. The Ganges basin on the Indian subcontinent and the Yangtze basin in China both have their headwaters in the Himalayas but span quite different climatic, economic, and cultural zones. Traditional conservation challenges in these basins are being exacerbated by significant changes in regional climate regimes. The Pantanal wetlands and Rio Negro basin in South America have received relatively smaller and more recent impacts from intense human economies but are facing equally dramatic climate changes. Basin-scale climate adaptation plans and programs in progress to mitigate climate impacts and facilitate ecosystem and economic transitions to new climate regimes are discussed.

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Title

Simplifying Barrier Culvert Determinations on Large-Scale Road Construction Projects

Abstract

Human population growth and fisheries are usually at a crossroad in regards to large transportation projects. Integrating fish passage restoration with road construction can be a cost-effective way to accelerate barrier correction for fish passage improvements and reduce equipment mobilization costs. The objective of this assessment procedure was to use field observations and available information to expedite fish passage determination on large scale road crossings.

Barrier culverts were identified using a step-wise process of data collection and analyses. Fish passage was evaluated on fish bearing streams using a three-level approach. The first level was a screening analysis that identified potential passage barriers based on field observations, culvert measurements, and best professional judgment. The second level considered potential barriers and subjected them to more rigorous analysis in order to determine the existence of a barrier. The third level considered the feasibility of culvert replacement, in terms of the physical features of the stream crossing, logistics, and cost.

In the few situations where field observations and available information were insufficient to make a fish passage determination, the culvert was identified as a potential barrier that required additional data and analysis.

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Title

Crayfish Distribution in Bear Creek, Jackson County Oregon: Non-native Displacement of a Native Species in an Urban Watershed.

Abstract

Invasive non-native species are a major threat to aquatic ecosystems. In this study, we determined the distribution of native signal crayfish (Pacifastacus leniusculus klamathensis) and the invasive ringed crayfish (Orconectes transfuga) in Bear Creek. Bear Creek is an urbanized tributary of the Rogue River and is located in Jackson County Oregon. In 1976 O. transfuga (a presumed subspecies of O. neglectus) was suggested to have replaced P. l klamathensis in most habitats on the Rogue River. We sampled Bear Creek drainage during two consecutive years at 65 mainstem and tributary sites using baited and un-baited minnow traps. Our distributional data suggests that O.transfuga is migrating to the upper portions of the watershed and could potentially displace P.l klamathensis in the Bear Creek Drainage. However, recent data confirms the presence of both O. transfuga and P. l klamathensis in the mainstem of the Rogue River below the confluence of Bear Cr. The mechanism of invasion by O.tranfuga is unknown at this time, but is likely related to altered habitats and aggressive competition between species. Numerous studies have been conducted on the invasive nature of P. leniusculus leniusculus introduced from the Pacific Northwest into areas of California, Europe, and Japan. However, little is known regarding the ecological consequences of O. transfuga displacing P. l klamathensis.

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Title

THE ASOTIN CREEK ASSESSMENT PROJECT – A STEELHEAD REFERENCE STREAM IN THE COLUMBIA RIVER BASIN

Abstract

Asotin Creek has one of the most abundant, self-sustaining, unsupplemented populations of ESA-listed steelhead in the Interior Columbia Basin – Averaging more than 500 spawning adults and 40,000 juveniles in just 46 kilometers. The goal of the Asotin Creek Assessment Project is to understand the life history of Asotin Creek salmonids, with an emphasis on wild, summer-run steelhead Oncorhynchus mykiss. The project was implemented in 2004, and has collected three years of adult data and four years of juvenile data. Adults are captured using a floating, resistance board weir. The spawning population in Asotin Creek averaged 516 adults. The number of females per redd was estimated at 0.92 and 0.64 in 2005 and 2007, respectively. In 2007, the juvenile steelhead population was estimated at 50,375 fish (95% CI = 43,517–59,289), from the spring and fall out-migrations combined. Thirteen paired smolt trap efficiency tests with fin-clipped and passive integrated transponder (PIT) tagged fish indicated a significant difference (p=0.048) in capture efficiencies between the two mark types. PIT tagging of juvenile steelhead over a three year period indicated that 4.9% of age 1 fish were detected at mainstem dams during the release year, while 68.4% and 78.8% of age 2 and age 3 fish were detected, respectively. The Asotin Creek steelhead population is near or above Viable Salmonid Population thresholds. The concept of supplementation has come to the forefront of salmonid conservation in the Columbia Basin. However, the effects of supplementation are not fully understood, and a significant difficulty in supplementation effectiveness monitoring is the lack of reference (control) streams. Asotin Creek may be the only reference stream that is collecting the wide array of data necessary for evaluating the effects of supplementation; a critical unknown in the Columbia Basin.

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Abstract

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Title

A Safety Net Artificial Propagation Project for ESA listed Snake River Sockeye Salmon

Abstract

In 1992, NOAA Fisheries, in cooperation with IDFG and the BPA, established a captive broodstock and rearing program for Snake River Sockeye Salmon. The Program's first goal was to prevent the extinction of this ESA listed population and then to amplify the population in order to produce fish that could be released in recovery efforts. Each year the safety net population is divided up into three genetically equivalent populations that are reared at separate locations to prevent complete loss of the gene pool should a catastrophic event occur at any one facility. The principal captive broodstock is maintained by IDFG at its ESA facility in Eagle, Idaho. NOAA maintains the two backup populations that are used to produce half the eyed eggs needed for juvenile releases and more than 90% of the fish in the adult releases at its' Manchester Marine and Burley Creek Freshwater Rearing Facilities. At Manchester the fish are reared in seawater that is filtered down to 20 microns and then passed through ultraviolet disinfection units to eliminate pathogens. The fish are spawned at Burley following a matrix designed by Idaho geneticists to minimize the loss of rare alleles. The eggs are incubated and juveniles reared at the Burley facility on pathogen free well water following strict biosecurity protocols to eliminate fish health problems. The NOAA program now produces over 140,000 eyed eggs for use in Idaho's egg box, presmolt, and smolt release projects as well as over 350 adults a year for volitional spawning in Idaho's Redfish Lake. The cooperative IDFG and NOAA fish culture efforts have successfully met their shared goal of preventing the ESU's extinction and amplifying the population to provide fish that are now routinely utilized in recovery efforts.

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Title

Utilizing Naturally Spawning Adults from a Captive Broodstock Program as a Re-introduction Strategy to assist in the recovery of an Endangered Snake River Sockeye Salmon Population.

Abstract

In December 1991, the National Marine Fisheries Service listed Snake River sockeye salmon (Oncorhynchus nerka) as endangered under the U.S. Endangered Species Act (ESA). Snake River sockeye salmon are a prime example of a species on the threshold of extinction, with the last known remnants returning to the Stanley Basin in central Idaho. On the basis of critically low population numbers, a captive broodstock project was implemented by federal, state, and tribal partners as an emergency measure to save Redfish Lake sockeye salmon. During the decade of the 1990s, a total of 16 wild fish returned to Redfish Lake; all were captured for the broodstock program. Amplification of the population through the use of captive broodstock techniques resulted in thousands of progeny being reintroduced into the habitat through the use of a “spread the risk” philosophy. This philosophy involves introducing fish at all life stages, prespawn adults, eyed eggs, presmolts, and smolts. Between 1999-2007, about 350 adults returned from the ocean utilizing these release strategies – an amplification of over 20 times the number of wild fish that returned in the 1990s. The use of naturally spawning adults produced from the captive broodstock program has proved to be an important reintroduction strategy by providing wild-type off-spring that rear naturally in their natal environment, migrate to sea and return. The number of adults released to spawn naturally has increased over the past two years as part of an effort to expand this project from a genetic conservation program into a recovery program. Between 1993 and 2007 approximately 2,500 adults have been released into Redfish Lake to spawn volitionally, producing an estimated 57,000 outmigrating smolts by 2009. Anadromous adult returns from these smolts are projected to total between 50 and 100 by 2011.

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Title

Potential benefits of floodplain restoration in the Middle and Coast fork Willamette rivers for spring Chinook

Abstract

This poster will focus on work by the Corps of Engineers to investigate the benefits of restoring floodplain habitat in the Middle and Coast Fork Willamette River (Oregon) for spring Chinook. The Corps is investigating the potential benefits and feasibility of floodplain restoration on the Willamette River in regard to salmon and other species. Historically, the Willamette was a major producer of spring Chinook and the Middle Fork was a major contributor to that production. Flood control dams altered the seasonal temperature schedule and eliminated much of the channel dynamics that shaped riverine and floodplain habitat. This project used habitat modeling to estimate the benefits of floodplain restoration on the lower Middle and Coast forks to contribute to the rebuilding of Willamette River Chinook. The biological benefits of floodplain restoration for spring Chinook below Dexter Dam were estimated using Ecosystem Diagnosis and Treatment (EDT) and hydrogeomorphic analysis. We defined five stream reaches in the Middle Fork and a single reach of the Coast Fork. Habitat characteristics were derived through analysis of aerial ortho-photographs. We compared conditions from two series of photographs. Those from 1953, the year prior to completion of regulating dams, were used to represent potential floodplain features compared to a set of photographs from 2004 representing current conditions. Below Dexter, floodplain conditions from 1953 were sequentially spliced into the current condition to present plausible (but not necessarily feasible) floodplain features. Benefits were assessed as the change in Chinook abundance and productivity. Results have indicated that spring Chinook would benefit from floodplain restoration though benefits are limited by high fall water temperatures. The poster will also explore the potential use of floodplains by Chinook life stages to guide restoration through the use of Chinook-habitat modeling.

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Title

Conservation hatchery steelhead trout contribution to wild smolt yield at the Keogh River

Abstract

A supplementation experiment, British Columbia's living gene bank (LGB) for steelhead trout, was intended to boost numbers during poor ocean conditions, and assumed hatchery spawners contributed to yield. Captive wild brood smolts (100/yr for 5 yrs) survived to maturity and spawning in the hatchery (61%). Equalized egg yield and isolated rearing preceded smolt releases (25,000-40,0000) near the river mouth where several thousand failed to migrate; some were enumerated in-stream for several months, competed with wild parr and cutthroat trout, predated on coho salmon and trout fry, and a few survivors matured the next year. Most displayed migration and survival patterns over the first weeks at sea similar to wild smolts, in studies with POST acoustic tags. Smolt-to-adult survival from 5 yrs was consistently lower for LGB smolts (<2%), and estimated at 7.6% for 2004 wild smolts and only 1.4% for 2005 returning as maiden-run spawners in 2007. Recent LGB smolt survivals were much lower, only 0.5% for both cohorts. These were extremely low rates of survival compared with the 30-yr average (10%). LGB returns were smaller-at-age, spawned earlier in lower reaches, and produced fewer fry by mid-summer. Annual numbers of smolts dropped and was much lower than expected for the level of wild and hatchery spawners based on recruitment estimates and a hatchery-wild interaction model. Smolt recruits fell to 5 (2005) and 6 (2006) smolts per spawner, similar to that at the same density of wild spawners under pre-restoration and poor climatic conditions (1990's). The contribution from conservation hatchery adults to subsequent smolt yield in the wild appears minimal or nil, but requires parentage analysis to confirm, and 2 more years of investigation on smolt yield.

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Title

Evaluating the Benefits of a Temperature Control Structure for the Hells Canyon Complex

Abstract

Snake River fall Chinook have been listed as threatened under the ESA since 1992, at which point numbers had declined to a low of 78 wild adult spawners. Since then a major supplementation effort was responsible for spawner numbers to increase but the wild component is not replacing itself. Coldwater releases from Dworshak Reservoir improve summer and fall water quality in the Snake River downstream of Lower Granite reservoir; there has been no additional improvement in habitat quantity or quality over the past decades. With continual shifts in migration timing in the Columbia River system to accommodate progressive changes in the thermal regime and near certainty of worsening climatic conditions, fall Chinook will need rapid recovery of water quality conditions that goes beyond what can be expected from piecemeal riparian recovery upriver.

CRITFC and the tribes have a shared management interest in the fate of fall Chinook. Starting with FERC's preparation of a DEIS for Hells Canyon Complex relicensing plus Idaho Power Company's request to increase the water temperature standard for fall Chinook spawning from 13°C (7DADM) to 16.5°C (single-day maximum), CRITFC conducted a comprehensive evaluation of the life cycle thermal requirements of fall Chinook, the habitat and water quality conditions downstream of HCC, and Chinook life history and historic performance in order to examine current risk factors and capability of utilizing a temperature control structure (TCS) at Brownlee Dam to moderate water temperatures. This analysis revealed that seasonal adjustments of water temperatures via a TCS have the capability to improve thermal conditions for adults holding below HCD, spawn timing, embryo development rate, and timing of juvenile emergence and outmigration. These adjustments have the capability to improve life cycle survival and significantly enhance ESU viability, reducing vulnerability to future climatic and flow-related impacts.

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Title

The use of 8.5 mm PIT tags for tagging juvenile Hanford Reach fall Chinook salmon in 2007

Abstract

Past efforts to PIT tag subyearling fall Chinook salmon with standard 12.5mm PIT tags have been restricted to those fish greater than about 60mm in length due to adverse affects of tagging smaller fish. This has made it difficult to tag large numbers of juvenile Hanford Reach fall Chinook salmon. In 2007, an 8.5mm PIT (model TX148511B) became available, allowing PIT tagging of juvenile Chinook salmon with lengths as little as 45mm. However possible tag-dependent differences in survival to, and detection at, downstream sites were of concern. Therefore, in 2007 we PIT tagged and released 9,955 juvenile Hanford Reach fall Chinook salmon with 12.5mm PIT tags and an additional 9,959 with 8.5mm PIT tags.

A smaller proportion of fish tagged with 8.5mm tags were detected at McNary and John Day dam bypass systems than for fish tagged with 12.5mm tags. The estimated detection rate of 8.5mm tagged fish was 99.4% at the John Day Dam juvenile bypass system and 99.8% at the McNary and Bonneville dam juvenile bypass systems. The estimated probability of detection for 12.5mm tagged fish was 100% at all three sites.

Survival from release to McNary Dam was significantly greater for fish tagged with the 12.5mm tags than for fish tagged with the 8.5mm tag (p=0.033). However, within each length group, there was no significant difference suggesting that survival is a function of size at tagging, rather than type of tag. Travel time from release to McNary Dam decreased as fish length increased for both tag groups (p=0.015 for 12.5mm tags, p=0.007 for 8.5mm tags).

We concluded that the 8.5mm tag was an effective substitute for the 12.5mm tag, especially for salmon between 45 and 60mm in length.

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Title

Statistical Methods for Coastal California Salmonid Monitoring

Abstract

Employees of State and Federal Agencies, Humboldt State University, and a private consulting firm recently participated in the development of a proposed Action Plan for Monitoring California Coastal Salmonids. The Action Plan includes, among other things, a statistical plan for sampling all coastal waters in California for salmonids. This statistical plan consists of a large generalized randomized tessellation stratified (GRTS) sample drawn from the entire state, soft stratification to target waters inhabited by different species (steelhead, coho, and Chinook), and rotating panels of stream segments to spread sampling effort among years and streams. The statistical plan was designed to estimate both status and trends in salmonid populations. In this talk, we summarize the Action Plan's statistical methods, as they are now envisioned.

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Title

Species Life-cycle Analysis Modules (SLAM): A Tool for Evaluating Fish Management Scenarios

Abstract

SLAM is a flexible tool for exploring the fish performance consequences of changes in life-stage survivals and capacities under different management scenarios. It is an open source java program that allows users to easily specify almost any life-cycle structure, from simple two-stage semmelparous species, to iteroparous species with dozens of distinct life-stages. Current SLAM analyses have focused on Pacific salmon, which will be used to illustrate the various features of the tool. Fish performance is measured in terms of the abundance of any particular life-stage at any point in the future and in terms of production ratios between any of the life-stages. There are a number of options for specifying the functional form of survival and reproduction transitions from one life-stage to the next and for specifying patterns of annual variability. A key feature of SLAM is that input parameters (e.g. survival or capacity), which are estimated external to SLAM, can be entered as a probability distributions rather than as point estimates. This produces output distributions, which provide more information to managers than simple point estimates. SLAM has built in sensitivity analysis capabilities, which include a global sensitivity variance portioning module to identify critical parameters influencing model behavior. These critical parameters can be targets for improved field monitoring. SLAM conveniently compares different potential management scenarios that are predicted to change specific life-stage survivals or capacities. For example, one can graphically explore the consequences of proposed habitat improvements that increase egg survival on the abundance of sub-adults, or the consequences of a proposed two year old fish harvest reduction on the number of spawners. Although transition parameterization is external to SLAM, the model can be fit to empirical life-stage specific survival and capacity time series data as a form of model calibration.

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Title

SLAM (Species Life-cycle Analysis Modules): A Tool for Evaluating Fish Management Scenarios

Abstract

SLAM is a flexible tool for exploring the fish performance consequences of changes in life-stage survivals and capacities under different management scenarios. It is an open source java program that allows users to easily specify almost any life-cycle structure, from simple two-stage semmelparous species, to iteroparous species with dozens of distinct life-stages. Current SLAM analyses have focused on Pacific salmon, which will be used to illustrate the various features of the tool. Fish performance is measured in terms of the abundance of any particular life-stage at any point in the future and in terms of production ratios between any of the life-stages. There are a number of options for specifying the functional form of survival and reproduction transitions from one life-stage to the next and for specifying patterns of annual variability. A key feature of SLAM is that input parameters (e.g. survival or capacity), which are estimated external to SLAM, can be entered as a probability distributions rather than as point estimates. This produces output distributions, which provide more information to managers than simple point estimates. SLAM has built in sensitivity analysis capabilities, which include a global sensitivity variance portioning module to identify critical parameters influencing model behavior. These critical parameters can be targets for improved field monitoring. SLAM conveniently compares different potential management scenarios that are predicted to change specific life-stage survivals or capacities. For example, one can graphically explore the consequences of proposed habitat improvements that increase egg survival on the abundance of sub-adults, or the consequences of a proposed two year old fish harvest reduction on the number of spawners. Although transition parameterization is external to SLAM, the model can be fit to empirical life-stage specific survival and capacity time series data as a form of model calibration.

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Title

Sources and magnitude of error in detection of Chinook salmon redds via ground and aerial surveys

Abstract

Biologists and managers often assume that detection probability for Chinook salmon redds is constant and known (and sometimes assume it to be 100%). Unanticipated variation in detection probability, however, can result in flawed inferences, particularly when detection varies systematically with environmental factors, observers, or redd characteristics. From 2001-2005 we investigated factors influencing error in ground and aerial redd counts for spring/summer Chinook salmon in the Middle Fork Salmon River drainage, Idaho. In 2007, we initiated research to describe sightability of fall Chinook salmon redds in the Deschutes River, Oregon. In this paper, we discuss results from both projects and implications for redd monitoring programs.

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Title

An estrogenic endocrine disruptor alters reproductive behaviors and fecundity of the red shiner

Abstract

Endocrine disrupting compounds (EDCs) are found worldwide in both aquatic and terrestrial ecosystems and can lead to developmental and reproductive disruption in fishes. Although EDCs are known to disrupt reproductive processes, less is known about their ultimate effects on reproductive output and population dynamics. In Colorado, concern has been raised over the possible detrimental effects of EDCs on endangered and threatened fish populations on the Great Plains. Many of these populations are below large urban and intensive agricultural areas, which increase the likelihood that they are exposed to EDCs. Our study evaluated whether an estrogenic compound might influence reproduction in the red shiner (Cyprinella lutrensis), a common native species of Colorado. The estrogenic EDC 17ß-estradiol (E2) is a natural hormone found in most wastewater effluent-treated waters. We exposed adult male red shiners to E2 at a concentration of 120 ng/L and compared these males to unexposed control fish. After 44 days of exposure, males were allowed to spawn with females, during which time male mating behavior, reproductive output, fertilization success, and hatching success was measured. After a three week spawning period, morphological and histopathological characteristics of the males were measured. We observed significant changes with E2 exposure: male mating behaviors were reduced, nuptial tubercles were fewer and less developed, spawning coloration was reduced, and gonads were less mature. In tanks containing exposed males, reproductive output, fertilization success, and hatching success was dramatically lower. Changes in behavior, secondary sexual traits, and reproductive development may influence mating opportunities and success, while decreases in reproductive output, fertilization success, and hatching success may influence survival and recruitment. Our study suggests that exposure to E2 influences developmental and morphological processes as well as productivity, potentially having negative consequences for population growth.

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Title
Estimating Salmon Passage in a Large, Silt-laden River - Sonar on the Yukon

Abstract
Within the Alaska portion of the Yukon River drainage three species of Pacific salmon (Chinook salmon Oncorhynchus tshawytscha, coho salmon O. kisutch, and chum salmon O. keta) are managed inseason for harvest by commercial, sport and subsistence fisheries, as well as to meet treaty commitments made under the U.S. / Canada Yukon River Salmon Agreement. The diversity and number of salmon stocks, combined with the geographic range of user groups, adds complexity to management decisions. While escapement estimates and run-strength indices generated by several projects within the drainage provide stock specific abundance and timing information, much of this information is obtained long after the fish have become unavailable to the fisheries. Obtaining timely information in the lower reaches is complicated by the sheer size, volume, and silt load in the mainstem river, along with the presence of a large number of non-target fish species. The Yukon River sonar project, located in the mainstem near the mouth of the river, has provided daily salmon passage estimates to fisheries managers for most years since 1986. This project uses a combination of 1) fixed location sonar to estimate the total daily upstream passage of fish and 2) a series of gillnets of different mesh sizes drifted through the acoustic sampling areas to apportion the sonar passage estimates to species.

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Title

Survival and Behavior of Juvenile Salmonids in the Lower Columbia River

Abstract

The passage experience through the Federal Columbia River Power System (FCRPS) for juvenile salmonids on the seaward migration may affect their survival in the final 235 km of the Columbia River. In an effort to increase the understanding of juvenile salmon mortality in this lower portion of the Columbia River we evaluated survival for acoustically-tagged run-of-the-river yearling and subyearling Chinook salmon from the tailrace of Bonneville Dam through the lower Columbia River and estuary between 2005 and 2007 using the CJS single-release survival model. Test fish were anesthetized, surgically implanted with micro-acoustic transmitters (0.6 g in air) and passive integrated transponder (PIT) tags and released in the Bonneville Dam tailrace. In both 2005 and 2006 four groups (n=161 to 245 per group) of yearling Chinook salmon were released. A total of 1,787 yearling and 2,790 subyearling Chinook salmon were released in the Bonneville Dam tailrace in 2007, respectively. Survival estimates of yearling Chinook salmon from 2005 and 2006 indicated a mean loss of 31.3 and 32.6% in this 235-km long reach, respectively. Estimated mean loss of subyearling Chinook salmon over the same reach was 49.6% in 2005 and 35.8% in 2006. In 2007 we increased the number of detection arrays to increase the spatial resolution of the mortality estimates. Tagged fish were detected on 10 autonomous acoustic receiver arrays on the seaward migration to partition loss over shorter reaches of this 235 km-long reach. Survival estimates from 2007 from these additional arrays showed most of the loss occurred in the lower 58 km the Columbia River where the river transitions into a broad, tidally-influenced estuary.

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Title

Differences in individual condition and environment associated with the development of alternative male life history tactics in a population of rainbow trout (Oncorhynchus mykiss)

Abstract

Alternative male phenotypes found in salmon and trout (salmonid species) are an excellent model for examining the evolution of alternative life histories. In salmonids, some males migrate to the ocean and return to spawn in freshwater at a larger size (anadromous), while other males mature in freshwater at a younger age and much smaller size (resident). Theory posits freshwater maturation tends to occur when an individual exceeds a reaction norm in growth rate and/or lipid content during a critical period occurring six-months to one year in advance of spawning, whereas those that fail to exceed the threshold will delay maturation. However, this understanding is based largely on fish living in artificial environments and very little information is available for fish living in nature. Thus, the influence of environment on individual condition in relation to freshwater male maturation is poorly understood. I examined how measures of individual condition and environment were associated with freshwater male maturation in a natural population of rainbow trout (Oncorhynchus mykiss). I collected fish nine months prior to spawning from several different streams in John Day River basin, Oregon, representing a variety of environmental conditions. Sex and state of maturity was determined visually with the aid of microscopy to determine the sex of immature individuals. Maturity of age 1+ males was modeled as a function of individual condition (prior year growth rate, length, % lipid). Individual condition was modeled as a function of three environmental variables: water temperature, conductivity, and population density. This research represents the first effort to examine potential differences in individual condition and environment associated with freshwater maturing male O. mykiss in natural stream conditions.

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Title

Residence time of juvenile Chinook salmon in the lower Columbia River estuary: is it remotely detectable?

Abstract

As ESA recovery plans for Pacific salmonids are being developed and finalized, the role of estuaries is being reexamined. Several studies in the Pacific Northwest have demonstrated that subyearling Chinook salmon reside in estuarine habitats to a greater extent than other life history types and species of salmon. Residence time of subyearling Chinook salmon is difficult to measure in the Columbia River estuary due to the magnitude and openness of the system.

In 2006 we ventured to see if we could recapture juvenile Chinook salmon that had been collected, PIT-tagged, and released in an emergent marsh in the Columbia River estuary. In 2008 we plan to monitor residence time and fine-scale movements of PIT-tagged Chinook salmon in two intertidal creeks in the Columbia River estuary using suspended arrays of PIT tag detectors.

We will discuss the results of the 2006 study and detail the challenges of designing and constructing PIT tag antennas for intertidal creeks in an emergent wetland.

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Title

Strong genetic divergence between riverine and lake-type sockeye salmon from the Kwethluk River, western Alaska

Abstract

Riverine sockeye salmon populations (those that do not use nursery lakes for juvenile rearing) tend to be characterized by greater genetic diversity and weaker population structure than lake-type populations. These findings have led some to hypothesize that riverine sockeye are the principal colonizing form and play the dominant role in long-term persistence of sockeye in a dynamic landscape. However, differentiation between riverine forms has been detected in Kamchatka, suggesting that the general patterns characterized for riverine sockeye do not apply in all parts of sockeye's range. In this study, we examined genetic diversity and population structure in lake-type and riverine sockeye from the Kwethluk River (Kuskokwim drainage, western Alaska), towards the northern edge of the species' range. As expected, lake-type sockeye exhibited lower genetic diversity and stronger genetic structure over short distances than did neighboring riverine populations. However, when compared to riverine populations from the Taku River (northern British Columbia), we found that riverine sockeye in the Kwethluk River were more closely related genealogically to riverine sockeye from the Taku than they were to Kwethluk River lake-type sockeye. This finding suggests that different life-history types colonized the Kwethluk River separately. In addition, estimates of genetic effective population size (NE) suggested that increased straying, rather than higher NE, was responsible for the decreased population structure in riverine sockeye. This is consistent with the dynamic nature of floodplain habitats that support these riverine sockeye.

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Title

Recovering Apache Trout in the Face of Stochastic Challenges

Abstract

At present, Apache trout occupy 27 streams within its historic range, largely due to recovery efforts. This number of streams is close to reaching the recovery criteria established in the 2007 Draft Apache Trout Recovery Plan. However, in 2007, barrier failure compromised several recovery streams and extremely low and variable chemical potency made renovating streams very challenging and sometimes unsuccessful. In addition, the impacts of drought were apparent for Apache trout, resulting in surveys that revealed the habitat occupied by small populations becoming even more marginal. Barrier failure and chemical problems are issues that agencies are prepared, and able, to solve. However, recovery criteria established in years of “normal” water conditions may not accurately reflect these conditions today, and trying to reach these criteria may become a daunting task. While agencies, Tribes, and public groups have put years of work and millions of dollars into consistent dedication to funding and staffing recovery actions, the end result is still uncertain. This presentation discusses these factors and the challenges of recovering a native trout in a changing climate of uncertain duration, while following official recovery criteria.

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Title

Observations of temperature and early salmonid life history in a regulated California River

Abstract

Stream temperature can have a significant influence on the behavior, development and overall habitat availability of native salmonids. Habitat modification due to stream regulation can further affect these relationships. Here, we assess the relationship between temperature and alevin development for Chinook salmon and steelhead in a regulated California river. We then describe the day-time distribution of juveniles along the regulated river as it relates to water temperature.

Chinook salmon and steelhead alevin development significantly correlated with intergravel temperature. Insulatory effects of a large, flood-control dam influenced temperatures throughout the year, with temperature warming downstream early in the spawning season and cooling later in the embryo development cycle. Secondary effects of river management on substrate quality further influenced temperatures and this had a significant effect on alevin development.

Throughout the late winter and spring, overall temperatures in the lower river gradually warmed, with distance downstream from the dam and habitat variability further affected available temperatures. Juvenile Chinook salmon and steelhead were observed throughout the lower river during day-time surveys. As we sampled downstream, both species were observed in warmer water even when cooler temperatures selected upstream were available.

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Title

Passage and behavior of adult Pacific lampreys at Willamette Falls dam, Oregon

Abstract

We used radio telemetry to monitor behavior and passage characteristics of adult Pacific lampreys during their upstream migration at Willamette Falls dam on the Willamette River near Portland, Oregon. Our objectives were to document: (1) the specific routes of passage at the dam and the falls; and (2) the duration of passage through different routes and overall passage success. In 2005, we radio tagged 116 lampreys and in 2006 we tagged 94 fish. In both years, over 90% of the fish returned to the project with a median travel time of 7 – 9 h. In 2005, 43 fish (35%) successfully passed the project via the fishway legs, with most fish using fishway leg 1. The peak of passage occurred in August and no fish passed over the falls, although several fish ascended to the top. In 2006, 24 fish (20%) passed the project, again primarily using fishway leg 1. Most fish passed prior to 9 June when the powerhouse was shut down due to construction. Two fish passed via the falls in early July. The time it took for fish to pass through the fishway ranged from 4 – 74 h depending on route. Fishway leg 1, the most commonly used route of passage, had a passage efficiency of around 60%. Many fish resided in the tailrace for various times and eventually moved downstream. Collectively, our results indicate that passage of lampreys at Willamette Falls dam is relatively poor. One factor that seems to be important to the passage success of lampreys is sufficient attraction flow at fishway leg entrances. Work is currently ongoing to identify specific barriers to lamprey passage and implement corrective measures.

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Title

Determining environmental effects using a rapid risk assessment: environmental performance measures for forest roads

Abstract

Best Management Practices (BMP's) for forest roads have evolved over the last 35 years, since adoption of Oregon's Forest Practices Act (the first in the United States). Oregon's BMP's are objective-based (not prescription-based), recognizing that one prescription can never fit all situations. Numerous studies have demonstrated how roads, including forest roads, can affect water quality and aquatic resources. The temporal and spatial relationships of the environmental effects, however, are complex, water quality sampling is costly, and results are often difficult to link to specific road problems. Furthermore, research results from other road systems or regions are often dated and not reflective of well-maintained road systems. Since most BMP’s deal with new roads, a landscape-level survey of existing roads is essential for understanding and managing the environmental effects of roads on aquatic organisms and their habitats. Here, we describe how results from a rapid, user-friendly road condition survey can be utilized, in a GIS, to evaluate several environmental performance indicators (e.g., road location in relation to streams or landslide/other serious erosion prone slopes; stream crossing effects on fish passage; washout and diversion risk at stream crossings; percent of road system with hydrologic connection to streams; etc.) and describe the techniques for evaluating road hazards as they relate to aquatic health. This information can also be used to compare roads systems across landscapes and prioritize aquatic restoration activities.

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Title

Assessing potential Fish Conservation Areas in the North Coast of Oregon

Abstract

A recent regional assessment for the North American Salmon Stronghold Partnership (NASSP) identified the North Coast of Oregon as an important area for salmon diversity and abundance. The Wild Salmon Center, in coordination with multiple partners, are developing an assessment of critical areas within the North Coast. The analysis is ownership-neutral and conducted at the landscape level across a region of over 6500 square kilometers. This broad scale assessment develops relationships between intrinsic potential for multiple species and watershed condition. A decision support model is developed to assess watershed condition. Fish survey data and existing GIS data that address stream, riparian, floodplain, and upslope condition are integrated. This presentation will focus on the methodology, preliminary results, and lessons learned through the process.

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Title

Juvenile survival estimates of hatchery and naturally produced sockeye in Lake Wenatchee, Washington

Abstract

Smolt production estimates are an important component in developing life stage survival models for anadromous salmonids. Since most hatchery sockeye salmon Oncorhynchus nerka are released as fry or subyearling parr, an estimate of the number of smolts is required because survival to the smolt stage is dependent on numerous factors and may be highly variable over time. The parr-to-smolt survival of hatchery sockeye salmon released as parr in Lake Wenatchee was monitored using rotary smolt traps between 1997 and 2005. During which, we examined the effects of release time and size on the survival to the smolt stage. We also estimated the smolt production and egg-to-smolt survival rates of naturally spawning sockeye salmon. We concluded that hatchery sockeye released from net pens in Lake Wenatchee in the fall had greater survival rates to the smolt stage than fish released in the summer. Several factors may have contributed to the greater over-winter survival including size at release. It is unknown if time or size at release or a combination of both is the cause of greater survival. Egg-to smolt survival rates of naturally spawning sockeye salmon ranged from 1.2% to 21.2%, and were strongly influenced by fall freshets.

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Title

Research Permits and Authorizations for Aquatic Species in Oregon, Washington, California, and Idaho

Abstract

Multiple salmon and steelhead species along the West Coast of the United States are listed as threatened or endangered under the Federal Endangered Species Act (ESA). Additionally, the southern distinct population segment, or DPS, of north American green sturgeon has been listed as threatened under the ESA. Research and monitoring related to abundance, distribution, life history, genetics, survival, and habitat utilization are essential for the continued conservation and recovery of all aquatic species. Any entity conducting research and/or monitoring on listed salmon or steelhead is required to obtain an ESA section 4(d) approval or section 10(a)(1)(A) research permit from NOAA's National Marine Fisheries Service (NMFS). Once NMFS issues protective regulations for the southern DPS of north American green sturgeon, obtaining an authorization for research will be similar to authorizations for listed salmon and steelhead. The recently launched NMFS website (http://apps.nmfs.noaa.gov/) called Authorizations and Permits for Protected Species (APPS), can help fishery biologists determine if an authorization is needed, identify what type of authorization is available, apply for a permit or authorization, submit an annual report, and find appropriate local or regional contact information. The Oregon Department of Fish and Wildlife is a partner in this effort; and therefore, researchers conducting research, monitoring, or rescue/salvage of any freshwater or marine fish or invertebrate can apply for an Oregon Scientific Take Permit (OR STP) through this web site. The other states in the region may also require take permits; however, they are not part of this online application. Workshops will be held in upcoming months to provide training in how to use the system.

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Title
Terrestrial Drivers of Coho Population Dynamics

Abstract
Each year, multiple factors determine the number of fish produced in a basin: the extent of channel scour during peak flows, the extent of surface water during low flows, the availability of suitable habitat at each life stage, the ability of spawning adults and juvenile fish to access these habitats. These aspects of river environments are largely driven by basin disturbances; the storms, floods, landslides, and fires that shape channels, reset riparian forests, and bring sediment and wood to streams. Terrestrial disturbances are thought to be an important control on population dynamics, but the linkages are poorly characterized. Because fish are mobile, these interactions span entire watersheds, perhaps entire regions. Because effects propagate through generations, effects of a disturbance may persist for years. The temporal and spatial scales involved in these interactions hinder empirical characterization of population responses to spatially and temporally distributed disturbances. To aid in our understanding of these processes, we have linked a landscape simulation model, which estimates sediment and wood fluxes to a channel network through time, with a habitat-based, life-cycle model. These linked models provide a tool for exploring potential interactions between terrestrial disturbance regimes, fish responses (e.g., their ability to repopulate disturbed areas), and population fluctuations.

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Title

Multiple-scale genetic subdivision in western freshwater mussels

Abstract

In the western US and western Canada, three genera (Anodonta, Margaritifera and Gonidea) and eight species of freshwater mussels are currently recognized. Of these, Anodonta is the most species-rich, with 6 species: A. beringiana Middendorff (1851); A. californiensis Lea (1852); A. dejecta Lewis (1875) (possibly extinct); A. kennerlyi Lea (1860); A. nuttalliana Lea (1838); A. oregonensis Lea (1838) (Turgeon et al. 1998). However, the taxonomy of western Anodonta has undergone many revisions, and species ranges and boundaries continue to be unclear. Until now, taxonomic designations have been made based primarily on conchological features, although they can be unreliable indicators of evolutionary divergence patterns. We used genetic tools to assess the depth and pattern of divergence among Anodonta species in the western US and western Canada, including as much topotypic material as possible. In a limited phylogenetic analysis, we find 1) that A. nuttalliana/californiensis and A.oregonensis/kennerlyi are distinct, highly divergent clades, and 2) that A. beringiana is more closely allied with A. woodiana, an Asian species, than either of the other two western North American clades. Additionally, we present the results of preliminary nuclear genetic analyses on populations of the A. nuttalliana/californiensis clade, which indicate pronounced basin-specific subdivision.

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Title

Controlling New Zealand mudsnails at infested fish hatcheries: summary of studies and management recommendations

Abstract

New Zealand mudsnail (Potamopyrgus antipodarum; NZMS) infestations of water systems of fish hatcheries or other facilities have created management dilemmas. Stocking of fish from infested waters may risk spreading snails to new locations, and reliable and environmentally friendly methods of removing NZMS from source waters are needed. We evaluated the use of a hydrocyclonic separator in field trials at Hagerman National Fish Hatchery, Idaho. Hydrocyclone filters use centrifugal force to remove particles with a specific gravity greater than water. Field trials of the test prototype have been successful in removing 100% of the snails from hatchery inflow waters. We modeled the transit time of water particles and three sizes of NZMS in the filtration system at two 68 and 97 gpm. We found that the residence time of water particles was the same regardless of flow rate, but residence time of the snails increased with size of NZMS and with decreased flow rates. We found that all life stages of snails were removed, and the larger sized snails took longer to pass through the test system. We suggest that gas saturation or supersaturation with CO2 can be used to kill collected snails from the waste stream. Combining information from tests of this system with data on the survival and transit of ingested snails in the GI tract of trout, we pose a system that could be used for removing snails from fish and hatchery waters. This type of hydrocyclonic separation system may have future potential for removing free-swimming veliger larvae of invasive zebra or Quagga mussels.

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Title

Effect of Changing Land Use on the Distribution of Coho Salmon

Abstract

In many areas of the Pacific Northwest, salmon populations are found in watersheds undergoing rapid development. Determining the impact of these changes on salmon has been complicated by the lack of fish population data and interannual variability in salmon abundance. We utilized counts of returning coho salmon from 1984 through 2001 at 84 sites in four Puget Sound basins to determine if changes in land use correlated with alterations in the distribution of spawning fish. Land use changes were determined using Land Sat imagery, county zoning designations and aerial photographs. Salmon spawning declined about 75% over the study period at sites with increased urban land use. Increases in spawning were observed at forested sites and those that experienced an increased rural residential use. Current zoning indicates that future development in these four basins will primarily occur in areas accessible to coho salmon; only 35% of the area downstream from barriers to anadromous fishes is designated as forest. Spawning salmon were not evenly distributed among the 84 study sites; some sites consistently supported large numbers of fish and others very few. Maintaining salmon populations in rapidly developing areas will likely require the identification and protection of these highly productive sites and steering development to areas of lower productivity.

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Title

Biological control of zebra and quagga mussels: Potential use of a novel microbial agent

Abstract

The invasion of zebra and quagga mussels (Dreissena spp.) and their spread throughout North America over the last two decades have dramatically altered the composition and functioning of freshwater ecosystems and resulted in severe economic impacts totaling hundreds of millions of dollars annually. An environmentally safe and effective control method for widescale use, however, still is not commercially available. As a consequence, lakes and rivers are being inadvertently polluted by the discharge from power plants and other raw-water dependent facilities that currently have almost no choice but to use non-selective biocides (like chlorine) to control their pipe infestations. Meanwhile mussel populations continue to spread unchecked because there is no safe method that can be used for control of these mussels in open waters. Strain CL145A of the bacterium Pseudomonas fluorescens, however, has now been identified as having significant potential as the first environmentally safe control agent - capable of use not only by industry but also for treating open waters. Cells of this bacterial strain contain a natural product which is lethal to zebra mussels when ingested. Dead cells are equally as lethal against these mussels as live cells, providing clear evidence that the mussels die from a toxin, not from infection. Commercial formulations are now under development that will contain dead cells, thus further reducing environmental concerns. Research progress to date will be reviewed, in particular the lack of non-target impact. At dosages which produced high zebra mussel mortality, for example, no bacteria-induced mortality has been recorded among fish, ciliates, daphnids, and bivalves.

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Title

Chinook Salmon Retrospective Run Reconstruction, Kuskokwim River Alaska

Abstract

We estimate that the annual abundance of the Chinook salmon run to the Kuskokwim River of western Alaska has ranged from 150,000 to 400,000 fish (average 250,000) over the past 30 years. These estimates are the preliminary product of an ambitious cooperative initiative that combines the talents and resources of local Native organizations, private expertise, and State and Federal agencies. This work draws on collections of subsistence and commercial harvest data, fragmented historical escapement data from tributary streams, large-scale mark-recapture studies from recent years, and an assortment of age composition data sets to reconstruct the salmon runs by age from 1976 to 2007. A time series of total abundance and escapement estimates by age is essential for investigating the causes of recent volatile swings in Chinook salmon abundance that resulted in severe curtailment of important subsistence and commercial fisheries from 1999 through 2003. While Chinook salmon abundance has since recovered, the reasons for the crash and subsequent recovery are unknown. The disturbance was large scale, appearing to affect salmon returns throughout western Alaska. Anomalous ocean climatic conditions in the Bering Sea during the early marine stage of the salmon life cycle are the primary suspect, rather than acute human-induced causes. Results of this work will provide the data essential for the examination of the causes of the swings in population abundance as well as make available information essential to making informed fishery management decisions.

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Title

Effects of Stress and Injury Associated with Transporting Live Tilapia

Abstract

Aquaculture of tilapia in Idaho, using available geothermal water sources, is a growing industry. Tilapia are transported long distances from fish culture facilities to urban centers for the live fish market where a variable amount of mortality is experienced. We are studying the transportation and distribution processes to identify stressful practices and to make recommendations that could enhance survival. Importantly, we are testing the hypothesis that stress and trauma, particularly physical injury, experienced during the transport process predisposes the fish to infection. This is supported by data on fish from both laboratory simulated transport and actual transport from the growers to the market. Physical injury was assessed by using fluorescein dye on fish from various discrete aspects of the hauling process including crowding, truck loading, unloading, and subsequent holding. Our work indicates that such things as the type of net used may affect the injury incurred by the fish. Furthermore, the addition of salts to the hauling medium or a pre-transport salt dip reduces mortality despite the injury to fish.

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Title

Community Action for a Healthy Watershed; MFWWC Watershed Education & Stewardship Program

Abstract

A healthy watershed is achieved by preserving and managing watershed function in an inclusive way including its biological, physical, hydrological and sociological systems. A watershed ecosystem is complex and therefore many of us understand the number of variables and interests groups that have to be considered in developing and accomplishing the goals of a watershed management plan. Maintaining and restoring watershed health can be achieved on a broad comprehensive scale through community collaboration, habitat restoration, education and volunteer efforts. The Middle Fork Willamette Watershed Council is a non-profit organization that formed in 2000 with the mission to work together as a community to restore and sustain the ecological integrity and economic viability of the watershed and to promote local control of our future by providing effective voluntary solutions to watershed issues.

The Middle Fork Willamette Watershed is close to a million acres with the headwaters of the Middle Fork Willamette River originating at Waldo Lake and Diamond Peak and extending to the boundaries of Eugene and Springfield where it converges with the Coast Fork Willamette River. Land use practices include public and private timber industry, agriculture, grazing, small woodlands management, recreation, land conservation and habitat restoration. The Middle Fork Willamette Watershed supports federally and state-listed species such as spring Chinook, Oregon chub, winter Steelhead, northern red-legged frog, western pond turtle, Willamette daisy and other species.

Representatives from all interests groups work collaboratively to manage the watershed effectively. Landowner participation, education and volunteer efforts are the most important contributions in restoring habitat and developing better land stewardship for now and future generations. The Haws Oregon Chub Enhancement Project and the Middle Fork Willamette Watershed Rangers Education Program are two great examples of how community action leads to a healthy watershed.

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Title

Investigating sources of mortality of spring Chinook salmon smolts in the Grande Ronde River Valley with emphasis on predation by great blue herons

Abstract

Trapping and PIT-tagging studies conducted throughout the Grande Ronde Basin have shown that considerable mortality of hatchery and natural spring Chinook salmon smolts Oncorhynchus tshawyscha occurs in the 91 km Grande Ronde Valley reach. Potential sources mortality in this reach include predation, entrainment in oxbows used for irrigation, and lethal late-season temperature increases. In this study, we investigated the magnitude of predation on smolts by one predation source: great blue herons Ardea herodias. A total of 1,006 PIT tags from the 2000 to 2007 migration years were detected on the ground beneath a heron rookery located on Catherine Creek, a major spawning tributary of the Grande Ronde River. Mean annual mortality rates were estimated at 1.0% for hatchery smolts and 1.6% for natural smolts. These are minimum estimates since not all tags consumed by herons were deposited in the rookery. The higher natural smolt mortality rate may be associated with their longer travel times through the Grande Ronde Valley compared to hatchery smolts. Estimated total hatchery Chinook consumption rates from 2000 through 2007 show a gradual increase with a peak in 2006. This may indicate increasing heron population levels or increasing use of this relatively new prey source in the basin. Overall, predation by great blue herons accounts for only a small portion of the smolt mortality observed in the Grande Ronde Valley. Further investigations into other sources of mortality in the valley using PIT-tags are ongoing.

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Title

Implementing the Oregon Plan for Salmon and Watersheds Monitoring Program – Ten Years and Still Counting

Abstract

As coho stocks have declined in Oregon, management needs have driven progressively more intensive monitoring. A major component of the Oregon Plan for Salmon and Watersheds, implemented in 1997, was improved and expanded monitoring designed to provide statistically rigorous data on the status, trend, and distribution of salmonid populations and their habitat. In order to meet these goals, the Oregon Department of Fish and Wildlife adopted a spatially balanced random survey design that incorporated a rotating panel design and integrated four monitoring projects which evaluate adult coho spawners, juvenile coho, fish habitat, and water quality. A statistical sample reduces bias and allows inference about a population. Only statistical designs will answer the demands of viability criteria required for listed species. In addition to these traits, a spatially balanced random sample increases precision. A rotating panel design bolsters trend detections and improves sampling efficiency. We have tested this design on the ground over the last decade. It has improved the precision of our population estimates at the basin scale by 17 percent, and has facilitated trend detection. It allows us to estimate and depict populations with a high degree of spatial resolution, and was an important component of the coho assessment prepared by the State of Oregon to inform NOAA Fisheries in their deliberations on whether or not to relist coho. In addition, the flexibility afforded by this particular design has been critical as the agency has responded to evolving needs and priorities.

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Title

Monitoring the effects of salmon carcass addition on riverine food webs: an experimental field study on the Elwha River

Abstract

The impending removal of two dams on the Elwha River will restore access by anadromous salmonids to over 90% of the basin. In order to understand how re-colonizing salmon may affect river productivity, we are conducting nutrient limitation and salmon carcass addition experiments above and below the Elwha Dam. Our questions are: (1) is the Elwha River nutrient limited, (2) will the addition of carcasses result in increased productivity, (3) will these potential changes be amplified above the dam, and (4) how long with these effects persist over time? Our study sites are paired reference and treatment reaches in multiple side channels of the Elwha River. At each site we are collecting data on nutrient limitation, primary and secondary production, juvenile fish use, and the transfer of marine resources through the riverine foodweb. A pilot-scale study was completed in the winter of 2007 with the full-scale experiment currently underway for winter 2008. Our preliminary results suggest that while Nitrogen and Phosphorous typically co-limit primary productivity on the Elwha River, this limitation is not evident 1-3 months post carcass addition. Periphyton growth in our treatment reach was higher than in the reference reach post carcass placement, and contained a higher proportion of the heavier 15N isotope that is indicative of marine resource utilization. This study will help to develop a more mechanistic understanding of how marine nutrients affect freshwater productivity, and do so in the context of monitoring a major watershed restoration effort.

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Title

Migration survival of sockeye salmon, Chinook salmon, and steelhead from the Salmon River headwaters

Abstract

Downstream migrating Snake River sockeye salmon, spring Chinook salmon, and steelhead smolts have been PIT-tagged near the headwaters of the Salmon River, Idaho since the late 1980s. Facilities retrofitted to dams of the Federal Columbia River Power System (FCRPS) in the mainstem Snake and Columbia Rivers detect many of these tagged fish as they pass. We obtained data from the PIT-Tag Information System (PTAGIS) and used them to estimate reach and stock specific survival rates along the 1,100 km migration to John Day Dam, which is 345 km from the Pacific Ocean, and from there to adult return. The goals were to compare trends among stocks and reaches, and to identify environmental and biological factors that explain year-to-year variation in migration survival. Over the last decade, survival rates were similar for steelhead and Chinook salmon but lower for sockeye salmon, however trends were similar among stocks. Migration survival rates per km were two to three fold lower downstream of Lower Granite Dam (within the FCRPS) than above the dams. Numbers of adult returns were closely correlated with smolts surviving in-river to John Day Dam. River discharge during migration explained most of the variation in survival from release to Lower Granite Dam, however, adding length at tagging improved regression models for Chinook salmon and steelhead. Factors relating to survival within the FCRPS were more complex, but river discharge was consistently the most important regressor explaining migration survival to John Day Dam. Because survival was strongly positively correlated with reach-specific river discharge, which is depleted throughout the migration route, increasing discharge is likely to increase smolt-to-adult survival for these stocks.

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Title

Thermal tolerance of zebra and quagga mussel populations in the southwest U.S.

Abstract

The invasive quagga mussel, Dreissena rostriformis bugensis, was discovered in Lake Mead (AZ/NV) during January 2007. Zebra mussels, Dreissena polymorpha, were discovered in 2003 at Lake Oologah, Oklahoma. These populations occur where summertime surface water temperatures average near 29°C, close to what is estimated to be the upper thermal limit for these species. This work establishes the chronic upper thermal tolerance of Lake Mead quagga mussels, Lake Oologah zebra mussels and a northern population from Hedges Lake, NY. Mussels were acclimated for two weeks prior to experimentation. Quagga mussels, whose upper thermal limit is under some debate, were acclimated to 20°C to ensure survival while zebra mussels were held at various temperatures (5, 10, 15, 20, 25 and 30°C). Experimentation was conducted for 28 consecutive days at 20°C-33°C for quagga mussels and 28-34°C for zebra mussels. The median survival times for Lake Mead quagga mussels, and zebra mussels from Hedges Lake and Lake Oologah acclimated to 20°C and chronically held at 29°C were 480 ± 10 h, 483 ± 14 h and 355 ± 10 h, respectively. The apparent inability of Lake Oologah zebra mussels to survive long term at 29°C in the laboratory is corroborated by field observations of massive mortality events during summer 2006 and 2007. Despite high selection pressure in Lake Oologah there does not appear to be any thermal adaptation occurring in its zebra mussel population as is evident by their low survival time. Thermal data for Lake Mead quagga mussels suggests that the population will not thrive in shallow waters during the summer, although deeper waters will remain ideal for mussel growth and reproduction year round.

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Title

Ecology of Age-0 Walleye Pollock during Anomalously Warm and Cool Years in the Eastern Bering Sea

Abstract

Eastern Bering Sea (EBS) age-0 walleye pollock Theragra chalcogramma abundance decreased as ocean conditions changed from anomalously warm to cool. This observation supports the oscillating control hypothesis, which states that variability in Bering Sea pollock abundance is due to a restructuring of the fish community that is influenced by ocean temperature. Whole body energy content of age-0 walleye pollock was greatest for fish inhabiting cooler northern EBS waters and for the entire EBS during an anomalously cool year. We hypothesize that anomalously cool ocean conditions alter the timing of an energy allocation shift from growth to somatic tissue energy storage. Increased variability in ocean temperature and continued warming in the EBS will likely affect age-0 pollock ontogeny, subsequent survival, and the status of age-0 pollock predators.

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Title

Results of boater surveys at the Lake Mead National Recreation Area following the recent invasion of the quagga mussel.

Abstract

Invasive species alter ecosystems, have major impacts on native species, and cause millions of dollars of damage to critical infrastructures. The quagga mussel was recently found (Jan 6, 2007) in Lake Mead, Nevada and surrounding waters of the Lower Colorado River. These mussels, originally from the Ukraine, have spread across the United States in less than 2 decades and are able to invade new waters by attaching to boats and trailers. To help stop the spread of invasive species to pristine waters, boater education is vital. The University of Nevada Las Vegas initiated 100th Meridian boater surveys on Lake Mead from October 2007-2008 that identified boater cleaning habits, their past and future launching locations and serves to educate boaters about the quagga mussel. Contact surveys, trailer counts and windshield surveys were administered at all of Lake Mead's functional marinas. Current results from these surveys will be presented and high risk areas for future invasions, based on our surveys, will be identified. These data can be used to identify possible locations where focused educational and enforcement strategies could be implemented.

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Title

Use of Barge Transport on a Seasonal Basis; Winners and Losers

Abstract

Past research indicates that on an annual basis, transporting juvenile hatchery and wild steelhead and hatchery stream-type Chinook salmon by barge from Snake River dams to a release site below Bonneville Dam generally results in greater smolt-to-adult returns (SARs) than allowing smolts to migrate downstream through a series of reservoirs and dams, but not so for wild stream-type Chinook salmon. Recently, we have used PIT tag data from smolts detected at Lower Granite Dam to estimate SARs, downstream survival between Lower Granite and Bonneville Dams, and differential post-hydropower system mortality (D) for transported and non-transported fish on a weekly basis throughout the migration season. Results indicate that SARs varied greatly within and between years for both groups, and the efficacy of transport varied seasonally and by species and origin. In most years, transport resulted in little or no benefit for early Chinook salmon migrants, particularly those of wild origin, but greater benefit for mid- to late-season migrants. Chinook salmon migrants transported early in the season and non-transported migrants late in the season had the highest post-hydropower system mortality. Steelhead generally benefited from transport throughout the migration season, with non-transported migrants showing a strong seasonal decline in SAR. Snake River dam collection and bypass systems do not have the capability to separate steelhead and Chinook salmon smolts, thus, complicating possible management strategies of when to utilize transportation to maximize returns of all stocks and species. Under the conditions evaluated, not transporting during the early part of the migration will likely result in increased SARs for wild Chinook salmon, but decreased SARs for steelhead, and in some years for hatchery Chinook salmon.

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Title

Age at Ocean Entry of Snake River Basin Fall Chinook Salmon and its Effect on Adult Returns

Abstract

Prior to 2002, it was largely assumed that juvenile Snake River Basin fall Chinook salmon migrated seaward during summer and fall and entered the ocean as subyearlings. However, recent PIT tag studies have revealed that many smolts delay migration and enter the ocean as yearlings. It has been difficult to characterize, understand, and incorporate this alternative juvenile life history into management and research paradigms. We used existing data collected primarily during migration years before the summer spill program began to: 1) describe age-at-ocean entry for the Snake River Basin population of full-term wild adults; 2) describe age-at-ocean entry for transported subyearlings; 3) describe age-at-ocean entry for inriver migrants; and 4) summarize the limited information on smolt-to-adult return rates (SARs). Both subyearling and yearling migrants made substantial contributions to the return of full-term wild adults. Subyearling and yearling ocean entry was evident in full-term adults from summer and fall transport groups as well as inriver migrating groups. The tendency to become a yearling ocean entrant increased as the migration season progressed. There was also an increase in SARs as the migration season progressed. We found that: 1) subyearling and yearling migrants made substantial contributions to adult returns regardless of how they reached the sea; 2) the relatively high SARs for late migrants destined to become yearling ocean entrants likely compensated for a high rate of mortality during early rearing; 3) the relatively low SAR for early migrants destined to become subyearling ocean entrants may or may not have been a function of inriver conditions (i.e., no summer spill). Determining the effects of summer spill on SARs of inriver migrating subyearling ocean entrants is an important area for future research.

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Title

Traditional ecological knowledge and biological sampling of non-salmon fish species in the Yukon Flats region, Alaska

Abstract

This project combines social scientific and biological methods to contribute to contemporary knowledge of non-salmon fish species in the Alaska communities of Fort Yukon, Circle, Central, Beaver, and Birch Creek Village. Centered in the Birch Creek area, these communities have long relied on non-salmon fish species for subsistence purposes. This project investigates traditional ecological knowledge and subsistence harvests of whitefish (Coregonus spp. and Prosopium cylindraceum), sheefish (Stenodus leucichthys), northern pike (Esox lucius), Arctic grayling (Thymallus arcticus), longnose sucker (Catostomus catostomus), burbot (Lota lota), and Alaska blackfish (Dallia pectoralis) for a large portion of the upper Yukon River drainage. Key respondent interviews were used to gather information about Alaska Native language terms and place names, seasonal movements of non-salmon species, traditional and contemporary harvest methods, preservation and preparation methods, relative abundance, and traditional stories and beliefs. In addition to ethnographic work, this project included a complementary biological assessment of population characteristics of northern pike in Birch Creek. Preliminary results indicate that many non-salmon fish are harvested incidentally while fishing for Chinook and chum salmon, primarily with fish wheels. A considerable number of comments related concern about salmon declines and possible future viability of non-salmon species. Several participants expressed observations of widespread drying of lakes, sloughs, and streams, and reduced flooding on the Yukon River. Decreased water levels were identified by interview participants as a cause of whitefish habitat loss. Biological assessments of northern pike in the area indicate a varied geographic distribution, with a higher proportion of large adult northern pike present in the lower section of Birch Creek. This study has broadened our knowledge of these patterns and has revealed the highly variable use of whitefish and other non-salmon fish in the southern Yukon Flats region.

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Title

Lewis River Case Study: Salmon Population Dynamics

Abstract

The Lewis River, a Washington tributary to the Lower Columbia River, is a key watershed for the recovery of fall Chinook in the threatened Evolutionary Significant Unit. Increased viability prospects from changes in harvest and habitat are reviewed, based on proposed actions to harvest and habitat for both the undammed and naturally productive East Fork and the North Fork with multiple dams and hatchery inputs.

In this application of the Species Life-cycle Analysis Modules (SLAM) framework, we examine how identified habitat limiting factors could be reduced, and the resulting life stage improvements. Building on earlier work for the East Fork and the North Fork Lewis Rivers, we model changes in abundance and productivity, as well as risk for future population levels to be below possible quasi-extinction thresholds. The region is heavily impacted by agriculture, forestry, residential development, diversions, barriers to passage, and gravel mining. Given priority areas for restoration and preservation, we ask how varied development and conservation scenarios in conjunction with human population growth in this region affect the prospects for meeting Chinook population recovery and harvest goals.

Salmon harvest management goals and changes in fishing communities create dynamic population responses. Harvest rates are set to meet the population rebuilding targets, and modeled for interactions with the human-induced changes in habitat. Using GIS data and salmon population density for various habitat subtypes, past spawner abundance, and harvest data, we incorporate uncertainty across inputs to present possible distributions of abundance and probabilities of harvestable population sizes. The results show potential impacts from changing conditions on East Fork fall Chinook targets of approximately 2,000 natural spawners, along with the prospects for North Fork fall Chinook to continue to achieve an escapement goal of 5,700 natural spawners.

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Title

An Analysis of the Potential Impacts of Mining Activities on Fish Populations in Thompson Creek, Idaho, Using Long-Term Data.

Abstract

Aquatic biological sampling has been conducted since 1980 on Thompson Creek, a tributary of the Salmon River in Idaho, to assess potential impacts of construction and operation of an open pit molybdenum mine operated by Thompson Creek Mining Company. In 2007, fish were sampled from four sites in Thompson Creek; two upstream and two downstream of Thompson Creek mining activities. Trout density and biomass, sculpin density and biomass, trout relative weight, and Idaho Department of Environmental Quality Stream Fish Index were similar at sites upstream and downstream of Thompson Creek mining activities. Density estimates were available for 18 years from 1980 through 2007 at two sites in Thompson Creek; one upstream and one downstream of mining activities. Density of trout and sculpin, the predominant fish present, has varied substantially at these sites since 1980. Using 18 years of data, mean trout density and mean sculpin density were not significantly different between the sites upstream and downstream of mining activities. No significant temporal trends in trout or sculpin density were detected at sites upstream or downstream of mining activities. Trout density estimates were higher at the site downstream of mining activities in 9 of the 18 years (50 percent) sampled. Sculpin density estimates were higher at the site downstream of mining activities in 10 of the 18 years (56 percent) sampled. This study illustrates the benefit of long-term data when assessing impacts on fish populations, as the fish populations in Thompson Creek exhibited substantial interannual variation and interpretation of a limited temporal dataset could have resulted in inaccurate conclusions.

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Title

Upper Grande Ronde Stream Restoration Effectiveness Monitoring

Abstract

This presentation describes the monitoring design and results from the Upper Grande Ronde Section 319 National Monitoring Program (NMP) project. Monitoring was conducted by Oregon Department of Environmental Quality (DEQ) from 1993 through 2005. The primary goal of this study was to evaluate the effectiveness of channel restoration efforts in McCoy Creek, a degraded meadow stream located in the Upper Grande Ronde Watershed. Results show livestock exclusion by itself may not result in improved habitat and recovery of sensitive aquatic life; however, restoration of meandering wet meadow channels can improve habitat and benefit sensitive aquatic life in a relatively short time frame (2-5 years).

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Title

Minute temperature decrease triggers hormone mediated downstream movement in Pacific salmon

Abstract

We have both field and laboratory observations and data that suggest that downstream orientation and perhaps seaward migration in juvenile Pacific salmon (Oncorhynchus spp.) is triggered or regulated by slight decreases in water temperature independent of changes in flow in the rivers. Further, our data suggest that the relationship between temperature and downstream orientation is mediated by hormones associated with smoltification. These contentions are based on our findings that over a three year period, small decreases in water temperature (< 2 C) were associated with elevations in plasma cortisol levels in smolts but not resident masu salmon (O. masou) in a small Japanese river that is tributary to the Pacific. In an artificial raceway, cortisol implantation increased downstream orientation in masu salmon smolts, and a slight decrease in water temperature (< 1 C) increased plasma cortisol levels as found in the natural stream migrants. In Oregon, Chinook salmon (O. tschawytscha) juveniles, exposed to a similar decrease in water temperature also exhibited an increase of cortisol levels. And, coho salmon (O. kisutch) parr in an artificial stream exhibited downstream orientation when exposed to a 1 C drop in water temperature. On the other hand, coho salmon parr given thyroxine or cortisol implants showed constant downstream movement independent of water temperature, similar to that of fish not implanted with hormones but exposed to a decrease in same water temperature. Therefore, we conclude that a slight decrease in water temperature is one of the cues resulting in downstream migratory behavior in Pacific salmon juveniles.

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Title
Wenatchee River Coho Restoration

Abstract
Indigenous stocks of coho salmon Oncorhynchus kisutch no longer occupy upper Columbia River basins. Columbia River coho populations were decimated in the early 1900s. For several reasons, including the construction and operation of Columbia River hydropower projects, habitat degradation, harvest management, and hatchery practices, naturally reproducing coho populations have not been re-established. In 1999, the Yakama Nation began testing the feasibility of reintroducing coho to the Wenatchee Basin with specific goals to: 1) determine whether a broodstock can be developed from lower Columbia coho stocks whose progeny can survive in increasing numbers to return as adults to the mid-Columbia; and 2) initiate natural reproduction in areas of low risk to sensitive species. To date, three generations of broodstock development have occurred and transfers of lower Columbia River coho have been discontinued. We are measuring the spatial distribution and abundance of returning adults, rearing distribution, smolt production estimates, and return rates for naturally produced adults. With feasibility goals met the reintroduction project is transitioning to focus on increased local adaptation, decreasing domestication selection and increasing fitness in the natural environment.

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Title

Spawning distribution of adult hatchery sockeye salmon released as parr from net pens in Lake Wenatchee, Washington

Abstract

Artificial propagation of sockeye salmon interrupts the early phases of their life history cycle typically occurring between the egg and smolt stage. Hatchery sockeye salmon reared initially in a hatchery and subsequently released as parr from freshwater net pens suspended in a lake, cannot imprint on a specific tributary water source. As a result, the spawning distribution of returning adults may differ from that of naturally produced fish. We used radio tags and carcass surveys to determine if the spawning distribution and location of adult hatchery sockeye salmon reared and released from net pens in Lake Wenatchee was similar to that of naturally produced sockeye salmon. Over two years, 100 hatchery sockeye salmon were radio-tagged and tracked to their spawning location. No radio-tagged sockeye salmon were found spawning in Lake Wenatchee, the lake outlet, or other nearby rivers. All radio-tagged sockeye salmon that were tracked into tributaries of Lake Wenatchee spawned in similar locations as naturally produced fish. Although the spawning distribution of hatchery sockeye salmon between tributaries was different from that of naturally produced fish based on carcass surveys, the mean difference was small (10.8%) and ranged between 0% and 29%.

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Title

Spectral reflectance patterns in northeastern Pacific tidepools

Abstract

Northeastern Pacific tidepool fishes exhibit cryptic colorations and patterns. However, it is not possible to accurately determine their spectral characteristics using the human visual system. Measuring the reflectance spectra of tidepool fishes as well as the reflectance spectra of their environment is an important first step in developing an understanding of their visual system as well as assessing how closely they are color-matching their surroundings. We measured a number of environmental spectra as well as fifteen species of tidepool fishes using a spectroradiometer. Here, we present general information on the spectral reflectance patterns of those species as well as a number of environmental features found in tidepools along the coast of San Juan Island, Washington. Major body color spectra of fishes are shown as well as a number of case studies in which modeling is used to assess the degree of color matching presented to possible predators. Disruptive patterning is clearly visible in a number of species. Further, this study reveals tidepool fishes reflect low infrared. In some cases peak reflectance patterns in the infrared are aligning closely with infrared peaks from chlorophyll found in tidepool vegetation. While reflectance of the low infrared chlorophyll peak has been found in neotropical frogs, to our knowledge this is the first record of such reflectance in fishes.

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Title

Tidal circulation, nutrient capture and oxygen: rearing stress in Oregon south coast estuaries

Abstract

Estuaries within the Southern Oregon-Northern California region tend to be relatively small due to steep terrain and stream gradients. Streams entering these estuaries are well-oxygenated, but summer rearing temperatures are also elevated. Thus, from New River to Winchuck River, estuaries of limited extent serve as critical summer thermal refugia, primarily for juvenile chinook. Daily dissolved oxygen (DO) surpluses, reflecting photosynthesis, and deficits, reflecting respiration, ranged widely among nine estuaries sampled 2002-2006. Relations between plant-available nitrogen transport and oxygen response are complicated by the progressive seasonal restriction of tidal circulation, by harbor protection facilities, and by type of aquatic vegetation. Stagnant bar-bound conditions and either riverine or marine nutrient inflows prior to closure resulted in DO supersaturation, measured as high as 272% and 252% in the two smallest estuaries. As residence times increase, organic matter is captured, most visibly in the form of green filamentous algal mats. Deficits of DO, measured by magnitude and duration below saturation, are associated with decomposing organic matter and longer periods of respiration as photo periods decrease through the summer. Superimposed on the seasonal trend, prolonged respiration resulting from coastal morning fog and high tide backwater within tidal freshwater areas, depressed the daily cycle further. In the smallest estuaries, early and rapid development of the sand bar in some years can trap juvenile salmonids in a freshwater embayment, without continued marine contributions of either nutrients from upwelling or wave-oxygenated water. Interannual sampling reveals dynamics and feedback linkages among streamflow, nutrient sources/capture, and climate forcing. This attempt to quantify tidal, seasonal, and interannual frequency of conditions that lead to DO stress in these small estuaries, is expected to result in an index of estuarine sensitivity/response to nutrients. Such an index is needed to ensure that nutrient criteria are appropriate and protective of salmonid rearing.

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Title

Water Quality in the Hells Canyon Complex and the Water Quality Certification Process

Abstract

The Hells Canyon Complex is a highly eutrophic system. It receives water from a 188,008 square kilometer watershed that contains extensive anthropogenic development with corresponding highly altered flow and severely degraded water quality. Issues associated with Section 401 certification of the Hells Canyon Complex (HCC) include elevated total dissolved gas levels during periods of spill, low dissolved oxygen during summer and fall, and a modified thermal regime. Idaho Power Company (IPC) proposes to install spillway flow deflectors on all three dams that comprise the HCC to reduce supersaturation. IPC proposes to implement its assigned total maximum daily load dissolved oxygen responsibility in Brownlee Reservoir plus additional aeration to supplement concentrations in the Snake River downstream of the HCC. Brownlee Reservoir dissolved oxygen enhancement can be accomplished either by transition zone oxygen injection or upstream equivalent phosphorus reductions through water quality trading. With regard to temperature, IPC is proposing to fund a watershed temperature enhancement management program (TEMP) to improve habitat, water quality and flow conditions throughout the Snake River watershed. The program includes annual funding of $1,000,000 for riparian enhancements and $2,000,000 for flow enhancement, resulting in a projected funding level of $120,000,000 through the anticipated 40-year license term. IPC is proposing the TEMP in lieu of a temperature control structure (TCS) at Brownlee Dam. A TCS could manipulate temperatures downstream of Brownlee Dam during times when Brownlee Reservoir is thermally stratified. However, IPC’s watershed approach represents a more holistic remedy to the Snake River temperature issues and provides substantial temporal and geographic benefits beyond a TCS. With the watershed approach, there is substantially less risk to aquatic resources within and downstream of Brownlee Reservoir because it does not rely on releases of anoxic, hypolimnetic water from Brownlee Reservoir to cool downstream reaches.

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Title

Status Review of Chinook Salmon from the Klamath River Basin

Abstract

The status of Upper Klamath and Trinity Rivers Chinook salmon Evolutionary Significant Unit (ESU) was evaluated with data through 2006. All populations or stocks are native to the ESU in origin but are variable in production type. Most tributary spawning populations (except the Trinity River) are dominated by naturally produced fish. Main-stem spawning populations below hatcheries are mixed hatchery and natural production types. Between 1980 and 2005 tributary populations fluctuated greatly due to variable ocean survival but the trend for this 26 year period was static. These naturally produced populations declined 70% during 2004 and 2005. Since 1992 spring Chinook trends have mirrored those of fall Chinook. Each race is declining at about the same rate. Hatchery escapement between 1980 and 2005 increased an average of 6.4% per year. Escapement of mixed (hatchery and natural) production types to natural spawning areas near hatcheries increased an average of 3.5% per year during 1980-2005, but declined 58% during 2004-05. The proportion of hatchery fish escaping to hatcheries compared to total escapement to the basin has increased from 18% (1978-82) to 49% (2004-05). Recovery of naturally produced populations is not likely in the foreseeable future because grilse (jack salmon) returns have been declining since 2002 and freshwater disease incidence continues to be high. The National Marine Fisheries Service assessment of this ESU (Williams et al. 1998) is no longer accurate because of severe declines in naturally produced salmon, increased proportions of hatchery produced fish, over fishing, and recent deterioration of freshwater habitat due to disease, low flows, increased nutrient loading, and stream warming. The naturally produced populations, especially the two remaining spring Chinook stocks, are in danger of extinction in the foreseeable future. Hatchery stocks and mixed production stocks are likely to become endangered with extinction in the foreseeable future.

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Title

Estuarine residency and habitat association patterns of outmigrating coho salmon smolts in Humboldt Bay, California

Abstract

Information regarding the importance of estuarine habitats to juvenile coho salmon (Onchorhynchus kisutch) is limited. In Humboldt Bay, on the northern coast of California, this information gap is due both to low numbers of juveniles entering the Bay and the low efficacy of traditional methods for sampling juvenile salmonids in estuarine and marine habitats. We used surgically implanted acoustic transmitters to track the movements of 32 coho salmon smolts emigrating from Freshwater Creek, through the slough, and into and out of the Bay. The movements of individual fish were recorded using an array of up to twenty-seven fixed hydrophone receivers and by mobile tracking from a vessel. Of the 32 coho salmon tagged, 28 migrated through the Freshwater Slough estuary and resided for an average of 12 days in the slough. Of the 28 fish that entered Humboldt Bay, 24 apparently left Humboldt Bay for the open ocean and resided for an average of 15 days in the marine portion of the bay. Fish tagged early in the study remained in the brackish water of the slough longer and smaller fish appeared to remain in the Bay longer. Details regarding diel movement patterns and habitat association are also reported.

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Title

On-going monitoring of Lahontan cutthroat trout responses to watershed restoration and barrier removal

Abstract

In 2001 Trout Unlimited initiated monitoring of age class structure and movement of Lahontan cutthroat trout within the Maggie creek drainage, northeastern NV, to collect baseline data for tracking responses to a long-term collaborative habitat restoration effort and planned reconnection of the metapopulation in 2005. In the three project streams, five years of baseline demographic data were collected before barrier removal, using 3-pass electroshocking at 44 sites throughout the tributaries. Several other efforts were also undertaken to understand movement and population structure in the disconnected watershed: weirs monitored from 2003-2005 captured several large (365-600mm) fish out-migrating from tributaries, suggesting the retention of exploratory movement behavior and migratory-size fish even in the presence of barriers; genetic analyses in 2005 suggested moderate differentiation and, despite the presence of barriers there was evidence of some movement among streams, primarily downstream from Beaver Creek into neighboring Coyote and Little Jack Creeks.

Three road culverts and an irrigation diversion that fragmented habitats were removed in 2005, and two years of data have now been collected following watershed reconnection. It is difficult to attribute positive responses to date to restoration efforts, as populations have also suffered and recovered from several disturbances in recent history, including a fire in 2001 and a severe drought in 2003/2004. However, LCT numbers have increased and age class structure seems to have improved (filling in larger classes), in conjunction with significant improvements in riparian habitat condition and watershed connectivity. The apparent health and resiliency of the populations through fire and drought likely reflect the ability of the improved system to sustain the fish in a dynamic environment. Future monitoring will include intensive sampling of the mainstem river and repeat genetic analyses to try to capture signals of movement among tributaries.

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Title

Influences of wildfire, habitat size, and connectivity on trout in headwater streams revealed by patterns of genetic diversity

Abstract

Wildfire is a natural process that is important to many stream ecosystems, but the natural ability of fish to respond to wildfire-related disturbances is becoming increasingly constrained by human activities that fragment and degrade stream habitats. In this study we used molecular genetic markers (DNA microsatellites) to examine the effects of wildfire and related disturbance in comparison to habitat fragmentation on native rainbow trout in the Boise and Payette River basins, Idaho, USA. We surveyed genetic diversity of fish collected from 55 tributary streams to examine levels of diversity in samples without a history of recent wildfire to those with a history of stand-replacing wildfire, as well as those that had experienced both wildfire and a severe channel-reorganizing disturbance. Stream habitats also varied substantially in size (catchment basin area) and isolation caused by human-constructed road culverts. Based on prior work in these basins, we expected both wildfire and channel reorganization to have reduced local population sizes significantly. We expected that wildfire-related disturbance should reduce genetic diversity via founder effects or population bottlenecks, but our results showed little evidence of these influences. In contrast, levels of genetic diversity were reduced in samples of fish collected upstream of movement barriers, likely due to restricted gene flow and lower effective sizes of isolated local populations. We also observed a positive correlation between habitat size and genetic diversity. An unexpected result was that 15 of 55 samples showed genetic evidence of hybridization between rainbow trout and nonnative cutthroat trout. Results of this study suggest that human influences, such as barriers to dispersal and introductions of nonnative fish pose greater threats to populations of native trout than wildfire itself.

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Title

An analysis of individual transferable quotas for both the commercial and recreational fishing sector

Abstract

Individual transferable quotas (ITQs) have been implemented in some commercial fisheries. These ITQ management programs have led to increased profits, decreased costs of gear and labor, and a safer and more stable industry. Despite these successes, ITQs have been limited to just a few commercial fisheries, and are virtually nonexistent for recreational fisheries. While the operations and value-creating mechanisms of the recreational fishing industry are completely different than those of the commercial industry, in reality, the two compete for the same resources. In fisheries where there is both a commercial and recreational sector, the benefits accrued by ITQ management in the commercial fishery may be dissipated by the fishing levels in the recreational sector. This study focused on the Santa Barbara Channel Nearshore fishery, with both commercial and recreational sectors. We analyzed the potential economic, environmental, political and social benefits and impacts of implementing an integrated “fish tag” system for both commercial and recreational sectors. The framework for this analysis can be applied to many other fisheries with both commercial and recreational sectors.

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Title

Habitat Restoration and Protection Projects in the Yakima Basin

Abstract

This presentation focuses on the restoration and protection projects that are underway in the Yakima Basin. Illustrated projects focus on stewardship and protection of streamside habitat for native fishes, water quality and terrestrial wildlife. The presentation will emphasize management strategies that account for shifting demographics in the basin, as well as the benefits of collaboration with private landowners and other resource management entities. Examples of successes and failures will be provided.

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Title
The Oregon Hatchery Research Center

Abstract
Pacific Northwest hatcheries have changed over the past 100 years in reaction to numerous societal and environmental demands. Now hatcheries are not only responding to changing management needs they are also conducting basic and applied research that will determine their future roles. The Oregon Hatchery Research Center is an innovative facility designed to address both practical management issues and fundamental research questions. It is owned by the Oregon Department of Fish and Wildlife and is operated jointly by ODFW and Oregon State University. We investigate the differences between hatchery and wild origin fishes, in relation to the management and conservation of native species. Research includes tests of conventional hatchery procedures as well as innovative experimental analyses under controlled environmental conditions. We are conducting genetic pedigree analyses of mate choice and spawning success in steelhead, coho and Chinook salmon, assessing the role of jack males in mating, and relating genetic parentage to subsequent survival and growth of juveniles. We are using stable isotopes to determine food web structure in coastal coho, and to assess the impacts of carcass placement programs. We are developing and testing techniques for production of sterile steelhead to minimize genetic and behavioral impacts of hatchery fish on sympatric wild populations. We are tagging and tracking individual juveniles to determine the factors that regulate smolting success in wild and hatchery steelhead and coho. All these activities include collaborations with colleagues across Oregon, the rest of the Pacific Northwest, and from as far afield as Iceland, Japan and Korea. Our research is integrated with education and outreach to encourage the public awareness and participation, with internship programs at universities and colleges, and with electronic and print publication of information.

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Title
Nez Perce Tribal Harvest Management and Monitoring

Abstract
Harvest management activities are enormous in scope, encompassing fishing conducted year-round in the Snake River Basin (SRB). Within this area, the Tribe has the reserved right to access fully 50% of the fish available for harvest. One purpose of the Harvest program is to provide the fisheries harvest management plans, evaluations and assessments necessary to procedurally implement and protect treaty reserved fishing rights. The Tribe is responsible for developing the plans necessary to insure that proposed harvest is biologically and legally sound and that it occurs (i.e. take numbers, locations, dates and gear types) in the manner designed.

Harvest monitoring schedules and strategies are designed and implemented to properly manage Nez Perce treaty fisheries so as to stay within the tribal harvest share and conservation needs of the resource. Fishery catch is useful information for management purposes that include estimation of total tributary fishery harvest, determination of fish stock status, run reconstructions and forecasting, and relative contribution of hatchery programs to fisheries. For each season the Harvest Monitoring Program will collect fishery catch data, produce harvest estimates and statistical analysis, and maintain harvest databases for each salmon and steelhead season. The Tribe will describe how it expects to monitor tributary fisheries in a sampling plan. Sampling activities typically will include some or all of the following methods for tributary monitoring: 1) Creel Survey, 2) Direct Inseason Interview Survey, and 3) Post-Season Interview Survey. The task is to estimate confidence intervals (CI), precision (indicator of data quality), and variance (indicator of monitoring effort) in catch for the SRB tributary fisheries that use data produced from the various survey collection methods.

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Title

Combining spatial and temporal stream temperatures measurements to investigate surface/groundwater exchange across a semi-arid alluvial floodplain

Abstract

Stream temperature is an overriding influencing in aquatic ecosystems. Throughout the Western United States, elevated stream temperatures imperil many native aquatic organisms by radically altering the spatial and temporal dimensions of critical habitats. In particular, the Umatilla Tribes rely on high quality ecological products or First Foods for their wellbeing. A research effort was initiated to better understand the floodplain conditions that create and maintain a diversity of stream temperatures supportive of native aquatic organisms. During the past decade, increased measurement capability has contributed to a richly detailed stream temperature datasets for ~50km of the Upper Umatilla River, Oregon. Measurements from remote sensing and field datasets suggest that water exchange between the channel network and hyporheic zone has a significant influence on the spatial and temporal scales of stream temperatures along the river. Hyporheic exchange influences the longitudinal pattern of stream temperature and shows strong correlations with channel form. These results suggest that geomorphic restoration may be necessary to maintain temperature regimes for cold-water species.

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Title
Layers of Information--Locating Documents

Abstract
The amount of research conducted on salmon in the Columbia River basin can be staggering. Reading through documents to find information on a specific location can be daunting.

Geo-referencing specific locations mentioned in documents could help to show where studies have been concentrated as well as the exact locations where data were recorded. By building a digital library of this type of information, researchers and scientists could save time spent poring over documents and review literature at a much faster rate.

Developing this type of information will be a time intensive task, but could easily be folded into the task of building digital libraries as undertaken by the StreamNet Library.

Documents would be examined by library staff for location information. Working with GIS staff at the Columbia River Inter-Tribal Fish Commission, we would build a map to show the locations derived from the document. Library staff would scan the document into PDF format. The locations would become click-able links to the specific pages in the document that discuss work done in those locations.

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Title

Developing regional environmental flow standards for Washington State

Abstract

Washington’s streams and rivers are naturally dynamic and complex ecological systems that provide significant economic, social, spiritual, and recreational value. Despite Washington's reputation as a perpetually rainy place, the water needs of people and natural ecosystems are increasingly in conflict. Century-long decline of Pacific salmon, degraded water quality of rivers flowing into the Puget Sound, and continued loss of wildlife habitat are all strong signals of current water demand stress in this region. Water managers are becoming increasingly cognizant of these pressures, yet there remains a critical knowledge gap of the ecological tradeoffs associated with various flow management practices, including instream flows as presently mandated in Washington. Here, we introduce a new research initiative to advance the science and develop the tools required for ecologically sustainable water management in Washington. Our approach follows the Ecological Limits of Hydrologic Alteration (ELOHA) framework by synthesizing the knowledge and data collected from individual rivers into a scientific framework that supports and guides the development of environmental flow standards at the regional scale. We present a state-wide hydrologic classification of unregulated rivers and quantify the range of natural flow variation that regulates characteristic ecological processes and habitat characteristics for distinct hydrologic types. This provides a baseline or reference condition against which ecological responses to alteration can be measured across multiple river segments falling along a gradient of hydrologic alteration. As an example, we develop flow-ecology relationships for hydrologic types according to population patterns of life history diversity for Chinook salmon (Oncorhynchus tshawytscha) throughout the Puget Sound. These results highlight the ecological effects of hydrologic alteration and help form the basis of flow management for both river ecosystem protection (proactive flow management) and sustainable restoration (reactive flow management) for salmon life history diversity.

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Title

The Amphibian Disease Chytridiomycosis: Global Update and Fisheries Management Concerns

Abstract

Global amphibian declines are attributed to several factors including habitat loss and degradation, invasive species, chemical pollutants and diseases. Amphibian chytridiomycosis is an emerging infectious disease caused by the aquatic fungus Batrachochytrium dendrobatidis (Bd). Bd is now linked to amphibian losses on several continents. An international Bd conference held in Arizona in November 2007 brought scientists and managers together to synthesize current knowledge and develop management strategies. Three key aspects of that conference included development of a global map of Bd detections and no-detections; compilation of a list of knowns, unknowns, and research priorities; and formation of task groups to address selected topics, where one group focused on links to fisheries management concerns. The mapping project has found Bd sampling has occurred or is ongoing in 87 countries. Bd has been detected in 233 of 455 anuran species sampled, and in 24 of 36 salamander species sampled. The western portion of North America is relatively well-sampled for the fungus, where it appears prevalent, and is linked to massive die-offs. The list of Bd unknowns is about twice as long as the list of knowns, and unknowns include transmission mechanisms, and why some animals die and others appear to be resistant. Several topics link this disease to fisheries. First, field disinfection (e.g., bleaching boots and gear) is advocated to reduce human-mediated spread of the disease between water bodies. Second, quarantine of sites with massive die-offs should be implemented. Third, Bd has been detected in a US fish hatchery, and hatchery disinfection protocols are under development. Fourth, several amphibian bait species and the American bullfrog appear to be Bd-carriers, and they may spread the disease to native species that are more susceptible to infection. Lastly, fisheries biologists will be critical to Bd surveillance.

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Title

Evaluating landscape and watershed-level conditions: techniques for integrating tools and datasets to assess riparian and aquatic health

Abstract

A primary purpose of landscape and watershed-scale assessments is to identify factors that limit riparian and aquatic health (e.g., pollutant sources, sedimentation and erosion, lack of instream large wood, etc.). Numerous watershed assessment and modeling tools have been developed to assist natural resource managers in evaluating the effects of land use practices on riparian and aquatic habitats. Due to their standalone nature, however, combining these tools and disparate datasets into a comprehensive assessment can be difficult. Here, we some tools and techniques (old and new) and present some examples (from Idaho and Oregon) of how they can be integrated to identify problems and apply solutions to large-scale watershed issues. For example, empirical riparian data (field-collected and remotely-sensed) can be used to model growth and mortality in riparian areas. Results from the analysis can be utilized in a stochastic, spatially-explicit large wood recruitment model for identifying areas where Desired Future Conditions for instream large wood recruitment may not meet. Additionally, results from a rapid road risk assessment can be utilized with a landslide/debris-flow hazard analysis to identify road segments that are actively eroding and areas where road restoration and/or decommissioning activities could limit sedimentation risks to aquatic habitats. Collectively, results from these analyses can then be overlayed in a GIS to identify areas of near- and long-term risk and how roads interact with slope stability, landslide hazard areas, areas of high habitat intrinsic potential (IP), and fish habitat and abundance. Results from this type of a comprehensive analysis can be used to prioritize areas for protection and restoration. Lastly, we describe how these types of landscape and watershed-level assessments might be improved to better address ecological processes and integrity.

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Title

Natural Reproductive Success and Demographic Effects of Hatchery-Origin Steelhead in Abernathy Creek, Washington

Abstract

In order to optimize the use of hatchery produced fish while conserving wild stocks it is critical to understand the effects that hatchery rearing practices have on the development and performance of fish as well as the genetic and ecological risks posed to wild populations. We examined the performance and natural reproductive success of genetically similar hatchery-origin (HOR) and natural-origin (NOR) steelhead in Abernathy Creek relative to control streams. We initiated an integrated steelhead broodstock program by captively rearing NOR juveniles to sexual maturity. Juvenile steelhead (N = 30,000 per year) have been released from Abernathy Fish Technology Center (AFTC) yearly beginning in 2003. The number of NOR steelhead smolts migrating out of the creeks has been consistent among years. Emigration date and timing between the HOR and NOR fish were similar and did not vary among years. HOR and NOR steelhead differed morphologically and physiologically. HOR fish were longer and thinner than NOR fish. Gill Na+, K+ ATPase activity was higher in NOR migrants than HOR migrants. HOR migrants had higher plasma osmolality and [Na+] than NOR migrants. Sixteen percent of the NOR juveniles were produced from either a single or pair of individuals passed above the hatchery barrier.

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Title

Managing water supplies and conservation of fish and wildlife in the Salt and Verde rivers, Arizona

Abstract

The Salt River Project (SRP) manages seven reservoirs in central Arizona to meet the water supply needs of the metropolitan Phoenix area. Water supply management goals seek to maximize certainty in both hydrologic objectives and regulatory compliance. We accomplish these goals through three main program areas: Water Management, Community Programs, and Environmental Compliance. This presentation will focus on the challenges SRP faces in addressing the interface between water supply management and wildlife and fisheries conservation needs, and it will discuss the approaches and programs we implement to meet regulatory requirements. As an example, SRP and the City of Phoenix have developed a Habitat Conservation Plan on the Verde River to mitigate the effects of dam and reservoir operations on federally listed birds and fishes. The Plan also provides significant benefit to unlisted native aquatic species by addressing threats and instituting conservation measures, which may reduce the need to list and protect these species under the Endangered Species Act in the future

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Title

Glacial Lake sockeye restoration 2000-2005: Good science or serendipity?

Abstract

One goal of the Glacial Lake/Salmon Lake sockeye salmon (Oncorhynchus nerka) cooperative restoration project was to describe the sockeye run at Glacial Lake, 25 miles northwest of Nome. From 2000 to 2005, the Bureau of Land Management documented adult abundance and run timing at the alpine lake, and from 2003 to 2005, smolt outmigration timing and strength were also recorded. The weir count data have been used to ground truth ADF&G aerial escapement estimates. Adults were sampled for age-sex-length data, and fin clips were collected for genetic analysis. Smolt were sampled for age, length, and weight data. In 2005, the sockeye spawning grounds in the lake were mapped with GPS. Additional field work included collection of zooplankton, streamflow, and other hydrographic and limnological data. Initially, funding was provided by the Norton Sound Salmon Disaster Initiative for enforcement of anti-snagging regulations on the Sinuk River during the peak of the return. Public relations work was undertaken to inform the local community about the restoration and enforcement effort through radio and newspaper ads, and annual updates to a kiosk display at the Sinuk River Bridge. Sockeye outmigration begins with few age 3 smolt outmigrating first after lake surface water temperatures warm to 10o C, followed by the dominant age 2 fish outmigrating through the end of June, with fewer age 1 smolt departing throughout July. Smolt data suggests density-dependent growth. Adult escapement ranged from a minimum estimate of 1,047 fish in 2002, to record escapements of 8,115 in 2004 and 11,135 fish in 2005. Favorable Bering Sea conditions are most likely responsible for the plentiful sockeye escapements. Escapement was dominated from 2000-2003 by age class 2.3, or six year old fish, but age class 2.2 became as numerous in 2004 and 2005. These five year old, earlier returning fish were mostly females.

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Title

What's that small shad doing here? Evidence of multi-year freshwater residence by juvenile American shad

Abstract

Juvenile American shad Alosa sapidissima have been assumed to strictly exhibit a life history characterized by saltwater entry at age 0. However, presence of age 1 and age 2 juveniles in the freshwater reservoirs of the Columbia and Snake Rivers reveals the existence of an alternative life history type. The typical age 0 juveniles measured at Bonneville Dam during October averaged 77 mm FL (range 65 113 mm; n = 235) while age 1 and 2 juveniles averaged 184 mm FL (range 142-223 mm; n = 83). There was overlap in lengths of age 1 and age 2 type juveniles. Preliminary classification based on length suggests that age 1 and 2 juvenile shad are present in Snake River reservoirs. The size of the age 1 and 2 juveniles suggests that American shad are available as prey for piscivores throughout the year and could be contributing to predator survival and growth during periods when juvenile anadromous salmonids are not present. The diet of age 1 and 2 juveniles collected at Bonneville Dam during October contained items consumed by juvenile salmonids. We conclude that American shad in the Columbia River basin exhibit two juvenile life histories: one with a typical and rapid age 0 outmigration and one with one or more years in freshwater residence. The details of the alternative life history and ecological effects on the fish community have yet to be determined.

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Title

Habitat actions: the gift that keeps on giving?

Abstract

Following on results on parr-to-smolt survival published in 2005, we investigated whether or not the effects of tributary habitat actions on Snake River spring-summer chinook survival would be detectable in the adults returning to spawn one to three years after the juvenile smolts migrated to the ocean. Using a sample of over 460,000 parr PIT-tagged through 2003, we found that the best-fit model, selected using AICc, included habitat actions, and that more actions were associated with an increase in parr-to-adult survival. In addition, using a subsample of these fish detected as smolts in the lower Snake River, we discovered that smolts rearing in areas with large numbers of habitat actions had increased smolt-to-adult survival, when compared to those rearing in areas with fewer actions. Taken together, the results suggest that freshwater habitat actions have measurable, positive effects on the three chinook life stages where data are available to make reliable estimates of life-stage survival. However, since these are not formally designed experiments, we also found strong confounding among habitat actions and other covariates, especially land use/land cover and, by implication, pre-action habitat quality.

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Title

Behavioral thermoregulation by adult Chinook salmon in the Columbia River

Abstract

Water temperature is one of the key environmental variables influencing behavior, life history, and evolutionary trends for Pacific salmonids. For example, migration and spawn timing for adult anadromous salmonids have evolved to maximize fitness for adult migrants and subsequent juvenile stages. In the Columbia River, temperature regimes have been significantly altered by human activities, most notably the development and operation of dams and reservoirs throughout the basin. Global and regional climate change may also be influencing thermal conditions in the system now. We have conducted several studies to evaluate effects of water temperature in the main stem Columbia and Snake rivers on migration behavior and reproductive success of adult salmon and steelhead. One behavioral response to rising water temperatures is the use of cool-water refugia during migration. For spring–summer Chinook salmon, ~14% temporarily strayed into cooler non-natal tributaries during migration, with higher rates for summer than spring Chinook salmon. For upriver fall Chinook salmon, ~18% temporarily strayed into cooler tributaries. While temperature was one factor associated with spring–summer Chinook use of non-natal tributaries, other factors (such as hatchery origin) were also important. With fall Chinook salmon, Columbia River water temperature was the best predictor of temporary straying rates. In comparison to Chinook salmon, an average of 61% of upriver (Snake and upper Columbia River) steelhead used lower river tributaries during their upstream migrations, a behavior strongly related to Columbia River water temperatures. We believe this widespread use of non-natal tributaries by several Columbia River runs represents behavioral thermoregulation, and the behavior presumably confers some survival and/or fitness benefits. Other examples of cool water refugia use within the lower Snake River have been observed for Chinook, sockeye salmon, and steelhead. Importantly, the cumulative effects of warm temperature exposure on fitness of Snake River salmonid populations are difficult to quantify.

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Title

Use of Half-Duplex PIT systems to monitor passage of adult Lamprey at and between dams in the Columbia and Snake rivers.

Abstract

Passage success and escapement of adult Pacific lamprey (Lampetra tridentata) at mainstem Columbia River dams has become an issue of concern due to precipitously declining numbers of returning fish. Previous migration evaluations have used radio telemetry. We have investigated using an alternative technology, half-duplex PIT as a means to monitor passage of adult lamprey through the Columbia River. Development of this tool has focused on the design and placement of antennas and advances in reader and data logging capabilities. In 2007, we were able to compare information from migrating adult lamprey using both radiotelemetry and HD PIT- tagged fish. Study animals were released downstream of Bonneville Dam and their subsequent passage at Bonneville, The Dalles, John Day, McNary and Ice Harbor dams were monitored using telemetry receivers and half-duplex reader/antenna systems located within the fishways of these dams. We found detection efficiencies of HD PIT sites were ~80 to 100% at the dams and passage times calculated using both PIT and telemetry systems were similar. Of fish released at Bonneville Dam, approximately 4% reached McNary Dam, highlighting the current challenge of improving migration success for upriver lamprey populations. However, HD PIT appears to be an effective tool to efficiently monitor fish movements in complex systems such as the Columbia and Snake rivers.

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Title

Back to the Future: Reintroduction of Coho Salmon in the Clearwater River Subbasin

Abstract

K'állay or Coho Salmon (Oncorhynchus kisutch) were exterminated in Idaho's Clearwater subbasin following the construction of the Harpster Dam in 1910 and the Washington Water Power Diversion Dam in 1927. Early restoration attempts by the Idaho Department of Fish and Game (1962-1968) were unsuccessful. In 1986, Coho were officially declared extirpated from the Clearwater and Snake River subbasins. This loss was unacceptable to the Nez Perce Tribe, which recognized the cultural and ecological significance of Coho to the Clearwater subbasin. In 1995, the Nez Perce Tribal Fisheries Department initiated a Coho restoration program for the Clearwater River. The goal of the Nez Perce Tribe's Coho restoration project is to reestablish a localized Coho stock in the Clearwater Subbasin at levels of abundance and productivity sufficient to support sustainable runs and annual harvest. Using excess Coho eggs from lower Columbia River hatcheries, the Nez Perce Tribal Fisheries Department incubates, rears, and releases Coho juveniles into Clearwater tributaries historically known to contain Coho. These supplementation efforts have generated a progressive increase in adult Coho returns to the Clearwater River. To date, the highest return of adult Coho occurred in 2004 when 3,802 adults and 102 jacks crossed Lower Granite Dam (LGD). In 2007, 2,532 adult and 255 jack Coho crossed LGD, marking the second highest return of adult Coho since restoration efforts began in 1995. As a result, Clearwater broodstock have provided 100% of the egg take in three of the last four years. This is a significant advance towards establishing a localized Clearwater Coho stock, and demonstrates that restoring an extinct salmon species is possible.

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Title

Examining the relationship between soil nitrogen availability and riparian tree growth on the Queets River, WA

Abstract

Large wood (LW) creates channel diversity and important habitat for salmonids (Oncorhynchus spp.) and other riverine organisms. Generally, trees must be greater than 1 m in length and 0.1 m in diameter before they play an effective geomorphic role. However, attaining a large diameter in a riparian zone altered by frequent channel movement requires rapid growth rates. We examined two related questions: 1) Are higher rates of nitrogen mineralization associated with an increase in tree diameter growth? 2) Does soil nitrogen availability (estimated through mineralization rates) change as stands age? To answer these questions, we measured total nitrogen mineralization rates for 23 permanent plots (varying in age from <15 yrs to >200 yrs) along the Queets River, Washington. Preliminary results suggest that tree ring width, measured from cores taken from the 10 dominant trees in each of the 23 plots, is significantly different between plots of different ages. We will present additional data on soil nutrient availability and tree growth to answer these questions and to determine the effects of soil nutrient conditions on riparian tree growth.

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Title

Fish tagging techniques used as tools for evaluating river and stream restoration

Abstract

Numerous salmonid studies have developed information on fish growth, movement, and survival by utilizing fish tagging techniques such as passive integrated transponders (PIT) and radio telemetry. Simultaneously, stream restoration practices have increased over the last decade, becoming a multi-million dollar industry. We explore the question of how can fish tagging techniques be applied to answer questions related to stream restoration effectiveness? We present an overview of various fish tagging techniques and provide several examples from the Olympic Peninsula, the Puget Sound Basin, the Columbia River, and Montana on how techniques were used to collect information on individual and population-level salmonid growth, movement, and survival estimates. We also identify the types of stream restoration projects (e.g., fish barrier removal) that could benefit, and the data (e.g., juvenile and adult growth rates, juvenile to adult survival, stray rates, colonization rates, movement distances within and between life stages) gathered from such techniques. Lastly we list opportunities and caveats related to the use of fish tagging techniques in monitoring stream restoration effectiveness.

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Title

Migration patterns and habitat preferences of spawning brown trout in the Alpine Rhine River

Abstract

The Alpine Rhine River is the most important inflow river to Lake Constance. After the construction of a hydropower dam in the year 1962 the headwaters were isolated from the lake and the catches of lake resident brown trout collapsed. In the year 2000 a newly constructed fish ladder was put into operation and brown trout from Lake Constance regained free access to the headwaters. Between 2001-2006 we radiotagged 81 trout. The aim of the study was to answer the following questions:

- what is the behavior of the upstream migrating brown trout from lake Constance
- where are the most important spawning sites
- what is the habitat preference of spawning trout
- what is the post-spawning behavior and success of passage of the hydropower facilities for the downmigrating trout

In order to document migration behavior and habitat preferences, we used individuals caught in the fish ladder in Reichenau (90 km upstream of Lake Constance). Fish had strong preferences for the River Vorderrhein, but there they did not show particular preferences for specific stream reaches. The maximum observed migration distance was 126 km. The spawning habitat preferences were documented (depth, velocity and substrate).

After spawning some individuals (18 %) stayed on the spawning sites. 45 % of the individuals were not able to pass the hydropower facilities on the downstream migration. They died within the reservoir and the hydropower facilities. Only 18 % of the trout returned to Lake Constance. The downmigration was very fast (1-3 days).

In 2006 24 individuals on their upstream migration were caught by electrofishing at a close distance from Lake Constance (10-20 km upstream). These fish showed a completely different behavior and only 3 individuals reached the fish ladder in Reichenau. Hydropeaking and floods had a distinct effect on the upstream migration.

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Title

Monitoring habitat changes resulting from habitat restoration: New approaches for an old tool

Abstract

There is a need to monitor the effectiveness of in-stream restoration activities. However, funding for monitoring is limited. As a result, in-stream habitats are often characterized as a means of monitoring the effectiveness of in-stream habitat restoration projects, since the measures are easier to measure then biotic responses. Habitat variables selected for monitoring are often selected based on their presumed relevance to biotic communities. We propose a hierarchical method for characterizing habitats that allows habitat conditions to be assessed across several spatial scales. We discuss how these habitat variables can be related to biotic communities using juvenile salmonid densities as an example. The usefulness of this method for evaluating potential habitat restoration activities and assessing the benefits of the restoration activities is provided. The benefits of this method are that they can help guide restoration and mitigation activities and it provides insight into important habitat characteristics across several spatial scales. This is essential since the importance of a habitat variable may change with the spatial scale considered. The usefulness of this method relies on ones ability to identify adequate relationships among biotic communities and measured habitat variables and developing these relationships can be expensive. However, overall cost effectiveness may be increased by selecting more appropriate restoration alternatives due to pre-project assessments and the reduced costs associated by measuring only habitat features during post-project monitoring makes this a potentially promising method.

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Title

Working together to assist Snake River sockeye salmon: Utilizing partnerships between hatcheries and research to gain ground towards recovery.

Abstract

Working together to assist Snake River sockeye salmon: Utilizing partnerships between hatcheries and research to gain ground towards recovery.

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Snake River sockeye salmon Oncorhynchus nerka were listed as endangered in 1991. Prior to listing, a captive broodstock program was initiated to prevent species extinction and to begin rebuilding the population. Between 1991 and 2007, the captive broodstock program produced approximately 3,846,000 eyed-eggs to meet broodstock as well as reintroduction needs. Progeny from the captive broodstock program are reintroduced using four strategies: 1) eyed-eggs are planted in Pettit and Alturas Lakes in November and December; 2) age 0 presmolts are released to Alturas, Pettit, and Redfish lakes in October; 3) age-1 smolts are released into Redfish Lake Creek and the upper Salmon River in May; and 4) hatchery-produced adult sockeye salmon are released to Redfish Lake for volitional spawning in September. Joint hatchery and research monitoring and evaluation efforts have focused on maximizing the use of limited hatchery rearing space and identifying and prioritizing the most successful reintroduction strategies. The programs near term goals of preserving genetic diversity and ultimately preventing extinction have been successful. Current and future plans focus on transitioning from a genetic conservation program to a species recovery program. To enable this transition, the current broodstock station at Eagle, Idaho is under construction to double production and the development of a new smolt rearing facility is under investigation. The program is a cooperative effort among IDFG, NOAA Fisheries, Shoshone-Bannock Tribes, ODFW, and University of Idaho with funding primarily provided by the Bonneville Power Administration.

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Title

Genetic variation, ancestry and population structure in native Arctic grayling in the upper Missouri River: conservation implications and the “ghost” of impacts past

Abstract

Arctic grayling (Thymallus arcticus) are commonly associated with drainages of the Arctic and north Pacific oceans, but a disjunct population is native to the Missouri River system in Montana and Wyoming. Like a number of native salmonids that were widely distributed and locally abundant prior to Euro-American settlement, native grayling in the Missouri River have been reduced to a handful of remnant populations. Conservation efforts have focused primarily on protecting the fluvial population in the Big Hole River, and re-establishing fluvial populations elsewhere. Widespread historical stocking of exogenous grayling has created some uncertainty about the origin of extant populations and the composition of native gene pools. Additionally, dramatic declines in native populations may have reduced the genetic template for restoration activities. Effective conservation would benefit from a better understanding of genetic ancestries, and whether bottlenecks have substantially altered genetic diversity of remnant populations. Consequently, we conducted a population-level genetic analysis of native and introduced grayling from 18 locations. We genotyped 730 grayling at 10 microsatellite loci and used these data to identify population groupings, genetic variation within and among groups, and evaluate evidence for population bottlenecks. We found significant divergence among native populations from the Big Hole River, Madison River, and Red Rock lakes. The Big Hole population had greater heterozygosity and allelic diversity than the Madison and Red Rock populations, both of which showed evidence of recent bottlenecks. Most introduced grayling populations traced their ancestry to the adfluvial Red Rock lakes population, but we did not find strong evidence that stocking of hatchery grayling has homogenized native gene pools. Rather, geographic patterns of genetic variation were consistent with divergent local populations likely connected, historically, by occasional gene flow. We discuss these findings with respect to ongoing conservation activities.

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Title

Influence of habitat size and time since isolation on persistence of westslope cutthroat trout in isolated stream networks

Abstract

Habitat fragmentation and isolation of local populations is a recognized threat to persistence of native fishes. Even so, such isolation may reduce the effects of invasion by non-native fishes, leading managers to intentionally isolate some populations. Given the current extent of habitat fragmentation, expected effects of climate change, and non-native invasions, conservation of native salmonid fishes in the western US will commonly require the direct management of isolated populations. The extent and quality of habitat available above migration barriers has been strongly associated with persistence or the time to extinction for several species of salmonids. Because the relationships are expected to be species specific, we attempted to characterize the relationship of habitat size and time since isolation with persistence of westslope cutthroat trout (Oncorhynchus clarkii lewisi, WCT). WCT still occupy an estimated 58% of their historical range, but 81% of conservation populations exist as isolates. We used recent inventories of culvert road crossings to identify fish migration barriers on national forests in a central portion of the species range, and fish survey data to determine whether WCT presently exist above these barriers. We used logistic regression to analyze presence of WCT as a function of fundamental habitat characteristics (habitat size, gradient, temperature) in the isolated stream network. Preliminary analyses showed that occurrence of WCT declined markedly in stream networks with contributing area <1000 ha. Ongoing analyses aim to refine this habitat size threshold, and to estimate the effect of time since isolation based on how long the culvert has been present. Results will help refine assessments of risks for currently isolated populations, and validate decision models used to analyze trade-offs between threats of isolation versus invasion.

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Title

Development and implementation of a monitoring program for estimating impacts of mark-selective Chinook salmon fisheries in Puget Sound, Washington

Abstract

Large-scale hatchery salmon fin-clipping programs coupled with mark-selective (i.e., adipose fin clip-selective) harvest regulations provide Puget Sound/Strait of Juan de Fuca anglers opportunities to exploit abundant hatchery stocks while minimizing impacts on weakened wild salmon populations. Due to their wild salmon capture-and-release component, mark-selective fisheries (MSFs) also pose sampling and impact-estimation challenges that do not exist for equivalent non-selective fisheries. Understanding and meeting these challenges is critical given the growth in interest in MSF implementation elsewhere and the need for reliable fishery-impact assessments under state–tribal and international co-management arrangements. In our presentation, we review the Washington Department of Fish and Wildlife-Puget Sound Sampling Unit's Chinook salmon (Oncorhynchus tshawytscha) MSF monitoring framework, relate practical lessons learned through intensive MSF monitoring, and identify issues affecting the reliability of past and future MSF assessments. We developed a comprehensive monitoring program that has enabled us to collect the data needed to characterize the impacts of MSFs occurring in Puget Sound/Strait of Juan de Fuca waters. Our program includes both angler-interview and catch-sampling components (at access sites); instantaneous effort counts (aerial and boat based) and origin-of-trip surveys; WDFW-administered test fisheries; and a voluntary angler-reporting component. Encompassing a diversity of fishery (e.g., quota- vs. season-managed fisheries) and sampling circumstances (e.g., areas with many vs. few access sites), we have adapted and employed this general approach in nine separate marine areas since 2003. The success of our efforts to date—assessed in terms of reliability (i.e., accurate, precise, and timely reporting of fishery parameters) and transparency—can be attributed to the cooperation of anglers participating in MSFs, the coordination of Puget Sound Sampling Unit staff at all levels, and an agency-level commitment to the future use of MSFs as a management tool.

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Title

Early marine survival and behavior of Steelhead (Oncorhynchus mykiss) smolts through Hood Canal and the Strait of Juan de Fuca

Abstract

Marked declines in Hood Canal and Puget Sound steelhead populations have been detected in the last 10 to 20 years, and have been shown to contrast markedly with the relatively stable condition of populations along the Washington and Oregon coasts. This discrepancy between the health of Coastal as opposed to Puget Sound steelhead populations suggests that nearshore smolt migration may constitute a major cause of mortality. Acoustic telemetry was used to investigate survival, migration timing, and migratory behavior of steelhead smolts during two consecutive outmigrations. In 2006, smolts (n = 159) from four Hood Canal streams (Big Beef Creek, Dewatto River, Skokomish River, and Hamma Hamma River) and one stream feeding into the Strait of Juan de Fuca (Snow Creek) were monitored, while a greater number of smolts (n = 187) from the Hood Canal streams were studied in 2007. Fish from the Hood Canal streams included four wild populations and one hatchery population, which originated from the Hamma Hamma River. Estimated survival rates for wild and hatchery smolts from river mouths to the northern end of Hood Canal ranged from 67% to 85% in 2006, and from 64% to 84% in 2007. For the migration from the north end of Hood Canal to the Strait of Juan de Fuca, estimated survival rates ranged from 23% to 49% in 2006, but were not reliably measured in 2007. In 2006, travel rates through Hood Canal (x = 8.0 km/d) were significantly lower than those observed in the Strait of Juan de Fuca (x = 25.7 km/d). Detailed knowledge of steelhead survival and patterns of nearshore habitat use not only aid in determining causes of population decline, but also help define extinction risk and recovery actions for this ESA-listed species.

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Title
Mining, Ranching, and Improved Riparian Habitat

Abstract
Newmont Mining Corporation operates several gold mines near Carlin, Nevada. One, Gold Quarry, has required ground water pumping since the mid 1990's. Prior to pumping, the BLM prepared an Environmental Impact Statement that evaluated the potential effects this might have on surface water. The Maggie Creek Watershed Restoration Project was designed to improve riparian conditions prior to any predicted impacts actually occurring.

Surrounding Newmont's gold mines is the 450,000-acre TS Ranch, a mixture of private and public lands. About 30,000 acres of the ranch are used for mining purposes with the balance run as a working cattle and hay operation. A major emphasis of the ranch operation is habitat restoration to benefit both wildlife and ranch operations. The integration of riparian improvement and ranch operations requires the 'four mores': more management, more maintenance, more monitoring, and more money.

The major hydrostratigraphic units include carbonates, clastics, intrusives, volcanics, and basin-fill sediments ranging in age from the Early Paleozoic to Quaternary. These rocks are juxtaposed by episodes of mountain building, erosion and basin and range faulting. Surface flow originates from snowmelt, rainfall, and groundwater discharge from springs. Maggie Creek has both gaining and losing reaches along its length. Tributary stream baseflow is supported by groundwater discharge from clastic rocks in their upper reaches while Maggie Creek's perennial flow is groundwater discharge from basin fill sediments.

Since 1990, an extensive piezometers network has been monitored. Shallow groundwater adjacent to Maggie Creek has stabilized and is higher as a result of the improved riparian conditions. In 1993, a 600 cfs flood carried 8,000 tons per day of sediment, by 2005, the same 600 cfs flood carries less than 1,000 tons per day of sediment which demonstrate the filtering power of properly functioning riparian zones.

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Title
Changing paradigms for hatchery programs

Abstract
Releases of hatchery-reared salmon and steelhead (Oncorhynchus spp.) are commonly used to compensate for lost fish production (mitigation) and to increase abundance of naturally produced spawners for depressed populations (conservation and supplementation). In recent years, hatchery programs for salmon and steelhead have undergone many changes to make them more scientifically robust, adaptable, and goal-oriented. However, the performance of hatchery origin fish (even those raised by “best management practices”) in the wild is more important for the recovery of depressed populations of salmonids. Emerging information has shown that the reproductive success of hatchery produced fish is lower than naturally produced when spawning in the wild. New information from one study suggests a long-term decline from the heritable effects of domestication. Other changes, such as earlier timing of migration and spawning, younger age at maturity, and reduced fecundity may also affect overall fitness of the population. Releasing fish for the mitigation (harvest) component away from spawning habitat, and changing the conservation objective to be purely experimental (testing hypotheses) would give managers a better understanding of the effects of hatcheries in meeting multiple goals, while at the same time reducing long term risks to the target populations.

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Title

The effect of uncertainty in monitoring data on status assessments for Snake River Spring/Summer Chinook salmon

Abstract

We developed a simulation model that describes the effect of uncertainty in monitoring data on our ability to assess status of Snake River Spring/Summer Chinook. The model was built with the cooperation of the Interior Columbia Technical Recovery Team, who provided the decision framework for our model. Using the model, monitoring data and resultant status assessment can be simulated for different types of monitoring programs under various scenarios of salmon abundance, productivity, spatial distribution and diversity. I will discuss the results of our work and, more generally, the concept of evaluating data quality and decision criteria using a simulation approach. This project is part of the Collaborative, Systemwide, Monitoring and Evaluation Project, which is a collaborative effort to improve monitoring programs for salmonids in the Columbia basin.

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Title

Use of dual frequency identification sonar (DIDSON) to estimate steelhead escapement in systems with low abundance in central California

Abstract

Steelhead (Oncorhynchus mykiss) in central and southern California are listed as Threatened and Endangered under the Endangered Species Act. Obtaining escapement estimates is critical for measuring progress of recovery planning. Steelhead population estimates are difficult to obtain due to their rare and widely-spaced nature and turbid winter stream conditions in these regions. These factors make traditional escapement surveys impractical and require the need to obtain complete population censuses. We tested the feasibility of using dual frequency identification sonar (DIDSON) to estimate steelhead escapement in three systems with low abundance in central California: Big Creek in Monterey County and the San Lorenzo River and Scott Creek in Santa Cruz County. DIDSON uses sonar to produce high-quality images in turbid water, which allows for detection and enumeration of fish, as well as estimation of fish size and swimming direction. Each deployment yielded insight into equipment durability, the importance of site selection, data management techniques, and how fish behavior affects data processing. Our 2006 experiment in the San Lorenzo River lasted 8 days and was focused on equipment durability and obtaining a dataset to compare with counts from an upstream fish trap. DIDSON counts from this site yielded 41 upstream migrants compared to 46 passed at the fish trap. There were some differences in operation time between the two methods which may account for the discrepancy. DIDSON deployment in Big Creek (2007) spanned the entire steelhead run season. Issues with fish behavior (i.e., milling) at the Big Creek site made data analysis difficult; our escapement estimate was between 22 and 33 fish. The Scott Creek (2008) deployment will also span the entire steelhead run season and data validation will be possible using results from a weir located 200 m downstream.

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Title

Risk to native fishes: influence of anthropogenic stressors

Abstract

Although anthropogenic activities often influence ecosystem processes and biotic communities, they are rarely integrated into conservation planning due to the difficulty in quantifying associated threats to biotic integrity. The objectives of this study are to first, create an ecological risk index by quantifying risk of anthropogenic threats at a landscape scale in the Lower Colorado River Basin, and second, determine the utility of an ecological risk index in assessing threats to native fishes. Anthropogenic stressors included in this study are dams, canals, land use (i.e., percent agriculture, percent urban), mining, roads, railroads, stream crossings, 303d listings, non-point discharge elimination system permits, water diversions, and hazardous sites and were identified from various sources including the National Land Cover dataset, National Dam Inventory, and other spatially referenced coverages. Density of each stressor was calculated for all 73,072 catchments found in the Lower Colorado River Basin. Various threat metrics (i.e., presence/absence of stressor, frequency with equal weighting, values based on literature) were used to assess a wide range of techniques in quantifying risk by catchment and watershed. Although cumulative risk values were highly variable, the various metrics consistently classified catchments near urban centers as high risk. Life-history characteristics of fishes found within each catchment will be used to assess the usefulness of an ecological risk index. If found effective an ecological risk index will be a practical tool to help managers identify areas that are in greatest conservation need and prioritize catchments for future conservation efforts.

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Title

Upper Colorado River Endangered Fish Recovery Program: Implementation Issues

Abstract

The Upper Colorado River Endangered Fish Recovery Program was established in January, 1988. The Program's goal is to recover four endangered fish species in the Upper Colorado River Basin while water development and management activities proceed in compliance with state water law, interstate water compacts, and the Endangered Species Act. Approximately 800 miles of rivers have been designated as critical habitat. Actions taken by the Program are considered by U.S. Fish and Wildlife Service in determining whether water depletion activities are provided with ESA compliance by the Program. To date, more than 1,500 existing and new water projects depleting 2.1 million acre-feet per year have been provided with compliance under the Program. There has been no litigation on ESA compliance associated with the Program. During the 19 year life of the Program, critical implementation issues have included:

•Establishing an effective governance structure.
•Expediting actions to benefit endangered species.
•Clarifying the relationship of Program actions to ESA compliance.
•Providing adequate staffing for the Program.
•Developing a long range plan that provides a common view of future Program actions and use of that plan for annual priorities and budgeting.
•Establishing a relationship with Congress and the executive branch to assure Program funding.
•Maintaining support among Program participants (states, federal agencies, water users, environmentalists, and power customers).
•Developing an effective adaptive management strategy to assure the application of sound science.
•Informing the public regarding Program activities.

Timely resolution of critical implementation issues is essential. The Program has successfully addressed and resolved these issues.

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Title

Washington State's Top 10 List of Incredibly Important AIS PowerPoint Bullets

Abstract

10. There are more than 10 things to say about regional coordination and how our state manages AIS.
9. Things can usually be thought of in groups of three's – so this should be either a Top 9 or Top 12 list.
8. One group of three I like is: Species, Pathways & Politics.
7. Another group of three is: Environment, Culture & Politics.
6. My last group of three is: Science, Technology & Politics.
5. Have you heard any good AIS jokes lately? Me either.
4. Did I mention Spatial, Temporal & Politics?
3. Free tip: My Job is only as good as Your Job.
2. Does Public Health Threat count as a group of three?
1. Convincing the public that AIS will cause the destruction of civilization as we know it is bad for moral. Especially when they don't listen.

0.1 It's hard to compete with Hillbilly fishing tournaments and species that can produce a million eggs a year.

0.01 And, I have hope.

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Title

Spatial and temporal changes in the Rio das Velhas, Brazil: an anthropogenically altered and recovering river

Abstract

In Brazil, most urban sewage is still discharged without treatment into rivers. This is the situation for the Rio das Velhas, the Rio São Francisco's second most important tributary in water volume (mean annual discharge of 631 m3/s). It receives in its upper course the sewage of the Metropolitan Region of Belo Horizonte (MRBH), which has more than four million inhabitants. Our study focuses on the effects of urbanization and late investments in sewage treatment on the spatial and temporal distribution and fish biodiversity in the Rio das Velhas. Unlike other Brazilian rivers, its fish fauna was studied from 1850 to 1856. Fifty-five fish species were recorded; 20 of them were first described at that time, when there were no more than 40 known species in the entire São Francisco basin. Recent fish samples, approximately 150 years later, indicate 117 fish species, although some of past records may represent locally extinct species. Spatial effects of MRBH's discharge included changes in water quality and declines in fish richness and diversity. The effects of urbanization on the fish fauna of the main stem, especially near the MRBH, were also marked in comparison with tributaries, which support almost 75% of the total fish species of the whole basin, including native and alien records. We found 37 species (34% of local fauna) exclusively in these well preserved affluents. However, the effects of the investments in sewage treatment on fish distribution are evident. Many species, including large sized migrants, such as the dourado (Salminus fransciscanus), have increased their range in Rio das Velhas, and have been recorded progressively closer the MRBH. The absence of dams in the Rio das Velhas main course, associated with connectivity with the Rio São Francisco system and its well preserved tributaries, also increase its rehabilitation potential.

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Title
Central Oregon Angling & Enforcement

Abstract
Human Population and Growth: The Western Challenge
Abstract for the American Fisheries Society

Central Oregon Angling
David Pond, Sergeant
Oregon State Police – Bend
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The population and growth of central Oregon has exploded over the past 10 years. The numbers of law enforcement professionals who enforce the angling regulations and protect the fisheries have remained the same. The increase in new residents to central Oregon which is well known for it's trophy trout opportunities has increased the incidents of angling violations and pressure to certain fisheries.

With the growth of central Oregon and it's known trophy trout fisheries certain areas have been impacted causing frustration to anglers, outdoor persons, and managing agencies. These impacts to our fisheries have caused limited entry to a segment of river, increased monies spent expanding or improving access to area water bodies, increased pressure, and increased violations.

Please join us for a discussion on cases worked and challenges that face law enforcement.

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Title

An evaluation of extinction-risk criteria for Pacific salmon conservation units

Abstract

My research objective is to improve the definition of extinction-risk for Pacific salmon species by determining which extinction-risk criteria best reflect the chance of quasi-extinction (extremely low abundance) for the individual conservation units (CUs), which are spatially-defined management units. I will perform a retrospective and prospective analysis to assess the chance of quasi-extinction of each specific CU by analyzing whether the CU meets the criteria for classification as “at risk of extinction”. I will use two sets of evaluation criteria, those developed for Canadian biota by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and another set that I develop. For each extinction-risk criterion, the retrospective analysis will examine the historical spawner escapement data to determine the number of triggering events (extinction-risk criterion met) that would have occurred in the past for each salmon CU. I will also note the management action (applied harvest rate) that was taken after each triggering event (if any) through an examination of the stock-recruitment data, and whether the population recovered to levels considered “not at risk of extinction”. The prospective analysis will develop a computer simulation model to determine the probability of quasi-extinction for a few populations of conservation concern under several plausible harvest rates and climate change scenarios. The results from my research will be useful to Fisheries and Oceans Canada when they are attempting to implement Canada’s policy for the conservation of wild Pacific salmon, as they will have a better categorization of extinction-risk for the Pacific salmon species, which allows them to manage the individual CUs effectively.

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Title

COMPARATIVE EXPRESSION OF GLYCOLYTIC AND GLUCONEOGENIC ENZYMES WITHIN AND AMONG STRAINS OF RAINBOW TROUT (Oncorhynchus mykiss) FED DIFFERENT LEVELS OF CARBOHYDRATES

Abstract

Plant protein-based feeds for carnivorous fish inevitably contain carbohydrates (CHO) of starch origin, and carnivorous fish do not utilize starch as an energy source very efficiently. Intra-specific variation in CHO utilization has been reported but has not been studied. Three strains of rainbow trout (RBT) were used in a factorial design to examine variation in tolerance of CHO considering performance parameters and gene mRNA levels at regulatory points related with CHO utilization. The strains of RBT were fed iso-nitrogenous and iso-lipidic diets with four dietary wheat starch inclusion levels (0, 15, 25 and 35% starch). Diets were designed to meet and exceed the amount of starch typically found in freshwater RBT feeds. Two-factor ANOVA was used to evaluate differences in weight gain, FCR, HSI, plasma glucose levels, and gene expression in glycolytic and gluconeogenic enzyme expression. With the exception of FCR, there were no significant interactions between the two factors for any of the data presented. In our factorial experiment we were successful in identifying differences in growth performance, HSI and plasma glucose levels in three strains of RBT fed varying levels of dietary starch. Increasing dietary starch level also led to elevated levels of plasma glucose and HSI. The responses of these classic growth parameters were expected and are characteristic of RBT fed diets high in CHO. With increasing inclusion of dietary starch, levels of GK and GS mRNA expression increased correspondingly. Utilization of starch peaked at the level of 25% as reflected in weight gain, FCR, HSI, and GK and GS mRNA expression. GK mRNA expression was maximum with the optimum growth at the 25% starch level. Evidence of glucose being processed as a storage substrate is provided by the increased liver size (increased glycogen deposition) as a result of GS mRNA up-regulation.

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Title
Got Gas? Try Recompression!

Abstract
Overfished species of rockfish (Sebastes spp.) from the Northeast Pacific experience high bycatch mortality due to "barotrauma," induced from the rapid change in pressure during capture. As a result, "catch and release" techniques may not be effective for some species. Field experiments show that it may be possible for rockfish to recover from barotrauma if quickly recompressed prior to release. However, no work has followed the physiological recovery of rockfish after recompression or determined if it is possible for rockfish to survive barotrauma in the long term. We induced barotrauma in adult black rockfish (Sebastes melanops) from a simulated depth of 35 m with subsequent recompression. Following recompression, rockfish were slowly acclimated to surface pressure and transported to recovery tanks. Blood and selected tissues (eye, heart ventricle, head kidney, liver, rete mirable, and gonad) were sampled at days 3, 15, and 31 post-recompression to evaluate the cellular-level response during recovery. No mortality from barotrauma occurred during the duration of the experiments (n=60). Results showed that damage due to barotrauma at the macroscopic level consisted of swimbladder damage, and at the histological level only rete mirabile damage was present. Analyses of plasma enzymes indicative of tissue damage in humans showed high variability in treatment, control, and field control fish leading us to conclude these enzymes are not reliable indicators of tissue damage in rockfish. IGF-1 levels were also analyzed for differences among treatment and control fish over the recovery period.

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Title

Microhabitat partitioning by an eastern Cascades stream fish community.

Abstract

Throughout the Pacific Northwest, stream ecosystems have been altered extensively by anthropogenic factors, however, little data exists on how many of these stream ecosystems functioned prior to disturbance. Today, there is much interest in both restoring native fish species to streams from which they have been extirpated and enhancing declining populations. Previous research of stream fish assemblages has shown that microhabitat availability is an important component of fish species distribution, therefore the ability to identify suitable locations for restoration and enhancement efforts will increase the likelihood of success of such endeavors. Furthermore, the ability to effectively enhance or rehabilitate disturbed sites is increased with knowledge of the critical components of a species' preferred microhabitat.

The focus of this research was to quantify microhabitat use by all members of a relatively pristine eastern Cascades stream fish assemblage. The goals were to identify preferred day and night microhabitat types for each species, detect interspecific differences in microhabitat use, detect intraspecific differences in use between different age classes of a species, and identify diel shifts in microhabitat use. The American River, WA, a tributary of the Yakima River, served as the study site for this research. Day and night snorkel surveys were conducted to locate and mark fish locations within a 150 meter stretch of river. Microhabitat variables measured included total depth, focal depth, average velocity, focal velocity, distance to cover, distance to shore, cover types present, and substrate type. Results indicate that inter- and intraspecific microhabitat partitioning occurs within the American River fish assemblage, although there is also considerable overlap between some species' microhabitat use. Also, diel shifts in microhabitat use did occur, emphasizing the importance of taking both day and night microhabitat needs into account when developing restoration strategies.

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Title
Flow Restoration through Water Transactions

Abstract
The four Pacific Northwest states in Columbia Basin have allocated water rights to agricultural producers through a system of legal water rights first established in the nineteenth-century when it seemed there was no end to freshwater. Now, though, in many places, more rights have been assigned than there is water to meet them. During a typical growing season, stretches of many key streams and rivers in the Columbia Basin run low – and sometimes dry.
The Columbia Basin Water Transactions Program (CBWTP) was established in 2002 to fund and support voluntary, market-based strategies that improve environmental flows for anadromous and resident fish populations in the Basin. The CBWTP philosophy is to improve flow for fish and wildlife habitat in a manner that respects the value of irrigated agriculture and the water rights held by agricultural producers. The CBWTP is administered by the National Fish and Wildlife Foundation (NFWF) in partnership with the Bonneville Power Administration (BPA). Since 2002, the CBWTP has helped build the capacity of 11 entities working to enhance environmental flow and funded nearly 150 water right transactions that have restored ecologically-significant environmental flow to critical streams and rivers in the basin. The CBWTP and its partners collaborate with irrigation districts, landowners, agricultural producers, and community leaders to improve environmental flows.
Andrew Purkey will present the evolution of an environmental flow market in the Pacific Northwest since 1993. He will detail the multi-disciplinary nature of this approach and how these efforts have been useful for successful restoration of environmental flows through water right transactions. He will also present how water transactions can be a response to the impacts of climate change and human population growth in the basin.

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Title

The Removal of Brownsville Dam: Significant for Fish and Human Communities

Abstract

The Brownsville Dam was located on the Calapooia River 3 miles upstream from the town of Brownsville in the Middle Willamette Valley. Its sole purpose was to divert 2 cubic feet per second of water into a three-mile long canal, which flows through the center of Brownsville and is an important aesthetic aspect of the community. After three years of public meetings a decision was made to support removal of the dam with the caveat that water be maintained in the historic canal.

The Calapooia Watershed is home to two species listed as “threatened” under the federal Endangered Species Act: winter steelhead and spring Chinook. Currently, fewer than 100 fish return each year. Cutthroat trout and pacific and brook lamprey are also present. The Brownsville Dam is one of the last two remaining dams on the Calapooia impeding fish passage.

Project design and full scale permitting activities started in November of 2006. Design efforts included dam removal options, sediment transport modeling, and water diversion improvements. All permits were obtained and dam removal activities were conducted in August 2007 under a turnkey approach. The dam consisted of a 100 foot long reinforced concrete structure. The first stage of dam removal involved the installation of various clean water by-pass methods and BMP’s. Next a 15-foot notch in the dam was removed to allow continuous river flow through the channel. The entire dam was removed in less than three weeks with minimal turbidity, and the river was graded to conform to the surrounding channel geometry. Less than 1 acre of site disturbance occurred, and all the regulatory permit conditions were met.

The approved fish screen and pumping station will be installed in the summer of 2008. Oregon State University received funding to monitor the project over three years.

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Title

Using First Foods to Direct Natural Resources Management

Abstract

The Confederated Tribes of the Umatilla Indian Reservation's (CTUIR) Department of Natural Resources has organized its functions and responsibilities through a focus on traditionally gathered resources identified by the Tribal community as "First Foods". The cultural recognition of First Foods is demonstrated in the serving ritual for native foods in the CTUIR's longhouse, the center of community culture. The physical and temporal organization of First Foods manifested in the serving order is also observed in the active physical and ecological processes occurring on the landscapes on which the community depends. Traditional culture and contemporary science reinforce the First Foods paradigm. We seek to utilize First Foods to bring attention to ecological processes that may be devalued outside of Tribal culture and to prioritize efforts to re-naturalize those processes that produce and sustain First Foods. Further, we suggest First Foods provide a direct and culturally appropriate means to monitor and report restoration success to the Tribal community.

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Title

Revegetation following channel reconstruction in NE Oregon

Abstract

Riparian vegetation is an essential component in stream restoration projects. Planting success in a recently constructed channel is necessary because the lack of vegetation makes the channel highly susceptible to erosion. However, revegetation has often failed due to inappropriate species selection, planting location, or methodologies. In 2003 a small intermittent stream in northeast Oregon was reconstructed to improve cold water fish habitat. In 2005 some stream banks still remained bare despite riparian revegetation efforts. To measure planting success, two native sedges, Carex nebrascensis (Nebraska sedge) and Carex utriculata (beaked sedge) were transplanted in 2006 on to depositional and erosional geomorphic surfaces. Transplant survival and expansion were evaluated for two seasons. Results showed that sedges produced more shoots on depositional surfaces than on erosional surfaces. Nebraska sedge produced more new shoots than beaked sedge on both planting locations. However, all sedge transplants survived the first growing season. Scour from high flows prior to second season sampling caused high mortality of transplants from uprooting. Beaked sedge was more susceptible to uprooting from scour than Nebraska sedge. Our results display the importance of choosing the appropriate species for revegetation and suggest that planting success may be contingent on the design of a reconstructed channel and its ability to carry high flows.

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Title

Effects of 8.5 mm Passive Integrated Transponder tags on juvenile Chinook salmon survival and growth

Abstract

Application of 12 millimeter Passive Integrated Transponder (PIT) tags represents a commonly used procedure for mark-recapture studies for anadromous salmonids, yet the use of the 12 millimeter tags have generally been restricted to fish >65 millimeters. The recent development of an 8.5 millimeter PIT tag provides a means to tag younger, smaller salmonids, however effects of the tag have not yet been tested. The purpose of our study was to measure instantaneous and delayed mortality of juvenile spring/summer Chinook salmon Oncorhynchus tshawytscha following implantation of an 8.5 mm PIT tag, and to assess differences in growth and condition factor between three different size groups of fish that received three different treatments; PIT tags, punctures only (no tag), or those that were anesthetized only. Results showed a lack of tag-related mortality across any of the groups of fish. Tag loss was higher in smaller fish and was influenced by tag placement. Neither growth nor condition factor appreciably differed between treatments. These results, provided there is strict adherence to tagging protocols, provide support for use of the 8.5 millimeter PIT tag in fish as small as 46 millimeters.

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Title

Population of origin of Arctic cisco (Coregonus autumnalis) collected in the Colville River subsistence fishery.

Abstract

Arctic cisco (Coregonus autumnalis) harvested from the Colville River subsistence fishery are thought to be anadromous, overwintering migrants from the Mackenzie River, Canada. Local fishers currently question sustainable recruitment to this fishery based on recent development and potential climate change impacts in the nearshore waters of the Beaufort Sea, which provide rearing and overwintering habitat. Our study tests the population of origin for fish collected from the Colville River by comparing genetic data derived from Colville River Arctic cisco with two anadromous spawning populations collected in the Arctic Red and Peel rivers, both tributaries of the Mackenzie River. We analyzed sixteen microsatellite loci and direct sequence information for a 594 nucleotide fragment of the mitochondrial ATPase subunit VI gene. Microsatellite allelic frequencies revealed no significant differences in pairwise FST among these three populations supporting the hypothesis that the Mackenzie River is a source of Arctic cisco recruiting to the Colville River fishery. However, differences in mitochondrial DNA based on twelve rare haplotypes found only in the Colville River indicated potential additional source populations. The identification of additional source populations will be critical to understanding the population dynamics of Arctic cisco in the Beaufort Sea and the sustainability of the Colville River fishery.

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Title
Assessing the Conservation Status Assessments of Freshwater Mussels

Abstract
Information needs to be gathered and evaluated against a number of criteria to assess the conservation status or risk of extinction of a species. These criteria are similar between several commonly used assessment methods; including the IUCN (World Conservation Union) and NatureServe (formerly The Nature Conservancy) and the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Population size, area of occupancy, trend, threats, extent of occurrence and vulnerability, trend and threats are the major ones. It is a challenge to derive defendable numbers for any of these for many species; but a particular challenge emerges with the freshwater mussels in the west. They have been not well surveyed, they are difficult to survey and there are knowledge gaps in life history and habitat requirement that makes determining vulnerability and threats problematic.

I will review the criteria required for assessments, recent surveys that have been conducted and discuss some of the problems encountered using the Rocky Mountain Ridged Mussel (Gonidea angulata) in British Columbia as an example. This species will be assessed in 2009 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) which uses the regional IUCN methodology for assessing extinction risk. It is also assessed via NatureServe methodology in British Columbia and each of the western states where it is found.

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Title

Results of a range-wide status assessment of sockeye salmon

Abstract

The Salmonid Specialist Group (SSG) of the IUCN World Conservation Union conducts range-wide status assessments of salmonids and helps focus international attention on salmon conservation. This assessment represents the first effort to examine anadromous Pacific salmon using the IUCN Red List of Threatened Species guidelines. We considered extinct and extant populations throughout the native range of the species, including the United States of America, Canada, and the Russian Federation. We assembled trend data on abundance for sockeye salmon Oncorhynchus nerka from 243 separate spawning sites across the Pacific Rim. Using this database and some additional information, we evaluated the status at both global and subpopulation scales. We provide Red List categories for sockeye salmon at both the global level and for a total of 80 subpopulations defined by freshwater and marine ecoregional groupings and genetic differentiation. The subpopulations, as a result of guidelines stipulated by IUCN, represent units defined by extremely low rates of geneflow and, as a result, may contain numerous spawning sites supporting sockeye salmon adapted to specific nursery lakes or river reaches. For our global assessment, we concluded that the species as a whole is not threatened. Where sufficient data existed, we found the greatest number and concentration of threatened subpopulations in British Columbia, a likely result of a combination of factors, including poor marine survival rates, habitat loss, mixed-stock fishing practices and deleterious effects of enhancement activities. We were unable to assess the status of many subpopulations in the western part of their range due to insufficient data. We conclude with a series of recommendations on improving status of this species. This effort sets a new precedent for identifying threatened Pacific salmon populations and helps raise awareness of wild salmon conservation at the international level.

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Title
SPENCER CREEK - THE GOOD, THE BAD AND THE UGLY

Abstract
The Good – Spencer Creek is the only spawning tributary that seeds the Oregon Section of the Klamath River with redband trout. A coordinated resource management plan (CRMP) was implemented on this important spawning tributary in the mid 1980's to improve watershed conditions for fish, grass production for livestock, and to provide for sustained timber removal. Results of the community efforts resulted in excellent redband trout habitat in Spencer Creek as well as continued multiple use.

The Bad – There have been occasional problems with habitat destruction in the wetland areas of Spencer Creek, including an incident from Memorial Day weekend, 1996.

On the night of March 23 and into the next day March 24, 2007 a group of young people had a party on Spencer Creek. The party was conducted approximately in the middle of the redband trout spawning area located on Spencer Creek, near the peak of the spawning period. During the course of the party one individual ran his purpose built 4-wheel drive pickup up and down a section of Spencer Creek causing a great deal of damage. He became stuck, two additional persons attempted to remove the stuck vehicle, causing additional damage to the creek and resulting in an additional vehicle being stuck in the creek. A criminal investigation was conducted which resulted in numerous criminal charges.

The Ugly – Surveys were conducted using two ODFW observers immediately below the area and immediately above the area to determine the average numbers of redband trout redds per mile and the impact to the wild redband trout spawning in the effected reach.

This presentation will highlight the efforts of habitat restoration and the challenges and cooperation of Oregon Department of Fish & Wildlife and Oregon State Police in protection of the habitat.

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Title

Klickitat Fisheries: Facility Transition and Hatchery Reform Efforts

Abstract

In recent years, scientific inquiry has lead to new thinking about how and why to engage in artificial production. New approaches view artificial production programs as means to better integrate the benefits of technology and nature rather than as ends that merely result in the replacement of natural fish with artificially produced fish. Over the past 50 years, wild and artificially produced spring Chinook (Oncorynchus tshawytcha), fall Chinook (O .tshwytcha), coho (O. kisutch), and steelhead (O. mykiss) in the Klickitat Basin have been managed primarily to provide fishing opportunities in an effort to fulfill treaty trust responsibilities and mitigate for the loss of fisheries in the Columbia Basin above Bonneville Dam due to construction of the Columbia River hydroelectric dams. As part of this effort, the Klickitat Hatchery, Lyle Falls and Castile Falls Fishways were constructed between 1949 and 1963. In 2006, the Yakama Nation and the Washington Department of Fish and Wildlife executed an unprecedented agreement to transition management of the federally funded Mitchell Act Klickitat Hatchery and Fishways to the Yakama Nation's Yakima/Klickitat Fisheries Project (YKFP). This presentation will summarize Yakama Nation efforts to update artificial production programs in the Klickitat Basin to make them consistent with “hatchery reforms” long advocated by the Columbia River Tribes and now widely promoted by regional scientists and policy makers alike.

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Title

Evaluation of methods to estimate salmon escapements in the Lower Columbia River ESU

Abstract

Weirs and mark-recapture study designs are generally believed to provide the most reliable estimates of salmon spawning escapement and are often adopted when precise and accurate information is needed on adult abundance. Since these methods are expensive compared to other monitoring methods, the implementation of weir and mark-recapture methods for all salmon populations in Washington is currently cost prohibitive. Typically, salmon escapements in the Lower Columbia River ESU were estimated from a peak count expansion factor develop in a single year for selected populations from historic studies, and applied to the selected and similar populations to estimate total escapement from the 1960's through the 1990's. After the listing of salmon populations under the Endangered Species Act in the Lower Columbia River ESU in the late 1990's, the Washington Department of Fish and Wildlife implemented a study to evaluate spawning ground survey methods including count expansion, Area-Under-the-Curve, and redd surveys to estimate total escapement because of concerns about the assumptions in and application of previous expansion factors and resulting escapement estimates. We will present preliminary results from this monitoring effort.

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Title

PTAGIS: more than juvenile survival and travel time

Abstract

The primary purpose of PIT tagging in the Columbia River basin has been to assess the operational impacts of the hydro-system on juvenile salmonids using survival estimates obtained from the Cormack-Jolly-Seber model and the analysis of travel time. However, with increased tagging of juvenile salmonids in the tributaries and mainstem of the Columbia River, there are many other potential uses of this data. We have chosen three topics to illustrate the potential of using PIT tags for other analyses. These areas include: 1) the use of PIT tag interrogation systems at Bonneville Dam to classify the summer and winter races of Wind River steelhead, 2) the use of PIT tags to estimate tributary smolt yield, and 3) the use of PIT tags to estimate the abundance and timing of different adult steelhead populations at Bonneville Dam. We will be presenting the results of our preliminary analyses.

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Title

Square One: Modeling the Ceratomyxa shasta Cycle in the Klamath River System

Abstract

The Klamath River salmon fishery was once the third largest in the Pacific Northwest. Data collected over the past decade in the Klamath River (KR) indicates severe infections by the myxozoan parasite Ceratomyxa shasta in out-migrating salmon. At high densities C. shasta causes ceratomyxosis, which can be lethal to juvenile salmonids. This increase in parasite induced mortality may be, in part, responsible for the declining numbers of returning adult salmon. In order to complete its life cycle, Ceratomyxa shasta requires not only a salmonid host, but also an invertebrate host, the freshwater polychaete Manyunkia speciosa. We have developed a mathematical model that identifies the basic interaction parameters for C. shasta and its two hosts. The purpose of this model is to develop an equation that defines the basic reproductive number of the ceratomyxosis disease cycle. From the basic reproductive number equation we will be able to estimate the key parameters that may be bottlenecks in the transmission cycle. We will conduct two field studies and one laboratory experiment to obtain estimates for some of the parameters in the model. In the field we will expose caged sentinel fish and measure flow to provide estimates of the transmission rate of C. shasta and the infectious dose juvenile salmon are exposed to in the river. In the lab, we will infect the polychaete with known numbers of myxospores to provide estimates of numbers of actinospores produced. Estimates of other parameters will come from the collaborative efforts with other research groups. Once we have confident estimates of the parameters, further research and management strategies can be attempted to disrupt the disease cycle.

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Title

Reflection on and Future Directions for Stream Restoration

Abstract

Restoration of stream habitat for Pacific salmon in the PNW has been a key component of conservation and recovery plans for many years. The fast majority of efforts focused on improving in-channel conditions and results were mixed. Generally, those that were deemed successful demonstrated statistically significant changes in numbers of juveniles or smolts. These correctly identified the factor limiting production and were intensive in scope and distribution. Unfortunately, little is known about failures because of the reluctance or inability to publish results, which makes it difficult to asses the collective effectiveness of restoration efforts. A comprehensive review of successful and unsuccessful efforts could improve the potential of future projects. Tracking and marking technologies, such as PIT tags, provide the ability to evaluate changes in adult numbers, which is probably the best indicator of a project's effectiveness. Changes in size as well as the number of fish should be considered in future evaluations. Additional challenges and opportunities for future of habitat restoration include an examination of the use of pre-determined standards (e.g., no. of pieces of wood/length of stream) to set restoration goals, and a focus on restoring ecological processes that create and maintain habitat. The latter is part of our changing understanding of aquatic ecosystems as being dynamic rather than as being in a relatively steady state. This will require identification of the processes, where they occur on the landscape, viewing the landscape as heterogeneous rather than homogeneous, and a long term perspective on the effectiveness of restoration efforts. A clear lesson from all these efforts is that the success of habitat restoration is problematic at best and that restoration is not a substitute for the protection of habitat and the ecological processes that create and maintain it.

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Title

Considerations for Large Scale Monitoring Programs and the Illusion of Failure

Abstract

Increasingly, monitoring programs attempt to evaluate changes in the condition of aquatic ecosystems over large spatial scales. However, most programs do not: (1) rigorously address temporal and spatial variability, since variability is not front and center in the physical and biological sciences dealing with aquatic ecosystems; and (2) recognize that each spatial scale has unique behaviors and properties. The tendency is to assume that there should be no or little variation in conditions at small spatial scales and, either explicitly or implicitly, that we can aggregate our expectations from small to large scales. This leads to the expectation that most, if not all, ecosystems should be favorable to aquatic organisms at any given time. The emerging view of aquatic ecosystems as dynamic rather than static through time and the properties of hierarchy theory challenge this perspective. Thus, an understanding of the unique behavior and properties of large scales and an appropriate reference for comparison is required for large scale monitoring efforts. We will need to use models to establish appropriate reference conditions for the area of interest because of the lack of large areas that have not been altered by human activity. Additionally, the focus on ecosystems requires consideration of the aggregate of attributes rather than consideration of them individually. Tools such as Decision Support Models and Bayesian Belief Networks provide means for assessing the aggregate of attributes to determine the ecosystem condition. Large scale monitoring programs need to consider changes in the distribution of ecosystem condition rather than changes in the means of individual attributes. The failure to recognize the unique behavior and properties of large scales, appropriately evaluate ecosystem condition, and to establish proper reference conditions will contribute to the “illusion of failure” of many restoration and conservation efforts.

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Title

Piscicide Alternatives: Mechanical Removal Yields Success in Managing Invasive Cyprinids in a Southern Oregon Trout Lake

Abstract

Over one million exotic tui chubs (Gila bicolor) and fathead minnow (Pimephales promelas) had drastically reduced the quality of the Fish Lake recreational rainbow trout (Oncorhynchus mykiss) fishery. Growth in stocked rainbow trout has been extremely low, as the invasive fishes had essentially depleted most of the available invertebrates in the lake. Tui chubs have also been associated with degraded water quality including blooms of the potentially toxigenic cyanobacteria (Anabaena flos-aquae). Fishing effort has been low and catch rates for stocked trout were also generally low. Based on case studies elsewhere in Oregon, removal of tui chubs would likely improve the trout fishery and water quality in Fish Lake. However, five prior attempts between 1951 and 1985 to completely eradicate tui chubs in Fish Lake with piscicides (rotenone and antimycin) have failed, and a new approach to invasive species management was needed. We developed a pilot project that used Oneida-trap nets, unbaited hoopnets, and a commercial gillnetter to reduce invasive fish biomass in summer 2007. Results from the pilot project far surpassed initial expectations. Total removal approached 400,000 fish (12.5 tons), or about 40% of the entire estimated chub biomass. Gillnets had higher catch per effort but trapnets had lower cost per catch. Trout bycatch was extremely low throughout the project and the lake experienced higher water quality than in recent years, coincident with chub removal. Future management of Fish Lake aims to continue the mechanical removal of invasive fishes and modify the stocking program to other potentially piscivorous trout species. Key elements to the success of this project were dedicated volunteers and student interns, strong public support and outreach, intensive interagency coordination and cooperation, and knowledge from previous studies that revealed chub distribution patterns. Not to mention persistence, hard work, and a wee bit of luck!

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Title
Peculiar Catfishes in the Modoc Triangle

Abstract
The presence of blind bullhead catfishes (Ameiurus) in Dog Lake, Oregon (Goose Lake Basin) was first recognized in the 1960's, where they represented a significant portion of the population (Weizel and McLaury 1964). These specimens were identified as the non-native Brown Bullhead (Ameiurus nebulosus), first introduced into California in 1874 and since widely dispersed about the West (Dill and Cordone 1997). Subsequent collections have encountered six additional populations containing large percentages of the blind phenotype, all in the Goose, Klamath and upper Pit River basins ("Modoc Triangle"). These specimens exhibit coloration that is distinct from sympatric phenotypic Brown Bullheads. No native bullheads are known from west of the Rockies. However, the Pliocene Lake Idaho fish fauna and other localities with similar fishes in the west did contain a (Ameiurus spp.). Furthermore, available vocabularies from pre-1900 tribes in the region record the existence of words for "bullhead", although it is not fully clear whether this applies to sculpin (Cottus spp.) or to a catfish. However, native myths include a "bullhead" character with behaviors that suggest a catfish. The ongoing investigation of the puzzling identity and origin of this blind phenotype is part of a broad project including exploration of paleontological, ethnographic, osteological, biogeographic, historical and genetic lines of evidence, as well as continuing field explorations.

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Title

Successful management of non-native fishes in a stream containing the endangered Modoc Sucker

Abstract

The Modoc Sucker (Catostomus microps) occupies small streams in the upper Pit River drainage of northern California and southern Oregon (Goose Lake Basin). Due to its small size (generally less than 18 cm SL) and restricted habitat, non-native predatory fishes pose a potential threat to localized populations. Populations occupying the Turner Creek drainage have maintained themselves for decades in sympatry with introduced populations of Green Sunfish (Lepomis cyanellus) and Brown Bullheads (Ameiurus nebulosus). Ecological interactions between the resident native fishes and these non-native species are poorly understood. However, Largemouth Bass, an extremely piscivorous species that recently entered the system, actively feeds on all size classes of Modoc Sucker, and even a single individual generally eliminates all native fishes from occupied pools. In May of 2005 heavy rains caused extensive reservoir overflow and sheet flow across the Devil's Garden Plateau, which drains down into the otherwise isolated streams, and a surge of non-native fishes entered the Turner Creek drainage from above. The principal species in this event were Largemouth Bass (Micropterus salmoides), Green Sunfish (Lepomis cyanellus), and Bluegill (Lepomis macrochirus). Survey and manual removal of centrarchids was initiated in June 2005. All Largemouth Bass and Bluegill had been removed by Fall 2007, and Green Sunfish have been substantially suppressed. Monitoring of the system is continuing in 2008. This management program provides an opportunity to evaluate the effectiveness of manual, targeted removal of non-native fishes in a small stream system without adverse impacts to the native fish fauna.

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Title

The ecological role played by lampreys in western North America - a question.

Abstract

Western North America is home to a diverse lamprey fauna ranging from Mexico to Alaska. Although the anadromous Pacific Lamprey is widely distributed, many taxa are narrowly endemic. Some systems contain as many as six species. Systematic diversity in western lampreys suggests that they may express similar ecological diversity, and a general review shows this to be true. Life history strategies include large anadromous species, freshwater predatory species and brook lampreys, which never feed as adults. Occupied habitats include oceanic feeding grounds, large rivers, headwater streams and mountain lakes. Adult sizes range from 80 to 600 cm. Yet, at a time when many people are just beginning to recognize that lampreys form an integral part of the western fish fauna and populations of the Pacific Lamprey have substantially declined, we have little understanding of the intrinsic role they play in aquatic ecosystems. While the basic life cycle of lampreys, including the two very distinct phases (ammocoetes and adults), is relatively well understood, the specific ecological roles of the various western lampreys are virtually unknown. Current research is naturally focused on direct conservation management - systematics, abundance, distribution, migratory behavior and susceptibility to habitat modification; but what is the role of ammocoetes as consumers and sequesterers of primary production in stream systems; are they selective and are they strictly filterers; do they interact with other filter-feeders (e.g. mussels); what role do they play in bioturbation; who are their predators? What is the impact of predatory adults on their prey populations; has it shifted with changes in prey populations; what role do lampreys themselves play as prey. What is the role of lamprey carcasses in local nutrient cycling and importation of marine nutrients into freshwater systems? What are the ecological differences between sympatric taxa? What would the world look like without lampreys?

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Title

Evaluating US Forest Service contribution to sustainability of aquatic and riparian species.

Abstract

National Forests under the 2005 Planning Rule are required to assess the contribution of National Forest System lands to the sustainability of ecosystems and species. We created decision-support models to formalize our assessment procedures and assumptions about the factors that contribute to healthy, sustainable aquatic species populations and their habitat in the Pacific Northwest Region. We evaluated the condition of habitat and local populations of focal species at a 6th-field hydrologic unit or subwatershed scale. The habitat evaluation is based on road density, channel constriction, and upslope and riparian vegetation, which serve as surrogates for habitat condition. Species population condition was evaluated using data on population status, distribution, habitat and genetic connectivity, and impact of non-native species. These results were aggregated to produce a sustainability outcome for each focal species at the subbasin (4th-field) scale. To determine Forest Service contribution to focal species ecological sustainability, we combined the 6th-field habitat condition results with percentage of occupied spawning and rearing habitat on National Forest System land and an estimate of the amount of protection provided to habitat by Forest Service land management plans. In addition, we describe how the model results can be used to help guide management strategies, such as delineating key watersheds that are conservation or restoration priorities.

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Title

Taxonomy and Systematic Relationships of Tui Chubs (Siphateles: Cyprinidae) of Oregon's Great Basin based on early life history characters

Abstract

Siphateles is one of the most widely distributed minnows in western North America with three recognized species: S. alvordensis, Alvord chub; S. boraxobius, Borax chub; and S. bicolor, the highly variable tui chub which includes several threatened or sensitive forms. A cytochrome b phylogeny supports this basic taxonomy but suggests two major clades in the S. bicolor complex: S. bicolor, primarily in Oregon and Washington and S. obesa, primarily in Nevada and Northern California. Curiously, there appear to be disjunct S. obesa in Oregon’s Summer Lake and Abert Basins. Although adult morphology is variable, previous workers have had difficulty deciphering the patterns. Here, we use early life characters, such as pigmentation, morphology, osteology, and developmental timing as taxonomic characters to corroborate the genetic phylogeny and provide a means to further understand the ecological interactions when sympatry occurs. For example, the occurrence of S. obesa in Oregon could be due to a recent human introduction or an ancient zoogeographic event and involve hybridization or ecological segregation. Because of their rarity and isolation, legal protection might be justified under one scenario but not the other.

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Title

A Data Management Approach to Support Aquatic Resources Monitoring

Abstract

The Integrated Status and Effectiveness Monitoring Program (ISEMP) is piloting a data management system to support status and trend monitoring programs in the Columbia River Basin. The system includes tools to support data processing, storage, analysis, reporting, and distribution to meet crucial data management needs of managers and analysts. These needs include: (a) compilation of data across geographic and organizational boundaries, (b) summarizing how, when, and where monitoring data was collected, (c) supporting a range of analytical methods to assess the status and trends of fish populations, habitat condition and the effect of restoration actions, and (d) the ability to adapt to future requirements. We have developed data management tools to support the workflow process from data collection to long term storage and analysis. Tools include: Protocol Manager, a database that documents data collection protocols and methods; the Aquatic Resources Schema that provides standardized data structures for water quality, fish abundance, and stream habitat data; the Automated Template Modules, data entry templates that are designed to ensure data integrity and compliance with data collection protocols; and, the STEM Databank, a central data repository designed as a flexible container for long-term storage, analysis and web-based distribution. We are currently piloting these tools with state, federal, and tribal agencies in the Wenatchee basin.

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Title

The use of snorkel surveys to assess the effectiveness of minimum instream flows for steelhead habitat

Abstract

We conducted snorkel surveys at an irrigation diversion on the Toppenish Creek watershed on the Yakama Indian Reservation. We snorkeled upstream and downstream from an irrigation diversion structures to assess the impacts of the diversion on the density of steelhead juveniles and to evaluate snorkel surveys as a method for monitoring minimum instream flow effectiveness. Surveys were conducted once a month by three person survey crews between June and October at three sites. One site was located above and below the diversion berm and a third was situated about on kilometer downstream. We surveyed these sites in 2005, 2006, and 2007. Wading discharge measurements were collected weekly at each site.

Minimum summer instream flows set by YN water code below the lateral diversion differed each year (2005 - 10cfs; 2006 – 12 cfs; 2007 – approximately 17 cfs). We found no difference in age 0 juvenile steelhead densities between the upstream and downstream sites in 2005 (t=-0.9521; p=0.369), 2006 (t=-1.685; p=0130), or 2007 (t=0.945; p=0.373). The difference in discharge upstream and downstream of the diversion may not have been enough to affect the densities of age 0 steelhead. Results may have also been influenced by an “accumulation effect” where age 0 steelhead drift downstream and collect downstream of diversion structures (which are impassible to small fry). We also observed increasing numbers of age 1 + juveniles (smolt size) from August through October indicating that gradual downstream pre-outmigration may occur during this time of year. Overall snorkel survey techniques have limited value in assessing effectiveness of prescribed instream flows.

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Title
Predictions for an invaded world: A strategy to predict the distribution of native and nonindigenous species at multiple scales

Abstract
Predictions for an invaded world: A strategy to predict the distribution of native and nonindigenous species at multiple scales.

Deborah Reusser1 and Henry Lee II2

Abstract
Habitat models can be used to predict the distributions of marine and estuarine nonindigenous species (NIS) over several spatial scales. At the estuary scale, our goal is to predict which estuaries are most likely to be invaded. At the habitat scale, the goal is to predict which specific locations within an estuary are most vulnerable to invasion. As an initial step in evaluating several habitat models, we are comparing model performance for a suite of benthic species with reasonably well known distributions on the Pacific Coast of the United States. Here we discuss the utility of non-parametric multiplicative regression (NPMR) for predicting habitat- and estuary-scale distributions of native and nonindigenous species. NPMR incorporates interactions among variables, allows qualitative and categorical variables, and utilizes absence as well as presence data. Preliminary results indicate that NPMR generally performs well at both spatial scales and that distributions of nonindigenous species are predicted as well as those of native species. For most species latitude was the single best predictor, though similar model performance could be obtained at both spatial scales with combinations of other habitat variables. Errors of commission were more frequent at the habitat scale, with omission and commission errors approximately equal at the estuary scale.

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Title

Pre-spawn mortality of Oncorhynchus kisutch in seven streams of Whatcom County, Washington

Abstract

Pre-spawn mortality (PSM) of coho salmon was first recognized in urban streams in the Seattle, Washington area in the late 1990's. Since then, PSM has been documented by NOAA Fisheries Science Center researchers, Wild Fish Conservancy surveyors, and others around western Washington. This study, conducted in Fall, 2007, focused on the occurrence of pre-spawn mortality of coho salmon in seven streams of Whatcom County, Washington. The goal was add to the growing body of information regarding spatial and temporal distribution of this phenomenon. Additionally, temperature, precipitation and land-use were recorded as environmental factors that may relate to the occurrence of PSM.

The seven streams in this study were dominated by either urban or agricultural watersheds. Hourly temperature was monitored at one location in each stream. Watershed land-use data were compiled in GIS to determine landscape characteristics. Precipitation data were collected to relate PSM occurrence to rainfall and associated effects such as runoff and discharge peaks. One hundred-seventy carcasses were collected during spawner surveys of the streams, and each carcass was examined for spawn success by field dissection. A gonadosomatic index was calculated for female carcasses, while a visual estimation of milt remaining was recorded for male carcasses. In addition to PSM data, length and weight data were collected on all carcasses, leading to the development of reach specific condition factor analysis. Five percent of the females exhibited pre-spawn mortality, and 4% of males were estimated to have at least 50% of milt remaining. Pre-spawn mortality in theses watersheds surveyed appears to be lower than has been documented in urbanized streams. However, the percentage of fish exhibiting reduced reproductive success due to PSM is high enough to impact depressed populations of coho salmon in Whatcom County.

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Title

Quantifying the Magnitude of Smolt Mortality from Avian Predators in the Columbia Basin: It's Not One of the 4-H's; What's the Big Deal?

Abstract

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Title

Quantifying the Magnitude of Smolt Mortality from Avian Predators in the Columbia Basin: It's Not One of the 4-H's, What's the Big Deal?

Abstract

East Sand Island at the mouth of the Columbia River supports the largest breeding colonies of Caspian terns (Hydroprogne caspia) and double-crested cormorants (Phalacrocorax auritus) in the world; neither of these colonies of native piscivorous waterbirds existed on this island 25 years ago. Thirteen of 20 Evolutionarily Significant Units of anadromous salmonids (Oncorhynchus spp.) from the Columbia Basin are threatened/endangered under the Endangered Species Act, due primarily to over-harvest, degraded habitat, hydropower dams, and hatcheries. Nevertheless, fisheries managers view avian predation as an impediment to restoring threatened salmonids because losses of juvenile salmonids to avian predators in the estuary were about 6.8 to 15.6 million/year during 2003-2006, representing ca. 5-15% of all out-migrating salmonids that survive to the ocean. In addition, smaller colonies of Caspian terns and double-crested cormorants near the confluence of the Snake and Columbia rivers, consume nearly 1 million smolts annually. Management of avian predation is a mitigation component of the action agencies' recovery plan for listed salmonids of the Columbia River basin. The federal agencies have recently initiated implementation of a controversial management plan for the Caspian tern colony on East Sand Island, which seeks to create tern nesting habitat at 6 sites outside the Basin, followed by a reduction in tern nesting habitat on East Sand Island to reduce colony size in half. Fisheries managers are also assessing the need and feasibility of managing the smaller Caspian tern colony on the mid-Columbia River. Attention is now shifting to the cormorant colony on East Sand Island and its impact on smolt survival in the estuary, which now exceeds that of Caspian terns. Studies are planned to assess the impact of cormorant predation on salmonid recovery and the feasibility of managing the size of the cormorant colony.

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Title

New directions for broad-scale monitoring: distribution monitoring and landscape models.

Abstract

As our understanding and study of fish populations have become more refined, there has been an increasing emphasis on the importance of the spatial aspects of populations. It is no longer adequate to simply estimate the population size of a species for a state or region; we are moving forward to ask questions on the scale of individual basins, and beyond that to ask questions regarding the distribution of populations within a basin. The advent of easily accessible Geographic Information Systems (GIS) has facilitated both the design of sampling regimes that will allow us to ask these questions, and the development of tools that allow us to relate the distribution of fish to landscape features such as geology or land use. The Oregon Department of Fish and Wildlife has implemented a spatially balanced integrated monitoring design for coho salmon in the Oregon Coastal ESU since 1998. We are now exploring this rich dataset using spatial analysis tools and landscape layers to create models of fish production based on landscape characteristics. We are also working to develop tools to quantify the distribution fish within their range.

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Title

Salmon Life Histories, Habitat, and Food Webs in the Columbia River Estuary

Abstract

From 2002 through present we have investigated juvenile Chinook salmon life histories, habitat associations, and food webs in the lower Columbia River. At shallow water beach seine sites in the main-stem river, subyearling Chinook salmon occur during all months of the year, increase in abundance from January through late spring and decline rapidly after July. Recently emerged fry disperse throughout the estuary in early spring, and fry migrants are abundant in the estuary until April or May each year. Chum salmon migrate rapidly through the system as fry and are absent after May. Annually, mean sizes of salmon increase from the tidal freshwater zone to the estuary mouth, which likely reflects both growth during residency and continued entry of smaller individuals from upriver. In wetland habitats in the tidal freshwater zone (emergent, forested, and scrub-shrub sites), subyearling Chinook salmon are abundant from March through July, when water temperature remain below about 19 oC. Wetland habitats are used primarily by small subyearling Chinook salmon < 90 mm. Genetic analysis demonstrates that subyearling Chinook salmon found in main-stem and wetland habitats originate from both upper and lower Columbia Basin ESUs, including less abundant groups such as Interior Summer/Fall Chinook. Juvenile Chinook salmon in the main-stem river feed primarily on adult insects and epibenthic amphipods. Estimated growth rates from otolith analysis average 0.5 mm/day. In the wetland sites, insects are the primary prey for juvenile salmonids, with mark-recapture studies yielding growth rates of 0.67 mm/day. Otolith, mark-recapture, and stable isotope results confirm that subyearling Chinook salmon from all Columbia River ESUs reside in the estuary for extended periods, utilize a diversity of habitat types, and interact with wetland food webs for periods of weeks to months. These results suggest populations throughout the basin will benefit from estuarine habitat restoration.

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Title

Grand Canyon salmonid monitoring; a case study in sampling design.

Abstract

The Colorado River from Lake Powell to Lake Mead through Glen and Grand Canyons has been sampled extensively since the late 1980's. Glen Canyon, the 16-mile tailwater of Glen Canyon Dam, has been managed primarily as a blue ribbon rainbow trout (Oncorhynchus mykiss) sport fishery. Both fixed and random sights have been utilized in this recreational fishery for the past six years. Random sights are stratified by habitat and sampled in the proportion in which they are available in this reach. Recent power analysis suggests that fixed sights provide limited additional information. The remaining 270 miles of the Colorado River upstream of Lake Mead are managed primarily for native fish including the endangered humpback chub (Gila cypha). Resident non-native rainbow and brown trout (Salmo trutta) persist throughout this portion of the river. The native fish management reach of the Colorado River has been stratified by 11 geomorphic reaches and is randomly sampled within these reaches. Power analysis was utilized to determine the number of samples necessary within each reach to adequately monitor changes in catch indices for both rainbow and brown trout. Although the native fish management reach was not stratified by habitat, sample efforts are similar to those in Glen Canyon because habitats are sampled in the proportion in which they are available and accessible.

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Title
Optimizing control methods for an invasive crayfish

Abstract
The northern or virile crayfish (Orconectes virilis) has been introduced throughout the southwestern United States. These introductions have negatively impacted a variety of native species, including fish, amphibians, snakes, snails, and vegetation. Additionally, due to their burrowing activities (as well as vegetation removal) erosion, siltation, and suspended sediments have increased. Control methods have been attempted in the past with little thought to the efficiency and effectiveness of particular methods. A popular control method involves trapping; however, effectiveness varies due to crayfish activity and temporal susceptibility to traps. We are investigating the life history of four introduced populations of O. virilis within Arizona streams using mark-recapture methods. Results of these investigations will be used to construct population models with the goal of determining the most effective and efficient means of crayfish control or eradication. Preliminary results (May-Dec) reveal survival, and capture probability varies by site and season. Depending on the site these parameters can also vary by sex. Control methods must be tailored to a particular time of year and technique to be effective at controlling or eradicating crayfish populations. The probability of capture appears to be highest in late summer and fall. Both male and female crayfish are more active at this time of year (mating season) and abundance is low compared to the previous months. Future work will investigate the feasibility of control by concentrating trapping activities in certain seasons or areas.

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Title

Estimating salmon and steelhead response to watershed restoration: How much restoration is enough?

Abstract

A critical need for recovering listed salmon populations is an estimate of potential increases in salmon production from different restoration actions. Using data from existing evaluations of habitat restoration techniques, we estimated the average and standard error of coho and steelhead parr and smolt production for wood placement, boulder placement, constructed logjams, constructed side channels, reconnected floodplain habitats, and culvert removal. We then developed three hypothetical restoration strategies using different combinations of techniques and applied these to small, medium and large watersheds to predict the increases in parr and smolts for each strategy. Wood and boulder placement increased coho parr densities by an average of 0.59 to 3.19 fish/m of stream and coho smolt densities by 0.21 to 0.53 fish/m. These same actions increased steelhead parr by -0.05 to 0.30 fish/m, and steelhead smolts by 0.04 to 0.10 fish/m. Constructed side channels and reconnection off-channel areas increased coho and smolts by 0.32 and 0.45 fish/m and steelhead 0.32/m. When these numbers were combined with different restoration scenarios, total fish production varied by watershed size and restoration type with most of the increases in parr and smolt production from the small and medium watersheds coming from constructed groundwater channels and wood placement. In contrast, in the large watershed most of the increase came from floodplain restoration (reconnection) for coho and from groundwater channels and constructed logjams for steelhead. The total percentage of a watershed that needed to be restored to detect a 25% change in steelhead or coho salmon smolts ranged from 9% to 56% depending upon species and watershed restoration scenario. These results demonstrate that a considerable amount of habitat restoration is needed within any one watershed to increase fish numbers to a level suitable for salmon recovery or to be detected by monitoring.

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Title

Response of larval lamprey and other benthic fishes to restoration of small western Washington and Oregon streams

Abstract

The placement of large woody debris (LWD) is a common habitat restoration method in North American streams and several studies have documented positive responses of salmonid fishes to this practice. In contrast, little information exists on the effects of LWD placement on nonsalmonid fishes and amphibians. In this study, I examined the responses juvenile lampreys Entosphenus tridentatus and Lampetra spp., reticulate sculpins Cottus perplexus, torrent sculpins C. rhotheus, of giant salamanders Dicamptodon spp. to artificially placed LWD by sampling 29 small streams with paired treatment and control reaches. Densities and mean lengths of giant salamanders, and reticulate and torrent sculpins were not significantly different between treatment and controls reaches. Lamprey densities were significantly higher in treatment reaches than control reaches in Oregon streams, but not those located in Washington. Response of lampreys to restoration was positively correlated with increase in LWD. Lamprey length was also positively correlated with differences in percentage of pool area. Lamprey were found in highest densities in backwater pools and rarely found in fast water habitats. The strong preference of larval lamprey for pool and other slow water habitats, suggest that loss of floodplain and pool habitat throughout the Pacific Northwest due to human activities has likely not only contributed to the decline of salmonids, but also to larval lamprey. Moreover, placement of LWD appears to be successful strategy to improve habitat for larval lampreys and fishes that require pools and other slow water habitats.

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Title
Understanding and using large scale stream habitat data

Abstract
Unlike stream biota data which can be summarized in a limited number of ways (presence/ absence, abundance, density), information on stream habitat has been collected and summarized in an almost infinite number of ways. While there is little argument about the need to understand the relationship among landscape characteristics, hillslope processes and stream conditions, there is still much to be learned about how choices made in measuring stream characteristics affects this understanding.

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Title

Treating stream restoration as a research opportunity to understand drivers of fish production

Abstract

Ecosystem-scale habitat manipulations are rare in ecology, and in freshwater they have largely focused on manipulation of nutrients or predators in lake ecosystems. Ecosystem manipulations in running waters have been even rarer, until the recent advent of large-scale habitat restoration in rivers and streams which have seen billions of dollars directed to stream restoration in the Pacific Northwest. Large-scale restoration projects represent a unique opportunity for scientists and managers to understand the drivers of production in streams and rivers, and for adaptively managing and refining restoration techniques. Restoration projects can be designed to answer fundamental and applied questions of interest to habitat managers and research scientists without necessarily compromising the fundamental goal of effectively restoring stream habitat. I consider approaches for designing restoration projects as research opportunities to understand habitat effects on fish growth, production, ecology, and adaptive life history traits through 1) designing restoration projects with contrasting habitat treatments, 2) adaptively staging treatments in time so as to maximize habitat production while allowing assessment of restoration effects, and 3) designing restoration projects as semi-permanent research sites for long-term monitoring and study of habitat-productivity relationships. Capitalizing on these opportunities will require greater collaboration between research scientists, managers, and restoration practitioners at the proposal and design stage.

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Title

Population Characteristics of Jenny Creek Suckers (Catostomus rimiculus): Age-Size Relationships, Age Distribution, Apparent Densities, and Management Implications

Abstract

Jenny Creek suckers (Catostomus rimiculus) are an isolated population of Klamath smallscale suckers, separated from the Klamath River by a large, natural waterfall. We compared growth rates between the Jenny Creek and Klamath River populations, ageing fish by counting opercle annuli. The growth rate of the Klamath River fish was slightly but significantly higher ($p<0.05$) than that of the Jenny Creek fish during the first year of growth. By age five, the growth rate of the Klamath fish was over three times faster than the Jenny Creek fish ($p<0.001$). Same-sized individuals of different ages indicated that growth rates varied for individuals within each population. Regardless, our length-age regressions for each population were strong ($R2 = 0.8687$ for Klamath and 0.8061 for Jenny Creek, respectively). The oldest Klamath fish was aged at 17 years (391 mm SL). The largest Jenny Creek fish (141 mm SL) was aged at 5 years; however, fish > 141 mm SL were not sampled. We then took our age-length regression and applied it to four summers of snorkeling population data for the Jenny Creek sucker. Larval recruitment was strong in three of the four sample years. Other population data were troubling: unlike 1992 and 1993, the 2003 and 2004 surveys found almost no adult Jenny Creek suckers. Our data do not explain why this pattern is present. Adult mortality, movement into non-sampled areas, or migration out of the system may all be causes. An isolated population like the Jenny Creek sucker depends entirely on larval recruitment to sustain densities. There is some potential that the Jenny Creek sucker population could suffer setbacks without thoughtful management of Jenny Creek watershed.

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Title

Growth and Survival of Salmon in Response to Competition and Climate Change: Implications for Interactions of Wild and Hatchery Salmon

Abstract

Many salmon hatcheries throughout the Pacific Rim were built, in part, on the premise that the ocean provided an unlimited capacity to support hatchery and wild salmon. However, a number of studies have documented density-dependent growth of salmon in the ocean during early and late marine stages in response to competition within and between species. Questions have arisen as to whether competition and reduced growth at sea translate to lower survival of salmon and whether changes in ocean regimes can alter this relationship. Few studies have tested these questions, in part, because the capacity of the ocean to support salmon is dynamic and because experimental controls are difficult to achieve. We review evidence from our recent studies that incorporate the natural experimental control offered by alternating-year abundances of pink salmon. These studies indicate competition at sea can lead to reduced salmon growth and survival and to potentially lower reproductive potential of survivors. Recent studies also show that climate change may affect prey availability and may therefore influence the significance of competition. We present new information linking salmon growth in freshwater to their growth during early marine life. We conclude that growth of salmon is key to their survival and that competition at sea is an important mechanism of survival that must be considered when evaluating large scale hatchery production in relation to wild salmon survival, especially during periods of unfavorable ocean conditions.

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Title

SOUTHCENTRAL ALASKA INVASIVE NORTHERN PIKE (ESOX LUCIUS) INVESTIGSATIONS AND DIFFERING MANAGEMENT SENERIOS.

Abstract

Northern Pike (Esox lucius) are non-indigenous to the Susitna drainage and were thought to have been established through a series of illegal introductions in the early 1950's. The Susitna drainage is a large river basin encompassing tens of thousands of square miles and is roughly the area of the state of Indiana. This system is comprised of hundreds of shallow lakes, clear water tributaries, and sloughs. To date northern pike have expanded throughout most of this drainage system. Though indigenous populations of northern pike coexist with native salmonid populations in other Alaskan watersheds this may not be the case in the Susitna Drainage. This project was initiated in 1994 to study select Susitna Drainage northern pike populations and to document the effects of northern pike expansion on existing native salmonid populations. The preliminary results of this study along with differing management scenarios are presented.

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Title

Southcentral Alaska Invasive Northern Pike Investigations and Differing Management Scenarios

Abstract

Northern pike (Esox Lucius) are non-indigenous to the Susitna drainage and were thought to have been established through a series of illegal introductions in the early 1950's. The Susitna drainage is a large river basin encompassing tens of thousands of square miles and is roughly the area of the state of Indiana. This system is comprised of hundreds of shallow lakes, clear water tributaries, and sloughs. To date northern pike have expanded throughout most of this drainage system. Though indigenous populations of northern pike coexist with native salmonid populations in other Alaskan watersheds this may not be the case in the Susitna Drainage. This project was initiated in 1994 to study select Susitna Drainage northern pike populations and to document the effects of northern pike expansion on existing native salmonid populations. The preliminary results of this study along with differing management scenarios are presented.

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Title

Western Regional Panel: Coordinating ANS issues in the West

Abstract

The Western Regional Panel (WRP) on Aquatic Nuisance Species was formed in 1997 to help limit the introduction, spread and impacts of aquatic nuisance species into the Western Region of North America. This panel of public and private entities was formed by a provision in the National Invasive Species Act of 1996. The spread of nonindigenous aquatic species is causing significant economic and ecological problems throughout North America. Invasive, non-native species are one of the leading threats to the ecological integrity of forests, grasslands, and waterways. Recognizing the threat to western aquatic ecosystems and water delivery systems caused by nuisance exotics has raised concerns with representatives from State, Provincial, and Federal agencies as well as Private water interests. The WRP encompasses an extensive geographic range, all states and provinces west of the l00th Meridian as well as Guam, Hawaii and Alaska. The goal of the WRP is to protect limited western aquatic resources by preventing the introduction and spread of exotic nuisance species into western marine and freshwater systems though the coordinated management and research activities of state, tribal, federal, commercial, environmental, research entities and other regional panels. The WRP was formed to promote a cooperative regional response to the threat of aquatic invasive species, especially among member states. States have broad authorities and resources that are critically needed to combat invasive species. Aquatic invasive species impact states economically and environmentally. The WRP is attempting to assist our member states by recommending actions that will reduce the risk of aquatic invasive species for each state and our region as a whole. The WRP encourages our member states to implement actions to reduce the risk from aquatic invasive species for our region.

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Title

Development of an Integrated Monitoring Program to Detect the Status and Trends of Salmonid Population and Habitat on Sakhalin Island, Russia

Abstract

This project aims to improve the ability to measure salmonid population and habitat condition and detect trends on Sakhalin Island through the creation of a comprehensive, long-term fish and habitat monitoring program. The program will employ a rotating panel study design, focusing on individual ecoregions of the island year by year. We will thereby encompass the entire island of Sakhalin with our program, allowing for enhanced ability to measure regional habitat and population condition and trends. Digital Elevation Models of monitored basins will be analyzed in the remote sensing software program NetMap. Using basin physical parameters derived from satellite imagery, key sites for within-basin monitoring can be identified, including quality habitat locations for the various salmonid species and places where erosion could affect survival. A suite of physical habitat and salmonid population parameters, gathered from methodologies employed by the Russian Federal Fisheries Agency, the Sakhalin Fisheries and Oceanography Institute and the USDA Forest Service, will be measured within the study basins. The fish population studies included in this program build on existing monitoring plans for pink and chum salmon on Sakhalin. The program will also include a suite of other salmonid species commonly found on the island: coho and cherry salmon, Sakhalin taimen, arctic char, arctic grayling, and Dolly Varden. The results generated will provide a more comprehensive understanding of the status and trends of salmonids and their freshwater habitat on Sakhalin Island.

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Title

Rockfish sex ratios - What are they telling us?

Abstract

Life history theory suggests that selective pressures will generally result in populations having a fertilization sex ratio of 50:50. Only under very unusual circumstances will populations diverge from this pattern. The numerous species of rockfish (genus Sebastes) that reside along the west coast of North America exhibit a diverse array of life-history traits, including diversity in apparent sex ratio. This presentation reviews information on apparent sex ratio for seven rockfish species: black rockfish (S.melanops), blue rockfish (S.mystinus), canary rockfish (S.pinniger), chilipepper rockfish (S.goodei), Pacific ocean perch (S.alutus), yellowtail rockfish (S.flavidus), and widow rockfish (S.entomelas). The apparent sex ratios for this group of species range from being dominated by males (black, canary, and yellowtail rockfish) to being dominated by females (blue and chilipepper rockfish). The presentation explores plausible alternative mechanisms that might cause the apparent sex ratios to differ from 50:50 (e.g., sex-dependent mortality versus behavior). In some cases the different mechanisms have profound implications for stock assessments and our perception of stock status.

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Title

Wy-Kan-Ush-Mi Wa-Kish-Wit - History and Vision for Tribal Fisheries Management in the Columbia River Basin

Abstract

The salmon's spirit is Wy-Kan-Ush-Mi Wa-Kish-Wit. Respect and reverence for this sacred life is the foundation of the tribe's plans to restore Columbia Basin salmon. Before non-Indian settlement, Northwest Native Americans successfully managed annual runs of 10-16 million salmon in the Columbia River Basin. Salmon unselfishly gave of themselves for the physical and spiritual sustenance of humans. Columbia Basin salmon populations have plummeted to approximately 500,000 annually above Bonneville Dam and many once-productive habitats are now inaccessible to salmon. Now treaty tribes, whose religious and cultural existence depend on salmon must retain traditional values and employ contemporary tools to restore salmon. Salmon are indicator species: their declines indicate the integrity of the entire Columbia River watershed is threatened. The tribe's have identified a goal of 5 million salmon annually for sustained natural production and support of Indian and non-Indian fisheries. Principles to accomplishing the goal include: 1) honor treaties, trust responsibilities and co-management authority of tribes with commitment to rebuilding salmon; 2) adaptive management to continually inform our work forward; 3) comprehensive actions which address mortality at each salmon life history stage; 4) protection and enhancement of watersheds to preserve existing and re-naturalize degraded stream functions; 5) rebuilding lost or depressed natural salmonid production by using supplementation in a scientifically sound manner; and 6) weigh the costs of restoration with the value of restoration which must include the spirit of the salmon - Wy-Kan-Ush-Mi Wa-Kish-Wit. Salmon is but one of the First Foods recognized in tribal culture. For the future of Columbia Basin restoration, the CTUIR seeks to utilize First Foods to call attention to ecological processes that provide sustained production of the remaining foods, and thereby protect the context of foods upon which Tribal culture depends.

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Title
Aggravations In The Analysis Of PIT-tag Data

Abstract
Wide-spread PIT-tagging of juvenile salmon in the Columbia River Basin, in conjunction with a user-friendly database updated in near real-time, has resulted in a powerful tool for researchers conducting particular studies. It also creates the potential for additional meta-analyses using pooled data across studies. This is useful for assessing system-wide management strategies and is a cost-effective way to address scientific questions beyond the original research scope. However, such analyses often require caveats when statistical inference is limited because the individual studies were not designed with the "big picture" in mind. For example, tagged fish may not represent untagged populations of interest, sample sizes may not be appropriately weighted across cohorts, and/or experimental treatments may have altered fish behavior relative to untreated individuals.
This can produce aggravation for data analysts. It can be challenging and time-consuming to determine what information about the pooled dataset is required in order to confidently make statistical inference. Also, it can be discouraging to be forced to eliminate data from individual studies due to lack of comprehensive statistical design, consequently limiting inference on important questions.
These meta-analyses and associated aggravations are demonstrated using three PIT-tag detection examples. Estimation of passage distributions at dams for assessing system-wide avian predation effects was limited by level of sampling information and effects were influenced by management scenarios. A comparison of survival versus differential passage routes at multiple dams in 2002 was impacted by unusual project operations at Lower Monumental Dam. Finally, comparison of hydro-system delayed effects using detections at an estuarine pair-trawl was complicated by "non-representative" sample sizes based on specific research and not relative stock abundance.

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Title
Bull Trout Redd Monitoring in the Wallowa Mountains

Abstract
Bull trout were listed as threatened under the Endangered Species Act in 1998 due to declining populations. The U. S. Fish and Wildlife Service (Service) recommends monitoring populations in subbasins where little is known including the Grande Ronde and Imnaha subbasins. Spawning survey data is important for determining relative abundance and distribution trends in bull trout populations. The Bull Trout Redd Monitoring in the Wallowa Mountains poster summarizes the 2007 bull trout spawning data collected in the Wallowa Mountains of NE Oregon and compares this with past years' data. Bull trout spawning surveys have been conducted on similar index areas for selected Grande Ronde and Imnaha River streams from 1999 to 2007. Surveys were conducted by the Oregon Department of Fish and Wildlife (ODFW), U.S. Forest Service (the Forest), Service, Nez Perce Tribe (NPT), National Marine Fisheries Service (NMFS), Anderson Perry, and by fisheries consultants. Objectives of the survey included; locate bull trout spawning areas, determine redd characteristics, determine bull trout timing of spawning, collect spawning density data, determine and compare the spatial distribution of redds along the Lostine River in 2005 through 2007 and over time use this data to assess local bull trout population trends and the long-term recovery of bull trout. Timing of spawning, total redds, redd sizes, and redd locations are documented in the poster. The local bull trout populations are relatively stable for the survey period. The Imnaha population is one of the strongholds within the Imnaha Subbasin and within the Wallowa Mountains. The Lostine River and Bear Creek contain brook trout and hybridization may be occurring.

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Title

A Bioenergetics Approach to investigating the impact of American Shad on Columbia River Salmon.

Abstract

Title: A Bioenergetics Approach to investigating the impact of American Shad on Columbia River Salmon.

Bioenergetics modeling has proven to be a useful tool in fisheries research, offering both predictive and quantitative analyses of fish growth and consumption. A bioenergetics approach is particularly advantageous when research questions involve multiple species and trophic levels, as is the case with American shad Alosa sapidissima. In the Columbia River, American shad are an introduced and highly successful anadromous fish. The presence of large numbers of American shad in the Columbia River may have both positive and negative impacts on salmon, with important temporal and spatial components. For example, juvenile shad may compete with late migrating juvenile fall Chinook salmon Oncorhynchus tshawytscha for small prey, but provide earlier migrants with a rich and abundant source of food. We will be linking bioenergetics modeling of multiple native and introduced fish species with empirical data to investigate how American shad may be impacting Columbia River salmon.

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Title
STATUS OF WARNER SUCKERS IN SOUTHEASTERN OREGON

Abstract
The Warner sucker, Catostomus warnerensis, is endemic to the Warner Valley, an endorheic subbasin of the Great Basin in southeastern Oregon and northwestern Nevada. This species was historically abundant and its historical range includes three permanent lakes, several ephemeral lakes, and three major tributary drainages. Warner sucker abundance and distribution has declined over the past century and it was federally listed as threatened in 1985 due to habitat fragmentation and threats posed by the proliferation of piscivorous non-native game fishes. In 2006, we conducted investigations in Hart and Crump Lakes to quantify the abundance of Warner suckers, to search for evidence of recent recruitment, and to estimate sucker abundance relative to nonnative fish abundance. We found the Warner sucker populations in Crump and Hart Lakes were severely depressed. The 2006 abundance estimates (CPUE) for suckers in the lakes were some of the lowest on record. In addition, we found little evidence of recent recruitment of suckers to the lake populations. The 2006 sucker size distribution was dominated by large, older fish and the average sucker length has increased steadily since the lakes were recolonized following their desiccation in 1992. We also found that the proportion of nonnative fish in the catch has increased during this time period. In 2007, we conducted distributional surveys and obtained population estimates of suckers in the Warner basin tributaries. We found the distribution of stream suckers to be patchy with a few areas with relatively high abundance. Future investigations will be discussed.

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Title

THE PACIFIC NORTHWEST AQUATIC MONITORING PARTNERSHIP: A FORUM FOR REGIONAL COORDINATION

Abstract

The purpose of the Pacific Northwest Aquatic Monitoring Partnership (PNAMP) is to provide a forum for coordination of aquatic monitoring efforts in the region. As of 2007, 19 state, tribal, federal, and regional entities were signatory to the PNAMP Charter. Many more entities participate in PNAMP workgroups, subcommittees, or individual workshops.

PNAMP strives to assist monitoring programs in the region by working to improve scientific information needed to inform resource management decisions, seeking efficiencies through compatible and cooperative monitoring efforts, and improving information sharing between monitoring programs across the region. Current PNAMP tasks include: protocol review and development; monitoring design work; tools to improve data documentation; and coordination of monitoring across mandates and subject areas. PNAMP works to advance formal recommendations to partners, works with regional information management entities to foster a regional environmental information strategy, and has begun to outline a “regional monitoring operational plan” that could meet aquatic resource information needs.

PNAMP believes increased collaboration will provide a collective focus on issues, results, and future needs related to monitoring in the short term and will increase effectiveness and efficiency of aquatic resource monitoring on a regional scale in the long term. We appreciate the considerable effort contributed by many experts toward these goals and would like to encourage anyone interested to join this collaborative effort.

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Title

The effect of gonadectomy on hatchery summer steelhead (Oncorhynchus mykiss) behaviour: Implications for hatchery and wild interactions.

Abstract

Non-native hatchery summer steelhead were stocked into the Clackamas River, Oregon to provide for a recreational fishery near Portland. Recently the fishery has been limited to the lower section of the Clackamas River to protect the native winter steelhead on spawning grounds. To reestablish the fishery, sterilization of hatchery fish is being considered. I studied the behavior and river residence times of sterile hatchery summer steelhead in the Clackamas River to determine the viability of sterilization as a method to reestablish the fishery. I hypothesized that steelhead that have undergone gonadectomy (castration) will have altered residence times and migration patterns in the river when compared to sham operated fish. The objectives of the study were to determine behavior of sterilized adult hatchery steelhead and residence times in the river and to determine if sterilized steelhead will be available to anglers. Forty sterilized fish and 39 sham-operated fish were tagged and radio tracked from July through December. The majority of fish movements were in the upstream direction for both sterilized and sham-operated steelhead, and no tagged steelhead left the Clackamas River system during the study period. Migration rates were similar for both groups, however, on average, locations where sterilized steelhead were found tended to be downstream of sham-operated fish. The study showed that minor differences in river position occur between sham-operated and sterilized steelhead and that both groups remained in the river and were available to anglers. A separate experiment demonstrated that castration was complete for the females but that some of the males still may have been able to reproduce some months after the procedure.

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Title

Using stable isotopes to inform river restoration science

Abstract

Stable isotopes are gaining increasing popularity as tracers of materials and energy in ecosystems. Applications range from small-scale microbial studies focusing on biogeochemical cycling to large-scale investigations of animal migrations. In aquatic systems, stable isotopes have been particularly useful in understanding food webs interactions, relying largely on carbon, nitrogen, and sulfur. More recently, analyses of additional elements such as hydrogen, oxygen, and strontium have offered a broadened view of the underlying geo-climatic template on which community interactions occur. Further development of new quantitative mixing models has also aided these efforts. I will provide an overview of past and current techniques in stable isotope ecology and discuss what I see as a unique opportunity for using stable isotopes to inform river restoration science.

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Title

The Effects of Grazing Management Strategies on Burned and Unburned Riparian Areas in Central and Northern Nevada Great Basin

Abstract

The interactive effect of wildfire and grazing strategies remains unclear for Northern and Central Nevada fisheries. To obtain a more thorough understanding of fisheries habitat impacts and general riparian response to wildfire, we cataloged grazing practices on 40 burned (1999-2001 fires) and 40 unburned lotic riparian sites over a twenty-year period (1986-2006). Through review of federal agency allotment files and discussions with land managers we identified the grazing management approach for each riparian area. Grazing management records were aggregated by common practices including season, duration, and rotation of use and then related to riparian conditions in 2004 or 2005. We hypothesize that a combination of generally successful grazing strategies will be associated with positive trends in stream survey data. Such strategies might include spring use, short seasons of use, rotation of use, etc. Monitoring data (e.g., utilization), riparian functional rating, vegetation type, topography, and landscape setting will be considered in addition to the grazing strategy and stream survey data. We intend to develop a statistical model that will serve as a land management tool for understanding the site-specific riparian grazing strategy/fire interactions that influence riparian processes over time. We anticipate the results of this study will provide insight for managers regarding the effects of livestock grazing on fisheries in anticipation of and following wildfire in the Northern and Central Nevada Great Basin.

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Title

Trophic interactions among lake trout, kokanee, and Mysis relicta: Does lake morphometry mediate impacts on kokanee?

Abstract

Introductions of the freshwater shrimp Mysis relicta are associated with declines in planktivorous fish populations in many lakes throughout western North America. Mysis may negatively impact planktivorous fishes by consuming a shared prey resource (exploitative competition) or by enhancing the density and body size of shared predators (apparent competition). I evaluated evidence for these interactions between Mysis and kokanee (Oncorhynchus nerka) in Lake Chelan, WA. I compared food web patterns between two lake basins of contrasting depth to investigate the potentially mediating influence of this habitat characteristic. Zooplankton production was enhanced in the shallower lake basin but Mysis density was not enhanced, resulting in a greater food supply available to kokanee in that basin. Kokanee migrations between basins were not explained by seasonal food availability alone, suggesting that predation risk was also an important factor. Lake trout diets contained more Mysis in the shallower basin, and this was associated with a seven-fold greater catch per unit effort of lake trout compared to the deeper basin. This result was consistent with strong apparent competition in the shallower basin. Cohort analysis and bioenergetics model simulations were used to estimate relative rates of predation on kokanee by the lake trout populations in each basin. I compare Lake Chelan to other oligotrophic lakes and propose that lake depth may mediate the relative importance of exploitative competition and apparent competition in Mysis interactions with planktivorous fishes. Understanding this change in ecology along a depth gradient may be crucial for managers who aim to conserve planktivorous fish populations.

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Title

Tale of two salmonids: Contrasting adult migration behavior of John Day River summer steelhead and spring Chinook salmon.

Abstract

We examined PIT tag observations of 301 returning wild adult summer steelhead and 297 spring Chinook from the John Day River from 2005–2007. We determined migration timing, identified common observation histories, and examined potential factors affecting migration behavior of these species. Peak movement past Bonneville Dam occurred from late-April through mid-May for Chinook and late-July through early-August for steelhead. Chinook exhibited five unique detection histories and were observed at five separate detection sites. Steelhead exhibited 14 unique detection histories and were observed at 12 sites. While less than 10% of Chinook were detected at McNary Dam 74 miles upstream of the John Day River mouth, greater than 50% of the steelhead migrated past McNary Dam. Kelt detections of PIT tagged steelhead confirm that John Day origin fish stray and spawn in the Umatilla and Snake River basins. While John Day Dam pool height did not significantly differ during the peak return of both species (263 feet), mean John Day River attraction flow from 2005–2007 was 17 to 84-fold greater during the Chinook migration (988–7,997 CFS) compared to flows during the steelhead migration (47–95 CFS). As of February 22, 2008, only 30 (26%) of the 114 John Day origin steelhead observed at Bonneville Dam had been detected at the new John Day River antenna array suggesting that the John Day steelhead return rate is lower than expected. Straying and low return rates by adult steelhead may limit success of habitat restoration projects in the John Day River basin and help explain the long-term decline in redd counts.

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Title

Development of a Guidance Curtain to Increase Juvenile Chinook Salmon Use of a Surface Flow Outlet.

Abstract

In 2004, the Portland District U.S. Army Corps of Engineers constructed an 1800’ concrete bypass channel connecting to the existing Bonneville Dam Second Powerhouse Corner Collector Chute. This surface bypass route was designed to collect fish from the Second Powerhouse forebay and safely transport these surface oriented juvenile salmonids to an area in the tailrace with lower predator abundance and high average river velocities where the PH2 and spillway channel converge.

Post-construction evaluations of the new corner collector at the Second Powerhouse of Bonneville Dam 2004 and 2005 indicated that passage survival for juvenile salmonids was highest through the corner collector relative to all other routes. Further, these studies indicated that Corner Collector Passage Efficiency (CCE; the proportion of fish passing B2 via the corner collector), although high for steelhead, was relatively low for both yearling and subyearling Chinook salmon.

The Corps combined information from fish behavior studies and Computational Fluid Dynamic (CFD) modeling to determine the forebay sighting (length, depth and angle) of a Behavior Guidance Structure (BGS). The Corps of Engineers is currently installing a 720’ shallow-draft (10’ draft) behavioral guidance structure into the forebay of the Second Powerhouse for the 2008 juvenile salmonid migration season. It is expected that strategically locating this BGS will significantly increase CCE for yearling and subyearling Chinook salmon thereby increasing both project and dam passage survival at Bonneville Dam for those species.

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Title

Food Web Effects of Marine Reserves as Inidicated by Stable Isotopes

Abstract

California's nearshore fishes are dominated by species that frequent kelp beds and rocky reefs. These stocks are overfished or in danger of becoming so throughout their range. California species-specific conservation measures include revised quotas and some gear limitations. Multi-species measures include the maintenance and expansion of marine reserves (no-take areas). Beyond the generally accepted desire for more and bigger fishes, the ecological-focus of nearshore management remains poorly defined, with a need for credible ecological indicators. We examined the potential for stable isotopes as ecological indicators in a pilot study using 282 stable isotope samples taken from a variety of organisms, adjacent to and distant from reserve boundaries, and both inside and outside of Monterey Bay. Giant kelp (Macrocystis pyrifera) dC13 levels were slightly lower inside Monterey Bay than out (Rsq=0.08, p=0.05), but were not significantly different adjacent to versus distant from reserve boundaries. Kelp rockfish (Sebastes atrovirens) dN15 levels were correlated (Rsq=0.34) with fish length distal to reserves, but exhibited a flat relationship (Rsq=0.06) adjacent to reserve boundaries. Lingcod (Ophiodon elongatus) dN15 levels were highly correlated with fish length adjacent to reserves (Rsq=0.41), but not so distal to reserve boundaries (Rsq=0.07). It appears that these patterns reflect ecological changes associated with a reserve effect. In a neural network analysis of dN15, dC13, and geographic location (inside vs. outside Monterey Bay), reserve status of each collection location was always discernable (Rsq=1.00). Discriminant analysis of dN15, dC13, and geographic location was significant for reserve status as well (p<0.01). Isotopic indicators can provide a sensitive and economical means of monitoring marine reserve effects provided that collateral work is in place to help reveal their true meaning.

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Title

Life History Trajectories and Limiting Factors Analysis

Abstract

The performance of fish stocks is limited by multiple factors operating across their life history. Long-term improvement in performance is achieved through change in one or more limiting factors to relax bottlenecks. Limiting Factors Analysis (LFA) focuses on identification and prioritization of attributes that are inhibiting fish performance. A life history trajectory (LHT) is a collection of spatial-temporal and biological information describing possible space-time-organismal configurations. LHT is generated using mechanistic or conceptual models of movement and natural history. The utility of LHT is that it describes duration of exposure to a particular limiting factor at a location for a species or life stage. The LHT approach is similar to, but differs from, an individual based model because the focus is not on behavior of individuals but rather the potential exposure of various life history solutions to a given environmental attribute within a spatial-temporal stratum. This mathematical sample of exposure provides a quantitative framework for analyzing limiting factors with a transparent connection to the life history of a species. The duration of exposure can be used as a unit-less weighting of the impacts of a limiting factor against performance metrics such as survival or production of a given life stage. The approach has been used in a variety of analytical frameworks including the Ecosystem Diagnosis and Treatment system. The LHT approach has considerable applicability to fisheries management and conservation modeling whenever the natural history of a species presents a variable exposure to environmental attributes across space and time. This paper will discuss the LHT concept and show how it can enrich a limiting factors analysis. We propose that LHTs be applied whenever the resulting analytical solution is biologically meaningful or significantly different from a singularly habitat approach.

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Title
Standard Methods for Sampling North American Freshwater Fishes

Abstract
Standardization in industry, medicine and science has led to great advances. However, despite its benefits, freshwater fish sampling is generally unstandardized, or at most standardized locally. Standardization across large regions would allow for measurement of large-scale effects of climate or geography on fish populations; larger sample sizes to evaluate management techniques; reliable means to document rare species; easier communication; and simpler data sharing. With increased interaction among fisheries professionals worldwide, reasons for wide-scale standardization are more compelling than ever. The Fish Management Section of AFS, collaborating with the U.S. Fish and Wildlife Service, U.S. Bureau of Reclamation, U.S. Bureau of Land Management, National Park Service, USGS Cooperative Research Units Program, National Fish and Wildlife Foundation, AFS Education and Computer User's Sections, and Arizona Game and Fish Department is developing a book of standard sampling methods for North America. Almost 50 United States, Canadian and Mexican fish sampling experts are authors. "Standard Methods for Sampling North American Freshwater Fishes" describes standard methods to sample fish in specific environments so population indices can be more easily compared across regions and time. Environments include ponds, reservoirs, natural lakes, streams and rivers containing cold and warmwater fishes. This book provides rangewide and regional averages; calculated from over 4000 data sets from 42 states and provinces; of size structure, CPUE, growth, and condition for common fishes collected using methods discussed. Biologists can use these data to determine if fish from their waterbody are below, above, or at average for an index. Methods were reviewed by 54 representatives from 33 North American agencies and by biologists from five European and one African countries. Final drafts were reviewed by an additional 36 sampling experts. These procedures will be useful to those hoping to benefit from standard sampling in their programs.

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Use of Flat-Plates and Hand Scanners to Decode PIT Tags on Piscivorous Bird Colonies

Abstract

Avian predation on PIT-tagged juvenile salmonids and subsequent deposition and recovery of tags on several breeding colonies has contributed to studies quantifying stock-specific effects of predation on ESA-listed salmonids in the Columbia River basin. We used mobile detection equipment to decode PIT tags deposited on breeding colonies to evaluate effects of avian predation throughout the basin. Electronic recovery of PIT tags began in 1998 and nearly 680,000 unique tag codes have been recovered from avian breeding colonies ranging from locations near the confluence of the Columbia and Snake Rivers to colonies located in the Columbia River estuary. In 2007, we recovered over 63,000 PIT tags using physical recovery (magnets) and electronics. Choice of methodology was dependent on colony substrate and densities of deposited tags. Magnets were used to reduce tag densities on large colony areas and lower the potential for code collisions (when two or more codes are within an electronic field, neither tag may be read) during subsequent electronic recovery. Electronic recovery utilized two hand-held antenna types (circular and triangular) and large tractor-propelled flat-plate antennas (four-coil and six-coil). The six-coil antenna was powered using a six-port multiplexing transceiver, and the four-coil flat-plate antenna was powered using four individual single-port transceivers. We compared recovery techniques using 2007 results from the Crescent Island tern colony (river kilometer 510). A total of 13,658 unique codes were recovered and 61% were removed using magnets. Hand-held antennas accounted for an additional 20% of tags, generally from areas inaccessible to flat-plate antennas. Flat-plate antennas accounted for the remaining 19% of recovered codes, and each read about 4,200 tags. In seven passes over the colony area, mean (SE) number of unique codes read per pass was 2,507 (126), with about 80% duplicate reads.

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Title

The use of trap and haul to reestablish anadromous fish into historically important habitat in the Upper Cowlitz River

Abstract

The Cowlitz River historically supported abundant runs of coho, spring and fall Chinook salmon and steelhead and sea-run cutthroat trout. In the 1960s, Tacoma Power completed the Cowlitz River Project, composed of two high dams that effectively blocked volitional migration to about 80% of the spawning habitat for anadromous fish. Initially, Tacoma Power attempted to collect out-migrating smolts upstream of the second dam with Lake Merwin type traps. This trapping was unsuccessful and discontinued after 1973. This effectively eliminated anadromous fish production in the Upper Cowlitz Watershed until the construction of the run-of-the-river Cowlitz Falls Dam (1994) and integral juvenile fish collection facility (1996) by Lewis County PUD, with funding from Bonneville Power Administration. These facilities enabled collection of downstream migrants upstream of the Cowlitz River project reservoirs. This smolt collection capability is essential to reintroduce salmon and steelhead to the historically productive 380 linear km of anadromous habitat upstream of Cowlitz Falls Dam.

The reintroduction program began by seeding the upper watershed with juvenile and adult spring Chinook, coho and late winter steelhead from indigenous hatchery stocks. These activities demonstrated that the upper watershed is still capable of producing robust numbers of juvenile salmonids. The reintroduction is based on the effective capture of migrating smolts at Cowlitz Falls Dam and their transportation to the lower Cowlitz River to continue their ocean-ward migration, as uncollected smolts become landlocked in the reservoirs. In eleven seasons of operation, over two million smolts have been collected and transported to the lower Cowlitz River. Smolt collection efficiency is critical to the success of the reintroduction and research since 1998 has focused on evaluating and improving surface collector performance. Some improvements have been made, however additional improvements will be needed to meet reintroduction goals.

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Title

Rearing and overwintering habitat capacities for juvenile coho over time – tracking the impact of land use modifications from the 1930s

Abstract

A variety of reasons interact to contribute to declines in anadromous salmon runs in the Pacific Northwest. We conducted a study to determine if modifications in stream habitat in a Pacific Northwest watershed could be a prominent factor in the substantial decline in coho salmon outmigrants between the years 1940 and 2000. To assess developmental impacts in the watershed, we completed a land use change analysis for multiple time periods between 1944 and 2000 for Minter Creek watershed in the Puget Sound. We characterized physical stream conditions over time and estimated juvenile coho habitat capacity for current and historic watershed conditions. Removal of natural riparian vegetation through time was used to identify concentrations of reaches with substantial anthropogenic changes within the 60 year time frame. Summer habitat surveys were conducted to assess distribution and quantity of summer rearing habitat for coho salmon and stream habitat complexity. We also conducted winter habitat and snorkel surveys overlapping summer survey reaches, and determined a conversion factor for stream summer to winter pool size and distribution. Reaches with channel complexity features (sinuousity, percent pools, LWD frequency) in the lowest 30th percentile for each stream with consistently modified riparian conditions through time were considered to have anthropogenically impacted reach structure. We applied a capacity model modified from Reeves et al (1989) to estimate summer rearing and overwintering habitat capacities using summer and converted winter habitat distribution under current conditions, and calculated historical capacities representative of two earlier time periods, 1940 and 1985, by “resetting” the impacted reaches to representative conditions. We discuss preliminary findings on impacts to the landscape and if habitat changes contributed to capacity differences, and if this relates to declining run size over the previous 60 years.

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Title

Strategies for Increasing Survival of Salmon and Steelhead that are transported through the Hydrosystem.

Abstract

Transporting juvenile salmon around the hydrosystem has long been a tool to decrease direct mortality during the outmigration. While it has been successful, it has not been the silver bullet hoped for by many. Research has been continually conducted in conjunction with operational transportation.

Areas of current research include, seasonal effects, transporting to the estuary, and differential delayed mortality. Significant improvements to transportation operations are possible with increased within-year temporal resolution. For example early to mid-April migrating smolts return at higher rates if bypassed to migrate in-river; however, those passing in May perform better if transported. We have also observed very high return rates for subyearling Chinook collected and transported in fall. Studies are under way to enable better optimization of the transportation program. Bill Muir will be presenting the detail of this later in the symposium.

Improving the survival rates of those fish that are transported is also an area of active work. Differential Delayed Mortality, the phenomena where transported fish often have a lower survival rate post-hydrosystem than in-river migrants will be discussed by Derek Fryer later in the symposium. We are studying this is because it has been debated in the literature and potentially highlights potential avenues of improving survival. We are also in the third year of examining the potential advantages for transporting to the estuary instead of only to be below Bonneville dam. Whether subyearling Chinook benefit from transportation is also being studied, comparing smolt to adult survival rates between fish designated to be transported if collected to fish being bypassed if collected.

Although great improvements have been made in in-river migration survival over the past 15 years, a refined transportation program will continue to be an important tool in hydrosystem fish passage.

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Title

Distribution and Abundance of Umpqua Chub and Smallmouth Bass in the Umpqua River Basin, Oregon: Are Bass Eliminating Chub?

Abstract

Umpqua chub is small cyprinid endemic to the Umpqua River Basin and considered “sensitive-vulnerable” by the State of Oregon. A 38-site survey throughout the drainage by Oregon State University in 1987 found its distribution to be greater than historical records indicated, but the presence of nonnative piscivorous smallmouth bass was noted with concern. A repeat survey in 1998 found the distribution of chub had contracted, with populations restricted primarily to lower order tributaries. Umpqua chub was completely absent from main stem sites. In the 1998 survey, Umpqua chub was captured at only 50% of sites where it was found in 1987 but smallmouth bass distribution and abundance had expanded. In summer 2006 and 2007 we sampled 141 sites in 14 waters in 6 subdrainages to better understand distribution and abundance of Umpqua chub and smallmouth bass. Umpqua chub was found at 47 sites (33%), smallmouth bass at 73 sites (52%), and both species were found concurrently at 18 sites (13%). Whereas smallmouth bass was found throughout most of the sampled waters, Umpqua chub was mostly restricted to small reaches in 5 subdrainages and was found at only 4 sites in 2 other waters. Umpqua chub was primarily found in areas upstream of smallmouth bass, having been eliminated in downstream areas. Continued expansion of smallmouth bass poses a serious threat to the existence of Umpqua chub.

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Title

Cost Effective and Valid Remote Sensing Methods to Measure Riparian Conditions

Abstract

Three large watershed (>100,000 acres each) in Northeastern Nevada,including the Maggie Creek Basin, have had extentive ground monitoring since the late 1970's. Riparian habitat conditions, trout populations, water flow, water sedimentation and static water level are some of the attributes that have been measured. Three types of grazing have been practiced in these watersheds; continuous season-long, different types of rest and rotation and total rest. Ground monitoring has shown the effects of these grazing practices. We have shown that remote sensing can be highly correlated to ground monitoring. Thus remoting sensing can be used as a very cost effective and quick means to quantify key riparian function indicators. These remote sensing techniques were developed in collaboration with the land managers that have been responsible for ground monitoring within the three watershed.

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Title

Restoring a Lost Bull Trout Population: Habitat Augmentation on the Upper Middle Fork Willamette River

Abstract

Historically, the Middle Fork Willamette River and its tributaries contained a healthy population of bull trout (Salvelinus confluentus). However, as anthropogenic expansion spread throughout the watershed bull trout numbers declined. The construction of three dams on the Middle Fork Willamette River, from the 1950's to 1960's, blocked adult upstream migration and created a lethal downstream passage. Further habitat fragmentation occurred in the 1970's and 1980's as roads were constructed without fish passage capabilities, and large wood was salvaged from the stream channels. By the early 1990's the bull trout population had diminished to a point where it was considered "probably extinct" in the Middle Fork Willamette (Buchanan et al. 1997). Shortly thereafter, a reintroduction program was initiated to reestablish bull trout in the watershed. In 2000, we began a large scale habitat recovery program for the entire watershed to restore lost bull trout habitat. After many years of intensive efforts by the Forest Service and a multitude of partners, we were rewarded in 2006 with the first natural reproduction of bull trout in the watershed since the early 1990's. The Middle Fork bull trout population appears to be increasing as our restoration efforts continue. In 2008 we are planning to remove the last fish passage barrier on an important bull trout spawning tributary, and supply additional spawning and rearing habitat by constructing an enhanced alternate channel. The future of the Middle Fork bull trout population shows signs that it is rebounding after decades of decline. We intend to continue our rigorous habitat recovery program until we meet our objective of restoring a healthy population of bull trout in the Middle Fork Willamette Watershed.

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Title

Impact of Double-crested cormorants on Rainbow Trout Stocked In An Urban Lake, Reno NV

Abstract

Double-crested cormorants (Phalacrocorax auritus) are known to impact local fish populations. To estimate consumption of rainbow trout in Virginia Lake, Reno, NV, we released 2,248 rainbow trout (Onchorhyncus mykiss) into the lake over three occasions. We then sampled a cormorant nesting island in the lake weekly following each release. We used band recovery models and temporal symmetry capture-mark-recapture models in program MARK to estimate predation rate and monthly survival probability of rainbow trout. Using Brownie et al. (1985) tag recovery models, we estimated that 19% (95% CI: 14-26%) of rainbow trout survived from the first to the second stocking event, while only 4% (95% CI: 2-9%), of rainbow trout survived from the second to the third stocking event. The probability of recovering a dead rainbow trout increased from 3% (95% CI: 2-4%) to 27% (95% CI: 24-30%) from the first to the second stocking event, then declined to 18% (95% CI ± 16-21%), on the third stocking event. We estimated the probability of encountering a tag on the island, conditional on the tag being present on the island, decreased from 49% (95% CI: 42-55%) to 32% (95% CI: 26-38%) after the second and third stocking events, respectively. Using recoveries of tags from double tagged fish, we estimated that 48% (95% CI: 47-49%) of tags eaten by double-crested cormorants were deposited on the island. Overall, we estimated that the probability of a rainbow trout being eaten by a double-crested cormorant was 1.14 (95% CI: 1.00-1.28) and 1.18 (95% CI: 1.03-1.32) after the second and third stocking events, respectively. Our very low survival estimate (0.04), combined with our high harvest estimate (1.0), was consistent and suggested that double-crested cormorants consumed virtually all stocked fish, once double-crested cormorants had returned to the lake.

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Title

Impacts of supplementation: Genetic diversity in supplemented and unsupplemented populations of summer chum salmon in Puget Sound

Abstract

Supplementation, where wild-origin fish are used as hatchery broodstock and their offspring allowed into wild spawning areas, is a tool used to support salmonid populations at risk of extinction. Managers seek to increase census size and boost effective population size (Ne) while minimizing risks of drift and inbreeding from hatchery intervention. Here we document impacts of five to ten years of supplementation on endangered summer-run chum salmon in Hood Canal (HC) and Strait of Juan de Fuca (SJF) in Washington State and compare them genetically to unsupplemented summer and fall-run chum salmon from HC and South Puget Sound. Microsatellite allele frequencies separated collections into four run-timing and geographic groups. Similar to patterns prior to supplementation, HC and SJF summer chum genetic relationships followed a metapopulation pattern of isolation by distance, suggesting that supplementation minimally impacted population structure. In most supplemented subpopulations, there were no effects on diversity and Ne, but high variance in individual pairwise relatedness values indicated overrepresentation of family groups. In two subpopulations, hatchery impacts (decreased diversity and lower Ne) were confounded with extreme bottlenecks. Rebounds in census sizes in all subpopulations suggest that general survivorship has improved and that possible negative hatchery effects will be overcome.

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Title

Forage fish spawning in an urbanized Puget Sound embayment.

Abstract

Coastal development and increasing urbanization around Puget Sound, Washington present challenges for protection or restoration of nearshore ecological processes. The U.S. Geological Survey initiated a multidisciplinary study to better understand the ecological processes affected by urbanization, and to provide information to managers who have regulatory responsibilities to protect nearshore areas. This research effort was initiated to describe the criteria for suitable spawning habitat for Pacific sand lance (Ammodytes hexapterus) and surf smelt (Hypomesus pretiosus pretiosus). These forage fish species depend on the nearshore environment for spawning and rearing and have “no net loss” regulations to protect documented spawning areas from the impacts of shoreline development. Urbanization is associated with a wide range of shoreline perturbations such as armoring and landscaping that may affect beaches used for spawning. We selected a 10 km length of shoreline along an embayment (Liberty Bay) that represents a gradient of urbanization, from highly urbanized to undeveloped. We randomly selected 20 beach segments (30 m long) within the 10 km length, and sampled each beach twice for forage fish eggs during their spawning period in December 2006 and January 2007. At each beach we collected sediment samples and recorded a series of descriptive variables. We collected a total of 40,043 eggs, with the number of eggs found on a beach ranging from 1 to 5,425. Species composition consisted of 94% surf smelt, with sand lance and rock sole comprising the remaining 6%. Egg counts and descriptive variables are currently being used to develop a model to predict likely spawning beaches.

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Title

ASSESSMENT OF JUVENILE COHO MOVEMENT AND HABITAT USE PATTERNS DURING SPRING, SUMMER AND EARLY FALL WITH IN THE MIDDLE KLAMATH RIVER

Abstract

The Karuk Tribe conducted the first year of a multi year study to assess juvenile (young of the year) coho movement and habitat utilization patterns in the Middle Klamath River during spring, summer and early fall with respect to seasonal changes in river flow and water quality conditions. Study cooperators included the Yurok Tribe and the Bureau of Reclamation. The study was conducted within the roughly one hundred mile river reach between Iron Gate Dam and the confluence with the Trinity River. The primary objective of this study is to gain information on movements and habitat use of juvenile coho in the mainstem Klamath River during periods when water temperatures regularly exceed their thermal tolerances. Sampling methods used to assess movement and habitat utilization included upstream migrant trapping, downstream migrant trapping, seining, minnow traps and snorkeling. PIT tagging and freeze brand marking techniques were used to track distribution within tributaries, movement between tributaries and further seasonal redistribution. Juvenile coho movements into non-natal cold water tributaries occurred in early summer coinciding with mainstem water temperatures warming. During mid-summer, upstream movements of PIT tagged coho within tributaries were documented and in one case movement in the mainstem between cold water tributaries was documented. Results suggest coho salmon in the Klamath River system may utilize diverse life history strategies which enable survival during periods of high water temperature and poor water quality.

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Title
West Cascades Bull Trout: An Overview and Update

Abstract
Bull trout west of the Cascade Range are unique among populations throughout the United States in that they exhibit the full suite of life history types for the species. Although not all populations exhibit all life history types, these types can include resident, fluvial, adfluvial, and anadromous. This life history variability is important for maintaining biodiversity and resilience to habitat changes, whether from fragmentation due to dams or from altered stream flows due to climate change. This presentation will present an update/overview of bull trout in this region, including summarizing recent studies describing the temporal and spatial variability in movement at different life history stages, strategies for recovery of populations, changes in status and threats, and information and research needs.

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Title

Restoration through collaboration: Fossil Creek, Arizona

Abstract

Fossil Creek is a tributary to the Verde River in central Arizona. In 1999, after a century of diverting Fossil Creek's flow for hydropower, Arizona Public Service committed to decommissioning two powerplants and restoring flows. Prior to flow restoration, biologists recognized the opportunity to restore the stream's native fish community. Fossil Creek remains a stronghold for native fish in the Gila River drainage, yet invasion of exotic species has prevented recruitment in native aquatic vertebrates, including ranid frogs. In a collaborative effort between state and federal agencies, including two national forests, universities; and volunteers, native fishes were salvaged from over 10 stream miles which included designated wilderness. Piscicides were applied to the stream and native fishes were repatriated after exotic fishes were eliminated. A barrier was constructed to prevent future upstream migrations while simultaneously preserving wilderness values. Monitoring results have indicated that native fish increased fifty fold where flow was restored and exotic fish were removed. In contrast, native fish did not increase below the constructed fish barrier where exotic fish remain, despite similar increases in flow. In the arid southwest, physical habitat improvement alone will not recover native fish where exotic fish are established. During planning efforts for Fossil Creek, biologists also included stocking listed-fish species that historically were found in the drainage. Two years after salvaged fish were returned to the stream, five listed species have been stocked. The philosophical outcome of this project was a renewed sense of what can be accomplished when agency mandates to protect native species are supported and conflicting politics are set aside. It also instilled hope and generated excitement for other fish restoration projects in the Southwest that were once considered unachievable because of logistical or political constraints.

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Title

Restoring a Native Fish Community: Mechanical Removal Efforts in Bright Angel Creek, Grand Canyon National Park

Abstract

The Fish and Wildlife Service is working with Grand Canyon National Park to restore native fish populations in Bright Angel Creek, a tributary to the Colorado River using mechanical removal of nonnative trout. The purpose of this project is to enhance native fish populations and restore natural ecosystem values within the Park. Currently, Bright Angel Creek is home to nonnative brown and rainbow trout and native species such as speckled dace, bluehead sucker. Endangered humpback chub also use the inflow areas during parts of the year. Brown trout are removed using two methods. The first uses a weir placed at the mouth of Bright Angel Creek to intercept fish migrating upstream to spawn. During 2006, only 54 brown trout were captured in the weir, 87% lower than efforts in 2003 suggesting changes in the mainstem Colorado such as temperature have impacted migrating brown trout. The second method uses multi-pass electrofishing to deplete numbers of brown trout. In 2006, 158 brown trout were removed from a 3km sampling reach in Bright Angel Creek. This represents an average of 55% of the estimated number of brown trout present in this reach. Abundance estimates for brown and rainbow trout varied between the two species where rainbow densities were between 3 and 1.6 times higher than browns. Length frequencies of rainbow and browns indicate a strong year class for both species from spawning events in 2006. Few fish captured exceeded 250mm. The lack of larger fish indicates that the weir was effective in intercepting migrating adults and that the dual approach of operating the weir and incorporating electrofishing sampling as a removal method is effective in targeting different life history stages in Bright Angel Creek.

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Title

Lake Washington Sockeye, Changing Rivers, Changing Landscape

Abstract

Oncorhynchus nerka in the Lake Washington Basin have a long history. While some details are obscured in history it is evident that a population of O. nerka existed in the basin prior to modifications in the basin's infrastructure. Several major changes have been made to the flow of water into and from the Lake Washington Basin. The flow of water has also been altered through landscape changes from forested uplands, to farmlands, to urban uplands. Non-local stocks of O. nerka were introduced into the basin in an effort to provide sockeye fishing opportunities. The Lake Washington sockeye fishery is very important to the region. There have been a number of efforts to improve sockeye fishing opportunities in Lake Washington. Current efforts include the operation of a hatchery and plans to replace that hatchery with one with twice the incubation capacity. Because of concerns about hatchery operations, monitoring and evaluation of hatchery and wild sockeye production are ongoing. This data will provide input to an adaptive management process for hatchery operations.

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Title

Pinniped Predation on Salmonids and Sturgeon in the Lower Columbia River

Abstract

We have used day-time surface observations between January 1 and May 31 to enumerate pinniped abundance and predation on fish at Bonneville Dam since 2002. Minimum abundance estimates of pinnipeds present has increased from 31 in 2002 to between 80 and 111 since 2003. Most identified pinnipeds were California sea lions (Zalophus californianus), but Steller sea lion (Eumetopias jubatus) numbers also increased, from none in 2002 to 10 in 2006. Harbor seals (Phoca vitulina) were also present. Pinnipeds arrived earlier each year, and both average daily pinniped abundance and the number of days individual animals were present increased. Predation on adult Chinook salmon (Oncorhynchus tshawytscha) and steelhead (O. mykiss) increased from an estimated minimum of 1,010 in 2002 to 3,859 in 2007, while the salmonid run decreased from 284,733 in 2002 to 88,474 in 2007. Predation on Pacific lamprey (Lampetra tridentata) was also significant, comprising up to 9% of total take. Steller sea lions predation on white sturgeon (Acipenser transmontanus) has increased from one sturgeon observed caught up through 2005 to an estimated 315 caught in 2006 and 467 caught in 2007. Deterrence efforts began in 2005 and have escalated through 2007, including the installation of physical barriers at fishway entrances, acoustic deterrents, dam based harassment with non-lethal measures, and boat based harassment. Physical barriers were largely effective, but while the other deterrents had limited success in altering the behavior of sea lions, no measures effectively reduced predation on salmonids. Pinniped predation in the Columbia River below Bonneville Dam is known to occur, but has not been systematically quantified. Limited observations in the area immediately below the dam are currently underway.

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Title

Migratory patterns of adult bull trout in selected basins in northeast Oregon.

Abstract

Understanding migratory behavior of adult bull trout is important because it can be an indicator of habitat diversity and connectivity. We used radio telemetry to quantify migratory characteristics of adult bull trout in selected drainages in the Grande Ronde, Walla Walla, Umatilla, and John Day river basins to learn how they have adapted to local conditions and human alterations to the riverine environment. Habitat in study drainages varied from nearly pristine to severely degraded. From 1997 to 2002, we radio-tracked 103 fish through at least one spawning and overwintering period, 72 of which we tracked for >1 year. Migrations between spawning and wintering locations were longest in the Imnaha River (mean annual range, 98 km), Wenaha River (53 km), and Lostine River (48 km), which are relatively pristine watersheds. Shorter migrations were observed in the John Day River (10 km); Mill Creek (18 km), a major tributary of the Walla Walla River; and the Umatilla River (22 km); where humans have more severely altered the riverine habitat. We observed unique migratory patterns that included upstream and downstream postspawning migrations to wintering locations in the Grande Ronde River and lengthy (>41 days) staging behavior before and after spawning in Walla Walla River. Adults tracked through consecutive spawning periods (N=38) migrated to the same tributary as the previous year and displayed strong fidelity to previous spawning and winter locations. Our results suggest there is a relatively high degree of habitat connectivity in the Grande Ronde and Imnaha river basins and potential habitat fragmentation restricting migratory extent in Mill Creek, the Umatilla River, and the John Day River. Some migratory characteristics observed here differed markedly from observations elsewhere in the species distribution and add to our knowledge of the complex behavior of bull trout.

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Title

Freshwater Mussels on Central Oregon Preserve: Identifying Ecological Threats and Needs

Abstract

Freshwater mussels are the most highly at-risk freshwater dependent species in the U.S. Working at a high desert central Oregon nature preserve, we conducted various investigations into the distribution and species specific needs of the native freshwater mussel assemblage. Investigations included: distribution surveys, observations of species specific effects of drought, genetic tests for significance of local variants, host fish identification, small-scale life stage habitat preferences, and the effect of relocation to local refugia. Awareness of the presence and ecological requirements of freshwater mussels allows us to take them into account when making management and restoration decisions. It also allows us to plan for the abatement of possible future threats like global climate change and its effects. Additional needs include: further host fish identification and tracking of population trends and region-wide status.

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Title

Efficient Spatially-Balanced Designs for Monitoring Status and Trends of Salmonid Populations

Abstract

The distribution of a fish species over its range will always exhibit some spatial pattern. That pattern is driven and modified by a variety of natural and anthropogenic factors. It is possible to take advantage of spatial pattern to improve the efficiency of a sampling design to assess status and trends of the population, even if the pattern itself is unknown. Spatially-balanced designs are defined, and some techniques for creating spatially-balanced probability designs are discussed. Sources for design software and statistical assistance for design and analysis of monitoring programs are identified

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Title

Riparian Ecological Sites and State-and-Transition Models

Abstract

State-and-transition models (STM) have been widely adopted as a tool for explaining upland plant community dynamics and response to disturbance within rangeland ecosystems during the last decade. The STM concept is tied directly to the land inventory method known as ecological site descriptions (ESD) developed and used extensively by the Natural Resource Conservation Service (NRCS). In the mid-1990's NRCS adopted the STM as a management tool to enhance understanding of plant community dynamics explained within ESDs. Recently, the United States Forest Service and the Bureau of Land Management have signed policy requiring the development of ecological site descriptions and corresponding STMs for all lands under their management. In essence, the majority of lands within the United States will have ecological site descriptions and corresponding state-and-transition models associated with them. The majority of the effort in ESD and STM development has been in upland communities, however efforts are now underway to develop the concepts for riparian areas. Ecological site descriptions and state-and-transition models will facilitate understanding of the interaction between the riparian plant community and the associated channel. Increased understanding of these fundamental relationships and the feedback mechanisms associated with functional systems versus degraded or degrading systems will provide management with a framework for deciding whether passive or active restoration is appropriate. The concepts of riparian complex, at-risk phases, thresholds, and ecological resilience will be discussed in the context of the state-and-transition model for riparian ecosystems.

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Title

Monitoring Entrainment in a Pacific Northwest Reservoir and Assessing its Impact on a Resident Cutthroat Trout Population

Abstract

The magnitude and likely impacts of entrainment on a resident cutthroat trout population were evaluated in a reservoir in the Bull Run River Watershed, Oregon, in 2007. Entrainment was monitored at a water intake without fish screens at staggered intervals throughout 2007 using hydroacoustics. An estimated 472 fish were entrained over the course of the year by water withdrawals. Fish abundance in the reservoir was also estimated twice, once at full-pool and once during draw-down, using hydroacoustic equipment attached to a boat. Resulting population estimates were 3,848 (±1,291, 95% CI) and 4,408 (±1,491, 95% CI), respectively.

Up to 10.7% to 12.3% of the population of fish in the reservoir may be entrained annually, though the actual value could be much lower. Cutthroat trout in the reservoir, however, experience no fishing mortality and the entire upstream watershed is in a near-pristine condition. An estimate of reservoir productivity based on its morphoedaphic index and a simple multiple life-stage Beverton-Holt model both suggest that the reservoir's cutthroat trout population can sustain the estimated level of entrainment without becoming unviable.

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Title

Water quality status and implementation of the Clean Water Act in the North Fork Coeur d'Alene River Subbasin, Idaho

Abstract

The North Fork Coeur d’Alene River Subbasin of northern Idaho is rich with history and natural resources. The mountain streams of this subbasin have long supported aquatic life found only in cool, clean waters, including westslope cutthroat trout and tailed frogs. A long history of timber harvest, road building, mining and other human disturbance has left many streams in this subbasin with water quality that cannot fully support beneficial uses, including cold water aquatic life and salmonid spawning.

There are more than 1,100 stream miles in the North Fork Coeur d'Alene River Subbasin. A large number are considered impaired by elevated water temperatures and excessive sediment. In some drainages, mining has left a dramatic legacy of habitat alteration and heavy metals contamination. The Idaho Department of Environmental Quality (IDEQ) implements state water quality standards and the federal Clean Water Act by determining beneficial uses of water bodies, assessing whether water quality supports these uses, and then implementing plans to achieve water quality improvements where needed.

To address water pollution in this subbasin, a Watershed Advisory Group has been convened. This group consists of representatives of stakeholder categories including federal and state agencies, county government, mining, timber, and local landowners. Total Maximum Daily Loads (TMDLs) are the mechanism for setting water quality targets. Together IDEQ and the Watershed Advisory Group are developing TMDL water quality targets for temperature and metals, and we are reviewing the effectiveness of a 2002 TMDL for sediment. An updated subbasin assessment of water quality status is also being conducted.

Perhaps most importantly, IDEQ and the Watershed Advisory Group are reporting significant habitat restoration and mining remediation work in the subbasin, and we are developing strategic approaches for further improvement to and protection of coldwater aquatic communities.

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Title

Using GPS and handheld computers to monitor steelhead populations

Abstract

Live fish and carcass counts, which are useful monitoring tools for adult salmon species, are not applicable to steelhead monitoring because steelhead spend a shorter time on spawning beds, are elusive and hard to count when not actively spawning, and often do not die where they spawn. Redd counts are a suitable proxy for steelhead abundance but add other challenges to the monitoring program. As steelhead spawn timing is protracted, a single redd count may be insufficient. However, because of highly variable redd longevity, individual redds should be marked to avoid double counting. The Oregon Department of Fish and Wildlife's coastal adult steelhead monitoring program is in its second year of using GPS and handheld computers to track individual redds on spawning grounds. The technology greatly reduces data entry and gives near real-time access to survey data. It augments, but does not yet replace, traditional redd marking techniques such as flagging and placing painted rocks.

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Title

Klamath River Thermal Refugia: Physical and Biological Characterization

Abstract

Summer thermal refugia in the Klamath River are areas of cool water in an otherwise warm channel and play an important role for salmonid survival. Summer period water temperatures in the main stem can exceed 25oC, while tributary inflows are often several degress cooler. Local hydrology and geomorphology can play a large role in determining the size and shape of the thermal refugia. Substrate, channel slope, and channel form of both the mainstem and tributary control the shape and size of the refugial area. Further, the creek water has the potential to infiltrate into the bed upstream of the confluence and emerge in the mainstem as upwelling hyporheic flow or groundwater. If bedrock is prevalent, the opportunity for such conditions may be limited, but the refugia may be more stable than those in alluvial channels. A high flow event during the winter of 2005-2006 scoured the mainstem channel and dramatically changed the structure of many thermal refugia. In summer 2006 and 2007, daytime snorkeling was conducted in the Beaver Creek and Tom Martin Creek thermal refugia to document coho salmon microhabitat use, including temperature tolerance. Klamath mainstem temperatures remained in the 20-25ºC range July through August. Most coho observations in the refugia were made at mainstem temperatures >23ºC. As mainstem temperatures cooled in September, coho counts declined. Tracking movements of juvenile coho during June – September within thermal refugia would help determine the fate of these fish (i.e., do they move into the tributaries, downstream, or do they succumb to high water temperatures). Minor stream restoration efforts to create pocketwater habitat in some tributary mouths would allow easier access for juvenile salmonids trying to escape high mainstem temperatures.

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Title

Movements and habitat associations of native and introduced catostomids in a tributary system of the Colorado River: Implications for restoration of the natives.

Abstract

Bluehead sucker Catostomus discobolus and flannelmouth sucker Catostomus latipinnis populations are declining throughout their native ranges in the Colorado River Basin. The Big Sandy River in the Green River Basin of Wyoming contains populations of both native sucker species, as well as introduced white suckers Catostomus commersonii and longnose suckers Catostomus catostomus, and introgressed forms of the native and introduced species. The Big Sandy River may become a focus of efforts to restore genetically pure populations of bluehead suckers and flannelmouth suckers in the future. Information on movement patterns and habitat associations of native and introduced suckers in the Big Sandy River was needed to guide such efforts. Twenty to twenty-two adults of each species were captured over 70 km of the Big Sandy River and implanted with radio transmitters in September or October 2006 and tracked until July 2007. Spatial distributions of the native and introduced catostomids overlapped widely in the Big Sandy River. During fall and winter all four species were relatively sedentary and generally found within 2 km of previous locations, and all four species selected pools with rock substrates. Spring movements and habitat use varied among species with bluehead suckers and flannelmouth suckers moving downstream, white suckers remaining sedentary, and longnose suckers moving upstream. Bluehead suckers selected pools with rock substrates, flannelmouth suckers selected braided channels with sand substrates, white suckers selected pools, and longnose suckers selected deep runs during spring. Bluehead suckers and flannelmouth suckers in the Big Sandy River displayed spring movements that appeared to differ from other populations. This research provides insights into management options for restoration of genetically pure bluehead suckers and flannelmouth suckers in the river.

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Title

Acute Toxicity of Potassium Chloride to Endangered Southwestern Native Fishes

Abstract

In 2007 quagga mussels were found in the water system of a federal hatchery that rears endangered southwestern native fishes. These fish are mainly stocked into waters of the Colorado River Basin where quagga mussels are already present, but preventing further movement or transfer of the mussel to other facilities or waters is a priority for State and Federal agencies. Potassium chloride is an accepted treatment for killing mussel veligers when transferring fish from waters that are positive for quagga mussels. Data is available on the effects of potassium chloride on many sport fish species but little research has been conducted on the effects on endangered native fish. Acute toxicity of potassium chloride to juvenile Colorado pikeminnow (Ptychocheilus lucius) (mean weight ± SD, 0.27 ±0.05 g; mean age 70 d, ±14 d), razorback sucker (Xyrauchen texanus) (mean weight ± SD, 0.35 ±0.13 g; mean age 105 d, ±7 d), and bonytail (Gila elegans) (mean weight ± SD, 4.58 ±1.34 g; age 147 d) was studied in 96 h static tests to determine the median lethal concentration (LC50). Colorado pikeminnow were significantly more sensitive to potassium chloride (96 h LC50 of 1280 mg/L) than razorback sucker (96 h LC50 of 1942 mg/L) of comparable size. The larger bonytail exhibited significantly lower sensitivity (96 h LC50 of 2670 mg/L) than both Colorado pikeminnow and razorback sucker. The results from these tests combined with continuing research on acute toxicity of potassium chloride within each species at different life stages will provide resource managers with baseline data for further development of quagga mussel treatments that result in minimal effects on native fish species.

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Title

SEA LION PREDATION ON ADULT SALMONIDS IN THE BONNEVILLE DAM TAILRACE

Abstract

In the late 1990s, California sea lions (Zalophus californianus) began congregating in the tailrace of Bonneville Dam on the Columbia River in the spring to prey on migrating adult Chinook salmon (Oncorhynchus tshawytscha) and steelhead (O. mykiss). Since 2002, we have used surface observations during daylight hours to determine the daily and seasonal abundance of sea lions, record predation on salmonids and other fishes, and evaluate sea lion deterrents used at the dam. The estimated number of pinnipeds, including California sea lions, Steller sea lions (Eumetopias jubatus), and harbor seals (Phoca vitulina), observed during the January 1 through May 31 study period increased from 31 in 2002 to between 80 and 111 since 2003. Pinniped presence increased as some sea lions arrived earlier each year. The number of days individual sea lions were documented at the dam increased each year, as did peak daily pinniped abundance. Most pinnipeds were California sea lions, but Steller sea lion abundance increased from none in 2002 to about 10 in 2007. Adult salmonids comprised 76% (n = 14,093) of observed catch from 2002 to 2007, and Chinook salmon was the most commonly identified prey species. Estimated salmonid catch increased from 1,010 in 2002 to 3,859 in 2007. The number of salmon and steelhead passing Bonneville Dam during the study period declined from 284,733 (2002) to 88,474 (2007), increasing the relative impact on the run. The estimated number of salmonids caught per observation hour increased from 1.5 in 2002 to 6.4 in 2004, but declined in subsequent years as sea lions arrived earlier (when fewer fish were available) in anticipation of the Chinook run. Although they appeared to alter the behavior of some sea lions, deterrents did not reduce total salmonid catch at the dam.

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Title

Freshwater Mussels of the Owyhee River Basin, OR—a Prehistoric Perspective

Abstract

Beginning in 2001, freshwater mussels have been inventoried and systematically sampled on drainages in the Owyhee River Basin, including 10 remote sites on the Owyhee River. Two mussel species, Gonidea angulata and Anodonta sp., were encountered in the main river, but only G. angulata was widespread with multiple age-classes. However, mussel shells found in prehistoric Indian middens located on the main river and on a tributary included shell fragments of Margaritifera falcata as well as G. angulata, indicating that both species were present and accessible for harvest ca. 1000 - 9500 years b.p. Because M. falcata relies on salmon and trout for hosts, its absence or scarcity in the mainstem Owyhee could be related to historic extirpation of anadromous salmonids and the subsequent introduction of unsuitable hosts such as nonnative smallmouth bass (Micropterus dolomieui). Declines in some European Margaritifera populations have been linked to trout host densities that drop below a critical threshold. G. angulata's fish host preferences are not fully determined, but this species appears to be less host specific than M. falcata and, therefore, less vulnerable to changes in fish assemblages. In addition, M. falcata's greater sensitivity to sedimentation may also have influenced its current distribution in the Owyhee Basin.

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Title
PIT Tagging of Northern Pikeminnow in the Lower Columbia and Snake Rivers

Abstract
Since 1991, the Northern Pikeminnow Management Program has implemented fisheries aimed at reducing predation on juvenile salmonids by northern pikeminnow Ptychocheilus oregonensis in the lower Columbia and Snake rivers. The Oregon Department of Fish and Wildlife uses mark-recapture methods to estimate fisheries exploitation rates on northern pikeminnow populations. Each spring, field crews tag northern pikeminnow with uniquely numbered spaghetti tags. Prior to 2003, pikeminnow also received a fin clip as a secondary mark to estimate loss of spaghetti tags. However, fin clips proved to be unreliable because of fin regeneration, natural fin deformities, and misidentification of clips.

In 2003, we decided to try Passive Integrated Transponder (PIT) tags as our secondary mark on northern pikeminnow. We planned to inject the PIT tag into the dorsal sinus of the fish because we believed that this location would provide ease of tagging with minimal mortality and tag loss. To verify this, we collected 40 pikeminnow for a controlled mortality and tag retention experiment. After 71 days we found that mortality was similar for both the tagged and untagged groups, and there was no loss of PIT tags during the experiment.

Since 2003, we have successfully used PIT tags to estimate tag loss rates for spaghetti tags. Because PIT tags can identify individual pikeminnow with great accuracy and with virtually no tag loss, we can confidently enumerate the number of fish that lose spaghetti tags each year. This enables us to make accurate adjustments to exploitation rates. In addition, our use of PIT tags allows us to calculate multi-year exploitation rates, which may provide a better picture of pikeminnow mortality. Finally, detection of PIT tagged pikeminnow at dams has given us glimpses into some of the movement patterns of these fish.

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Title

Macroinvertebrate Analysis Indicates Significant Improvement of Meadow Stream Health due to Livestock Distribution Efforts

Abstract

The objective of this study was to quantify relationships between grazing management and macroinvertebrate assemblages in mountain meadow associated stream reaches in California. Fifty-eight low gradient meadow stream reaches in the Sierra Nevada and Southern Cascades were enrolled in this cross-sectional survey during 2003 and 2004. The meadows and stream reaches enrolled in this study are contained within large pastures and allotments, typical of mountain grazing lands in California and the western US. Mean pasture/allotment size was 18,000 ac, with a median of 3,000 ac. Macroinvertebrate sample collection commenced in early June at low elevation sites (3000 to 5000 ft) and ended in late August at high elevation sites (7,500 to 9,000 ft). Substrate size class (cobble, gravel, fines), percent available solar radiation reaching stream water surface, and embeddedness of streambed substrates were measured along each macroinvertebrate sampling transect. Grazing metrics were determined by survey of the grazing manager at each site. Negative binomial regression was used to test for relationships between grazing practices, stream characteristics, and stream macroinvertebrate indices. We were able to statistically correlate ($P<0.10$) livestock distribution effort (days/year) with 11 macroinvertebrate indices. The act of implementing a distribution practice (yes v. no) was not significantly correlated to any macroinvertebrate indices. Positive correlations were found between livestock distribution effort and all sensitive (intolerant of pollution or habitat degradation) macroinvertebrate indices, while negative correlations were found for all insensitive (tolerant of pollution or habitat degradation) indices. These results provide strong evidence that active, consistent implementation of common livestock distribution tools is associated with increased riparian health.

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Title

The influence of release strategy and migration history on capture rate of Oncorhynchus mykiss in a rotary screw trap

Abstract

Rotary screw traps are used throughout the Pacific Northwest to capture emigrating juvenile salmonids. Calibrating the capture efficiency of each trap is essential for valid estimates of fish passage. To estimate capture efficiency, we released Passive Integrated Transponder (PIT) tagged Oncorhynchus mykiss upstream of a rotary screw trap in the South Fork John Day River, Oregon. Three strategies for release of fish recently captured in the trap were used. Of fish released during daylight 1.6 km upstream of the trap, 28% of medium-size fish (86-145 mm FL) were recaptured, and 14% of large-size fish (146-230 mm FL) were recaptured. When fish were released during daylight 4.8 km upstream of the trap, 33% of medium-size fish were recaptured, and 17% of large-size fish were recaptured. When releases occurred at twilight 1.8 km upstream of the trap, 42% of medium-size fish were recaptured, and 23% of large-size fish were recaptured. To avoid potential bias due to recapture of recently trapped fish, we used a PIT antenna to detect newly migrating O. mykiss (which were PIT tagged upstream 1-5 months before migration) as they approached the trap. Capture efficiency of these first-time migrants in the rotary screw trap was 53% for medium-size fish, and 40% for large-size fish. Twilight releases of recently trapped fish best approximated capture efficiency of newly-migrating medium-size fish, and although underestimated, this strategy was also best at approximating capture efficiency of large-size fish.

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Title

Nez Perce Tribe's Watershed Restoration Program

Abstract

The Watershed Division of the Department of Fisheries Resource Management began 10 years ago, in 1997. We began working on the Clearwater River drainage within the Nez Perce Tribe's Treaty Area, but have since expanded to all of the major drainages within the treaty territory to include SE Washington, NE Oregon, and the Salmon River Subbasin. Our program focuses on the ridge-top to ridge-top approach to watershed restoration, including all treaty resources. The uniqueness of our program comes in our relationship with partners, and the accomplishments that we have made through these partnerships. Our partners are as diverse as our projects. We have worked with several partners from federal agencies to state departments to private landowners. Our projects begin at the watershed scale with the development of a watershed assessment, including inventory and surveys. From there, working with our partners, we complete NEPA, ESA consultation, cultural resource surveys, and move on to implementation of restoration projects. Our restoration activities focus on a wide variety of restoration projects including: culvert surveys and replacements, bridge replacements, road decommissioning, soil restoration, wetland restoration, bioengineering, weed control and abatement, streambank restoration, fencing projects, trail improvements, and monitoring in the capacity of project effectiveness and watershed health. Projects are followed from start to finish with a monitoring program. Throughout the project, we try to incorporate an education program with the local schools, and throughout the project, our tribal government is involved at the policy level. We are still striving to define "What is a truly restored watershed?"

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Title

Annual growth of Lost River suckers in Upper Klamath Lake during the last century

Abstract

Lost River suckers (Deltistes luxatus) are endemic to Upper Klamath Lake, Oregon, and, along with shortnose suckers (Chasmistes brevirostris), were placed on the endangered species list in 1988 after several years of apparent recruitment failure. We examined otolith microstructure of adult Lost River suckers from two periods: those collected during spawning runs in 1970 (N=74), and those captured by USGS from 2001-2006 (N=198). Validated annuli indicated that Lost River suckers aged in this study were long-lived; the maximum age observed was 57 years. Growth appears determinant in both sexes, such that a 650 – 700 mm fish can be from 10 to 57 years old. Annual age adjusted growth for the period 1913 to 2005 in relation to weather and the lake environment will be discussed.

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Title

Cumulative Ecosystem Response to Restoration Projects: An Approach in the Columbia River Estuary

Abstract

Habitat restoration in the Columbia River estuary is a key element in the effort to protect and recover salmonid populations listed under the Endangered Species Act in the Columbia basin. Restoration projects are expensive, with individual projects often not coordinated and the effectiveness of multiple projects in producing an overall net ecosystem improvement untested. Therefore, science must provide evidence of cumulative net ecosystem benefits. The Corps of Engineers and others are restoring wetland habitat for juvenile salmonids in the 235 km tidal portion of the Columbia River. This large-scale restoration effort is accelerating and is anticipated to improve habitat quality through hydrological reconnection of existing and restored habitats. Currently, multiple groups are implementing a variety of restoration strategies. However, the region lacks standardized means to evaluate the effectiveness of individual projects, and methods for assessing estuary-wide cumulative effects. We recently developed a framework for such analyses, which includes a protocol manual for monitoring physical and biological metrics to standardize data collection. Typically, restoration actions for hydrological reconnection concern tidegates, culverts and dike breaches. We are using data from field studies at restored and reference sites in a weight of evidence meta-analysis to estimate net cumulative effects. Key tools include hydrological modeling and a GIS-based system to accumulate effects.

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Title

A caged mussel relocation experiment to investigate Margaritifera falcata mortality in a Puget Lowland stream.

Abstract

The western pearlshell mussel, Margaritifera falcata, was historically common in western coastal streams. Bear Creek, a Puget Lowland creek in King County, Washington, supported an apparently healthy M. falcata population into the late 1990s. Recently, the decline of this population became increasingly apparent as mussel beds became dominated by dead shells. The cause of this mortality is not clear since Bear Creek drains a watershed with relatively little urbanization.

In order to study the freshwater mussel die-offs in Bear Creek, we initiated a study to address the following questions: 1) How much M. falcata mortality has occurred and what is the spatial distribution of die-offs in Bear Creek? 2) Do healthy M. falcata become diseased when relocated to Bear Creek? 3) Is there a sequence of observable pathological events that leads to mortality? 4) Could toxic algae be responsible for the M. falcata mortality?

In December 2006 and May 2007, M. falcata mussels from the nearby Cottage Lake Creek population were relocated to Bear Creek. Relocated mussels were examined for changes in tissue morphology, glycogen levels, gamete development, and survivorship. Results from this research indicate that in most of the M. falcata beds surveyed, there was 93% decline in live mussels between 2002 and 2007. Mussels that were relocated to one of two sites along Bear Creek started dying in September 2007 and experienced nearly 40% mortality from September to early December. In an upstream lake that feeds Bear Creek, no algae commonly known to be toxic were observed. However, fathead minnow toxicity screening suggested that there was a toxic event in the lake. It is possible that the toxicity detected in the lake is associated with downstream mussel mortality.

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Title

Flow and temperature effects on salmonid production

Abstract

We conducted a study in free-flowing and impounded reaches of the Snake River to determine if migrational disposition and migration rate of subyearling fall Chinook salmon were affected by water velocity and turbulence. Migration rate (km/d) was calculated for individual radio-tagged subyearlings as they migrated downstream through six study reaches. We measured water velocities in each reach at flows of 351–4,880 m3/s and fitted reach-specific regressions from flow to predict velocity and the standard deviation of water velocity (a surrogate for turbulence) experienced by subyearlings for the times they were in each reach. Subyearlings were partitioned into groups according to their migrational disposition depending on whether they moved faster (direct migrants) or slower (indirect migrants) than the average reach velocity. The percentage of the subyearlings classified as direct migrants decreased as fish transitioned from riverine to reservoir habitat but then increased again to riverine levels as the fish continued to move downstream. Migration rate decreased substantially as fish passed into the reservoir and remained low thereafter despite the rebound in directed migration. Migration rate of the direct migrants was more highly correlated with velocity (r2 = 0.90) and turbulence (r2 = 0.90) than migration rate of the indirect migrants (velocity, r2 = 0.77; turbulence, r2 = 0.76). We concluded that water velocity and turbulence affected both migrational disposition and migration rate of subyearlings. We hypothesized that subyearlings respond to velocity and turbulence cues to affect downstream migration through active and passive behavioral choices. Regardless of species or global locale, our findings imply that the explanatory power of regression models fitted to explain variation in migration will be higher if course-scale variables such as mean flow are replaced by fine-scale variables such as velocity and turbulence.

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Title

The thiaminase content of American shad reduces its quality as a prey item.

Abstract

American shad (Alosa sapidissima) serve as prey items for predators in the Columbia River basin. In certain locations and times, shad comprise the major food source for some predators. Shad are congeners of alewife (Alosa pseudoharengus) and as such, may contain thiaminase an enzyme that degrades the essential vitamin thiamine (vitamin B1). Alewives contain thiaminase, and have been causally-linked to thiamine deficiency and subsequently to early mortality syndrome (EMS) in Great Lakes salmonines. The poor reproduction observed in certain populations of salmonines in the Great Lakes has been attributed to large dietary quantities of alewives. The catalytic activity of thiaminase (i.e. ability to degrade thiamine) has not been measured in shad. Thus, it was the objective of our study to: 1) evaluate the thiaminase content of shad from the Columbia River; and 2) assess the risk posed by shad as food items for various predators in the Columbia River. We found that shad from the Columbia River contained elevated amounts of thiaminase and indeed could be a threat to predators which utilize shad as a primary food source.

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Title

Coldwater fishes and thermal refuges in hot water: Synthesis and future directions

Abstract

Characterizing spatial and temporal variability of thermal refuges used by coldwater fishes is increasingly becoming important for researchers and water resources practitioners seeking to develop and apply water temperature standards in streams and rivers. We define thermal refuges for coldwater fishes at spatial scales ranging from microhabitats to entire catchments that change over time scales of seconds to centuries. Embedded within these multiple sources of variation there is also a continuum of habitat quality, in which certain kinds of refuges satisfy only a limited number of temporarily critical habitat requirements. We synthesize the concepts and observations presented in this symposium and evaluate the implications for resource managers of defining thermal refuges in terms of static limits as opposed to relative conditions of surrounding habitat and the environmental tolerances of the organism at risk. Because the use of thermal refuges by coldwater fishes is a facultative response to temporary environmental change, we propose that these "refugee" organisms be viewed as indicators of ecosystem stress and the need for ecological restoration.

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Title

Seeing the stream for the fishes with river-centered remote sensing

Abstract

Remote sensing is literally changing the way ecologists see rivers and streams and the organisms that live within them. Predominantly site-specific, fine-scale views of lotic environments that were so common in the past are evolving rapidly into high-resolution, geographically extensive remotely sensed surveys of physical and biological characteristics. This more rigorous, spatially explicit approach to pattern detection will make it possible to (1) determine with more precision the initial ecological conditions of rivers and associated biota, and (2) monitor the effects, and ultimately the success, of ecosystem restoration. The broad array of techniques described in this review of the “state of the art” in fluvial remote sensing illustrate that increasing the geographic extent and resolution of our perception through technical means amplifies the power and flexibility of studies to evaluate ecological patterns at multiple scales. Such approaches aim to align data collection and analysis with the innate process of pattern detection in humans and, thus, offer a more complete view that better reflects ecologists’ understanding of heterogeneity, context, and scale in stream ecosystems. Changes brought about by remote sensing in the way studies are designed and conducted will yield great potential for creativity and new discoveries in riverine ecology.

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Title

A do-it-yourself guide to full and half-duplex RFid; lessons learned tracking bull trout in the upper Willamette

Abstract

We use Texas Instruments Series 2000 low frequency systems to build stream-width interrogation sites for 23-mm half-duplex, passive integrated transponders (PIT tags). More recently, we also used the component board from an Allflex panel reader (Bond et al. 2007) to detect 12 mm full-duplex and 23 mm half-duplex PIT tags. We use these systems in conjunction with other methods, such as time-lapse digital video and an electronic fish counter (Vaki Riverwatcher), to determine adult abundance, track juvenile and adult bull trout migrations, determine the number of times an individual spawns, determine the earliest dam passage date, and juvenile-to-adult survival. In this presentation, I review the basic system components, building materials, parameters, common problems, general relationships, and advantages of a swim-through versus a swim-over antenna configuration. I describe the basic steps involved in building site-specific antennas and provide detailed schematics of ten different half-duplex and two different full-duplex antennas for a variety of applications, from large rivers to baited detection stations.

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Title

Diamond Lake, OR: 2006 Restoration, 2007 Recovery, and Latest Fishing Report

Abstract

In 1992, non-native tui chub (Gila bicolor) were found in Diamond Lake and presumed to have been illegally introduced. Within a few years, tui chub caused poor survival and growth of hatchery rainbow trout that resulted in a popular trout fishery to decline and water quality issues from toxic algae blooms to restrict recreational boating and swimming. Oregon Department of Fish and Wildlife began efforts in 1994 to initiate the public process at federal and state levels to complete restoration that could involve applying rotenone. Also, supplemental and experimental stocking programs were completed using additional funding sources to maintain angling interest and determine if predatory fish could regulate the chub population. Mechanical removal of fish was conducted pre-treatment in 2006 to reduce chub biomass and limit nutrients and dead fish post-treatment. Prior to treatment, the lake was drawn down eight feet below normal full pool and sampled for fish distribution in tributaries. The lake outlet head gates were closed and secured to contain all surface water flows during rotenone application and until the lake was rotenone free. The lake was treated with rotenone on September 13-15, 2006 using nine custom fitted pontoon boats to distribute the majority of the product into the lake, with two smaller boats, drip stations, and backpack applicators doing specialized shoreline treatment. Since the successful treatment, the ecosystem has rebounded with dramatically higher zooplankton and benthic macroinvertebrate biomass, lowered pH, and increased transparency. Trout stocking resumed in spring 2007 with conservative release numbers of 100,000 fingerlings, along with 84,462 various catchable and trophy fish. The abundance of benthic prey items available (60-200 lbs/acre) and large Daphnia resulted in above average trout growth and condition factors, greatly increasing the number of angler trips and catch rates for 2007.

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Title

Habitat Management within the ceded lands of the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO).

Abstract

Abstract: The Confederated Tribes of the Warm Springs Reservation of Oregon, through treaty negotiations in 1855 secured the exclusive rights to ownership and management of lands within the boundaries of the Reservation. The Tribes also secured the rights of co-management and shared use within the boundaries of the ceded lands or ancestral territory.

The boundary of the ceded lands for the CTWSRO are defined in the treaty of 1855 and encompass approximately ten million acres from Cascade Locks on the Columbia River, south along the Cascade crest to the 44th parallel near Bend, east to the summit of the Blue Mountains, along the hydrologic divide to include the entire John Day River Basin, and north to the Columbia River. The Tribes have co-management authority with regard to fish, wildlife, and water quality, alongside the state of Oregon and the Federal government, within these ceded lands.

This presentation will discuss the general strategy the CTWSRO are currently implementing to protect and enhance habitat for fish and wildlife within these ceded lands to exercise sovereignty. Along with recent accomplishments of the Bonneville Power Administration funded John Day Watershed Restoration Program and Oxbow and Forrest Conservation Areas

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Title

A thermal profile method for long river reaches to identify potential areas of ground-water discharge and preferred salmonid habitat and to document the longitudinal temperature regime

Abstract

The thermal regime of riverine systems is a major control on aquatic ecosystems. Ground water discharge is an important abiotic driver of the aquatic ecosystem because it provides preferred thermal structure and habitat for different types of fish at different times in their life history. In large diverse river basins with an extensive riverine system, documenting the thermal regime and ground-water discharge is difficult and problematic. A method was developed to thermally profile long (5 to 25 kilometers) river reaches by towing in a Lagrangian framework one or two probes that measure temperature, depth, and conductivity. One probe is towed near the streambed and if used, a second probe is towed near the surface. The probes continuously record data at 1-3-second intervals while a Global Positioning System logs spatial coordinates. The thermal profile provides valuable information about spatial and temporal variations in habitat, and, notably, indicates ground-water discharge areas.

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Title

Nonnative Fish Management in the Upper Colorado River Basin: A Case Study

Abstract

Over 40 species of nonnative fish inhabit the Upper Colorado River Basin and are predators, competitors, and disease vectors for the 14 fish species that are native to the system. The Colorado pikeminnow (Ptychocheilus lucius), humpback chub (Gila cypha), razorback sucker (Xyrauchen texanus), and bonytail (Gila elegans) are native mainstem species that are federally endangered as a result of water depletions and diversions, river impoundment and fragmentation, diseases, and negative effects of nonnative species. The Upper Colorado River Endangered Fish Recovery Program (Recovery Program), established in 1988, works to recover these species while water development proceeds in compliance with federal and state laws. Nonnative and sportfish management has been a key element of the Recovery Program since its inception. Threats associated with nonnative fish increased significantly during the drought of the early 2000s. In spring of 2004, Recovery Program partners adopted a policy to identify and implement nonnative fish management actions needed to recover the endangered fish. The policy recognizes the dual responsibilities of state and federal agencies to conserve listed and other native species while providing recreational sportfishing opportunities. The Recovery Program has implemented several actions to reduce threats from nonnative fish, including mechanical removal, screening off-river impoundments, nonnative fish stocking procedures, and changes in state bag and possession limits. Species that pose the greatest threat to survival of endangered and native fish species in the upper basin include the red shiner (Cyprinella lutrensis), northern pike (Esox lucius), smallmouth bass (Micropterus dolomieu), channel catfish (Ictalurus punctatus), and largemouth bass (Micropterus salmoides). The Recovery Program has implemented mechanical control of these key species with resulting shifts in size composition and total abundances. Exploitation models show that removal rates must be increased to cause recruitment failure in these nonnative fish populations.

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Title

Building a Conceptual Model to Describe the Effects of Stream Temperatures on Pacific Lamprey, Entosphenus tridentata, Distribution and Population Success, in Western Oregon.

Abstract

Using results from laboratory based temperature specific growth and survival experiments and observations of Oregon coastal stream temperatures, we provide an initial conceptual model that can be used to describe a portion of the habitat requirements for both juvenile and adult Pacific lamprey, Entosphenus tridentata, in Western Oregon.

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Title

Finding a needle in a haystack - using PIT tags to monitor changes in the natural rearing behavior of fish

Abstract

Changes in the natural rearing behavior of juvenile spring Chinook salmon Oncorhynchus tshawytscha were monitored using Passive Integrated Transponder (PIT) tags September through January in three study streams of the Grande Ronde River Basin, Oregon. PIT tags provided a means for assessing habitat use in relation to ecological factors and habitat quality, as well as monitoring adaptive behavior exhibited by fish to changing environmental conditions. PIT-tagging fish allowed for the detection of fish in the water column without capturing or handling, and provided a way of locating fish that were hidden amid interstitial spaces in pool habitats. In addition, PIT tagged fish were utilized for a multi-census approach to estimate abundance while providing monthly rates of growth from summer to winter for individuals that exhibited different early life strategies. The investigation found that higher quality habitats were associated with increased use by fish from summer to winter, and that changes in fish behavior were related to changes in water temperature. Ideas for rectifying some limitations of the technology used during the investigation will be discussed.

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Title

Quantifying use and selection of in-stream cover by coastal cutthroat trout in three watershed studies in western Oregon

Abstract

Predators like birds and mammals in particular have strong impacts on salmon and trout in larger lakes and rivers, but studies in small streams are lacking. One reason is that observing these predators directly is a daunting logistical challenge. Predators may only visit an area once in a year or even less frequently and have an important influence on fish populations. Thus, it is necessary to devise indirect approaches for understanding how fish may interact with predators in small streams, and how the ability of fish to avoid predators is tied to local habitat conditions. This is a key linkage between the response of fishes to forestry and natural processes that influence availability of habitat that fish may need to avoid predators (in-stream cover). In this study we measured characteristics of in-stream cover and quantified use and selection of this cover by cutthroat trout. We tracked fish marked with PIT tags during the summer low-flow period from August 1 to September 30, 2007 when cover is most limited. The specific objectives for this study include 1) measure patterns of use of in-stream cover by cutthroat trout across three watersheds in western Oregon, and 2) examine how different used cover is from randomly available habitat (i.e. what are fish selecting).

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Title

Johnson Creek Nacó'x (summer Chinook Salmon) Conservation: Protecting the Resource Now and into the Future.

Abstract

In the Johnson Creek drainage of Idaho, the Nez Perce Tribe has established a supplementation program to reduce the demographic risk of extirpation and to conserve genetic and life history traits of a threatened Nacó'x (summer Chinook Salmon; Oncorhynchus tshawytscha) subpopulation. This program exclusively utilizes natural origin fish for broodstock to ensure that supplementation fish only experience the hatchery environment for one generation. Comprehensive monitoring and evaluation of the supplementation program requires knowledge of phenotypic traits and life cycle survival rates of a species that exhibit a diverse life history. This program incorporates a life cycle and life history characteristic approach that monitors the fish from egg to adult to quantify, juvenile survival, smolt-to-adult return rates, and progeny-to-parent ratios. Utilizing survival estimation modeling, adult counts, spawning surveys, and genetic analysis, we examine life stage survival for both supplemented and natural fish.

Supplementation releases have occurred for the past eight years with smolt releases ranging from 57,392 to 120,415 fish. Smolt survival from Johnson Creek to Lower Granite Dam was 24-36% for supplemented fish and 39-62% for natural fish. The first complete cohort of returning supplemented and natural fish completed their adult returns in 2003. Smolt-to-adult return rates (Lower Granite Dam to Johnson Creek) for BY98 were 1.04% for supplementation fish and 2.08% for natural fish, 0.66 and 1.14 for BY00, and 0.31 and 0.22 for BY01. Progeny-to-parent estimates for BY98 were 13.7 for supplementation fish and 8.3 for natural fish, 2.1 and 1.9 (respectively) for BY00, 0.45 and 0.10 for BY01, and 0.65 and 0.13 for BY02.

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Title

A study to assess habitat utilization by juvenile coho salmon residing in the Lower Klamath River corridor

Abstract

Abstract.—Knowledge of juvenile coho salmon (Oncorhynchus kisutch) ecology in the Klamath River has typically been restricted to studies that are either limited in duration to fair weather months, and/or have been conducted exclusively within Lower Klamath tributaries. This previous focus resulted in a lack of knowledge of how juvenile coho utilize the mainstem river corridor (including sloughs and low gradient tributary confluences). This multi-year study conducted jointly with the Karuk Tribe, however, has sought to document the year-round life history of juvenile coho salmon within the Klamath River. Study sites extended from Happy Camp to the Pacific Ocean. Beginning in October, 2006 the Yurok Fisheries Program documented widespread non-natal immigration of juvenile coho out of mainstem river habitats into low gradient seasonally inundated habitats, estuarine sloughs, and off estuarine wetlands fed by both perennially flowing and seasonally intermittent tributaries. Waukell Creek has a confluence with the Klamath River near the top end of the estuarine zone, and was observed to be a major area of non-natal rearing not only for presmolt coho but also sub-adult trout. Peak upstream captures of presmolt coho entering Waukell Creek occurred in November and December, 2006, but continued throughout the winter. Peak captures appeared to be tied closely to changes in the mainstem hydrograph. Junior Creek Pond (within the Waukell Creek watershed) is an overwintering destination for a majority of the coho exiting the mainstem. Coordinated efforts with the Karuk Tribe and the use of PIT tags have documented mainstem river migrations of presmolt coho from as far away as Independence Creek (rm 90). Preliminary results indicate a far greater diversity to the early life history of coho salmon in the Klamath River corridor than previously thought.

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Title

A Decision Support System to Assess the Biological Sustainability of Oregon Coast Coho Salmon

Abstract

Conservation status of salmon is determined by a wide variety of factors, and comprehensive assessment requires integrating a complex set of information. The Oregon Coast Work Group of the Oregon and Northern California Coasts Technical Recovery Team (ONCC TRT) recently developed a suite of biological recovery criteria for the Oregon Coast Coho Salmon Evolutionarily Significant Unit (ESU). These criteria include information on fish abundance, productivity, diversity, distribution, and habitat at a variety of geographic scales: watersheds, populations, biogeographic strata, and the entire ESU. To provide a logically consistent and transparent integration of these criteria into a measurable ESU assessment, we adopted a formal decision support system (DSS) that evaluates low-level criteria at a variety of scales, and combines these through a logic network to evaluate biological sustainability at population, stratum, and ESU scales. GIS mapping of results provides a tool that allows decision makers to visualize how local conditions contribute to the overall assessment. In addition to providing a snapshot status assessment, the DSS could also allow exploration of recovery scenarios throughout the recovery-planning process. It is anticipated that the individual criteria and DSS network structure will evolve as our understanding of salmon conservation biology improves.

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Title

Genetic methods for studying non-equilibrium populations: promises and limitations

Abstract

Population genetic methods have been enormously useful in applied conservation biology. However, most standard population genetic models assume equilibrium conditions, which typically don't apply in restored habitats. Fortunately, recent theoretical and analytical developments, combined with the increasing availability of numerous highly polymorphic molecular markers, have opened up new opportunities for studying non-equilibrium processes using genetic markers. Two major types of applications will be discussed: that that study migration, and those that evaluate population size. Genetic assignment tests (which essentially use discriminant functions to assign individuals to population of origin) can be used to study real-time movements of individuals and metapopulation processes. Population size can be estimated in two ways using genetic methods: by using multilocus genetic 'tags' in a mark-recapture framework, or by estimating effective population size. Either approach can be used in a monitoring context to track changes over time. These methods have some limitations, which will be discussed along with experimental design and sampling issues.

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Title

A potentially adaptive physiological response to thermal habitat alteration by a globally invasive species

Abstract

The Invasive Species Specialist Group of the World Conservation union (IUCN) has included the western mosquitofish, Gambusia affinis, as one of the world's 100 worst invasive species. Initially introduced in many areas as a means to control the mosquito populations, G. affinis is currently the most widely distributed freshwater fish in the world, inhabiting every continent except Antarctica. The ability to tolerate or adapt to diverse environmental conditions is a fundamental trait that contributes to many species' invasiveness. A broad thermal tolerance, in particular, allows potentially invasive species to disperse across a larger latitudinal gradient. The results of this study establish upper and lower critical thermal limits for up to four populations of G. affinis across seasons at two acclimation temperatures, including a population exposed to artificially elevated temperatures produced by a steam-electric power station. Thermal temperature polygons were established to describe this species' eurythermicity, and to assess the capacity of this invasive species to adapt to anthropogenic alterations of its thermal habitat, which has broad implications for invasive species exposed to ongoing, global climate change.

This research was supported by Luminant Power through their Environmental Research Program.

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Title

Meacham Creek as a test bed for applying scale specific restoration tools in the Blue Mountains, Oregon

Abstract

Physical and ecological processes in riverine systems result in a range of specific habitat and water quality conditions that affect the health and composition of native fish populations. Changes to these ecosystem processes can lead to degradation and resultant conditions symptomatic of simplified morphology and poor water quality. Successful restoration of degraded stream systems requires knowledge about these complex processes, development of operational theories applicable to systems with similar attributes, direct monitoring information of a set of effective variables, linkage between science and implementation, and developed restoration methods within existing constraints (Wohl et al., 2005). Over the past several years, Umatilla River research efforts focused on understanding surface/groundwater interactions that regulate a complex regime of stream temperatures. This research has informed monitoring techniques and field instrumentation in this investigation. Results from this research suggest that complex hydrologic and geomorphic patterns maintain a network of flowpaths that drive thermal diversity across the floodplain.

Promoting the concept of restoration science and applying the Riverine Ecosystem Planning Approach, the knowledge gained from research efforts on the Umatilla River are linked to implementation through the Meacham Creek example. A previous watershed assessment for Meacham Creek identified limiting factors, including, water quality, floodplain and channel processes, and salmonid production. To avoid the pitfall of addressing only symptoms, restoration projects are being designed to restore and protect ecosystem processes. To date, active restoration has resulted in supplementing several hundred trees into the Meacham Creek floodplain and designing modifications to floodplain levees. Spatial and temporal targets have been developed for the Meacham Creek restoration effort and have allowed us to measure specific water quality and habitat variables at relevant scales. By investing in a substantial monitoring effort, we expect to better understand and protect ecosystem processes.

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Title

Evaluation of Low-Stress Herding and Supplement Placement for Managing Cattle Grazing in Riparian and Upland Areas

Abstract

By understanding the factors that influence where animal graze, rest and drink,
livestock can be redistributed in a predictable and effective manner, so that they do not have undesirable effects in grazed watersheds (George et al 2007).
Management practices are often needed to ensure that riparian areas are not heavily grazed by livestock. A study was conducted in Montana during mid summer to evaluate the efficacy of low-stress herding and supplement placement to manage cattle grazing in riparian areas. Naïve 2-year old cows with calves were annually assigned to 3 treatments: 1) free-roaming control, 2) herding from perennial streams to upland target areas that contain salt, and 3) herding to upland sites with low-moisture block supplement and salt. Treatments were evaluated in 3 pastures over a 3-year period in a Latin-square design (n = 9). Stubble heights along the focal stream were higher (P = 0.07) in pastures when cattle were herded (mean ± SE, 23 ± 2 cm) than in controls (15 ± 3 cm). Global positioning system telemetry data showed that herding reduced the time cows spent near (< 100 m) perennial streams (P = 0.01) and increased the use of higher elevations (P = 0.07) compared to controls. Forage utilization within 600 m of supplement sites was greater (P = 0.06) when cows were herded to low-moisture blocks (18 ± 6 %) compared to controls and herding to salt alone (8 ± 2 %). Moving cattle to uplands at midday using low-stress herding is an effective tool to reduce use of riparian areas. Herding cattle to low-moisture blocks can increase grazing of nearby upland forage but may not provide additional reduction in cattle use of riparian areas compared to herding to salt.

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Title

Dreissenid Detection in the West

Abstract

Early detection is the primary objective of dreissenid mussel detection efforts in western waterways where mussel densities are extremely low or absent. It is in the early stages of infestation, when population sizes are relatively small and isolated, that control efforts can be most effective. There are multiple methods for dreissenid monitoring. Public outreach and education are important components to an early detection program. Adult and juvenile mussels are sampled with artificial and natural settlement substrates, surface scrapings, benthic dredges, and visual inspections via SCUBA and ROVs. The planktonic larvae, veligers, are collected with plankton tows that are analyzed either through molecular or microscopic methods.

There are several early detection efforts in western waterways. The 100th Meridian Initiative is a cooperative effort between state, provincial, and federal agencies to prevent the westward spread of dreissenid mussels. Portland State University (PSU) has been coordinating volunteer monitoring for adult mussels since 2003 and veligers since 2005 as part of the 100th Meridian Initiative. There are many agencies in western U.S. that are involved with adult and veliger monitoring and include federal, state and local entities such as the National Park Service, Bureau of Reclamation, Kansas Department of Fish and Parks and the Southern Nevada Water Authority.

Dreissenid introduction into other western waterways can still be prevented but the risk of dreissenid introduction and establishment and spread in western waterways has increased. The recent discovery of zebra mussels in San Justos Reservoir, CA and Lake Pueblo State Park, CO as well as the dreissenid populations in Lake Mead, NV provide a proximate “seed stock” that can be transferred downstream and between basins. Efficacy of early detection efforts can be increased with continued regional coordination, focus of effort on high-risk water bodies and increased sampling intensity targeting veligers as well as juveniles and adults.

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Title

Improving Survival for fish passing through The Dalles Dam

Abstract

The Dalles Dam (TDA) currently has among the lowest dam passage survival rates for juvenile fish among the eight federal Columbia River power system (FCRPS) dams. The targeted goal for fish survival improvements at The Dalles Dam is to achieve 96% and 93% survival rates for spring and summer migrants, respectively. Such survival rates are consistent with performance standards under development in the Remanded 2004 Biological Opinion (BiOp). The achievement of such survival benefits are being attempted under a least cost approach, with the caveat of not negatively affecting other salmonid life histories, other aquatic species, water quality, or recreation activities.

The Dalles Configuration and Operation Plan (COP) provide the strategic direction for carrying out fish passage improvements at The Dalles Dam. Specific COP objectives include: (1) define the baseline condition for fish passage, (2) identify and prioritize fish passage alternatives, (3) describe the framework from which alternatives will be evaluated, (4) identify critical information gaps needed to make decisions, and (5) define the schedule and alternative implementation process for reaching targeted survival goals. An overview of physical & numeric modeling techniques used and the alternative(s) selected for reaching targeted survival rates will be presented at the symposium.

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Title
Okanagan River Restoration Initiative

Abstract
The Okanagan River Restoration Initiative is an outstanding example of a successful international partnership of government agencies and non-government organizations (including provincial, federal, first nations & groups) aimed at restoring salmon stocks in a transboundary watershed with borders that fish do not recognize. This project works in unison with three other projects on the Okanagan River (sockeye range extension, McIntyre Dam modification, and the Freshwater Management Tool) to address the key factors limiting salmonid production. Fish production in the Okanagan River was impacted by dams in the early 1900s and flood protection measures in the 1950s. The river was shortened by over 45%, and channelling eliminated 90% of the rivers riparian and wetland habitat. Approximately 84% of the river has been channellized, reducing egg-to-fry survival to half that found in non-channelled reaches (Long, 2004). In addition, channelization has completely removed key rainbow trout/steelhead juvenile rearing habitat (Matthews 2005 & 2006). This project will restore a portion of the Okanagan River to its original configuration, improving the habitat for indigenous species of sockeye salmon and kokanee (Oncorhynchus nerka), rainbow trout and steelhead (Oncorhynchus mykiss), chinook salmon (Oncorhynchus tshawytscha),and mountain whitefish (Prosopium williamsoni). Restoration objectives include setting back dykes, reconstructing natural river features, developing complex spawning and rearing habitat, improving egg-to-fry survival, reducing silt deposition, creating high quality complex rearing habitat, reconnecting the river with its former floodplain, and restoring riparian vegetation. The project utilizes an ecosystem-based, adaptive management approach to ensure all project elements are coordinated in a sustainable fashion. By moving back to a more historic channel morphometry, geographical range and river hydrograph we hope to move ahead to a more secure sockeye production scenario.

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Title

The Okanagan River Restoration Initiative – Moving Ahead by Moving Back

Abstract

The Okanagan River Restoration Initiative is an outstanding example of a successful international partnership of government agencies and non-government organizations (including provincial, federal, first nations & groups) aimed at restoring salmon stocks in a transboundary watershed with borders that fish do not recognize. This project works in unison with three other projects on the Okanagan River (sockeye range extension, McIntyre Dam modification, and the Freshwater Management Tool) to address the key factors limiting salmonid production. Fish production in the Okanagan River was impacted by dams in the early 1900s and flood protection measures in the 1950s. The river was shortened by over 45%, and channelling eliminated 90% of the rivers riparian and wetland habitat. Approximately 84% of the river has been channellized, reducing egg-to-fry survival to half that found in non-channelled reaches (Long, 2004). In addition, channelization has completely removed key rainbow trout/steelhead juvenile rearing habitat (Matthews 2005 & 2006). This project will restore a portion of the Okanagan River to its original configuration, improving the habitat for indigenous species of sockeye salmon and kokanee (Oncorhynchus nerka), rainbow trout and steelhead (Oncorhynchus mykiss), chinook salmon (Oncorhynchus tshawytscha),and mountain whitefish (Prosopium williamsoni). Restoration objectives include setting back dykes, reconstructing natural river features, developing complex spawning and rearing habitat, improving egg-to-fry survival, reducing silt deposition, creating high quality complex rearing habitat, reconnecting the river with its former floodplain, and restoring riparian vegetation. The project utilizes an ecosystem-based, adaptive management approach to ensure all project elements are coordinated in a sustainable fashion. By moving back to a more historic channel morphometry, geographical range and river hydrograph we hope to move ahead to a more secure sockeye production scenario.

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Title

The Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative: Barriers and Bridges to Cooperative Management of Fishery Research

Abstract

In an effort to mitigate resource conflicts and engage diverse stakeholders in sustainable resource management, decentralized collaborative approaches have evolved over the past decade and a half. Through cooperative management (or co-management), governmental managers and local or regional groups of resource users have jointly devised collaborative approaches to resource management and research. These co-management efforts meld aspects of governmental and community-level approaches. In this presentation, we examine the evolution and performance of what has emerged as one the largest examples of cooperative management of research and restoration addressing Pacific salmon: the Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative (AYK SSI). In 2001, in response to salmon declines, a diverse set of stakeholders established this innovative partnership including: two federal agencies, one state agency, one non-governmental organization, and three regional native organizations representing three different Alaska native cultures (Inupiat, Yup'ik and Athabascan). Based on five years of experience in the implementation of this collaborative research initiative, we examine a series of challenges including: 1) establishing a shared vision of research priorities necessary to understand the cause of salmon declines and support sustainable management; 2) using a consensus process to make research funding decisions among diverse stakeholders; 3) integrating capacity building for local involvement in salmon research into all aspects of the research program. We will discuss how such collaborative processes work and how they influence governmental research and management institutions. Understanding how these barriers and challenges have been addressed reveals both strengths and fragility of this cooperative research initiative and suggests potential modifications for future research governance design.

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Title

Does competition matter? Testing a multi-species habitat selection theory in a pair of high desert stream fishes

Abstract

Many current approaches to modeling fish habitat associations do not elucidate whether observed patterns are the result of distinct vs. shared habitat preference, thus ignoring the potential role that biotic interactions—such as competition—may play in structuring fish assemblages. This study addressed the question of whether habitat selection and behavior of two sympatric fish species of management concern, steelhead rainbow trout (Oncorhynchus mykiss) and juvenile Chinook salmon (O. tshawytscha), are affected by densities of intra- and interspecific competitors. A particularly useful framework for addressing the above questions is isoleg theory, a graphical model describing habitat selection and other behaviors of dominant and subordinate species as a function of competitor densities. At a series of 20 sites in two streams with independently varying densities of both species, we created artificially “good” habitat by supplementing food resources in treatment sites, and observing habitat selection and behavioral responses via snorkeling surveys and underwater video cameras, respectively. Both intra- and interspecific competitor densities appeared to affect O. mykiss habitat selection: migration into “good” habitats decreased at upper threshold densities of O. mykiss and increased at upper threshold densities of O. tshawytscha. Habitat selection by O. tshawytscha was not influenced by competitors, suggesting their distributions were affected by other factors than competition for space or resources in late summer. Framing questions in the context of existing habitat selection theory has the three-fold advantage of (1) advancing ecological theory through the application of an empirical test, (2) addressing questions of management concern regarding mechanisms of fish distributions, and (3) contributing to natural history by revealing interactions within the fish assemblage that have been either ignored or applied in systems (i.e., aquaria) that bear little or no resemblance to natural systems.

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Title

Zebra mussels and calcium: mapping a key limiting factor

Abstract

We used calcium concentration data from over 3,000 stream and river sites across the contiguous United States to classify ecoregions relative to their risk for Dreissena species invasion. We defined risk based on calcium concentrations as: very low (<12 mg/L), low (12 - 20 mg/L), moderate (20 - 28 mg/L) and high (>28 mg/L). Ecoregions comprising 9.4% and 11.3% of land area were classified as very low risk, and low risk. These areas included New England, most of the Southeast, and western portions of the Pacific Northwest. High risk ecoregions comprised 58.9% of land area. Ecoregions with highly variable calcium concentrations comprised 19.8% of land area; none could be classified as moderate risk. The majority of Dreissena occurrences (excluding the Great Lakes) were in high risk ecoregions, with most exceptions being in highly variable ecoregions. Mussel occurrences in low risk ecoregions were all in large rivers flowing from high calcium regions. Our map provides guidance about which areas should receive invasion prevention resources, as well as areas where those resources could be applied to other issues.

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Title

Nonwadeable Streams in the West: More and Less Than You Expect

Abstract

Field methods for flowing waters are determined by whether or not the stream is wadeable. Bioassessment sampling methods are now fairly well established for wadeable streams, which constitute the majority of the length of lotic ecosystems. A better understanding of the characteristics of non-wadeable streams and rivers should advance the development of methods for those ecosystems. We use data collected by the Environmental Monitoring and Assessment Program's Western Pilot Survey to characterize non-wadeable streams and rivers in the western U.S. Exclusive of the Colorado, Columbia, and Missouri Rivers, non-wadeable streams comprise 11% of the length of lentic systems in the West (9%, 14%, and 22% in Mountains, Xeric, and Plains ecoregions, respectively). Non-wadeable streams were widest in the Xeric ecoregion (median = 54 m) and narrowest in the Plains (median = 32 m) with 25% of Plains non-wadeable streams being < 20 m wide. Mean thalweg depths did not vary by ecoregion and were fairly shallow (median = 1.4 m), with 25% of streams having mean thalweg depths of <1 m. Thus, a substantial number of relatively small streams require the use of boat sampling methods. There was no clear break in these size parameters between wadeable and non-wadeable sampling. Fish and amphibian IBI scores for nonwadeable sites did not differ significantly among ecoregions, but were generally lower than IBI scores for wadeable streams, significantly so in the Mountains aggregate ecoregion.

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Title

Spatial patterns in the distribution and conservation of imperiled fishes in the Lower Colorado River Basin

Abstract

The Lower Colorado River Basin (LCRB) has one of the most imperiled fish faunas in the nation. Our objectives were to evaluate the spatial and temporal patterns in the distribution of imperiled species (species state or federally listed and threatened or endangered) and their association with protected habitats. Species data were summarized by decade (1970s-2005) using Aquatic Ecological System (AES) boundaries. This boundary classification is one level of a hierarchical classification system for freshwater systems. Of the 386 AES in the LCRB only 257 have records for fish species. From 1970 through 2005, the proportion of AES with at least one imperiled species doubled. By 2005, half of the AES sampled contained >1 imperiled species. Less than 10% of AES with imperiled species have at least 50% of their area within a legally protected property. Protection of imperiled species may require protection of more habitats in areas of these species occurrences. Our results allow resource managers in the future to identify and focus conservation efforts on AES with increased numbers of imperiled species.

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Title

Development of watershed boundaries to aid conservation efforts in the Lower Colorado River Basin.

Abstract

Hierarchical class systems based on zoogeographic and environmental metrics often are used to create multi-scale watershed boundaries to evaluate aquatic community distributions and designate conservation areas. Previous work has developed five levels of a classification system that encompasses the Lower Colorado River Basin (LCRB). Our objective was to develop the 6th tier defined as an Aquatic Ecological System (AES) that can provide a practical and ecologically defensible watershed boundary for conservation designations. Research from central Missouri has found that the AES level captured distinctive aquatic systems and so may be suitable for the LCRB. We used an iterative approach to develop AES boundaries that incorporated data on change in magnitude of Shreve Link from one stream segment to another, dominant landform, regional occurrence (i.e. Colorado, Virgin, and Gila drainages), and a minimum Shreve Link value based on the distribution of values within each region and landform category. Once boundaries are created, AES can be grouped into similar types using surficial geology, soil permeability (hydrological group), soil surface texture (sand, loam, silt, clay), and dominant landform. AES types can then be related to multiple variables including biotic metrics such as species diversity of natives and non-natives, protection status of the land (public vs. private), and density of anthropogenic stressors. The culmination of this information could be used by natural resource managers in the decision-making process to select areas for conservation efforts for aquatic ecosystems.

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Title

Rotary Screw Trap Efficiency Trials: Can Hatchery Produced Chinook Salmon be used as Surrogates for Naturally Produced Chinook Salmon?

Abstract

Rotary screw traps are widely used to estimate passage of juvenile salmonids in tributaries to the Sacramento River as well as other coastal and inland tributaries in the Pacific Northwest. However, estimating downstream passage of naturally produced Chinook salmon may be difficult when insufficient numbers are available to conduct mark-recapture trials to estimate trap efficiency. Hatchery produced Chinook salmon are often used as surrogates with little or no testing for behavioral differences, which may affect the results of mark-recapture trials. To determine whether behavioral differences may preclude or limit the use of hatchery fish as surrogates in Battle Creek, a tributary to the Sacramento River, we conducted paired mark-recapture trials at various flows using hatchery and naturally produced fall-run Chinook salmon. Hatchery fish used for trials were from Coleman National Fish Hatchery located on Battle Creek, and naturally produced fall-run were captured in lower Battle Creek. To mimic natural migration patterns and reduce the potential for predation, marked fish were released after dark. Preliminary data for trials conducted within the flow range of 298 to 599 cfs indicate that trap efficiencies for hatchery fish were positively correlated with flow at the time of release (R2=0.638; P=0.003) while no correlation with flow was observed for naturally produced Chinook salmon (R2=0.077; P=0.470). Trap efficiencies for naturally produced Chinook salmon were higher during 7 of 9 paired releases, but lower during the other two releases. Flows were highest during the two trials when trap efficiencies were lower for naturally produced Chinook salmon, suggesting the relationship between hatchery and naturally produced Chinook salmon trap efficiencies may change at higher flows. We conclude that prior to using hatchery fish as surrogates for wild or naturally produced Chinook salmon, testing for behavioral differences should be done.

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Title

Characterization of putative migratory and sex pheromones in Pacific Lamprey

Abstract

This study was performed on Pacific lamprey (Entosphenus tridentatus) from the Pacific coast, to characterize putative migratory and sex pheromones. Mass spectrometry analysis of larval washing extract revealed the presence of petromyzonol sulfate, 3keto petromyzonol sulfate, allocholic acid, 3keto allocholic acid, petromyzonamine disulfate, and petromyzosterol disulfate. Mass spectrometry analysis of spermiating male washing extract revealed the main component as petromyzonol sulfate. Electro-olfactogram was performed on adult Pacific lamprey to determine the sensitivity and specificity of the compounds. EOG analysis revealed that the olfactory system of Pacific lamprey was able to detect identified compounds at low concentrations. This study may suggest that the identified compounds have pheromonal roles in Pacific lamprey. Further research is required to confirm the biological roles of the compounds.

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Title

Gear Sampling Effectiveness, Fish Assemblage Composition and Association with Wood in the Willamette River, Oregon

Abstract

We investigated species composition of fish assemblages, gear sampling effectiveness, and fish affinity to submerged wood in the Willamette River from Eugene, Oregon to the river mouth at Portland. We sampled fish assemblages with five collecting methods: boat electrofishing, backpack electrofishing, beach seining, hoop nets, and minnow traps. Three reach types (tributary junctions, multiple channel reaches, and single channel reaches) and 27 sites were sampled in 1998. Of the five gear types used, backpack electrofishers produced the greatest fish species richness (76.1%), beach seine (62.4%), boat electrofisher (57.6%), minnow traps (16.2%) and hoop nets (13.5%). Specific gear types captured greater numbers of particular fish groups (i.e., backpack electrofishers captured more Cottus species). Species composition changed along the river, with the upper river sites consisting mostly of native species (90.9%) and the lower river consisting mostly of non-native species (76.9%). Using backpack electrofishers, the most efficient sampling gear for river margins, 15 paired sites were sampled in 2003. Half contained natural levels of large wood and half were adjacent and devoid of wood. Sampled areas were enclosed with block nets and fish populations were measured by both multiple pass and mark-recapture techniques. Of the 15 paired sites, species richness in habitats with wood were twice those in habitats without wood. Total fish densities were five times higher in habitats with wood compared to habitats without wood; densities of fish were highest in 13 of the 15 pairs of sites where wood was present. Studies of fish assemblage richness require a combination of collection methods. Responses of fish populations to local habitat structure in large rivers may be obscured by general open-river survey methods, but experimental enclosures and use of mark-recapture estimators can reveal habitat relationships at smaller spatial scales.

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Title

Status and Life History Strategies of Bull Trout in the Hells Canyon Reach of the Snake River

Abstract

During relicensing of the Hells Canyon Complex (Brownlee, Oxbow, and Hells Canyon projects), Idaho Power Company completed a status assessment of bull trout (Salvelinus confluentus) associated with the projects and determined which life history strategies were present among the various populations. Above Hells Canyon Dam, bull trout populations were characterized as small resident headwater populations that had become genetically introgressed to varying degrees by Eastern brook trout but still possessed a remnant fluvial life history. No bull trout or hybrids were found in Brownlee Reservoir or tributaries to the reservoir. Below Hells Canyon Dam, fluvial bull trout utilized the Snake River and several major tributaries, though most were found to have migrated from the Imnaha River basin. Bull trout inhabited the mainstem Snake River and Hells Canyon Reservoir during winter and migrated to tributaries in the spring. The majority of fluvial bull trout spent the summer in tributaries before spawning in the fall and returning to the Snake River in late-fall to early-winter. Bull trout that remained in the mainstem Snake River through the summer were dependent on cold water refuge habitat near the mouths of tributaries and springs. Potential limiting factors for bull trout populations associated with the Hells Canyon Complex include: 1) genetic introgression from Eastern brook trout, 2) habitat fragmentation, 3) tributary habitat degradation, 4) competition with and predation from exotic fish species, and 5) reduced tributary productivity. Idaho Power Company proposed specific protection, mitigation, and enhancement measures to address limiting factors for Hells Canyon bull trout including plans for addressing: 1) fish passage, 2) fish pathogens, 3) tributary habitat enhancements, 4) marine-derived nutrient supplementation, 5) an Eagle Creek basin bull trout presence/absence survey, 6) a Pine Creek bull trout permanent monitoring weir, and 7) long-term monitoring and brook trout suppression in Indian Creek.

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Title

PIT-tagged fish: a wealth of information, but not cost free

Abstract

In the last 2 decades, passive integrated transponder (PIT) tags and the ability to detect them in fish, first at Columbia River dams, but now with detectors placed in streams, have revolutionized the ability to determine migration rates, timing, and survival for downstream migrant juvenile salmonids. From the individual-based data, researchers can now determine differences in these attributes between individuals and between groupings or populations of individuals from different areas. Of particular importance is the ability to determine differences in these attributes for fish that experience different migratory conditions while passing through the Columbia River hydropower system (FCRPS). It comes as no surprise to researchers, that timing, migration rates, and survival varies between individual juvenile fish based on size and condition, or between groups of fish from different hatcheries or spawning/rearing areas. The ability in recent years to detect PIT tags in adult fish as they migrate upstream through ladders at Columbia River dams has also provided the ability to determine adult conversion rates based on fish of known origin. More significantly, the detection of adults also provides a means to determine how differences in juvenile migration histories or juvenile characteristics influences smolt-to-adult return (SAR) rates. These data help managers devise strategies for juvenile fish that can lead to the highest rates of return. PIT tags, however, are not cost free. Recent analyses suggest that PIT-tagged fish return at rates potentially 20-30% lower than the unmarked population. Whether the discrepancy indicates real differences in survival is unknown. Research is planned to determine causes. Until the issue is resolved, researchers when reporting, and managers when making decisions, need to recognize that although PIT tags provide potentially a good comparison between groups, they do not provide an absolute measure of SAR.

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Title

Population dynamics of Oncorhynchus mykiss in a small coastal basin in Big Sur, California.

Abstract

Understanding the dynamics of populations is critical to the development of conservation and recovery plans. We initiated a long-term study of threatened steelhead (Oncorhynchus mykiss) in Big Creek, a small basin in the Big Sur coast of California, in 2005. Our primary goal is to develop a stage-structured population model to estimate population dynamics, identify environmental factors driving them, and assess the importance of resident and anadromous life-history strategies to overall population viability. Through biannual mark-recapture electrofishing surveys, PIT tagging, and stream-width and backpack PIT tag antennas we are tracking the fates of individual fish throughout 2700 m of stream habitat and passage to and from the marine environment. We are applying multi-strata robust design models to these data to estimate the abundance, survival, recruitment, and transition rates among various strata (age or size classes and geographic locations) comprising the population; these estimates will be the basis for parameters in the population model. We will present an overview of our conceptual population model and methods, and preliminary results from the first two years of the study.

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Title

Conservation Success Index: A Tool to Synthesize Broad-scale Assessment Data and Management Needs

Abstract

Increasing our ability to synthesize and compare fisheries assessment data among species and across geographic boundaries should facilitate a better understanding of the broad-scale condition of fish resources and necessary management strategies. We describe the Conservation Success Index (CSI), a tool designed to analyze the status of native salmonids and facilitate an improved understanding of range-wide protection, restoration, reintroduction, and monitoring needs. To date, the CSI has been completed for numerous native trout and char with summary status maps, data sheets, spatial analysis of management needs, and analysis of climate change and energy development impacts available at http://tucsi.spatialdynamics.com. We describe case studies illustrating how the CSI has been used to provide a multi-scale description of likely impacts of climate change and public lands energy development to population persistence for inland cutthroat trout and how this information may inform needed management priorities. Impacts from these future broad-scale disturbances are likely to compound existing problems associated with habitat degradation and introgression from introduced salmonids. Although specifically developed by Trout Unlimited to prioritize the organization's conservation work and to assist our members in understanding broad-scale conservation needs, the CSI may be useful to other organizations as a fisheries management or environmental education tool.

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Title

History of disturbances and the current status of salmonids in the North Fork Toutle River system

Abstract

The North Fork Toutle River (NFT) drains the northwestern slopes of Mount St. Helens, Washington. Prior to the 1980 eruption, the river systems arising there were among the most productive for anadromous fish in southern Washington, both in terms of diversity and abundance.

The catastrophic 1980 eruption negatively impacted the productivity of anadromous fish from the NFT. The immediate impact was a massive debris avalanche, which buried the upper 25 km of the NFT River valley. Secondary impacts included lahars that carried turbid and warm water, at levels lethal to fish, to the Cowlitz and the Columbia rivers. Tertiary impacts include ongoing high sediment levels generated by fluvial geomorphologic processes on the highly erodible landscape and non-vegetated mountain slopes.

Mount St. Helens has a history of frequent explosive eruptions; therefore anadromous species in the watersheds arising on the mountain have previously undergone correlated periods of local extirpation, followed by recolonization from the refugial population in the mainstem Columbia River.

The response to the 1980 eruption has uniquely included large-scale anthropogenic actions. The Army Corps of Engineers (ACE) constructed a Sediment Retention Structure (SRS), a permanent dam rising 50 m above the former floodplain and extending 600 m across the valley of the NFT. The SRS is a barrier to volitional fish passage. Below the SRS the ACE constructed a Fish Collection Facility where anadromous wild fish are collected and transported above the SRS to release sites in relatively intact and productive tributaries. Productivity remains abysmally low, with ~150 wild steelhead and ~300 wild coho returning in 2007, (~1% of historical run sizes).

Despite the significantly depressed populations of wild anadromous fish currently returning to the NFT, the system remains an excellent opportunity to explore the connections between landscape processes, habitat restoration, and fisheries science.

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Title

Precocious spring Chinook salmon parr in Catherine Creek, OR

Abstract

Spring Chinook salmon typically exhibit an anadromous life history, where juveniles migrate to the ocean at age-1, and return as adults from age-3 to 5. In some populations, Chinook salmon parr may exhibit an alternate life history in which parr remain and mature in freshwater (hereafter, precocious parr). Precocious parr are predominantly age-1 males and have different body morphology than immature parr. Precocious parr are larger, deeper in body shape, and darker in coloration than immature parr and in late summer have gametes that are easily expressed. We used snorkeling and seining techniques and mark-recapture methods to estimate the immature and precocious parr population in Catherine Creek, a tributary of the Grande Ronde River, during July and August 1998 to 2006. Precocious parr population estimates ranged from 23 to 1,141, and accounted for 0.7 to 5.5% of the total annual brood in Catherine Creek. We estimated that there were two to 26 precocious parr for every anadromous female on the spawning grounds from 1998 to 2006. Higher precocious parr to anadromous female ratios, especially in years of low adult escapement, indicate the potential for this alternate life history type to contribute to the population. Research that expands on the genetic contributions precocious parr would help to better understand the significance of this life history type.

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Title
The CALFED Experience: Working with a Wicked Problem

Abstract
The CALFED Bay-Delta Program was authorized by Congress in 1996 and its course of implementation was set in 2000, when a state-federal agreement was executed. The promise of CALFED was to restore the declining environment of the Sacramento-San Joaquin Delta, which serves as the hub of California's water supply. The Program has been implemented through four major objectives: water supply reliability, ecosystem restoration, water quality and levee system integrity. The first stage of the 30 year program of actions came to a close at the end of 2007. Assessments of the Program's accomplishments during this period will be discussed, as will a number of new processes that have been put into place to augment the work undertaken by CALFED. Issues facing the Delta, the largest estuary on the West Coast of the United States, have been a major topic of concern in California since the 2005 flooding of New Orleans. Among those issues are declines of important Delta species, urban encroachment, increases of invasive species, toxics, the potential for seismic activity to damage the Delta's aging levee system, seasonal flooding and litigation that has impacted the pumping of Delta water to other parts of the state. Another issue that has plagued CALFED since its beginnings and blamed as a reason for some of its failures is the lack of a strong and empowered governance structure. The California Bay-Delta Authority was authorized in 2003 with the passage of the California Bay-Delta Authority Act. Its major criticism is that despite its name, the Authority had no true authority to bring factions to the table to work out differences over how the Delta's ecosystem and water supply assets and issues would be managed. Recent developments have brought old issues that the Authority was to have resolved back to the forefront of California water.

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Title
California’s Delta: An Estuary in Crisis

Abstract
The Sacramento-San Joaquin Delta is the largest estuary on the west coast of the Americas. It began life as a large marsh traversed by shallow channels, where fresh and salt water intermingled with the tide. Its transformation began in the late 1800s, when Congress authorized its reclamation. Deeper channels and higher levees kept water and land separated, and man-made diversions helped keep salt and fresh water apart. The result was a vast man-made region that has increasingly become the focal point of statewide water issues and 60 years of litigation. As a result of natural and anthropogenic changes, the Delta ecosystem is under sustained stress: 90 percent of its wetlands have been lost to alternative land uses; primary production is at an all-time low; diversions of water from its watershed are at record highs; and its biomass is now composed of large numbers of non-native species. Yet it is the hub of the state's water supply and as such, a major source of drinking water for the state. The Delta is also a highly-valued ecosystem and home to more than 750 species of native plants and animals. It is a place that provides a unique way of life for California, with legacy towns, a rich agricultural heritage and historical character. It is part of a value system that warrants protection. The Governor and many Californians now recognize that the uses and values of the Delta we depend on are not sustainable. Past efforts to correct long-term problems have been marginally successful. In 2006, the Governor established an independent Blue Ribbon Task Force charged with developing a durable vision for sustainable management of the Delta. The Task Force adopted its comprehensive and controversial Delta Vision in 2007 and is now working on a Strategic Plan to implement its Vision.

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Title

Trinity River Fishery Restoration - Adaptive Management in Progress

Abstract

This paper describes implementation of Adaptive Environmental Assessment and Management (AEAM) on the Trinity River in northern California. The paper presents background of the Trinity River Restoration Program (TRRP), its organization, accomplishments, and prospects. Construction of the Trinity River Division (TRD) and export of roughly 74 percent of the Trinity's water resulted in substantial changes to the river, with associated declines in natural anadromous fish production. The TRRP is an administratively created program with the goal of facilitating dependent tribal, commercial, and sport fisheries' full participation in the benefits of restoration via enhanced harvest opportunities. The Trinity Management Council (TMC), the decision-making body for the program, consists of four federal agencies (USBR, USFWS, NMFS, USFS), two tribes (Hoopa Valley, Yurok), the state of California, and Trinity County. The Trinity Adaptive Management Work Group (TAMWG) is a 20-member stakeholder committee chartered under FACA. A Science Advisory Board (SAB) ensures scientific integrity, overseeing external review and programmatic process. The model for the TRRP is the Glen Canyon EIS. The TRRP has three advisory bodies, the TMC, TAMWG, and SAB, contrasted with two for the Grand Canyon. TRRP accomplishments since 2000 include replacing three bridges and clearing the floodway in preparation for restoration of geomorphically significant flow releases from the upstream dams. Infrastructure improvements in the floodway are complete, including waivers of liability with many of the 529 landowners in the primary restoration area. Gravel augmentation has begun, aiming towards an annual input of roughly 10,000 tons. And 9 of 44 planned channel rehabilitation projects are complete, with 8 more scheduled this year. The diversity of the TMC, TAMWG, Science Advisory Board, and TRRP scientists is a strength yet to realize its full potential.

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Title

Biological Monitoring of Large German Rivers: Sampling Effort, Data Interpretation, and Condition Assessment

Abstract

The implementation of the Water Framework Directive of the European Union (WFD) in 2000 requires future routine assessment of the ecological status of rivers using physical and chemical as well as biological quality components. For the first time, fish communities referring to their species composition, abundance, and age structure legally have to be considered as biological indicators. Therefore, a practicable national evaluation scheme has been developed for the fish-based assessment of the ecological quality of rivers. A basic premise of this quality assessment using fish according to the WFD is that the entire fish assemblage has been sampled in its relative abundance without bias toward taxa or fish length, which becomes increasingly challenging with river size. Sampling effort exponentially increases with river width and depth, when the efficiency of standard electric fishing drops down. Suggestions are presented concerning number of sites and length to be sampled by electric fishing as well as the application of complementary gears and methods in the mid channel section of large rivers.

Gains and losses of different sampling methods will be analysed and their impact on the assessment result illustrated.

Not surprisingly, the good fish-ecological status of large rivers was directly related to the number of fish and of fish species. Typical potamal, mid channel fish species were best represented by additional fishing gears, but electric fishing at night gained sufficient results too. However, the potential contribution of potamal species to a fish-based assessment will be discussed in general.

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Title

Developing a riparian vegetation and aquatic habitat dynamics model to inform management decisions in the Interior Columbia River Basin.

Abstract

We have developed a prototype model using a state and transition modeling framework (STM) to evaluate the effects of natural disturbances and land-use practices on aquatic and riparian habitats in a mountainous stream network in the interior western United States. The STMs consisted of discrete states defined by channel morphology and riparian vegetation. Transitions between states resulted from plant succession and from natural and anthropogenic disturbances. Channel conditions and habitat suitability for anadromous salmonids, based on known habitat associations, were ranked using a qualitative four-factor scale for each state in the STMs. Disturbance probabilities were varied to define both historical and current disturbance regimes. Prototype models were run for 120 years with the current disturbance regime to illustrate changes associated with Euro-American land management actions, and then run for an additional 50 years under the historical disturbance regime to illustrate the potential for passive recovery. Preliminary results are consistent with historic patterns, showing that Euro-American development dramatically changed riparian vegetation and channel conditions, which resulted in substantial declines in habitat quality. The models also suggest that passive recovery of channel conditions and habitat suitability could be rapid in some stream types, but is likely to be slow in others. This project is continuing with further development of the STMs, including integration of STMs with riparian zone mapping and classification techniques based on lidar and other advanced remote-sensing technologies. The long-term objective is to produce a spatially explicit decision support tool to inform land management decisions and to assist in riparian and stream restoration planning.

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Title

Designation, protection, and recovery planning for endangered sockeye in Sakinaw Lake, British Columbia

Abstract

A public petition initiated emergency assessment of the sockeye salmon population in Sakinaw Lake (‘Sakinaw sockeye’) by the Committee On the Status of Endangered Wildlife in Canada (COSEWIC) in October 2002. COSEWIC concluded that Sakinaw sockeye was a designatable unit of biodiversity, that its abundance had declined by 98% over 12 years (3 generations), and confirmed its status as Endangered in 2003, just before the official proclamation of Canada’s new Species At Risk Act (SARA). In January 2005, the Canadian government announced its decision not to legally list Sakinaw sockeye because the automatic prohibitions of SARA would create unacceptable social and economic costs for the commercial fishing and recreational fishing sectors, some Aboriginal peoples, and coastal communities. Nevertheless, government committed to the protection, monitoring, and rebuilding of the Sakinaw population. A recovery team was appointed to develop a detailed conservation strategy, and various research and recovery programs were initiated. Despite greater restrictions on mixed-stock fisheries and hatchery fry supplementation, escapements have continued to decline, averaging less than 33 fish annually since reliable total counts began in 2003. Reliable monitoring of marked fry, smolt, and returning adults has confirmed that freshwater survival remains high but marine survival is now extremely low, primarily due to unknown natural causes. Intensive stocking of Sakinaw Lake with fed hatchery fry (the F2 progeny of hatchery-reared adults) began in 2006, and may be the last hope for recovery.

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Title

Predation of marine mammals on fish in central and south-coast Oregon rivers

Abstract

The populations of many native species have increased or expanded in distribution in recent decades, sometimes with negative consequences to sympatric native species that are rarer or less adaptable to anthropogenic changes to the environment. An example of this phenomenon from the Pacific Northwest is predation by locally abundant pinnipeds (seals and sea lions) on threatened, endangered, or otherwise depleted salmonid (Oncorhynchus spp.) populations. Understanding the extent and nature of pinniped predation can provide important inputs into risk assessments and other modeling efforts designed to aid the conservation and recovery of salmonids in the Pacific Northwest. Such understanding may also help inform management actions designed to reduce the impact of pinniped predation on salmonids, which potentially range from short-term lethal removal programs to long-term ecosystem restoration and protection efforts. We provide a summary of our research-to-date on pinniped predation on salmonids and other fish in places other than the Columbia River. We'll focus on our efforts in the Alsea River estuary where we have applied survey sampling methodology, acoustic telemetry, and molecular genetics to quantify the amount of harbor seal (Phoca vitulina) predation on a depressed run of coho salmon (O. kisutch).

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Title

Management Tools and Techniques for Riparian-Wetland Area Grazing Management

Abstract

Successful grazing strategies generally involve a combination of management tools and techniques that aid livestock managers. These tools can help improve riparian-wetland area function within pastures by promoting livestock distribution in a variety of manners, which include attracting livestock away from riparian areas, herd management and animal husbandry practices that promote mobility, and restricting livestock from riparian areas. The use of these tools and techniques in conjunction with a grazing strategy have been found to be successful on many different sites around the west.

Livestock operators and land managers need to consider and evaluate the economic implications of using various management tools and techniques during the development of the grazing plan. The cost of these techniques, including installation of improvements and practices, loss of grazing area, extra hay, grazing land, and leases, decrease in stocking rate, and the change in management may preclude the use of a particular tool or technique. A comprehensive grazing strategy that addresses maintenance needs and uses adaptive management practices to determine if the goals and objectives are being met will help find success.

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Title

Effects of Stocking Salmon Carcass Analogs in Klickitat River tributaries

Abstract

In the Klickitat River subbasin in south-central Washington, salmon carcass analogs were stocked in two streams in 2002 and 2003 to restore marine-derived nutrient sources and increase salmonid growth and survival. A third stream was used as a control. Salmonid fish abundance, growth, and stomach contents were monitored before and after carcass analog placement. Fish, invertebrate, and periphyton samples were collected for stable isotope analysis (to determine if nutrients from carcass analogs were incorporated into the stream food web). Water quality samples were collected to determine if nutrient overloading occurred in streams. Significant differences in growth were found between fish in treated and untreated reaches. Fish in treatment reaches exhibited higher instantaneous growth rates approximately one month after the first carcass analog stocking. Stomach sampling indicated that fish consumed the carcass analog material directly. Stomach fullness of fish in treatment reaches was higher than in untreated reaches in the first few weeks following carcass analog stockings. No significant differences were detected in fish abundance between treatment and control streams after carcass analog stocking. Stable isotope analysis provided some evidence that nutrients (primarily nitrogen) were incorporated into periphyton and invertebrates, although this evidence is not strong. No significant differences in water quality were observed between treatment and control streams after analog stocking. This and similar studies show that carcass analogs provide a viable pathogen-free alternative to stocking salmon carcasses. The analogs provide a direct food source to salmonids, and may provide nutrients for stream food webs. They can also increase stomach fullness and growth rates of individual fish. They may improve individual fish condition sufficiently to improve overwintering or smolt survival. Refinement of stocking densities and treatment duration will further improve the usefulness of carcass analogs.

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Title

Developing and implementing a research and restoration plan for the Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative

Abstract

Responding to declines in salmon returning to the Arctic-Yukon-Kuskokwim (AYK) region in the late 1990s and early 2000s, a coalition of regional groups initiated the AYK Sustainable Salmon Initiative (SSI). The coalition sought and obtained funds to focus research efforts to better understand the factors that control variability in salmon returns to the region. A six member scientific and technical committee was formed to develop a research and restoration plan, review projects submitted for funding, and make funding recommendations to the Initiative. A National Research Council (NRC) committee was commissioned to review the current state of knowledge and make recommendations concerning the content of the research and restoration plan. Based on those recommendations, a research and restoration plan was drafted by the scientific and technical committee and, then, reviewed by the NRC before being adopted as the foundation of AYK SSI research program. The plan resulted in 11 high priority hypotheses to be addressed. The plan is intended to be an evolving document and will undergo periodic review and revision. In this presentation, we will discuss the scientific foundation of the research and restoration plan, strategies for implementation, and the strengths and weaknesses of such an approach.