OREGON CHAPTER
AMERICAN FISHERIES SOCIETY

40th Annual Meeting

"Our History, the Current State of Affairs, and our Future"

18 February—20 February 2004

Sunriver Resort

Sunriver, Oregon

Oregon Chapter
American Fisheries Society
P.O. Box 722
Corvallis, OR 97339

http:/oregonstate.edu/groups/orafs

NEW SITE! (after March 1, 2004) - http:/orafs.org

LKBrenner@comcast.net

OREGON CHAPTER
AMERICAN FISHERIES SOCIETY

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The Oregon Chapter of the American Fisheries Society gratefully acknowledges the generosity of our sponsors. Sponsorship of our annual meeting underscores our common interests in constructively addressing natural resources issues and professional development. Thank you!

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We also thank and recognize all the businesses and individuals that made a special Oregon Chapter AFS contribution or donated an item, service, or trip to our raffle and auction.

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ACKNOWLEDGEMENTS

Special thanks go to all of the presenters of papers and posters and to those who coordinated and convened sessions. We are grateful for your time and special contribution to the Oregon Chapter AFS meeting.

To those whose names were not forwarded in time to be included in this program, or saw a need and pitched in to help, we thank you!

Lastly, but not in the least, we acknowledge the countless hours of volunteer time and effort the go into making the Oregon Chapter meeting a success. Without the time, energy, and dedication of all the volunteers, we would not be able to plan and conduct a meeting of this size and caliber. Please consider getting involved in planning the 2005 Annual Meeting, or putting your energies into an officer or committee chair position. The Oregon Chapter AFS needs you! Contact Loretta Brenner for more information at: LKBrenner@comcast.net; or visit our website at: http:/oregonstate.edu/groups/orafs, or after March 1, 2004: **(http:/orafs.org)**

Special thanks to the Bonneville Power Administration for printing the program and Peter Lofy for in-house assistance.

Oregon Chapter American Fisheries Society 40th Annual Meeting
February 18-20, 2004; Sunriver Resort

PROGRAM AT A GLANCE

"Our History, the Current State of Affairs, and Our Future"

PROGRAM SCHEDULE – TUESDAY, FEBRUARY 17, 2004	
Time Slot	
1:00–5:00pm	Workshop A: "Publish or Perish? Skills for Science-Writing and Publishing" Martha Brookes, Facilitator **Landmark** Workshop B: "Radio and Acoustic Telemetry: Tags, Tagging, and Reception" Carl Schreck, Facilitator **Great Hall**
5:00-7:00pm	Evening Social for Workshop Participants **Heritage**
5:30-7:00pm	Workshop C: "The Most Common Technical Presentation Mistakes and How to Avoid Them" Ray Beamesderfer and Dave Ward, Facilitators **Landmark**

PROGRAM SCHEDULE – WEDNESDAY, FEBRUARY 18, 2004	
Time Slot	
8:00-11:30am	Workshop A continued: "Science-Writing" **Landmark** Workshop B continued: "Telemetry" - (note room change) **Heritage**
10:00-5:30pm	Annual Meeting Registration, Welcome Coffee and Tea (10-11:30am) **Landmark Gallery & Great Hall Foyer** Poster Session Setup 12:30-6:30pm **Great Hall**
11:30am-12:30pm	Luncheon—Honoring Past Presidents and Fishery Workers of the Year (additional fee) **Pineland (Located in the Lodge)**
1:00–3:15pm	*Plenary Session*: Elizabeth Furse, Director, Institute for Tribal Government Russell Sadler, News Columnist and Political Commentator Don Ratliff, PGE and long-time American Fisheries Society Member **Homestead**
3:15-3:45pm	*Refreshment Break* **Great Hall Foyer / Heritage Gallery**

PROGRAM SCHEDULE – WEDNESDAY, FEBRUARY 18, 2004 continued

Time Slot				
3:45–5:30pm	Concurrent Sessions			
	Homestead	**Pineland (Lodge)**	**Landmark**	**Heritage**
	Session 1 Protecting Oregon's fisheries—past activism, Part I Convener: Don Ratliff	*Session 2* The non-salmonids: marine species Convener: Brad Ryan	*Session 3* Contributed papers on range, agriculture, and fish Convener: Troy Brandt	*Session 4* Contributed papers on trout, salmon and char Convener: Tom Hoffman
6:00-7:00pm	Student-Mentor Social - Match the Hatch **Heritage**			
7:00-11:00pm	Chapter Poster Session & Social **Great Hall**			

OREGON AFS PROGRAM SCHEDULE—THURSDAY, FEBRUARY 19, 2004

Time Slot				
6:45-7:45am	Spawning Run (sign up at the registration desk on Wednesday)			
7:30-8:00am	Morning Coffee &Tea **Great Hall Foyer *Only***			
8:00–11:50am	Concurrent Sessions			
	Pineland (Lodge)	**Heritage**	**Great Hall**	**Landmark**
	Session 5 Protecting Oregon's fisheries—past activism, Part II Convener: Don Ratliff	*Session 6* Estuaries as habitat Conveners: Carl Schreck and Scott Heppell	*Session* 7 Contributed papers on freshwater ecology Convener: Bob Hughes	*Session* 8 Fire and aquatic ecosystems Convener: Gordie Reeves
9:50–10:10am	*Refreshment Break* **Heritage Gallery, Great Hall Foyer, Upper Art Gallery (outside Pineland)**			
12:00–1:20pm	Business Lunch (officer elections, by-law changes, resolutions, scholarship winners, 2003 best student paper & poster) **Homestead**			
1:30–5:20pm	Concurrent Sessions			
	Pineland (Lodge)	**Great Hall**	**Heritage**	**Landmark**
	Session 9 The non-salmonids: Columbia River Conveners: Kevin Kappenman, and Molly Webb	*Session 10* Reinventing hatcheries for conservation & restoration Convener: Susan Gutenberger	*Session 11* Urban fish recovery, habitat, and water resources Convener: Cindy Studebaker	*Session 12* Things without backbones Convener: Jen Stone
3:20–3:40pm	*Refreshment Break* **Heritage Gallery, Great Hall Foyer, Upper Art Gallery (outside Pineland)**			

	OREGON AFS PROGRAM SCHEDULE—THURSDAY, FEBRUARY 19, 2004 continued
Time Slot	
5:30pm-12:30am	Social Hour (5:30-6:30pm)—**Homestead** (all welcome) Oregon State University Alumni Social (5:30-6:30pm) —**Location TBA** Banquet & Awards Ceremony (6:30-7:30pm)—**Homestead** (additional fee) Raffle and Silent and Oral Auction (7:30-9:00pm)—**Homestead** (all welcome) Jazz Band "Pizazz" After-hours Mixer (9:00pm-12:30am)—**Homestead** (all welcome)

PROGRAM SCHEDULE—FRIDAY, FEBRUARY 20, 2004				
Time Slot				
	Concurrent Sessions			
	Landmark	**Heritage**	**Great Hall**	**Pineland (Lodge)**
9:00am-12:10pm Sessions 13, 14, 15 8:45am-12:10pm Session 16 only	*Session 13* Cattle management and streams Convener: Jimmy Eisner	*Session 14* Contributed papers on stream and river biology Convener: Joe Zydlewski	*Session 15* The non-salmonids: suckers, parasites, and you Conveners: Kevin Kappenman and Molly Webb	*Session 16* Contributed papers on Columbia River salmon and steelhead Convener: Steve Cramer
10:10-10:30am	*Refreshment Break* **Heritage Gallery, Great Hall Foyer, Upper Art Gallery (outside Pineland)**			
12:10pm	Meeting Adjourns			

Oregon Chapter American Fisheries Society 40th Annual Meeting
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"Our Past, the Current State of Affairs, and Our Future"

2004 ANNUAL MEETING PROGRAM

Tuesday February 17

1:00-5:00pm Premeeting Workshops (Registration starts at 12Noon):

Workshop A: "Publish or Perish? Skills for Science-Writing and Publishing"
Martha Brookes, Facilitator, **LANDMARK**

Workshop B: "Radio and Acoustic Telemetry: Tags, Tagging, and Reception"
Carl Schreck, Facilitator, **GREAT HALL**

5:00-7:00pm Workshop Social **HERITAGE**

5:30-7:00pm Workshop C:"The Most Common Presentation Mistakes & How to Avoid Them"
Ray Beamesderfer and Dave Ward, Facilitators **LANDMARK**

Wednesday February 18

7:00am-11:00pm	Presentation Preview and Practice Room	**FIRESIDE**
8:00-11:25am	Pre-meeting Workshops A & B: (continued) "Science Writing" "Telemetry" (note room change)	 **LANDMARK** **HERITAGE**
10:00-11:30am	Welcome Coffee and Tea	**GREAT HALL FOYER**
10:00-5:30am	Registration Desk & Sales Tables	**LANDMARK GALLERY**
11:30am-12:30pm	Luncheon – (Past Presidents' & Fishery Workers of the Year)	**PINELAND**
12:00-6:30pm	Poster Set-up	**GREAT HALL**
1:00-3:15pm	Plenary Session	**HOMESTEAD**
3:15-3:45pm	**Refreshment Break**	**GREAT HALL FOYER & HERITAGE**
3:45-5:30pm	Concurrent Sessions 1,2,3,4	***See specific session for room***
6:00-7:00pm	"Match-the-Hatch"- Student Mentor Social	**HERITAGE**
7:00-11:00pm	Chapter Poster Session and Social	**GREAT HALL**

Wednesday February 18

Names of Student Presenters <u>Underlined and in Bold</u>

*** Indicates Presenter (if first author not presenting paper)**

PLENARY SESSION:

Opening Remarks & Welcome

1:00-1:15pm Dave Ward, President, Oregon Chapter AFS
Doug Olson, President-elect & Program Chair, Oregon Chapter AFS

Plenary Speakers

1:15-2:15 **Elizabeth Furse,** *"Treaties are the supreme law of the land"*
Former Congresswoman and now Director of the Institute for Tribal Government, Furse will address the federal trust responsibility towards Indian Tribes.

2:15-3:00 **Russell Sadler,** *"The origin of Oregon's much-discussed environmental ethic and why it is in jeopardy"* News columnist and political commentator on the environment, will speak on the past, present, and future of fish and the environment in Oregon and the Northwest.

3:00-3:15 **Don Ratliff,** *"The Oregon Chapter of AFS: A legacy of active professionalism, "*
Pacific Gas and Electric employee and long-time American Fisheries Society member, Ratliff will reflect upon the Oregon Chapter's legacy of active professionalism

3:15-3:45 BREAK

HOMESTEAD

SESSION 1: Protecting Oregon's Fisheries—Past Activism by the Oregon Chapter that Really Made a Difference, Part I

Convener: Don Ratliff, Pacific Gas and Electric

3:45 Session Welcome

3:50 Save our bays initiative, 1960s–70s;
Jerry MacLeod, Oregon Department of Fish and Wildlife (retired); Howard Horton, Oregon State University; past activity of the Oregon AFS Estuary Conservation and Development Committee

4:10 Elimination of the legal use of the insecticide Sevin in Oregon estuaries 1983-84;
Dave Buchanan, Oregon Department of Fish and Wildlife (retired); and Dan Bottom, NOAA Fisheries*

4:30 Oregon AFS and Senate Bill 397: Oregon's riparian protection legislation;
Steve Smith and Jim Newton; past activity of the Oregon AFS legislative and stream habitat committees

4:50 Pacific salmon at the crossroads;
*Willa Nehlsen, Jack Williams, and **Jim Lichatowich***, past activity of the AFS Endangered Species Committee*

5:10 Federal ESA petition to list Snake River Chinook salmon;
Gordie Reeves, USDA Forest Service; Krystyna Wolniakowski, National Fish and Wildlife Foundation; Past Activity of Oregon AFS Chapter Presidents*

PINELAND (located in the Lodge)

SESSION 2: The Non-salmonids: Marine Species

Convener: Brad Ryan, NOAA Fisheries

3:45 Session Welcome

3:50 Use of PIT tags to monitor black rockfish population trends;
Steven Parker, Polly Rankin, Robert Hannah, and Don Bodenmiller, Oregon Department of Fish and Wildlife*

4:10 Maternal age is a determinant of larval performance in black rockfish (*Sebastes melanops*);
Colin Chapman, SP Cramer and Associates, Inc.

4:30 Capture-related stressors impair sablefish immune system function: implications for discard mortality;
Sarah Lupes and Carl Schreck, Oregon State University; and Michael Davis and Bori Olla, NOAA Fisheries*

4:50 Ecology of the spiny dogfish (*Squalus acanthias*) off the Oregon and Washington coasts: life history
Jaclyn Richards, Oregon State University*

LANDMARK

SESSION 3: Contributed Papers on Range, Agriculture, and Fish

Convener: Troy Brandt, River Design Group Inc.

3:45 Session Overview

3:50 Watershed restoration planning in the upper Klamath basin;
Troy Brandt, River Design Group, Inc.

4:10 Fish use of seasonal drainages within an agricultural landscape;
Randall Colvin, W. Gerth, K. Boyer, G. Giannico, J. Li, Oregon State University; and J. Steiner and S. Griffith, USDA-ARS*

4:30 Great Basin redband trout habitat improvement using felled western juniper;
Casey Matney, Tamzen Stringham, Oregon State University; Chad Boyd, U.S. Department of Agriculture; and Robert Gresswell, U.S. Geological Survey*

4:50 Biological indicators used to measure pesticide effects on steelhead in Hood River, OR;
Channing St. Aubin, Portland State University; Eugene Foster and Fenix Grange, Oregon Department of Environmental Quality*

5:10 Umatilla River temperature analysis-Floodplain condition and hyporheic flow;
Matthew Boyd, Carollo Engineers

HERITAGE

SESSION 4: Contributed Papers on Trout, Salmon and Char and Their Habitat

Convener: Tom Hoffman, U.S. Fish and Wildlife Service

3:45 Session Overview

3:50 Behavior of bull trout in situ: Alone, with native rainbow trout, and with brook trout;
Barbara Shields and Monique Szedelyi, Oregon State University*

4:10 Odell Lake bull trout recovery, Part I: The rehabilitation of Trapper Creek, Oregon;
Brad Houslet, Louis Wasniewski, and Paul Powers, USDA Forest Service*

HERITAGE

SESSION 4 continued: **Contributed Papers on Trout, Salmon and Char and Their Habitat**

4:30 Geographic factors influencing genetic structure among barrier isolated populations of coastal cutthroat trout;
Troy Guy*, Oregon State University; Robert Gresswell, U.S. Geological Survey; and Michael Banks, Oregon State University*

4:50 The relative quality of habitat: Juvenile Chinook salmon in the Metolius River basin, Oregon;
Jens Lovtang* *and Hiram Li, Oregon State University*

5:10 The unit characteristic method: A habitat-based technique for estimating stream carrying capacity;
Nick Ackerman and Steve Cramer, SP Cramer & Associates, Inc.*

For Wednesday Evening Events, Please See Page 11

Thursday February 19

6:45-7:45am	Spawning Run (sign up at registration desk on Wednesday)	**MEET OUTSIDE**
7:00am-11:00pm	Presentation Preview and Practice Room	**FIRESIDE**
7:30-8:00am	Early Morning Coffee & Tea	**GREAT HALL FOYER *only***
7:30-5:30am	Registration Desk & Sales Tables	**LANDMARK GALLERY**
8:00-11:50am	Concurrent Sessions 5, 6, 7, 8	***See specific session for room***
9:50-10:10am	**Break**	**GREAT HALL FOYER, HERITAGE, UPPER ART GALLERY**
12:00-1:20pm	Business Lunch (all welcome)	**HOMESTEAD**
1:30-5:20pm	Concurrent Sessions 9, 10, 11, 12	***See specific session for room***
3:20-3:40pm	**Break**	**GREAT HALL FOYER, HERITAGE, UPPER ART GALLERY**
5:30-6:30pm	Social Hour (all welcome, no-host bar, complimentary beer)	**HOMESTEAD**
5:30-6:30pm	Oregon State University Alumni Social	**LOCATION TBA**
6:30-7:30pm	Banquet & Awards Ceremony (additional fee)	**HOMESTEAD**
7:30-9:00pm	Raffle & Silent & Oral Auction (all welcome)	**HOMESTEAD**
9:00-12:30pm	Jazz Band "Pizazz" (after-hours mixer—all welcome)	**HOMESTEAD**

PINELAND (located in the Lodge)

SESSION 5: **Protecting Oregon's Fisheries—Past Activism by the Oregon Chapter that Really Made a Difference, Part II**
Convener: Don Ratliff, Pacific Gas And Electric

8:00 Session Overview

8:10 The 1987 Oregon Chapter AFS review of the Siskiyou National Forest Plan;
Richard Nawa, Siskiyou Regional Education Project

8:30 An ecosystem strategy to conserve aquatic biodiversity;
Dan Bottom, Sandy Bryce, Sharon Clarke, Jeff Dambacher, Chris Frissell, Bob Hughes, Hiram Li, Dale McCullough, Al McGie, Kelly Moore, and Rich Nawa, past activity of the Oregon Chapter AFS watershed classification and aquatic biodiversity subcommittee*

8:50 Gearhart Mountain bull trout workshop and proceedings;
Phil Howell, USDA Forest Service; Dave Buchanan, Oregon Department of Fish and Wildlife (retired); and Don Ratliff, Pacific Gas and Electric, past activity for Oregon Chapter AFS Natural Production Subcommittee*

9:10 A Brief History of the Oregon Chapter's Activism on Behalf of Bull Trout;
Kirk Schroeder, Oregon Department of Fish and Wildlife, and past activity of Oregon Chapter AFS Natural Production Committee and Past-President

9:30 Choosing your battles and lessons learned-the politics of fisheries science;
Krystyna Wolniakowski, National Fish and Wildlife Foundation, Portland, OR; and Don Ratliff, Pacific Gas and Electric; past activity of Oregon Chapter AFS presidents, and Legislative Committee*

9:50 – 10:10 BREAK

10:10 Panel Discussion and Question and Answer Session: The politics of fisheries science

Question 1. When and how has AFS involvement been effective in the past?

Question 2. When has the Oregon Chapter been effective? How could participation been more effective?

Question 3. What present questions/issues might be appropriate for AFS involvement?

12:00pm Noon Thursday Lunch & Business Meeting (all registrants welcome)

HERITAGE

SESSION 6: Estuaries as Habitat

Conveners: Carl Schreck and Scott Heppell, Oregon State University

8:00 Session Overview

8:10 Is there a link among life history diversity, the estuary and population resilience in salmonid fishes?;
Ian Fleming, Oregon State University

8:30 Residence times and physical habitat opportunity in the Columbia River estuary and plume;
Michela Burla** and Antonio Babtista, Oregon Graduate Institute*

8:50 Environmental and management impacts on juvenile salmonid migratory behavior and survival;
Shaun Clements, Carl Schreck, Mark Karnowski, Dave Jepsen, Nathan Truelove, Oregon State University and Antonio Babtista, Oregon Graduate Institute*

9:10 Habitat use and movement of sea-run cutthroat trout in the Salmon River estuary;
Lisa Krentz**, Hiram Li, Ian Fleming, Oregon State University and Kim Jones and Trevan Cornwell, Oregon Department of Fish and Wildlife*

9:30 Feeding ecology of sea-run cutthroat trout in the Salmon River estuary, Oregon;
Daniel Jones, Carleton College; Ian Fleming and Lisa Krentz, Oregon State University; and ***Trevan Cornwell**** *Oregon Department of Fish and Wildlife*

9:50-10:10 BREAK

HERITAGE

SESSION 6 continued: Estuaries as Habitat

10:10 Residence and growth of sub-yearling Chinook salmon in an estuarine marsh;
Dave Hering *and Ian Fleming, Oregon State University; Dan Bottom, NOAA Fisheries; and Kim Jones, Oregon Department of Fish and Wildlife*

10:30 The diet of juvenile fall Chinook using tidal marsh habitat in the Nehalem Bay;
Crystal Hackmann*, Carl Schreck, and Selina Heppell, Oregon State University*

10:50 Toxic Contaminants in PNW Estuaries, and Effects on Pacific Salmon;
T.K. Collier, L.L. Johnson, M.R. Arkoosh, N.L. Scholz, and J.P. Meador, NOAA Fisheries, Northwest Fisheries Science Center*

11:10 Can non-native species transform Oregon estuaries?;
Sylvia Behrens Yamada, Oregon State University

11:30 Natural resource recreational estuary use along the Oregon coast;
Eric Schindler, Oregon Department of Fish and Wildlife

12:00pm Noon Thursday Lunch & Business Meeting (all registrants invited)

GREAT HALL

SESSION 7: Contributed Papers on Freshwater Ecology and Techniques

Convener: Bob Hughes, Dynamac Corp.

8:00 Session Overview

8:10 A biointegrity index for coldwater streams of Western Oregon & Washington;
Robert Hughes, Dynamac Corp; Shay Howlin, West Inc.; and Philip Kaufmann, U.S. Environmental Protection Agency*

8:30 Estimating the contribution of aquatic insects to terrestrial food webs along a western Oregon stream;
Alex Farrand*, Sherri Johnson, and Judith Li, Oregon State University*

8:50 Are stream crossing culverts a barrier to the movement of the Pacific Giant Salamander (*Dicamptodon tenebrosus*)?;
Jina Sagar*, Oregon State University; Deanna Olson, USDA Forest Service; Richard Schmitz, Oregon State University; and John Guetterman, Bureau of Land Management*

9:10 Fish biomass as a function of discharge: a 2D meso-habitat approach to IFIM;
Gregory Stewart*, Oregon State University; and Richard Anderson, Colorado Division of Wildlife*

9:30 Fish utilization of regulated seasonal floodplain wetlands;
Julie Henning*, Oregon State University; Robert Gresswell, U.S. Geological Survey; and I. Fleming, Oregon State University*

9:50 – 10:10 BREAK

10:10 The effect of environmental factors associated with the introduced three spine stickleback, *Gasterosteus aculeatus*, and its parasite, *Schistocephalua solidus*, in the upper Deschutes basin;
Wataru Koketsu*, Oregon State University*

10:30 Effects of acute and chronic stressors on the migratory behavior of juvenile hatchery steelhead (*Oncorhynchus mykiss*) in Abernathy Creek, Washington;

Nathan Truelove*, Shaun Clements, and Carl Schreck, Oregon State University and Gayle Zydlewski and Don Campton, U.S. Fish and Wildlife Service*

10:50 Performance of juvenile steelhead trout (*Oncorhynchus mykiss*) produced from cryopreserved milt;
Michael Hayes, Jay Hensleigh, Reg Reisenbichler, Steve Rubin, and Lisa Wetzel, U.S. Geological Survey*

11:10 Linking landscape condition, stream habitat, and fish performance to identify recovery strategies for lower Columbia River salmon populations;
Gardner Johnston, SP Cramer & Associates

11:30 OWEB regional restoration project prioritization framework;
Paul Hoobyar, Watershed Initiatives, LLC

12:00pm Noon Thursday Lunch & Business Meeting (all registrants invited)

LANDMARK

SESSION 8: Fire and Aquatic Ecosystems

Convener: Gordie Reeves, USDA Forest Service

8:00 Session Overview

8:10 Death, monsters, healthy forests, and you;
Steve Wondzell, USDA Forest Service

8:30 Fire and aquatic ecosystems of the western USA: Current knowledge and key questions;
Peter Bisson, Bruce Rieman, Charlie Luce, Paul Hessburg, Danny Lee, Jeffrey Kerhner, and Gordon Reeves, USDA Forest Service; and Robert Gresswell, U.S. Geological Survey*

8:50 Fire in riparian zones: a reconstruction of historical fire occurrence in riparian forests of the Blue Mountains and southern Cascades of Oregon, and an evaluation of crown fire potential in riparian forests of the Blue Mountains, Oregon;
Diana Olson, USDA Forest Service; Nathan Williamson, USDI National Park Service; and James Agee, University of Washington*

9:10 How do landscapes organize fire effects on channels? Lessons from the 1996 Tower fire, North Fork John Day, Oregon;
William Russell, Oregon State University

9:30 Wildfires, geomorphology, and riverine habitats;
Lee Benda, Daniel Miller, Paul Bigelow, and Kevin Andras, Earth Systems Institute*

9:50-10:10 BREAK

10:10 Does wildfire favor invasion of nonnative fishes?
Clint Sestrich** and T.E. McMahon, Montana State University; and M.K. Young, USDA Forest Service*

10:30 An evaluation of the short-term effects of the Hayman fire on aquatic ecosystems;
*J.L. Kershner, **L.M. Decker***, and D. Winters, USDA Forest Service*

10:50 Effects of fire on the biota of high-elevation lakes in the Cascade Range of Oregon;
Robert Gresswell and Gary Larson, U.S. Geological Survey; E.A. Deimling, USDA Forest Service; and C.D. McIntire, R.L. Hoffman, and W.J. Liss, Oregon State University*

LANDMARK

SESSION 8 continued: Fire and Aquatic Ecosystems

11:10 Fires, roads, and native salmonids: a story from North-Central Idaho
Charles W. Huntington, Clearwater BioStudies, Inc.,

5:30pm—12:30am Social, Banquet, Awards, Raffle, Auction, and Music

PINELAND (located in the Lodge)

SESSION 9: The Non-Salmonids: Columbia River

Conveners: Kevin Kappenman, Columbia River Inter-Tribal Fish Commission; and Molly Webb, Oregon State University

1:30 Session Overview

1:40 Use of PIT Tags to evaluate predation by colonial waterbirds on juvenile salmonids;
Brad Ryan, John Ferguson, and Ed Nunnallee, NOAA Fisheries*

2:00 American shad in the Columbia River;
Jim Petersen, Dennis Rondorf, Dena Gadomski, and Dan Feil, US Geological Survey; and Richard Hinrichsen, Hinrichsen Environmental Services*

2:20 Adult Pacific lamprey migratory behaviour at two mid-Columbia River dams using radio-telemetry;
*Louise Porto and Bryan Nass, British Columbia; and **Tom Dresser***, Grant County PUD*

2:40 Evaluation of adult Pacific lamprey bypass designs at Bonneville Dam;
Mary Moser, NOAA Fisheries; and Darren Ogden; Pacific States Marine Fisheries Commission*

3:00 Could predation be affecting recruitment of age-0 white sturgeon?;
Dena Gadomski and Michael Parsley, US Geological Survey*

3:20 – 3:40 BREAK

3:40 Summary of movement of white sturgeon among Columbia River reservoirs;
J. Chris Kern, Oregon Department of Fish and Wildlife

4:00 Demystifying sturgeon—remote telemetry provides insight into the daily life of white sturgeon in the lower Columbia River;
Michael Parsley, Nicholas Popoff, and James Hatten, US Geological Survey*

4:20 Response of white sturgeon to pipeline and hopper dredge operations;
Nicholas Popoff and Michael Parsley, US Geological Survey*

4:40 Movements, spawning, and distribution of white sturgeon (*Acipenser transmontanus*), within the Priest Rapids project area, mid-Columbia River, Washington, USA;
Tom Dresser, Grant County Public Utility District

5:30pm—12:30am Social, Banquet, Awards, Raffle, Auction, and Music

GREAT HALL

SESSION 10: Reinventing Hatcheries for Conservation & Restoration

Convener: Susan Gutenberger, U.S. Fish and Wildlife Service

1:30 Session Overview

1:40 Monitoring and evaluation of a production Chinook supplementation facility;
David Fast, Yakama Nation

2:00 Application of the Ecosystem Diagnosis & Treatment (EDT) model to assess the feasibility of hatchery releases in the Yakima and Klickitat basins;
Joel Hubble and Chris Frederiksen, Yakama Nation*

2:20 The Culture, Monitoring and Evaluation of Reconditioned Kelt Steelhead in the Yakima River Basin;
Joe Blodgett and David Fast, Yakama Nation*

2:40 Fish Health in the 21st century: A preview of fish health management for restoration and conservation hatcheries;
Ray Brunson, U.S. Fish and Wildlife Service

3:00 Management goals for hatchery broodstocks: genetic integration vs. segregation;
Don Campton, U.S. Fish and Wildlife Service

3:20-3:40 BREAK

3:40 Elements of supplementation;
Andre Talbot, John Whiteaker, Danielle Evenson, and Douglas Hatch, Columbia River Inter-Tribal Fish Commission*

4:00 Use of hydraulic sampling methods to source spring Chinook salmon eggs for a captive propagation program;
Jeff Heindel, Danny Baker, Paul Kline, and David Venditti, Idaho Department of Fish and Game; and William McAuley, NOAA Fisheries*

4:20 Warm Springs National Fish Hatchery spring Chinook salmon (*Oncorhynchus tshawytscha*) program: An integrated tool balancing harvest, supplementation, and conservation of wild populations;
Bob Spateholts and Geoff FitzGerald, Confederated Tribes of the Warm Springs Reservation; Doug Olson, Rod Engle, David Hand, Tom Hoffman, Mike Paiya, Mavis Shaw, and Don Campton, U.S. Fish and Wildlife Service*

4:40 Use of video technology to investigate hatchery and wild fish interactions and hatchery fish behavior;
Rod Engle and Tom Hoffman, U.S. Fish and Wildlife Service*

5:00 Oregon's new hatchery research center;
Charlie Corrarino, Oregon Department of Fish and Wildlife; Dan Edge*, Oregon State University; Mark Lewis, Mary Buckman, and Mario Solazzi; Oregon Department of Fish and Wildlife.*

5:30pm—12:30am Social, Banquet, Awards, Raffle, Auction, and Music

HERITAGE

SESSION 11: Urban Fish Recovery, Habitat and Water Resources

Convener: Cindy Studebaker, City of Portland

1:30 Session Overview

1:40 A natural history of an urban stream: Education and outreach in the Johnson Creek watershed;
Seth White, USDA Forest Service

2:00 Historic and current salmonid distribution in Marion County, Oregon;
Michael Bonoff, Jessica Burton, Jeanne Fromm, Matt Thorburn, Lisa Milliman, Judith Ingram Moore, and Ken Roley, Mason Bruce and Girard, Inc.*

2:20 Fish distribution above and below culverts in the Portland metropolitan area;
Alena Pribyl, Oregon Department of Fish and Wildlife

2:40 Ecological criteria for prioritization of culvert replacement;
Bruce Hansen, USDA Forest Service; J.L. Ebersole, U.S. Environmental Protection Agency; B. Miller, Oregon Department of Fish and Wildlife; and S. Hendricks and M. Furniss, USDA Forest Service*

3:00 Techniques for enhancing stream flow where water quantity is a primary limiting factor to the carrying capacity of aquatic habitat;
Steven Parrett, Oregon Water Trust

3:20-3:40 BREAK

3:40 The implications of flow and habitat changes in urban river restoration in the lower Willamette River at Portland;
Chris Prescott, City of Portland

4:00 The role of water-control structures as habitat restoration/enhancement tools in floodplain wetlands in the lower Willamette River;
Cyndi Baker and Rose Miranda, Ducks Unlimited, Inc.*

4:20 Habitat use by juvenile salmonids with emphasis on woody debris and large river channels;
Roger Peters, U.S. Fish and Wildlife Service

4:40 Large woody debris jams, channel hydraulics and habitat formation in urban stream restoration;
Tim Abbe, Herrera Environmental

5:00 Building a science based approach to salmon recovery in a River City;
Michael Reed, City of Portland

5:30pm—12:30am Social, Banquet, Awards, Raffle, Auction, and Music

LANDMARK

SESSION 12: Things Without Backbones

Convener: Jen Stone, U.S. Fish and Wildlife Service

1:30 Session Overview

1:40 Periphyton as a diagnostic tool for salmon recovery;
Bob Danehy, Weyerhaeuser Company; and A. Rugenski, Idaho State University*

2:00 **Fish and Macroinvertebrate Assemblages in Western Oregon Forested Headwater Streams—Patterns in Existing Databases**;
Alan Herlihy, Judy Li, Bill Gerth, and Janel Banks, Oregon State University*

2:20 Freshwater mussels of the Owyhee River basin—a prehistoric perspective;
Cynthia Tait, Bureau of Land Management; and Allan Smith, Pacific NW Native Freshwater Mussel Workgroup*

2:40 Functional role of mussels in the benthic environment;
Jeanette Howard, UC Berkeley

3:00 Association of a rare color form of *Margaritifera falcata* and native trout with stream habitat complexity;
Michelle Steg and Craig Bienz, The Nature Conservancy*

3:20-3:40 BREAK

3:40 Freshwater mussels of the Umatilla and Middle Fork John Day rivers—A tale of two drainages;
Jayne Brim-Box, David Wolf, Jeanette Howard, and Christine O'Brien, Confederated Tribes of the Umatilla Indian Reservation*

4:00 *Margaritafera falcata* mortality associated with an excessive degree of shell erosion in low-hardness waters of the Siuslaw watershed, Oregon;
Ray Kinney, Siuslaw Watershed Council

4:20 Effect of drought on two mussel species at the Sycan Marsh, Oregon;
Michelle Steg and Craig Bienz, The Nature Conservancy*

4:40 Zebra mussels and mudsnails, oh my! Volunteer monitoring and invasive species detection in the Western United States;
Robyn Draheim and Mark Systsma, Portland State University; and Stephen Phillips, Pacific States Marine Fisheries Commission*

5:00 Benthic macroinvertebrate optima: implications for stressor identification;
Shannon Hubler and David Huff, Oregon Department of Environmental Quality*

5:30pm—12:30am Social, Banquet, Awards, Raffle, Auction, and Music

Friday February 20

7:00am-12 Noon	Presentation Preview and Practice Room	**FIRESIDE**
8:30am-12:30pm	Registration Desk & Sales Tables	**LANDMARK GALLERY**
8:45am-12:10pm	Concurrent Sessions 16 *only*	**PINELAND (in the Lodge)**
9:00am-12:10pm	Concurrent Sessions 13, 14, 15	***See specific session for room***

10:10-10:30am Break GREAT HALL FOYER, HERITAGE, UPPER ART GALLERY

Please note: There will be no early morning coffee & tea on Friday

LANDMARK

SESSION 13: Cattle Management and Streams

Convener: Jimmy Eisner, Bureau of Land Management

9:00 Session Overview

9:10 Understanding livestock behavior to improve grazing management;
Michael Borman, Oregon State University

LANDMARK

SESSION 13 continued: Cattle Management and Streams

9:40 Livestock grazing management systems for riparian-wetland areas;
Jimmy Eisner, Bureau of Land Management

10:10-10:30 BREAK

10:30 Removing livestock from riparian areas—is it necessary?
Sandra Wyman, National Riparian Service Team

11:00 Management strategies for sustained beef cattle grazing on forested rangelands;
Tim DelCurto, Oregon State University

11:30 Open Discussion on Cattle Management and Streams

12:10pm Session Ends and Meeting Adjourns

HERITAGE

SESSION 14: Contributed Papers on Stream and River Biology

Convener: Joe Zydlewski, U.S. Fish and Wildlife Service

9:00 Session Overview

9:10 Geographic variation in genetic and meristic characters of coastal cutthroat trout;
Thomas Williams, Oregon State University; NOAA Fisheries and Gordie Reeves; USDA Forest Service*

9:30 Characterizing movements and migrations of coastal cutthroat trout in Abernathy Creek and Chinook River, Washington, two tributaries of the Columbia River;
Jeff Johnson, Joe Zydlewski, and Gayle Zydlewski, U.S. Fish and Wildlife Service*

9:50 Movements of coastal cutthroat trout (*Oncorhynchus clarki*) in the lower Columbia River;
Joe Zydlewski and Jeff Johnson, U.S. Fish and Wildlife Service; Shaun Clements, Mark Karnowski, and Carl Schreck; Oregon State University; Gayle Zydlewski, U.S. Fish and Wildlife Service*

10:10-10:30 BREAK

10:30 IBI metric development for streams and rivers in western forested mountains and arid lands;
Thom Whittier, Bob Hughes, and Gregg Lomnicky, Dynamac Inc.*

10:30 Restoration of ecological processes in the Tenmile Creek watershed on the central Oregon coast;
Jack Sleeper, USDA Forest Service; Steve Johnson, Tony Stein, Oregon Department of Fish and Wildlife; and Paul Engelmeyer, National Audubon Society*

10:50 Effects of increasing in-channel large woody debris on the production and survival rate of salmonids in Tenmile Creek, an Oregon coastal stream;
Steve Johnson, Jeff Rodgers, Mario Solazzi, and Tom Nickelson, Oregon Department of Fish and Wildlife*

11:10 Data Standards: What are they and why do they matter?
Bruce Schmidt, Pacific States Marine Fisheries Commission

11:30 Streamlining the data collection process using mobile data collection applications;
Mike Hawbecker, Ken Collis, and Allen Evans, Real Time Research*

12:10pm Session Ends and Meeting Adjourns

SESSION 15: The Non-salmonids: Suckers, Parasites, and You

Conveners: Kevin Kappenman, Columbia River Inter-Tribal Fish Commission; and Molly Webb, Oregon State University

9:00 Session Overview

9:10 Monitoring of adult Lost River and shortnose suckers in Upper Klamath Basin, Oregon;
Eric Janney, Brian Hayes, Torrey Tyler, and Heather Hendrixson, U.S. Geological Survey*

9:30 Movements and behavior of radio-tagged adult Lost River and shortnose suckers in response to water quality in Upper Klamath Lake, Oregon;
Barbara Adams, U.S. Geological Survey

9:50 Adult Lost River sucker and shortnose sucker in Link River and Keno Impoundment;
Rich Piaskowski, Bureau of Reclamation

10:10-10:30 BREAK

10:30 If you build it, will they come? Evaluating the response of a large warmwater fishery and its users to intensive habitat enhancement projects;
Ian Reid, USDA Forest Service

10:50 Skeletal deformities and parasites in Newberg pool fish;
Michael Cunningham, Douglas Markle, Michael Kent, Virginia Watral, and Larry Curtis, Oregon State University*

11:10 Induction of skeletal lesions in fathead minnows with the cercariae of *Apophallus* (Digenea) collected from snails (*Flumenicola virens*) from Newberg pool, Willamette River, Oregon;
Michael Kent, Michael Cunningham, Douglas Markle, ***Virginia Watral****, and Larry Curtis, Oregon State University*

11:30 Fish as biovectors for contaminant transport to inland freshwater systems: (How) does this work in Arctic Alaska?;
Jesse Ford, Oregon State University; Susan Allen-Gil, Ithaca College; John Seigle, Oregon State University; Derek Muir, National Water Research Institute; and Maasak Akpik, Joeb Woods, and Joshua Nashagnik, Alaska*

11:50 Do airborne contaminants affect fish in the lakes of western U.S. National Parks?;
Adam Schwindt, C. Schreck, L. Ackerman, S. Usenko, J.M. Ramsay, S. Simonich, and M. Kent, Oregon State University*

12:10pm Session Ends and Meeting Adjourns

PINELAND (located in the Lodge)

SESSION 16: Contributed Papers on Columbia River Salmon and Steelhead

Convener: Steve Cramer, S.P. Cramer & Associates, Inc.

8:45 Session Overview

8:50 Use of turbulent flow to guide anadromous juvenile salmonids;
Russell Perry, Gabriel Hansen, M. Jared Farley, and Dennis Rondorf, U.S. Geological Survey*

9:10 Effects of a removable spillway weir on the migration of radio-tagged juvenile hatchery and wild steelhead;
John Plumb, Amy Braatz, Noah Adams, and Dennis Rondorf, U.S. Geological Survey*

9:30 Identification and enumeration of steelhead (*Oncorhynchus mykiss*) kelts in the bypass collection facility at Lower Granite Dam;
Allen Evans, Real Time Research, Martin Fitzpatrick, and Ken Collis*

9:50 Project abundance, passage, conversion, and return rates from steelhead (*Oncorhynchus mykiss*) kelts passing lower Columbia River dams (2001-2002);
Robert Wertheimer, Patricia Madson, and Mike Jonas, U.S. Army Corps of Engineers*

10:10-10:30 BREAK

10:30 Columbia River fisheries management under ESA and co-management agreements;
Steve King, Oregon Department of Fish and Wildlife

10:50 Predicted success of salmonid reintroduction above dams: Sensitivity of estimated abundance to assumed capacity and survival parameters;
Michael Daigneault and Guy Norman, S.P. Cramer & Associates, Inc.*

11:10 An evaluation of fresh water recoveries of fish released from National Fish Hatcheries in the Columbia River basin, and observations of straying;
Stephen Pastor, U.S. Fish and Wildlife Service

11:30 Does high incidence of hatchery straying depress wild production of steelhead? The Deschutes River experience;
Steven Cramer, S.P. Cramer & Associates, Inc.

11:50 Lessons after 10 years of large-scale supplementation and habitat restoration to recover salmon and steelhead populations in the Hood River;
Steven Cramer, S.P. Cramer & Associates, Inc.

12:10pm Session Ends and Meeting Adjourns

2004 Plenary Session Speakers

Elizabeth Furse, *"Treaties are the supreme law of the land"*

Furse is a former Oregon Congresswoman and currently Director of the Institute for Tribal Government. She will address the federal trust responsibility towards Indian Tribes, what it means to states and state agencies, and are treaties the best protection for the environment?

Russell Sadler, *"The origin of Oregon's much-discussed environmental ethic and why it is in jeopardy"*

Russell Sadler has covered Northwest politics and civic affairs for more than 30 years. His daily radio broadcasts and weekly newspaper columns chronicled the course of the region's environmental triumphs and tragedies during the course of those three decades. Sadler has also taught in the environmental studies programs at Southern Oregon University in Ashland and the Oregon Institute of Marine Biology at Charleston on Coos Bay. Sadler's speech traces the origin of Oregon's much-discussed environmental ethic and why it is in jeopardy—important insight for those engaged in saving the remnant of the region's Columbia Basin salmon resource.

Don Ratliff, *"The Oregon Chapter of AFS: A legacy of active professionalism"*

For those of you that don't know me, my name is Don Ratliff, and I have spent nearly my entire career as a biologist for Portland General Electric at the Pelton Round Project on the Deschutes River, a couple hours downstream from here. I have also spent my entire career as a member of the Oregon Chapter of AFS, having first joined as an undergraduate at OSU 35 years ago. For me, being an active member of AFS has made all the difference in my career. During these 35 years I have had the privilege of knowing many of the fisheries professionals that started the Chapter and dedicated individuals that helped mold it into the largest and most successful Chapter in the world.

Behold, on the program you will notice that many of these old and fabled Characters, have been resurrected, and will tell stories of wow, and stories of triumph, in sessions on Wednesday afternoon and Thursday morning. Most will then join in a panel session Thursday morning to discuss common ideas, when and why we have been most successful in the past, and what issues of today might benefit from AFS involvement. In visiting with them and helping with abstracts, two major themes have emerged. First, history has shown that petty politics and agency bureaucracy are no match for articulate, dedicated, professionals working together, on their own time, across agency lines, communicating good information accumulated through science. Second, and most important, is that like me, the experience of being an active professional, of working with other professionals outside of normal contacts, has been the most enlightening and rewarding part of our careers. So I have this one suggestion for all of you. Find the time, make the time, to become involved with your Chapter. Step out of your comfort zone and up to the plate. You will be rewarded a hundred times over and this legacy of active professionalism, of protecting Oregon's fisheries where important resources are falling through the cracks of government, will continue for the next 40 years.

ABSTRACTS OF PAPERS

In alphabetical order by primary author's last name

Student presenters **underlined and in bold**

* Indicates presenter when multiple authors are listed

No Abstracts Were Available for the Following Papers:

Large woody debris jams, channel hydraulics and habitat formation in urban stream restoration;
Tim Abbe, Herrera Environmental

Habitat use by juvenile salmonids with emphasis on woody debris and large river channels;
Roger Peters, U.S. Fish and Wildlife Service

The implications of flow and habitat changes in urban river restoration in the lower Willamette River at Portland;
Chris Prescott, City of Portland

Building a science based approach to salmon recovery in a River City;
Michael Reed, City of Portland

The Unit Characteristic Method: A Habitat-Based Technique for Estimating Stream Carrying Capacity

Nick Ackerman* and Steve Cramer, S.P. Cramer & Associates, Inc., 600 NW Fariss Rd., Gresham, OR 97030, 503-491-9577, nick@spcramer.com

The Unit Characteristic Method (UCM) is a newly developed tool for estimating the capacity of a stream to rear juvenile steelhead (*Onchorynchus mykiss*) and spring chinook (*O. tschawytscha*). The UCM is a habitat-based model that is driven by habitat features typically measured during stream surveys, including surface area by unit type, depth, substrate, and cover. The model also incorporates the influence of inherent stream productivity as indicated by alkalinity and turbidity. The UCM was applied to all anadromous fish streams in the Hood River Basin to determine if carry capacities estimated from specific habitat measurements would differ from those estimated with the Smolt Density Model (SDM) about 15 years ago. Carrying capacities estimated with the SDM have been used as a standard for setting production targets in streams throughout the Columbia Basin. Detailed habitat measurements applied to the UCM indicated that carrying capacities for spring Chinook, summer steelhead, and winter steelhead in the Hood Basin were only 24-37% of those estimated by the SDM. Over-estimation of production potential was among the key reasons that adult returns have fallen far short of expectations after 10 years of supplementation. We found that carrying capacity per watershed area, as estimated by the UCM, was highly correlated to maximum observed production of steelhead and spring chinook smolts in a number of basins throughout the Pacific Northwest where smolt abundance has been monitored with outmigrant traps.

Movements and Behavior of Radio-Tagged Adult Lost River and Shortnose Suckers in Response to Water Quality in Upper Klamath Lake, Oregon

Barbara J. Adams*, U. S. Geological Survey, Western Fisheries Research Center, Klamath Falls Field Station, 6935 Washburn Way, Klamath Falls, OR 97603, 541-273-8689

In 2002, we initiated a three-year telemetry study investigating endangered adult sucker behavior with respect to water quality focusing in the northern one-third portion of Upper Klamath Lake, Oregon (UKL). In conjunction with this effort, a network of continuous water quality monitors was deployed in this area to determine the spatial and temporal variability of water quality. The objectives of this study were to: 1) determine the distribution and general movement patterns of radio-tagged adult Lost River suckers (LRS) and shortnose suckers (SNS) in UKL from June through September; 2) determine specific sucker locations and their association with water depth and selected water quality variables (i.e., dissolved oxygen (DO), pH and temperature); 3) determine specific movement rates of radio-tagged adult suckers from June-September; and 4) determine adult sucker behavior with respect to water quality. To date, 130 suckers have been tagged, 57 LRS and 73 SNS. Results from 2002 indicate that the distribution of tagged fish differed by species and week, but movement and movement rates did not differ between tagged LRS and SNS. Overall mean water depth association was 3.0 m for LRS and 2.6 m for SNS. Depth association for LRS was independent of lake elevation and declining available depth habitat in the study area. For SNS, depth association varied by lake elevation with the deepest depth associations occurring at both the highest and lowest lake elevations. Most suckers, 72% of LRS and 66% of SNS, were located in waters with DO concentrations ranging from 4 to 8 mg/l. Results from 2002 failed to show any behavioral responses to water quality conditions. Preliminary results from 2003 showed that suckers avoided extremely low DO levels (<2 mg/l) by moving into Pelican Bay, an area with higher DO concentrations and lower temperatures than other areas of UKL. This avoidance

behavior was clearly demonstrated between the weeks of July 13th and 20th when DO levels dropped considerably. During this time tagged sucker locations increased from 15% to 77% in Pelican Bay.

The Role of Water-Control Structures as Habitat Restoration/Enhancement Tools in Floodplain Wetlands in the Lower Willamette River

Cyndi Baker*, Ducks Unlimited, Inc., 1101 SE Tech Center Dr. #115, Vancouver, WA 98683, 360 885-2011, cbaker2@ducks.org; and Rose Miranda, Ducks Unlimited, Inc., Vancouver, WA

In the Northwest, hydrologic alterations have reduced the period of inundation on floodplain wetlands. Reduced connectivity of remaining floodplains with the river may limit access to habitat historically available to juvenile salmonids for over-wintering, feeding and resting stops in many riverine-floodplain systems. One approach to restoring ecological functions of floodplain wetlands is to actively manage water levels by using low-level dikes to hold water, and water-control structures to regulate the water-surface elevation. This can mimic the natural hydrology, in terms of duration of inundation and predictability of water on the floodplain. Six project sites on the lower Willamette River were monitored during the winter and spring of 2002 and 2003. Objectives were to describe fish use of floodplain wetlands, document fish-passage capability through various types of water-control structures, and describe passage opportunity through the structures while in operation. Of all fishes caught between November and May, 78% were native species. Introduced fishes increased in numbers with increased water temperatures and freshly-hatched juveniles in the spring. Yearling and sub-yearling coho and Chinook salmon were caught at all sites. Salmonids, caught in two-way traps in egress channels leading into three wetlands in 2002, moved in from November through May. Most that were caught leaving the wetlands (83%), moved out in April and May. No stranding was documented. Fish passage was documented in three types of water-control structures and passage through the operating period was described. Water-control structures may improve ecological function of floodplain wetlands, enhance habitat, and benefit native biota, including salmon.

Wildfires, Geomorphology, and Riverine Habitats

Lee Benda*, Daniel Miller, Paul Bigelow, and Kevin Andras, Earth Systems Institute, Seattle, WA and Mt. Shasta, CA

Wildfires of varying frequencies and intensities are an intrinsic part of natural landscapes and they join other disturbances, such as large storms, floods, and hurricanes, in triggering the episodic release of sediment and woody debris to streams and rivers. Fires, even low intensity burns, can trigger widespread surface erosion, gullying, and landsliding that lead to punctuated supply of habitat forming materials to channels and valley floors. To examine this conceptual framework, we conducted a field study of 27 km of 3rd – through 6th-order channels that had been subject to increased sediment supply from the Rabbit Creek fire (1995) in central Idaho. Alluvial fans that had enlarged because of post fire sedimentation triggered a number of morphological changes in channels and valley floors. Fans created knick points in mainstem channels causing an increase in channel gradient immediately downstream of them and a decrease in gradient upstream of fans for distances up to 4 km. Wide floodplains, side channels, and the beginning of terrace construction were associated with sediment storage in proximity to aggraded fans. Fan-related changes in channel gradients affected the spatial distribution of channel substrates. Fire-related mortality of riparian forests, in combination with flash floods, also led to large influxes of woody debris to channels and valley floors. Disturbances, including wildfires, may contribute to or govern significant aspects of physical heterogeneity and perhaps biological diversity in rivers. Consequently,

disturbances may be viewed as positive events in the life of a watershed. Moreover, when human activities such as stream cleaning, log drives, diking, riparian logging, and damming have simplified channels and decreased physical heterogeneity, disturbances in the form of fires, floods, and mass wasting may be a benefit in the long term because they may contribute to the elements that govern physical heterogeneity and perhaps biological diversity. Within this perspective, certain types of watershed disturbances may not need to be "restored" so that a watershed can "recover" but rather the disturbance itself may be an agent of "watershed recovery". Nevertheless, land uses such as timber harvest and fire suppression can alter the frequency and magnitude of natural disturbances with unknown long-term consequences. More studies are needed to decipher how disturbance in managed landscapes differ from those in natural systems.

Fire and Aquatic Ecosystems of the Western USA: Current Knowledge and Key Questions

Peter A. Bisson*, USFS, Pacific Northwest Research Station, 3625 93rd Avenue SW, Olympia, WA 98512; Bruce E. Rieman and Charlie Luce, USFS, Rocky Mountain Research Station, Boise, ID; Paul F. Hessburg, USFS, Pacific Northwest Research Station, Wenatchee, WA; Danny C. Lee, USFS, Pacific Southwest Research Station, Arcata, CA; Jeffrey L. Kershner, USFS, Washington Office, Logan, UT; Gordon H. Reeves, USFS, Pacific Northwest Research Station, Corvallis, OR; and Robert E. Gresswell, USGS Biological Resources Division, Forest and Rangeland Ecosystem Science Center, Corvallis, OR

Understanding of the effects of wildland fire and fire management on aquatic and riparian ecosystems is an evolving field, with many questions still to be resolved. Limitations of current knowledge, and the certainty that fire management will continue, underscore the need to summarize available information. Integrating fire and fuels management with aquatic ecosystem conservation begins with recognizing that terrestrial and aquatic ecosystems are linked and dynamic, and that fire can play a critical role in maintaining aquatic ecological diversity. To protect aquatic ecosystems we argue that it will be important to: (1) accommodate fire-related and other ecological processes that maintain aquatic habitats and biodiversity, and not simply control fires or fuels; (2) prioritize projects according to risks and opportunities for fire control and the protection of aquatic ecosystems; and (3) develop new consistency in the management and regulatory process. Ultimately all natural resource management is uncertain; the role of science is to apply experimental design and hypothesis testing to management applications that affect fire and aquatic ecosystems. Policy-makers and the public will benefit from an expanded appreciation of fire ecology that enables them to implement watershed management projects as experiments with hypothesized outcomes, adequate controls, and replication.

The Culture, Monitoring and Evaluation of Reconditioned Kelt Steelhead in the Yakima River Basin

Joe Blodgett*, Yakama Nation Fisheries, PO Box 151,Toppenish, WA 98948, 509-865-6262 ext 6706; jblodgett@yakama.com; David Fast, Yakama Nation Fisheries, Yakima, WA

Repeat spawning is a life history strategy that is expressed by some species from the family Salmonidae. Rates of repeat spawning for post-development Columbia River steelhead *Oncorhynchus mykiss* populations range from 1.6 to 17%. It is expected that currently observed iteroparity rates for wild steelhead in the Basin are artificially and in some cases severely depressed due to the hydropower system and various additional anthropogenic factors. Increasing the natural expression of historical repeat spawning rates using fish culture could be a viable technique to assist in the recovery of depressed steelhead populations. Reconditioning is the process of culturing post-spawned fish (kelts) in a captive

environment until they are able to reinitiate feeding, growth, and again develop mature gonads. To test kelt steelhead reconditioning as a potential recovery tool, we capture wild emigrating steelhead kelts from March through July at the Chandler Juvenile Evaluation Facility and evaluate short- and long-term reconditioning success at the next-door Prosser Hatchery on the Yakima River (rkm 75.6). Various diets have been evaluated to improve survival rates and gonad redevelopment success. Overall kelt survival rates in captivity more than doubled from 18% (2000) to 39% (2001). The 2002 project had a 34% survival rate for the long term reconditioning and a 70% rate for the short term. For the 2002 kelt migration, reconditioned fish were released in three groups on May 20/28, 2002 (below Bonneville Dam rkm 234) and December 10, 2002 (Yakima River near the Prosser Hatchery) and were monitored by PIT tags and radiotelemetry. All PIT tags for released kelts are submitted to the regional PTAGIS database.

Historic and Current Salmonid Distribution in Marion County, Oregon

Michael Bonoff*, Mason, Bruce, & Girard, Inc. 707 SW Washington Street, Portland, OR. 97205. 503 224-3445, mbonoff@masonbruce.com; Jessica Burton, Mason, Bruce, & Girard, Inc., Portland, OR; Jeanne Fromm, City of Salem, Community Development Department, Salem, OR; Matt Thorburn, Marion County Public Works, Salem, OR; Lisa Milliman, Marion County Planning Division, Salem, OR; Judith Ingram Moore, Mid-Willamette Valley Council of Governments, Salem, OR; Ken Roley, City of Salem, Public Works, Salem, OR

The City of Salem, Marion County, and the Mid-Willamette Valley Council of Governments, have completed an assessment of Historic Salmon Distribution in Marion County, Oregon. Using GIS coverages from multiple sources, this project combined barrier data (e.g., culverts, dams, waterfalls), hydrography (stream network), and fish-use data from Oregon Department of Fish & Wildlife to assess both current and historic use of area streams by spring chinook salmon, winter steelhead, and cutthroat trout. The project was funded by a Regional Investment Grant from the Mid-Willamette Valley Community Development Partnership, and supports planning and program objectives related to the listing of winter steelhead and spring chinook salmon under the Endangered Species Act and Statewide Goal 5. The primary objectives of this project were to:

- Collect and integrate GIS data layers on hydrography, fish use, and barriers;
- Document historic distribution of listed fish in Salem and Marion County;
- Assess current distribution using barrier and fish survey data;
- Describe data gaps in existing information, recommend strategies to obtain additional information to determine current distribution and monitor changes over time; and
- Help prioritize basins for enhancement and restoration projects.

The GIS database developed for this project will support a wide range of planning activities that require understanding of listed fish and their habitat. The Historic Salmon Distribution Study report is available on the City of Salem's web site.

Understanding Livestock Behavior to Improve Grazing Management

Michael Borman, Extension Rangeland Resources Specialist, Department of Rangeland Resources, Oregon State University, Corvallis, OR 97331

When designing a grazing strategy, livestock behavior, forage selectivity, plant and plant community responses, hydrology, and practicality are all factors that should be considered. In this presentation, I will focus on behavior and forage selectivity. Behavior is complex and dynamic. Behavior of an adult is influenced by where the animal was born and raised, interactions with the mother, interactions with peers, and interactions with the physical environment. Animal movement patterns are influenced by distribution of landscape influences such as location of water, shade, loafing and bedding sites, and supplements. Other factors include accessibility, distribution of plant communities, physical boundaries, and weather patterns. Animal diet selection is a function of what is available and feedback responses to nutrients and toxins. Riparian areas are often preferred because they often provide a concentration of positive reinforcers at little cost to the grazing animal. Behavior is a function of consequences and can be modified and managed through imposition of consequences, preferably positive.

An Ecosystem Strategy to Conserve Aquatic Biodiversity

Dan Bottom*, Sandy Bryce, Sharon Clarke, Jeff Dambacher, Chris Frissell, Bob Hughes, Hiram Li, Dale McCullough, Al McGie, Kelly Moore, Rich Nawa, Oregon Chapter American Fisheries Society Watershed Classification and Aquatic Biodiversity Subcommittee

In 1990 Oregon AFS members organized a Watershed Classification and Aquatic Biodiversity Subcommittee to address concerns about the rapid decline of many native aquatic species throughout the Pacific Northwest. For several years the Oregon Chapter had responded ad hoc to a growing deluge of forest management plans and other development proposals that were threatening aquatic resources. The Subcommittee hoped to devise a more forward-thinking strategy for maintaining aquatic biodiversity based on the conservation of whole ecosystems rather than the recovery of individual species. The original 14-member Subcommittee established criteria for identifying critical watersheds (later known as “aquatic diversity areas”). We established a database, mapped the distribution of candidate watersheds throughout Oregon, and distributed the results to 85 resource professionals to review and nominate additional watersheds based on the Subcommittee’s criteria. The effort proved timely and effective, as we were able to provide recommendations for key watersheds that were incorporated (anonymously) into a variety of regional conservation plans, including the “Gang of Four” recommendations for protection of late successional forests and the Northwest Forest Plan. The ADAs subsequently became a major component of the “Eastside Forest Scientific Society Panel” report which was requested by members of congress to assess the status of forests East of the Oregon and Washington Cascades and to offer interim recommendations for protection until a long-term plan could be formulated. Although we never succeeded in fully publishing the results, the database and maps have been widely circulated and used for many conservation purposes. The long-term success of this effort remains uncertain but vitally important to the region.

Umatilla River Temperature Analysis: Floodplain Condition and Hyporheic Flow

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The Umatilla River, Oregon, suffers from prolonged periods of sub-optimal and incipient-lethal river temperatures. Salmonids are highly adaptable and can utilize a wide variety of habitat; however, they require cool water temperatures. When exposed to temperatures greater than 18^{o}C (64^{o}F) rearing and migrating salmonids modify their behavior to alleviate stressful increases in their metabolic rates. In the Umatilla River salmonids seek out and move into cool water sources, such as tributaries, spring brooks or headwaters, but can become trapped by thermal barriers and low flows. This analysis considers land uses that contribute to stream heating: floodplain dissection, vegetation removal/disturbance, channel modifications (from bridges and roads railroads) and hydrologic disturbance (such as groundwater withdrawals). The influence of groundwater upon stream temperature dynamics is an important component to the habitat integrity of the Umatilla River. Hyporheic exchange between the river and the alluvial aquifer offers important heat moderation during periods of sub-optimal river temperatures (June through September).

This effort broadens the range of 'traditional' thermal sources to include the connection of the river to the alluvial aquifer via interrelated processes and landscape features in the floodplain, namely: land cover, morphology and hydrology (including subsurface water withdrawals). Remote sensing from aircraft is used to image topographic and land cover surfaces, and to detect the spectral patterns (electromagnetic signatures emitted from trees, ground surfaces, water, etc.) over the stream and floodplain. These data sets are extensively utilized in the analysis (for statistical analysis and as model inputs). Thermal infrared radiometry (TIR) was collected using a helicopter with a sensor (radiometer) that measures thermal radiation emitted from the ground, vegetation and the stream. Light intensity detection and ranging (LiDAR) was measured from an airplane with an instrument that emits laser pulses toward the ground that are then reflected back to a sensor, providing high resolution topography and land cover height data. Aerial photos provided visual information that can be used for mapping land cover and morphology features. Historical air photos (1949) were used to map stream position and land cover distributions. These spatial data sets are complied over a basin-scale and used as inputs for computer models to simulate hydrology (river flow, hyporheic exchange) and thermodynamics (heat transfer).

Three computer models were used: HEC-RAS (stream hydraulics), Wetlands Dynamic Water Budget Model (vertical hyporheic exchange) and Heat Source (heat transfer, mixing with tributaries, longitudinal hyporheic flows and stream temperature). Statistical analysis tested the developed theoretical basis for longitudinal and vertical hyporheic exchange. Simulated results indicate that hyporheic exchange is an important process for heat moderation and localized cooling in the Umatilla River. Morphology is a primary control of hyporheic exchange.

Watershed Restoration Planning in the Upper Klamath Basin

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Aquatic ecosystems in the Upper Klamath Basin have been significantly altered by historical and contemporary land use practices. Agriculture, grazing, logging, road construction, and rural development have undermined ecosystem integrity. Modified watershed hydrology, riparian communities, channel morphology, and aquatic habitat conditions have profoundly impacted the native fish community in the Upper Klamath Basin, including Upper Klamath Lake. Preliminary efforts to restore riparian and channel function on streams in the Sprague River watershed near Beatty, Oregon, offer promising opportunities to rehabilitate considerably degraded aquatic environments. Target project streams including multiple spring creeks and the mainstem Sprague and Sycan rivers, were prioritized in the *Master Plan for the Restoration of the Sycan and Sprague Rivers near Beatty, Oregon*, a guidance document for focusing restoration efforts in the middle Sprague River watershed. River Design Group is collaborating with local agencies and landowners to identify and achieve multiple land management and endangered species recovery goals through the application of innovative survey and design methods in addition to conventional and experimental restoration techniques. Restoration projects to be implemented in 2004 will re-establish hydrologic connectivity, improve fish habitat, and accelerate riparian recovery on three spring creeks in the Upper Klamath Basin. Once completed, the reconstructed streams are expected to provide cold water refugia and improved spawning conditions for the focus sucker species and Klamath redband trout.

Freshwater Mussels of the Umatilla and Middle Fork John Day Rivers—A Tale of Two Drainages

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Historically freshwater mussels were vital components of intact salmonid ecosystems and are culturally important to Native Americans. An inventory of the freshwater mussels of the Umatilla and Middle Fork John Day rivers in Oregon was conducted in the summer of 2003. Mussels were found at over 80% of sites in the Middle Fork John Day River, but at less than 10% of the sites sampled in the Umatilla River system. All three genera of mussels known for the western United States were found in the Middle Fork John Day River, and co-occurred at almost 50% of the sites sampled. In the Umatilla River, two genera were found, *Anodonta* and *Gonidea,* but only in the lower main stem and in one tributary. *Margaritifera* were not found in the Umatilla River, although historically they occurred in the system. Based on preliminary data, speckled dace are a primary host fish for *Anodonta* in the Middle Fork John Day River. Habitat degradation, including active channel change, and the decline of salmonid and other native fish populations may have contributed to the extirpation of mussels from historical locations. The data collected in this survey will be used to provide essential information for designing a recovery plan for freshwater mussels in the Umatilla River system.

Fish Health in the 21st Century: A Preview of Fish Health Management for Restoration and Conservation Hatcheries

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This presentation will explore diagnostic and preventative fish health procedures and programs using current innovative and future technology. The author will outline laboratory specific, hatchery specific, and large scale geographical methods of control for common and exotic fish diseases. Emphasis will be on conservation and restoration hatchery programs. The author will compare and contrast current hatchery and fish health procedures with those that should be accepted in the future. Semi-quantitative data will be presented on the costs and benefits of these procedures and the expected increase in survival related to these procedures.

Elimination of the Legal Use of the Insecticide Sevin in Oregon Estuaries

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In 1982, oyster growers from Tillamook Bay, Oregon maintained that spraying of the insecticide Sevin (Carbaryl) was necessary to kill burrowing mud shrimp, which render oyster beds soft and silted, therefore reducing oyster production. After reviewing data presented by the Department staff, the Oregon Fish and Wildlife Commission issued a permit allowing legal aerial spraying of Sevin on 140 acres annually in Tillamook estuary. The Oregon Shores Conservation Coalition and two other environmental groups appealed the permit ruling. We had previously collected contrary data that argued any spraying of Sevin on estuaries would cause immediate and delayed mortality and subsequent harm to a wide variety of non-target estuarine organisms. We both were working for the Oregon Department of Fish and Wildlife at the time of the appeal. We were invited to present our data at an estuarine conference sponsored by the Oregon Shores Conservation Coalition. We carefully presented our data at the conference. Then all hell broke loose. Certain staff biologists vociferously shouted at us and threatened to fire us. We felt very isolated and insecure. Fortunately, sage advice from our immediate supervisors and peer review and comments from the Water Resources Committee members of the Oregon Chapter of the American Fisheries Society probably saved our jobs; allowed us to proceed forward in this delicate situation; and allowed some starch to seep back into our spines. The courts ruled in April 1984 that a state land use regulation protecting estuaries was violated, and that there was a lack of data on the impacts of Sevin on non-target estuarine organisms when the permit was activated. Today it remains illegal to spray insecticides on Oregon estuaries.

Residence Times and Physical Habitat Opportunity in the Columbia River Estuary and Plume

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We have since 1996 been developing a progressively better understanding of the long-term trends of the circulation and physical water properties of the Columbia River estuary and plume. The underlying methodology includes systematic, integrated observations and numerical simulations of key physical variables (water levels, velocities, salinity and temperature), and is embodied in the CORIE observatory (http://www.ccalmr.ogi.edu/CORIE). Output products of CORIE have been used in support of fisheries

research, both (a) in interpretation of fish tag data, towards the understanding of the role of hydrology in determining fish migration patterns, and (b) in understanding long-term changes of physical habitat relevant to the productive capacity for wild, subyearling salmon (e.g., Bottom et al. (2001)). We will provide here an update on our efforts to characterize the seasonal variability of residence times and physical habitat opportunity in the estuary and plume, and to differentiate among the roles of river, ocean and atmosphere on such variability. Bottom, D. L., C. A. Simenstad, A. M. Baptista, D. A. Jay, J. Burke, K. K. Jones, E. Casillas and M. H. Schiewe (2001). *Salmon at River's End: The Role of the Estuary in the Decline and Recovery of Columbia River Salmon*, National Marine Fisheries Service.

Management Goals for Hatchery Broodstocks: Genetic Integration Versus Segregation

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A new conservation role for salmon hatcheries is emerging in the Pacific Northwest. This new role has been motivated by concerns regarding the potential negative impacts of hatchery-origin fish on natural populations and recent listings of salmon and steelhead under the U.S. Endangered Species Act. In response, hatchery programs are currently undergoing reform measures to (a) reduce genetic and ecological risks to naturally spawning populations and (b) assist directly with conservation and recovery of naturally spawning populations. Reform requires that each hatchery program explicitly state (1) the specific purpose and desired benefits to be derived from hatchery-origin fish and (2) the genetic management goals for the broodstock relative to naturally spawning populations. In the future, all hatchery programs will need to be classified as either Aintegrated@ or Asegregated@ depending on the genetic management goals for the broodstock. Hatchery programs are classified as integrated if the principal goal is to manage the broodstock as an artificially propagated component of a naturally spawning population. The goal of an integrated program is to artificially increase the demographic size or productivity of a population while preventing genetic divergence between the hatchery and naturally-spawning components. In an idealized integrated program, natural-origin and hatchery-origin fish represent two genetically equal components of a single gene pool. Conversely, hatchery programs are classified as segregated if the principal goal is to develop and manage a broodstock as a genetically discrete or segregated population relative to naturally spawning populations. Hatchery broodstocks for segregated programs are derived each year exclusively from hatchery-origin adults returning to the hatchery. In contrast to segregated broodstocks, integrated broodstocks require natural-origin adults to be included systematically in the broodstock each year to (a) prevent genetic divergence of the hatchery broodstock from natural-origin fish and (b) minimize potential genetic domestication effects. Although segregated broodstocks are simpler to operate, hatchery-origin fish from segregated programs may pose unacceptable biological risks to naturally spawning populations. In contrast, integrated hatchery programs are designed to minimize the biological risks to naturally spawning populations. Integrated programs require that the rate of gene flow from the natural environment to the hatchery environment exceed the rate of gene flow in the opposite direction. In general, at least 10-20% of a hatchery broodstock must be derived from natural-origin adults each year in integrated programs. All hatchery programs must be classified according to one of the two sets of criteria; Aintermediate@ programs are not possible. Moreover, Aintegrated@ and :segregated@ refer explicitly to the broodstock management goals for a hatchery program and to the presence and absence, respectively, of natural spawning by hatchery-origin fish.

Maternal Age is a Determinant of Larval Performance in Black Rockfish (*Sebastes melanops*)

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Relative body size has long been recognized as a factor influencing reproductive success in fishes, but maternal age has only recently been considered. We monitored growthand starvation resistance in larvae from 20 female black rockfish (*Sebastes melanops*), ranging in age from 5 to 17 years. Larvae from the oldest females in our experiments had growth rates more than 3 times as fast and survived starvation more than twice as long as larvae from the youngest females. Female age was a far better predictor than female size, suggesting that the increase in larval performance was not simply a function of increased female body size. The apparent underlying mechanism is a greater provisioning of larvae with energy rich triacylglycerol (TAG) lipids as female age increases. The volume of the oil globule (comprised primarily of TAG) present in larvae at parturition increases with maternal age and is a key determinant of subsequent growth and survival. These results suggest that progeny from older females can survive under a broader range of environmental conditions compared to progeny from younger females. Age truncation induced by exploitation may, therefore, have severe consequences for long-term sustainability of the population, and other populations of long-lived rockfishes as well.

Environmental and Management Impacts on Juvenile Salmonid Migratory Behavior and Survival

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We have conducted field investigations to determine the effect of anthropogenic disturbances in the upper watershed on the migratory behavior and survival of several salmonid species using biotelemetry in the Columbia River. Juvenile salmonids (*Oncorhynchus* spp.) were implanted surgically with radio or acoustic transmitters and released approximately 120 km upriver of the Ocean. Their migratory behavior was monitored from land and water from the point of release until fish had entered the nearshore ocean environment. Our data show that survival indices for fish that have passed through the hydrosystem vary both annually and between species (steelhead and subyearling chinook). In general, survival appears to be poorest during low water years. In the estuary we have shown that the hydrological regime dominates the movement patterns of the outmigrants. Residence time in the estuary appears to be largely a function of tides and migratory route. This may be significant as we have also shown that that survival varies depending on the migratory route, and time of passage (day/night) through the estuary. Using the CORIE model, an environmental observation and forecasting system for the Columbia River, which integrates a real-time sensor network, a data management system and advanced 3 dimensional numerical models we have attempted to explain the movement patterns of juvenile outmigrants in the estuary. Preliminary analysis suggests that data from the CORIE model corresponds well with salmonid migratory behavior suggesting that the model may be a useful tool for evaluating the impact of different hydrological regimes on fish movement. This work was supported by grants from the US Army Corps of Engineers (Walla Walla division), the Oregon Watershed Enhancement Board, and the Oregon Department of Fish and Wildlife.

Toxic Contaminants in PNW Estuaries, and Effects on Pacific Salmon

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Among the myriad stresses salmon face in estuarine habitats, exposure to chemical contaminants is being increasingly recognized as a factor that may adversely affect organismal health. Using a combination of laboratory studies, field assessments, and literature syntheses, we have been working to quantify stresses posed by these contaminants on salmon in the Pacific Northwest. Our studies are showing surprisingly elevated levels of legacy pollutants (PCBs, DDTs) in the tissues of juvenile salmon collected from estuaries in Oregon and Washington, including the Columbia River Estuary. In many cases, and for salmon with a variety of life histories, the measured levels approach or exceed recently determined thresholds for effects. In addition to legacy contaminants, current-use chemicals such as pesticides, pharmaceuticals, and fire retardants provide cause for concern. Our studies have shown that a number of pesticides, including metals, organophosphates, and carbamates, affect salmonid olfactory function and resulting essential behaviors. Data from Puget Sound, the Columbia River, and coastal estuaries are combining to show that toxic contaminants should be included as possible limiting factors in salmon conservation and recovery planning on the west coast of North America.

Fish Use of Seasonal Drainages Within an Agricultural Landscape

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Historically the Willamette River lowlands have been characterized by seasonal floods and their pulses of nutrients, sediments, and biota. During the past century, agricultural activities have altered many of these floodplain habitats. As a result, agricultural fields and drainages may offer habitat critical for the survival for native species of aquatic vertebrates in the Willamette Basin. In the winters of 2001-02 and 2002-03, the composition of fish communities and the spatial and temporal distributions of their species were examined in four sub-basins of the Upper Willamette River in western Oregon. Grass seed production is the predominant land use in these sub-basins and all our sampling locations were in seasonal creeks which ran through agricultural fields. Fish were sampled from November to May using minnow traps, hoopnets and backpack electrofishing. Standard fish habitat variables were recorded, as well as riparian vegetation features, water quality and discharge. Ten native species of fish, including four salmonids, were present in these habitats and were differentially distributed in response to drainage features. Ninety nine percent of the fish caught were native fish species. Fish diversity and community composition were associated with distance to perennial water. Fish diet and distribution will be examined during the winter of 2003-04.

Oregon's New Hatchery Research Center

Charlie Corrarino*, Oregon Department of Fish and Wildlife; Dan Edge*, Department of Fisheries and Wildlife, Oregon State University; Mark Lewis, Mary Buckman, and Mario Solazzi, Oregon Department of Fish and Wildlife, Corvallis, OR

The Oregon Department of Fish and Wildlife (ODFW) has been funded to build a research center at the site of the former Fall Creek Hatchery in the Alsea Basin. Roles and expectations of fish culture and hatcheries are changing in today's' climate of ecosystem management, ESA listings and diminished abundance of wild stocks. The goal of this Hatchery Research Center (HRC) is to develop an understanding of the mechanisms that may create differences between hatchery and wild fish and devise ways to manage the differences so that hatcheries can be used responsibly in the conservation and use of Oregon's native fish. Research will be conducted cooperatively between ODFW and Oregon State University and will include a strong educational component. We will identify methods to produce hatchery products that can help rebuild wild populations, provide for consumptive fishery benefits and minimize impacts on existing wild stocks. The information provided by the HRC will help ensure hatchery reform is scientifically based, effective and a wise use of public resources. We will present progress to date, initial design plans and potential research questions to be addressed. Educational components include both formal and informal educational programs. The HRC will be a venue for training state and federal hatchery workers as well as students from OSU and community colleges. The HRC will be a cornerstone in Oregon's progress toward refining and reforming the hatchery tool to best meet today's expectations and challenges.

Lessons After 10 Years of Large-Scale Supplementation and Habitat Restoration to Recover Salmon and Steelhead Populations in the Hood River

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Large-scale investment to supplement salmon and steelhead populations and to restore their habitat in the Hood River Basin began in 1991, and this talk summarizes the independent 10-year review of the BPA-funded program. Program elements included construction and operation of fish facilities to reestablish spring Chinook and supplement winter and summer steelhead, a variety of activities to restore habitat, and extensive monitoring and evaluation. Key lessons from comparing the original program goals to what has been achieved include the following. (1) The desire for better fish runs encourages overestimation of natural production potential. (2) Smolt production and adult returns have been far short of expectations. (3) Detailed habitat surveys enable more realistic estimates of natural production potential, and clarify which species and races are best suited to each watershed. Revised estimates of rearing capacity based on new data and analytical tools indicate the basin will support only 24%-37% of the original program goals for natural production. (4) Monitoring leads to new insights for opportunities to improve the program. This leads to program adaptation, which increases costs. (5) Offsite rearing adds impediments to program effectiveness. Rearing at offsite facilities in the Deschutes Basin led to high rates of straying and jacking. (6) Reintroduction with non-natal stock succeeds very slowly at best. Natural production of spring Chinook smolts (introduced stock) has been less than 10% of the estimated capacity. (7) Supplementation with natal stock retains genetic fitness for natural production. Genetic pedigree analyses of returning offspring showed that natal-stock hatchery fish, when allowed to spawn naturally, produced similar numbers of returning offspring to wild spawners. Introduced stocks were less successful at natural reproduction.

Does High Incidence of Hatchery Straying Depress Wild Production of Steelhead? The Deschutes Experience

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Hatchery strays compose a high percentage of naturally spawning steelhead in the Deschutes Basin in some years, but a low percentage in other years. The high percentage of strays among presumed natural spawners was the foremost reason cited for the ESA listing of mid Columbia steelhead. Data sets on spawner abundance, and the proportion of stray hatchery fish in various tributaries of the Deschutes Basin provide a unique opportunity to compare abundance trends between populations with different proportions of hatchery fish. The rise and fall of recruitment rates of natural fish per natural spawner have been parallel in the Yakima, Deschutes, John Day, Umatilla, and Warm Springs rivers, even though estimates of the hatchery proportion of the steelhead run to these streams ranges from 0% to greater than 50%. In particular, the Warm Springs River, where only wild steelhead are allowed to escape above a weir, showed similar population trends to other spawning areas in the Deschutes River and mid Columbia ESU. The assumption that hatchery steelhead negatively impact the productivity of wild steelhead in the Middle Columbia region was not supported by data available from streams in the region. Mechanisms to account for this outcome are revealed from recent genetics data on success of naturally-spawning hatchery and wild steelhead in the Hood River. Those data show that non-native hatchery fish contribute fewer offspring than native stock, such that natural recruitment is driven by the number of natural spawners rather than the combination of stray hatchery and wild spawners.

Skeletal Deformities and Parasites in Newberg Pool Fish

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Over the past decade, vertebral anomalies have been found commonly in native fishes in or near the Newberg Pool in the Willamette River. In 2002 we radiographed about 15,000 fish from a 100 mile section of the Willamette River to determine the spatial and temporal pattern of deformities in a variety of species. The Newberg Pool again showed the highest deformity rates. Deformities also showed seasonal patterns with fish born early and late in the year having fewer deformities than those born in the middle of the season. In 2003 we cleared and stained larvae to examine the relationship between deformities and a digenean parasite. Preliminary analysis of chiselmouth larvae from Newberg Pool showed about 90% of skeletal deformities were physically associated with the parasite. Future studies need to better understand why parasite infection rates are so high in Newberg Pool.

Predicted Success of Salmonid Reintroductions above Dams: Sensitivity of Estimated Abundance to Assumed Capacity and Survival Parameters

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A salmonid life history model (Salmon PopCycle) was used to estimate relative benefits from alternative scenarios for reintroducing salmon and steelhead populations above dams in the Lewis River, Washington. The model was used to examine equilibrium abundance of adult salmonids under different scenarios of juvenile outmigration survival, adult return migration survival, habitat capacity, habitat productivity, harvest rate, and smolt supplementation. Habitat capacity and productivity were obtained from the Ecosystem Diagnosis and Treatment (EDT) model, and input to the Salmon PopCycle model. Values for life history parameters were chosen within the range observed in similar populations. Simulations showed that incremental increases in migration survival resulted in progressively larger estimates of adult population size. Adult population abundance was slightly more sensitive to changes in survival during juvenile passage through the system than during adult passage through the system. These differences have implications for designing fish passage strategies past dams. Changes in habitat productivity had more substantial effects on estimated population size than changes in habitat capacity. Increased harvest rate resulted in predictable decreases in adult population size. Duration of smolt supplementation had little effect on the estimated adult population abundance.

Periphyton as a Diagnostic Tool for Salmon Recovery

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Small streams are an abundant watershed feature that typically do not support fish or support fish at low densities. Yet each small stream contributes to water quality of small fish bearing streams and eventually to habitat for anadromous fishes Periphyton is a term used to describe a collection of benthic non-vascular plants, which include algae, diatoms and bacteria, and are a central component of all stream ecosystems.

In addition to being a critical food chain link, the habitat requirements of periphyton community members can be used as indicators of substrate condition, sediment levels, stream temperature and nutrient regimes. We examined the changes in periphyton community characteristics in relation to sediment levels and nutrient availability in streams in ID and OR. Nutrient diffusing substrata (agar amended with phosphate and nitrate) were used to test periphyton responses to in situ sources of nutrients. Nutrient diffusing substrates have been proven useful to (1) evaluate local nutrient recycling processes, (2) validate theoretical models, (3) detect nutrient-limiting factors, and (4) supplement other bioassay techniques. We found that the representation in the periphyton community of the N-fixing genera (e.g. *Epithemia* spp.) was a sensitive indication of stream nitrogen status. Sediment levels were related to the relative abundance of sediment tolerant and intolerant taxa. These examples suggest that periphyton may be a useful diagnostic tool for evaluating the biological response of streams to changes in environmental conditions and a useful supplement to other tools being used to monitor salmon recovery.

Management Strategies for Sustainable Beef Cattle Grazing on Forested Rangelands

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Optimal distribution has long been a challenge for land and livestock managers on forested rangelands. Distribution relative to water is one of the most significant challenges. Slope, aspect, vegetation diversity also create unique challenges. Recent concerns regarding threatened and endangered species, as well as the federal clean water act have focused attention on the health and management of riparian areas and watersheds. Public opinion (particularly within the environmental community) has suggested and promoted the concept that cattle grazing and healthy streams are not compatible goals. In turn, exclusionary fencing (nonuse) seems to be suggested as the best alternative to improve/preserve the health of a riparian area. Objective of presentation: Numerous management strategies exist to improve the distribution of cattle relative to streams without the need for nonuse (fences): 1) Offstream water and 2) Summaries of various studies that compared the impact of offstream water.

Zebra Mussels and Mudsnails, Oh My! Volunteer Monitoring and Invasive Species Detection in the Western United States

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Zebra mussels *(Dreissena polymorpha)* arrived in the Great Lakes Region via the ballast water of a transatlantic vessel in the late 1980s. Within 10 years, zebra mussels colonized the Great Lakes and the Mississippi, Tennessee, Hudson, and Ohio River Basins. In addition to clogging intake pipes and encrusting natural and man-made structures, zebra mussels filter copious amounts of water and seriously impact the aquatic community, including native mollusks. New Zealand mudsnails (*Potamopyrgus antipodarum)* arrived in the Snake River in the mid-1980s. Over the next 15 years mudsnails spread throughout the West establishing populations in the streams and rivers of seven western states and three national parks. Little is known about their ecological impacts but, with densities often exceeding 100,000/m2, mudsnails dominate the macroinvertebrate biomass in many areas. Over the past three years PSU, in collaboration with Pacific States, has established a network of volunteers who monitor for zebra mussels using PVC colonization substrates suspended in the water column. Over 150 substrates are deployed in lakes and rivers in OR, WA, ID, MT, WY, AZ, and UT. To date, volunteers have reported no zebra mussels; however, one volunteer discovered the first New Zealand mudsnail population in Oregon outside the Columbia River. The monitoring program also provides an educational benefit: Volunteers promote public awareness of invasive species issues by sharing their expertise on zebra mussels, mudsnails and other invaders with friends and neighbors. PSU is currently working to expand this program and increase awareness of nonnative mollusks in the field biology community.

Movements, Spawning, and Distribution of White Sturgeon, (*Acipenser transmontanus)*, Within the Priest Rapids Project Area, Mid-Columbia River, Washington USA

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The Public Utility District No 2 of Grant County conducted a multi-year white sturgeon (*Acipenser transmontanus*) evaluation to determine what effects the Priest Rapids Project may have on sturgeon movements, habitat, age and growth, recruitment and reproduction. This is the first comprehensive evaluation that has been conducted on white sturgeon in the mid-Columbia River to date. Data from sonic-tagged white sturgeon adults documented seasonal movements from over-wintering areas upstream to tailrace spawning areas. Priest Rapids Project reservoirs appear to provide suitable habitat for all life stages of white sturgeon. More suitable habitat is available in Wanapum Reservoir, which also has the larger population of white sturgeon. There may be some sturgeon habitat limitations in Priest Rapids Reservoir that are suggested by the absence of younger age classes. Growth of sturgeon in the Priest Rapids Project Area was similar to that of other populations, with an average increase of 6.5 cm/year. The Priest Rapids Reservoir population showed a skewed sex distribution with a higher proportion of females, while the sex ratio in Wanapum Reservoir showed an even split. Lack of spawning habitat does not appear to be responsible for recruitment limitations, as successful spawning was documented in both reservoir populations. Egg and embryo viability was also confirmed. Possible explanations for the apparent limitations in recruitment may include limited rearing habitat, emigration losses from the population, potential effects due to river regulation changes, and/or demographic limitations resulting from small population sizes as female white sturgeon have physiological limitations that may permit spawning only once every three years. Grant PUD has proposed in its Final License Application to the Federal Regulatory Energy Commission (FERC) the development of a white sturgeon conservation facility. This proposal is an important step towards effective management of white sturgeon populations in the Priest Rapids Project Area.

Livestock Grazing Management Systems for Riparian Wetland Areas

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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 (Leonard et al.1997). 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 (Leonard et al. 1997). 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.

From the standpoint of achieving livestock management objectives and minimizing soil, vegetation, and water quality impacts, grazing management plans will vary. 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). There are, however, grazing strategies and practices that, under given circumstances, make control of livestock distribution and grazing intensity easier or at least achievable.

Use of Video Technology to Investigate Hatchery and Wild Fish Interactions and Hatchery Fish Behavior

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We placed an underwater video camera near a hatchery release tube to determine diel movement of volitionally released spring Chinook smolts from Warm Springs NFH and to record interactions between volitionally released hatchery fish and resident salmonids in the Warm Springs River. Based on video recorded using the camera, hatchery staff and tribal biologists of the Confederated Tribes of the Warm Springs Reservation, OR decided to place underwater cover and refuge for hatchery fish during the fall volitional release. We will highlight interactions recorded between resident salmonids, birds, and mammals captured on video sessions, present newly recorded video with underwater refuge in place, and discuss the benefits and limitations to using an underwater video camera in current hatchery evaluation studies.

Identification and Enumeration of Steelhead (*Oncorhynchus mykiss*) Kelts in the Bypass Collection Facility at Lower Granite Dam

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In the Columbia River Basin, upstream and downstream migrations of pre-spawned (or “mature”) and post-spawned (or “kelt”) adult steelhead (*Oncorhynchus mykiss*) overlap both geographically and temporally. The goal of this study was to 1) develop a rapid, non-invasive, and accurate method to distinguish pre-spawn from post-spawned steelhead and to 2) enumerate the abundance of kelts at a hydroelectric facility on the Lower Snake River. Ultrasound images of gonads were collected from a sample of known pre- and post-spawned steelhead to develop classification criteria. Results demonstrated that ultrasound images provide quantifiable selection criteria – based on the size, number, location, and/or echogeneity of gonads – for the accurate identification of maturational status. Females were easily identifiable by the presence or absence of an egg mass while males could be determined via differences in cross-sectional testis area. Based on these criteria, ultrasound imaging of adult steelhead examined at Lower Granite Dam’s (LGR) juvenile bypass facility from 2000 - 2002 revealed that the vast majority of the steelhead encountered during the spring (April - June) were kelts (> 90%). Approximately half of kelts enumerated were listed as threatened under the U.S. Endangered Species Act (ESA), representing 17%, 21%, and 7% of the entire protected run in 2000, 2001, and 2002, respectively. The majority of kelts examined were female and most were in good overall morphological condition. Based on the abundance of kelts at LGR, management initiatives to improve repeat spawning rates of steelhead may be considered an important part of a comprehensive plan to rebuild ESA-listed steelhead populations.

Estimating the Contribution of Aquatic Insects to Terrestrial Food Webs Along a Western Oregon Stream

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Aquatic insects leaving the stream in their adult stage to mate represent a net energy transfer from the aquatic to the terrestrial system if they are consumed or otherwise perish on land. Research conducted on a 4th order stream in Western Oregon investigated 1) the link between adult-stage behavioral patterns of several species and the proportion of individuals returning to the stream to oviposit, and 2) the relationship between the timing of emergence events with changes in riparian predator densities. Emergence and pan traps were used to obtain estimates of the proportion of a population returning to the stream. Insect behaviors investigated include diel flight activity, duration of the adult stage, and duration of the emergence event for 22 aquatic insect species throughout the summer 2001. As a group, mayflies (Order: Ephemeroptera) and caddisflies (Order: Trichoptera) exhibited greater activity at night than during the day, while stoneflies (Order: Plecoptera) appeared to have the opposite behavior, although differences were found among different species in the same order. Overall return proportions were 18 % for caddisflies, 28% for mayflies, and 37% for stoneflies, suggesting that the longer adult stages of Trichoptera may increase their vulnerability to predation. Analysis across taxonomic groups show similarities in return proportion among closely related species, but not in behaviors suggesting other factors are influencing their relative success in avoiding predators and returning to the stream. Spiders were very abundant in our study reach, possibly indicating an important flux of energy from the aquatic to the terrestrial system.

Monitoring and Evaluation of a Production Chinook Supplementation Facility

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The Yakima/Klickitat Fisheries Program (YKFP) has designed a supplementation program to enhance the spring Chinook salmon (*Oncorhynchus tshawytscha)* in the Yakima Basin. The purpose of the YKFP is to test the assumption that new artificial production can be used to increase harvest and natural production while maintaining the long-term genetic fitness of the fish population being supplemented and keeping adverse genetic and ecological interactions with non-target species or stocks within acceptable limits. This paper describes the design and operation of a production scale supplementation facility from broodstock collection protocols, through the factorial mating schemes, incubation, rearing experiments, and volitional release of 810,000 smolts from three acclimation sites. The experimental design includes testing new semi-natural rearing techniques (SNT) against the Optimum Conventional Treatments (OCT) of existing successful hatcheries in the Pacific Northwest. Monitoring efforts are directed at evaluation of the performance of supplementation fish in each of the following categories: comparison with the performance of naturally reared fish, the post-release survival of supplementation fish (both outmigrating smolts and returning adults), the homing and reproductive success of supplemented populations, the long-term fitness of supplemented populations, and the inter-and intra-specific interactions (including competition, predation and genetic effects) between supplemented and unsupplemented populations. Information resulting from this research can be used by resource managers to improve the survival and performance of hatchery reared salmonids.

Is There a Link Among Life History Diversity, the Estuary, and Population Resilience in Salmonid Fishes?

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Behavioral and life history impoverishment, through genetic and environmental impacts, can threaten populations and may be a major factor impairing their persistence and recovery. Salmonid populations are renown for their diversity of behavioral and life history traits that derive from both genetically and environmentally determined factors, and their interactions. Moreover, they reflect the meta-population structure found in salmonids and are likely important in the stability and resilience of populations to environmental change. There is a need to better understand how the components of behavioral and life history diversity represented within and among salmonid populations are essential for long term viability. For example, the role of estuaries in the life histories of Pacific salmon has drawn increasing attention as the number of populations recognized as threatened and endangered increase and become listed under the Endangered Species Act. Yet, basic and applied understanding of the role of estuaries in the life history of many salmonids remains poor. Conventional thinking, however, has focused on the idea of a single optimal size and time of transition by salmon through estuaries (e.g., the large size of released hatchery smolts to minimized estuarine use), overlooking the important components of salmonid life-history diversity that are likely linked to the diversity of habitats within estuaries. From the perspective of evolutionary ecology, however, this diversity likely reflects adaptive variation due to condition-, frequency- and/or density-dependent processes that result in multiple optima in terms migratory timing and habitat use. Elucidating the details of salmonid estuarine behavior can allow us to identify these processes, explain their shapes and hence population responses. The total productive capacity and stability of a population will be a function of the combinations of phenotypes (a result of salmon genotypes interacting with the diversity of biotic and abiotic environments) and habitats that allow for the full expression of behavior, including diverse life histories in estuaries. Here I explore the potential link among life history diversity, the estuary and population resilience (stability) in salmonid fishes using a phylogenetic comparative method.

Fish as biovectors for contaminant transport to inland freshwater systems: (How) does this work in Arctic Alaska?

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Recent studies in lakes of the upper Copper River system and on Kodiak Island, AK, have provided convincing evidence that sockeye salmon (*Onchorhyncus nerka*) may make substantial contributions to contaminant budgets of freshwater spawning lakes. In fact, in these systems biotransport by anadromous fish may constitute a larger source of semivolatile contaminants (e.g., PCBs, DDTs) to freshwater systems than atmospheric deposition. Our question was whether this scenario would hold for lakes of the Alaskan Arctic Coastal Plain, where (1) atmospheric inputs would be expected to be higher due to the higher latitude and (therefore) likely higher cold condensation/global distillation effect, (2) biotransport by amphidromous whitefish (primarily *Coregonus nasus* and *C. sardinella*) would be expected to be lower, due to the relatively low position of whitefish in freshwater foodwebs, and (3) deposition of

contaminant-bearing carcasses within freshwater spawning lakes would be expected to be lower, due to the amphidromous, rather than truly anadromous, life history of these coregonids. We studied seven lakes and one brackish lagoon on the western Arctic Coastal Plain, separating freshwater resident vs. amphidromous individuals using otolith microchemistry. Comparison of PCB burdens and fingerprints for freshwater resident vs amphidromous individuals of both species showed no significant differences related to life history. The relationship of this finding to both contaminant fingerprints from other freshwater species at the same and higher trophic levels and to findings from sediment cores from these lakes is discussed.

Could Predation be Affecting Recruitment of Age-0 White Sturgeon?

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White sturgeon (*Acipenser transmontanus)* populations in the Columbia River Basin have declined due to river impoundment and other factors, particularly in upstream reservoirs. Despite evidence of spawning, during some years and in some locations, little or no recruitment of young-of-the-year white sturgeon is observed. Using laboratory experiments, we examined if predation is a possible cause of larval and juvenile white sturgeon mortality and how environmental changes that have occurred since impoundment, such as reduced turbidities and altered habitats, may affect the outcome of predator-prey encounters. We found that when white sturgeon larvae or juveniles were the only prey available, they were readily ingested by prickly sculpins (*Cottus asper)* and northern pikeminnow (*Ptychocheilus oregonensis),* two common Columbia River predators. Furthermore, prickly sculpins preferred white sturgeon when a similar-sized prey, goldfish (*Carassius auratus)*, was also available. Preference of northern pikeminnow when offered both white sturgeon and coho salmon (*Oncorhynchus kisutch)* was inconsistent, but in most trials coho salmon were preferred. Environmental factors also affected predation rates by prickly sculpins on white sturgeon. Less white sturgeon larvae were eaten at higher turbidity levels. The presence of cover, stacked river rocks, also significantly reduced predation on white sturgeon larvae. Our results suggest that scutes offer little protection from ingestion for young white sturgeon, and also that altered habitat conditions may increase predation pressure. Therefore, predation on white sturgeon larvae and juveniles is one factor that may be limiting population sizes in the Columbia River Basin and should be considered in recovery efforts.

Effects of Fire on the Biota of High-Elevation Lakes in the Cascade Range of Oregon

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In 1996, a late-season wildfire burned approximately 4,000 hectares in the central Oregon Cascades. The burned area and neighboring unburned areas contained numerous lakes in a relatively uniform physiographic setting. This situation provided a unique opportunity to evaluate the effects of fire on lakes, and beginning in July 1997, we sampled 32 lakes (16 lakes in areas that had been intensely burned and 16 in unburned areas). Sampling was focused on small lakes (<1.5 hectare surface area) without fish populations. Physical, chemical, and biological (phytoplankton, zooplankton, and amphibians) data were collected during each of two sample periods, approximately one month apart. Although there was little

sign of recovery of terrestrial vegetation during 1997, riparian areas surrounding the study lakes were flourishing. Comparisons of lakes from inside and outside the burned area suggest no statistically significant differences in density of phytoplankton or zooplankton, and amphibians were found in all of the lakes despite the effects of fire on the upland portions of the watershed. Variations in biota among lakes appeared to be related to local environmental factors of individual watersheds. These observations underscore the importance of small lakes as potential short-term refugia for aquatic organisms from the direct effects of fire and other natural disturbances.

Geographic factors influencing genetic structure among barrier isolated populations of coastal cutthroat trout

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An understanding of the processes that shape the genetic organization and diversity of a species is fundamental to conservation efforts, and it is especially relevant to populations that are isolated above barriers to fish passage. In this study, microsatellite DNA variation was examined to assess the factors shaping the genetic structure and diversity among 28 isolated populations of coastal cutthroat trout (*Onchorhynchus clarki clarki*) in western Oregon. Among populations, microsatellite genetic variability at 7 loci ranged from 8 to 65 alleles (mean = 36 alleles). Strong population structuring (Fst = 0.35) among basins is likely related to the effects of genetic drift, population bottlenecks, founder effects, and small effective population sizes in above barrier populations. Results suggest that over long time periods, genetic structure and diversity in isolated coastal cutthroat trout populations are influenced by the interaction of gene flow and local basin features. Preliminary multivariate analysis identified basin slope and number of tributaries as landscape features most affecting genetic diversity among basins. Observed number of alleles in the Coast Range (mean = 49 alleles) was almost twice that observed in the Cascade and Klamath Mountains ecoregions (mean = 29 and 21 alleles respectively). A negative correlation between the number of alleles and river distance to the sea (r = 0.54) suggests gene flow contributed to the structure of these populations. Genetic distance (divergence) was positively correlated with geographic distance in pair-wise comparisons, and greater genetic distances were observed among Cascade and Klamath Mountain ecoregions.

The Diet of Juvenile Fall Chinook Using Tidal Marsh Habitat in the Nehalem Bay

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Estuarine habitats are heavily utilized by juvenile salmonids and seem to provide them with highly productive feeding grounds, refugia from predators and tidal fluctuations, and acclimation areas during smoltification. However, it is estimated that between 50% and 90% of the estuarine tidal marshes in Oregon and Washington have been lost due to anthropogenic disturbances. This study, conducted during the summer of 2003 in the Nehalem Bay along the Oregon coast, looked at the usage of some estuarine tidal marshes by juvenile fall chinook. Sampling was conducted on a bimonthly basis during high tide at four sites within the oligohaline and mesohaline transition zones of the Nehalem Bay. Fall chinook were collected for growth and diet information from the four sites. Stomach contents were analyzed for the

ratio of fullness to stomach size and for the origin of prey items (i.e. terrestrial vs. aquatic resources). Since the function of estuarine habitats is highly related to the biological productivity and the availability of suitable prey resources, these data could show if prey resources available within estuarine tidal marshes are a significant component of juvenile fall chinook diets.

Ecological Criteria for Prioritization of Culvert Replacement

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Culvert passage issues are gaining national and international focus, because they are implicated in the decline of particular species and in the more general loss of biodiversity in freshwater ecosystems. Millions of dollars are invested annually in the Pacific Northwest for culvert replacements to remedy fish passage. Without an ecological basis for the prioritization of culvert replacements, federal and state agencies risk spending large amounts of money on projects with unknown benefits to aquatic species. In an effort to increase understanding of juvenile fish movement and seasonal habitat use, the USFS Pacific Northwest Research Laboratory, in conjunction with the USEPA Western Ecology Division, are monitoring the movement of juvenile coho salmon, steelhead and cutthroat trout into and out of selected tributaries of the West Fork Smith River (central Oregon coast). Juvenile fish implanted with passive integrated transponder (PIT) tags are being used to determine movement, habitat use, survival and growth. PIT-tagged fish are being monitored with stationary PIT tag readers located in four tributaries with “fish friendly” culverts (i.e. meet current design standards) and with portable PIT-tag readers throughout the watershed. Recaptures of PIT tagged fish are allowing determination of habitat-specific growth rates. Seasonal movements of coho salmon and juvenile cutthroat trout and steelhead, coupled with differences in growth rate between tributary and mainstem habitats, reveal complex patterns of movement and growth at the watershed scale. We will continue to assess the role of seasonal habitat quality upstream of road crossings and its influence on the magnitude and frequency of juvenile movement.

Streamlining the Data Collection Process Using Mobile Data Collection Applications

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Custom data applications for palm computers (i.e., PDAs) can greatly increase the efficiency, accuracy, and flexibility of field data collection by incorporating (1) data validation and error checking capabilities, (2) pull down lists of specified data variables or codes, (3) auto entries, and (4) easy import of data from peripheral devises (e.g., PIT tag readers, GPS). Additionally, data collection with palm computers greatly simplifies the exchange of data between the field and office. Once data has been entered into a PDA it can be transferred directly into a MS Access database with the push of a button, thus eliminating the need for manual data entry. Palm computers are lightweight, inexpensive, and resistant to shock and inclement weather, with the use of specially designed cases. Equipped with palm computers, rather than the cumbersome datasheets and field notebooks, researchers can more easily meet the real-time data needs of today’s decision makers.

Performance of juvenile steelhead trout(*Oncorhynchus mykiss*) produced from cryopreserved milt

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We compared the performance of juvenile steelhead (*Oncorhynchus mykiss)* produced from untreated (UM) and cryopreserved milt (CM) and reared for 4-9 months. For the 1996 brood, CM alevins were heavier (~1.7%, $P<0.01$) than UM alevins and length was influenced by a significant milt-by-family interaction ($P<0.03$) suggesting a greater treatment effect for some families. No difference was found in length ($P=0.65$) or weight ($P=0.78$) for 1997 brood alevins, nor were there differences in percent yolk for either brood ($P>0.34$). In Growth and Survival Experiment (GSE)-I (1996) treatment groups were reared in separate tanks with a full food ration and we found no significant difference in survival (range 84-98%, $P=0.53$), length ($P=0.91$) or weight ($P=0.37$). In GSE-II (1996) and GSE-III (1997) treatment groups were reared on a low food ration in the same tank and except for a significant difference in the mean length of 1996 brood juveniles (UM>CM, 3-6%, $P<0.05$) there were no treatment effects. Cortisol responses of milt groups (1996) exposed to acute stress were not significantly different ($P=0.19$), but mean cortisol was significantly greater ($P< 0.01$) for CM than UM fish exposed to a 48-h stress (increased density). When exposed to three dosages of *V. anguillarum* we found similar mortality proportions ($P=0.72$) for UM and CM fish (1996). Significant performance differences among broods and families suggests a cautionary approach to the widespread use of cryopreservation for steelhead and the need for further evaluation.

Use of Hydraulic Sampling Methods to Source Spring Chinook Salmon Eggs for a Captive Propagation Program

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In 1995, the Idaho Department of Fish and Game, in cooperation with NOAA Fisheries, the University of Idaho, and the Shoshone-Bannock Tribes, initiated an experiment to determine if captive rearing could be used to prevent localized extinctions of spring chinook salmon and to insure a continuum of spawners in three Idaho streams. Program objectives include developing fish culture techniques to rear adults through maturation in the hatchery, reintroducing maturing adults with appropriate morphological, physiological, and behavioral attributes, and monitoring and evaluating post-release behavior and spawning success. Fish are reared through smoltification at the Idaho Department of Fish and Game Eagle Fish Hatchery. Rearing from smolt through adult occurs in seawater at the NOAA Fisheries Manchester Experiment Station. In brood years 1994 through 1998, pre-smolts and smolts were collected to source rearing groups. Rearing groups collected as juveniles experienced losses associated with the presence of parasitic gill copepods and bacterial kidney disease. In addition, fish from two of the three stocks were infected with the causative agent of whirling disease. All stocks collected as juveniles exhibited skewed sex ratios and were slow to convert to a hatchery diet. Since brood year 1999, eyed-eggs have been collected to source rearing groups using hydraulic sampling equipment. Survival from collection to ponding has ranged from 75.4% to 100% and averaged 96.3%. Survival from ponding to seawater transfer has ranged from 88.3% to 97.9% and averaged 93.8%. Parasitic gill copepod and whirling disease infections have been absent in the program since brood year 1999.

Additionally, mortality associated with bacterial kidney disease has been greatly reduced. Sex ratios in rearing groups are more evenly balanced and concerns associated with conversion to a hatchery diet have been eliminated. Drawbacks associated with sourcing rearing groups as eyed-eggs include higher age-2 male maturation and the potential disturbance of wild/natural redds.

Fish Utilization of Regulated Seasonal Floodplain Wetlands

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Seasonally flooded habitats located in the floodplain of the lower Chehalis River, Washington were examined to determine the degree and extent of fish utilization. Fish utilization was compared between regulated wetlands and non-regulated wetlands. Eighteen species were present with the most abundant being the Olympic mudminnow (*Novumbra hubbsi)* and three-spine stickleback (*Gasterosteus aculeatus)*. Fish abundance in the regulated sites ranged from ten thousand to one hundred thousand fishes. Coho salmon (YOY and yearling) were the most common salmonid at each site. In addition, regulated wetlands contained more salmonids than non-regulated wetlands. There may be temporal differences in utilization of wetlands by YOY and yearling age classes of coho salmon. The number of yearling out-migrants peaked earlier than YOY at both regulated sites. Numbers of YOY out-migrants continued to increase until high water temperatures and low dissolved oxygen concentrations became limiting. Survival of fishes utilizing seasonal wetlands were dependent on movement to the river before water quality decreased and/or the wetland became isolated and stranding occurred. Unregulated wetlands became isolated earlier in the year (beginning of April) before water quality decreased. In contrast, regulated wetlands became water quality limited before they became isolated. Preliminary results from year one will be presented.

Residence and Growth of Sub-Yearling Chinook Salmon in an Estuarine Marsh

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Restoration of estuarine marsh habitat is a priority of coastal salmon recovery plans, yet relationships between estuarine habitat and salmon behavior and performance remain poorly understood. Using a mark/recapture design, we quantified the growth, residence, and movement patterns of sub-yearling fall chinook salmon within an intertidal marsh system in the Salmon River estuary, OR. In June and July 2003, chinook were captured with a beach seine or trap nets at several sites both within the marsh channel network and at low tide refugia outside the marsh. During the first week of sampling, all chinook captured within the marsh (N=195) were marked with internally implanted PIT tags for later identification. Over the two month sampling period, we recaptured 70 unique individuals (recapture rate ≅36%), and many individuals were captured multiple times. Preliminary results indicate median marsh residence time was approximately 4 days, and some individuals remained in the marsh 30 days after initial tagging. Mean growth rate was 0.50mm/day in length (95% C.I. from 0.40 to 0.61mm/day). This work builds on previous marking studies in the Salmon River estuary, which have followed *groups* of fish, and allows us to examine variation in growth and behavior among *individuals*. Our results demonstrate the feasibility of a mark/recapture approach for monitoring salmon use of estuarine wetlands

and serve as pilot information for future work to evaluate the functional equivalence of restored and natural marsh habitats.

Fish and Macroinvertebrate Assemblages in Western Oregon Forested Headwater Streams - Patterns in Existing Databases

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As part of a research project investigating the effects of forest harvest practices on stream macroinvertebrates, we compiled existing data for Western Oregon headwater forest streams. The compiled database consists of 167 sites with watershed areas less than 10 km^2 that had measurements of stream macroinvertebrates, fish, physical habitat, water chemistry, and watershed land cover. The source of the data is from surveys conducted for EPA's EMAP program, the state of Oregon's Salmon Plan monitoring, and our own sampling efforts between 1994 and 2000. Almost all sites in the database were selected using the randomized EMAP survey design so they constitute a representative sample of all streams in this population. In the Coast Range, 86% of the sites contained salmonids and 56% contained non-salmonid fish species. In the Cascades and Klamaths, 56% of the sites had salmonids and only 5% non-salmonids. Watersheds for these sites were delineated and data on forest condition and logging history were clipped from available GIS layers. There were 189 macroinvertebrate taxa at the 167 sites with richness at individual sites ranging from 7 to 71 taxa. Ordination of the macroinvertebrate assemblages using NMS resulted in a 3 dimensional solution which accounted for 78% of the variation in the similarity among sites. Axis 1 was strongly related to % Ephemeroptera individuals and stream substrate size. Axis 2 was strongly related to % intolerant individuals and site slope and elevation. No strong relationships were evident between logging history and the NMS ordination axes.

OWEB Regional Restoration Project Prioritization Framework

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The Oregon Watershed Enhancement Board (OWEB) is charged by Oregon's state statute to "…establish statewide and regional goals and priorities that shall become the basis for funding decisions by the board." OWEB's Board has identified water quality improvement, stream flow enhancement, and listed fish species habitat enhancement as statewide priorities. Yet, determining a scientifically based process to prioritize watershed restoration project proposals that has the support of local watershed groups has proved challenging. OWEB contracted with Watershed Initiatives, LLC to create a pilot framework for identifying and documenting regional watershed restoration project priorities in two regions of the state. Watershed Initiatives, LLC created a framework that reflects a consensus within the conservation biology field and incorporated local priorities by reviewing local watershed assessments, action plans, and other local studies, as well as soliciting input from local Watershed Councils and other stakeholders through multiple meetings within the targeted regions. WI's team used the watershed-specific information and local stakeholder input to help develop regional watershed restoration project priorities in the Lower Columbia/Sandy River and the Hood Basins. The final product of this framework is a list of priority watershed restoration actions for each region. To provide statewide consistency, the project descriptions were derived from the OWEB *Restoration Project Types* inventory. Recently, the State's Independent Multi-Disciplinary Science Team endorsed the pilot prioritization framework. This presentation will provide an overview of the process the consultants used to establish regional priorities, including the

scientific principles, and the local, watershed specific documents, reviewed. The presentation will also provide a sampling of the project priorities established through the framework for each region.

Odell Lake Bull Trout Recovery, Part 1: The Rehabilitation of Trapper Creek, Oregon

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We re-constructed 0.5 miles of an available 0.8 miles of Trapper Creek, to restore hydrologic function and increase the quality and quantity of bull trout spawning and fry rearing habitat. We also needed to reduce the impacts of the Trapper Creek campground to bull trout and their habitat. For nearly 80 years, Trapper Creek has been negatively impacted from bridges, berms, gabions, developed campsites, and floods. A habitat assessment conducted along the stream length found <4% of fry rearing habitat, rated as good or fair, and none of the spawning habitat rated as good. A new channel design was developed utilizing reference reach data to determine a proper pattern, profile and dimension. Wood, boulders and heavy machinery were used to decrease bankfull width from 55 to 32 feet, and increase pool habitat from 13 to 20. Berms and gabions were removed allowing access to floodplain. Nearly 500 linear feet of side channel habitat was added and large wood complexes increased from 3 to 5 and were stabilized. Stream side protection was accomplished by closing and rehabilitating two campsites, moving portions of the channel, building fences and planting over 8,000 native riparian trees and shrubs. In all, quality bull trout fry rearing habitat was increased by 350%, while spawning habitat increased by nearly 400% over the 0.5 mile stream length. Twelve of 16 redds observed during 2003 surveys occurred in Phase 1. By providing a stream channel that is hydrologically stable, bull trout habitat can benefit substantially.

Functional Role of Mussels in the Benthic Environment

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Freshwater mussels are often the dominant consumer biomass in freshwater systems, yet the functional role of these organisms is only beginning to be understood. As filter feeding grazers, mussels can remove large amounts of particulate matter from the water column, and transfer those resources to the substrate as biodeposits (agglutinated mussel feces and pseudofeces). Mussel biodeposits are a nutrient rich and easily assimilated food source, and therefore may have significant trophic relevance in the benthic community structure. This study examines the functional role of *Margaritifera falcata* in a California North Coast Range river. We examined two main questions: (1) do mussels increase benthic resources in this system? (2) If so, does this increase result in alterations in macroinvertebrate community structure? Enclosure experiments in the South Fork Eel River show that mussels play a significant seasonal role in local food webs by increasing matter (both organic and inorganic) to the substrate, and alter the benthic macroinvertebrate community structure at two trophic levels (collector and predator).

Gearhart Mountain Bull Trout Workshop and Proceedings

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Bull trout traditionally had a bad reputation among both the public and fishery managers. In the 1980s biologists began to recognize the value and declining status of the species. In 1989 the Oregon Chapter of AFS, the *Salvelinus confluentus* Curiousity Society (SCCS) instigated by Del Skeesick (USFS), and the Oregon Dept. of Fish and Wildlife sponsored the Gearhart Mountain Bull Trout Workshop. The workshop had two primary objectives: 1.To share current information on bull trout, especially in Oregon, and 2. To resample bull trout distribution and abundance in tributaries of the upper Sprague and Sycan rivers. Papers from workshop presentations and the sampling conducted were published by the Chapter in a proceedings in 1992. Also included was a paper describing the status of bull trout populations in Oregon. These papers were the first published compendium of information on bull trout in the state and provided much of the technical basis for the Chapter's subsequent petition to list Klamath basin bull trout under the federal ESA. The proceedings have been widely cited and prompted a number of subsequent studies of Oregon bull trout populations. . An annual SCCS bull trout workshop following a similar format continues to be well attended. A similar workshop on redband trout was sponsored by the Chapter in 1996.

Application of the Ecosystem Diagnosis & Treatment (EDT) Model to Assess the Feasibility of Hatchery Releases in the Yakima and Klickitat Basins

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The EDT model in the Yakima and Klickitat basins is being developed so that it can be applied as an evaluation tool to assess the effectiveness of potential hatchery anadromous salmonid releases. This requires that all potential hatchery and/or acclimation sites be routed into the EDT hydrography layer along with the defined stream reaches. The EDT model is being applied in two ways. First, we are interested in knowing what subbasins are most likely to sustain a viable salmonid population based on current habitat conditions in terms of quantity and quality. Outcomes from the EDT model will be used to assess our best subbasins to site acclimation ponds for coho and fall chinook in the Yakima. Secondly, the EDT model is being applied to assess the potential benefit of various hatchery salmonid releases in both the Klickitat and Yakima basins. We are interested in determining the appropriate hatchery release size first, to know what might be expected for pre-smolt/smolt-smolt and smolt-adult survival rates based on the release location in the basin, as well as, to estimate the potential contribution of returning adults to harvest and to natural escapement for supplementation managed populations. Additionally, in the context of hatchery supplementation we are interested in knowing what the potential benefit is of a specific hatchery release to a specific natural salmonid population given current habitat conditions, and what benefits could be realized by various habitat improvements.

Benthic Macroinvertebrate Optima: Implications for Stressor Identification

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Macroinvertebrate assemblages are used by the Oregon Department of Environmental Quality to assess stream impairment. The predictive model RIVPACS is available for use in Western Oregon, and we are in the process of developing a statewide model. RIVPACS outputs are limited to identifying where macroinvertebrate assemblages differ from assemblages in reference condition, as well as identifying missing and replacement taxa. An important benefit to resource managers will be the coupling of tools that not only identify impairment, but also identify the likely causes of impairment.
We used Non-metric Multidmensional Scaling to identify the relationship of macroinvertebrate assemblages to temperature. Indicator taxa were identified as those taxa showing a strong correlation (r^2 > 0.1) to temperature. Weighted average regression and calibration were used to relate a taxon's relative abundance to field collected temperature, identifying a taxon's realized thermal niche. A transfer-function model was developed to predict stream temperature using only macroinvertebrate composition. Two separate assessment tools were developed to assess the likelihood of temperature as a cause of impairment. A qualitative tool links indicator taxa to RIVPACS outputs identifying missing and replacement taxa. Comparing the realized thermal niches of missing taxa to replacement taxa, shifts in thermal requirements can be observed. A quantitative tool compares the transfer-function modeled temperatures from taxa collected at the site to taxa predicted to occur by RIVPACS. Differences between these two modeled temperatures may indicate a departure from reference condition due to changes in stream temperature.

A Biointegrity Index for Coldwater Streams of Western Oregon & Washington

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We developed, tested, and applied an index of biological integrity (IBI) for fish and amphibian assemblages in coldwater streams of the Oregon and Washington Coast Range. A probability sample of 104 wadeable sites was quantitatively sampled for fish and amphibian assemblages, and physical and chemical habitat from 1994 to1996. Natural gradients and anthropogenic disturbances were assessed by examining digital data for catchment-scale road density and vegetation cover, along with site-scale physical and chemical habitat data. A set of 109 candidate metrics was evaluated for variance properties, redundancy, and responsiveness to multiple measures of disturbance, resulting in the selection of 8 metrics for the index. The IBI itself was subsequently evaluated for variance and responsiveness to disturbance, then compared against an independently selected set of 101 reference sites that had minimal anthropogenic disturbance. Our IBI was fairly precise, with an among-stream variance/index-period (error) variance ratio of 4.7 (indicating a theoretical maximum correlation of 0.83 between IBI and a predictor variable with a similar ratio). The IBI was significantly correlated with multiple estimates of anthropogenic disturbance, and reference sites had significantly higher IBI scores than the non-reference sites. Applying this IBI, we assessed fish assemblage condition in the Coast Range, inferring our results to all mapped (1:100,000-scale) wadeable streams in this region. Using the first or fifth percentile, or two standard deviations from the mean, of reference sites as biological criteria, 32-43% of stream kilometers (7,571-10,173 km) were classified as impaired. High IBI scores clustered near national parks and wilderness areas.

Fires, Roads, and Native Salmonids: A Story from North-Central Idaho

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Stream conditions within unroaded landscapes affected by natural cycles of disturbance and recovery can be substantially different than those found within nearby roaded areas dominated by cycles of resource extraction. In this presentation I will explore patterns evident in biophysical data collected from thousands of reaches of streams within the extensive unroaded and roaded landscapes of the Clearwater River subbasin in north-central Idaho. Much of the subbasin's unroaded landscape has been affected by large wildfires during the last 100 years, and the relative condition of fish habitat and populations within the historically burned areas may tell us something important about the "catastrophic" effects of fire.

Monitoring of Adult Lost River and Shortnose Suckers in Upper Klamath Lake, Oregon

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The U.S. Geological Survey has monitored endangered Lost River *Deltistis luxatus* and shortnose suckers *Chasmistes brevirostris* in Upper Klamath Lake, OR and its tributaries since 1994. Trammel nets are used throughout the spring spawning season to capture and tag adult suckers in the lower Williamson River, at shoreline spawning sites located on the eastern shore of Upper Klamath Lake, and at other non-spawning locations in the lake. In addition to trammel net sampling, the fish ladder at the Sprague River dam near Chiloquin, OR is also sampled for the presence of suckers. The primary objective of this study is to monitor spawning activity as well as adult population status of both sucker species. Preliminary data indicate interspecific temporal and spatial partitioning in spawning activity. Recapture data suggest the presence of distinct lacustrine and riverine spawning stocks in both sucker species. Annual changes in length frequency distribution show relatively little recruitment into spawning populations in recent years. Continued systematic sampling at the various monitoring sites will provide the opportunity to tag and recapture previously marked suckers. In the future, these capture-recapture data will be analyzed in program MARK using an open population model in order to estimate vital population parameters such as annual mortality, recruitment, and the finite rate of population change.

Characterizing Movements and Migrations of Coastal Cutthroat Trout in Abernathy Creek and Chinook River, Washington, Two Tributaries of the Columbia River

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An innovative technique using 23 mm Passive Integrated Transponder (PIT) tags was employed to compare two populations of wild coastal cutthroat trout (*Oncorhynchus clarki*) in the lower Columbia River. Chinook River (rkm 6) is a low gradient system that historically witnessed high tidal influences and today is subjected to more moderate tidal intrusions. Abernathy Creek (rkm 76) is a higher gradient system subjected to little tidal influence. For this study, cutthroat trout were PIT tagged in fall 2001 and 2002 by electrofishing upstream of stationary arrays. These arrays were designed to interrogate the

entire flow volume at one point continuously (year-round at a 50 millisecond resolution) without obstructing the path of the fish. Based on data from detections at these sites and recaptures during electrofishing, we compare life history parameters exhibited by these two populations of cutthroat trout.

Effects of Increasing In-Channel Large Woody Debris on the Production and Survival Rate of Salmonids in Tenmile Creek, an Oregon Coastal Stream

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We examined the effect of a significant increase in large wood on the summer population, smolt population, and freshwater survival rate of steelhead (*Oncorhynchus mykiss*), coastal cutthroat trout (*O. clarki*), and coho salmon (*O. kisutch*) in Tenmile Creek, a direct ocean tributary on the Oregon coast. The input of large wood resulted from a planned habitat restoration project in 1996, and an unplanned addition of wood from a major winter storm the same year. Sampling occurred for five years before and five years after the addition of large wood. A nearby reference stream, Cummins Creek, was also sampled for the same parameters for the ten-year period. We observed an increase in freshwater survival rates for steelhead and coho salmon in the treatment stream, with no measurable change for the reference stream. However, our results also illustrate the potential shortcomings of this study design under field conditions, and the potential for misinterpreting the results if a more modest sampling plan had been employed.

Linking Landscape Condition, Stream Habitat, and Fish Performance to Identify Recovery Strategies for Lower Columbia Salmon Populations

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One of the greatest challenges in salmon recovery planning is linking stream habitat and landscape conditions to fish population performance in order to identify habitat recovery strategies that have the greatest fish benefit. This task has been taken on by the Lower Columbia Fish Recovery Board for the Washington lower Columbia region, which includes the Grays, Cowlitz, Lewis, Washougal, Wind River, and other tributary basins from the Gorge to the coast. For these basins, fish habitat information was assimilated from past and current assessments, including habitat condition inventories, fish-habitat modeling, and watershed process modeling. These various tools are being integrated into a decision-making framework that identifies prioritized classes of recovery strategies based on biological criteria. Recovery strategies include preservation and restoration measures at the watershed and stream reach scale. The decision-making framework will incorporate a process for weighing potential recovery actions not only on biological criteria, but also on socio-economic and feasibility criteria. This comprehensive approach will ensure that chosen habitat recovery actions will provide the greatest “bang for the buck” in recovery of listed species.

Feeding Ecology of Sea-Run Cutthroat Trout in the Salmon River Estuary, Oregon

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Until recently, sea-run cutthroat trout, *Oncorhynchus clarki clarki*, were thought to use estuaries primarily as a migration corridor to and from the ocean, rather than as a rearing environment. However, a segment of the cutthroat population in Salmon River (Oregon) has an extensive estuarine life history. This study was designed to assess the diet of cutthroat trout that reared in the Salmon River estuary during the summer 2003. Fifty-five cutthroat trout, ranging in size from 130 – 400 mm, were collected by beach seine in three habitats of the Salmon River estuary from June 18 through August 1. Stomach samples were obtained by gastric lavage and described by taxonomy, number and weight. Fish community composition was also recorded at each site. Cutthroat trout fed actively on pelagic and benthic fishes, benthic invertebrates, and some terrestrial insects. Only 4 of 55 cutthroat had empty stomachs. Overall, prey availability and cutthroat diets varied by site, although there is a lot of variability amongst individual fish at each site. Estuaries provide habitat that supports a variety of prey items - both fish and invertebrates - that constitute an important part of the diet of small cutthroat, while still supporting the larger prey fish that large cutthroat thrive on.

Induction of Skeletal Lesions in Fathead Minnows with the Cercariae of *Apophallus* (*Digenea*) Collected from Snails *Flumenicola virens* from Newberg Pool, Willamette River, Oregon

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We conducted laboratory transmission studies following our observations of a strong correlation of metacercariae associated with skeletal lesions in cyprinid fishes from the Willamette River (see abstract by Cunningham et al.). Our field observations suggested that *Apophallus* sp. is the predominate metacercariae associated with these skeletal lesions. We harvested parapleurolophocerous cercariae from the snail *Flumenicola virens,* which has previous been described as the cercaria of *Apophallus donicus* in the Willamette River. Lab reared fathead minnows (*Pimephales promelas*) were exposed to cercariae at various ages ranging from 3-24 d post-hatch. Greater than 50% infection was observed in all exposure trials. The parasite also caused mortality, particularly in very young fish. Surviving infected fish exhibited skeletal deformities consistent with those seen in field surveys (e.g., lordosis, and fusion and thickening of centra), and the lesions were directly associated with encysted metacercariae. This laboratory study compliments our field observations, and further supports the hypothesis that skeletal deformities in cyprinid fishes from Newberg Pool are caused largely by digenean trematodes, specifically *Apophallus donicus*.

Summary of Movement of White Sturgeon Among Columbia River Reservoirs

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White sturgeon populations in the Zone 6 section of the Columbia River (Bonneville, The Dalles, and McNary reservoirs) are intensively managed to maintain fisheries and increase population abundance. Management decisions depend heavily on continuing research to determine changes in population parameters over time. Movement of individuals to and from these reservoirs can affect management of the populations in a variety of ways. Until recently, little evidence has been available to document movement of white sturgeon among reservoirs. It has been noted that white sturgeon do not utilize fish ladders effectively. However, since passage technology and detection effort at mainstem dams is largely geared toward salmonids, very little information is available on white sturgeon passage of the dams. We analyzed tagging and recapture data (PIT tags) from ongoing white sturgeon research activities from 1994-2003 to describe patterns of migration to and from these populations. We discuss the impact of these migrations on ongoing research activities; notably mark-recapture population estimates, harvest estimates, and efforts to boost reservoir populations by supplementation with transplanted fish.

An Evaluation of the Short-Term Effects of the Hayman Fire on Aquatic Ecosystems

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The aquatic ecosystems of the South Platte River within the Hayman fire area represent a highly altered landscape that has been influenced by a variety of activities including mining, vegetation management, road building, urbanization, recreation and water development. The speed and trajectory of aquatic ecosystem recovery within the Hayman fire area will be affected by a variety of factors. The recovery of the hillslope and riparian vegetation will influence how quickly the aquatic environments recover. Clearly, the areas that were less severely burned will most likely recover to pre-fire conditions most rapidly. Recovery of the severely burned watersheds will be most dependent on riparian recovery, the juxtaposition to high quality habitats that can provide sources for recolonization, and the mitigation of additional chronic disturbances. Rehabilitation of the aggrading perennial streams downstream from the fire is difficult at best. The large volume of sediment in the system, poor access in many areas, and the removal of spoil material would make this operation extremely difficult and costly. Efforts to accelerate the recovery of the hillslopes will help by reducing the future inputs of sediment, but so much sediment has already been mobilized, or is poised to move into the downstream areas, that relatively little can be done to stop the problem. Hence large amounts of sediment will continue to be delivered into the larger streams and reservoirs such as Cheeseman and the South Platte. These inputs of sediment—which are primarily sand and very fine gravel--will reduce reservoir storage capacity and potentially affect fish and macroinvertebrate habitat in the South Platte and other streams draining the areas burned in the Hayman fire. The post-fire response during the first five years will be a resorting and renewal of the stream environment. The disturbance resulting from the fire will be followed by an initial response period that can be highly variable, but generally moving toward recovery in the absence of more chronic disturbances.

Columbia River Fisheries Management Under ESA and Co-Management Agreements

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The Columbia River is home to thirteen species and stocks of salmon and steelhead listed under federal and state endangered species acts. Fisheries operate according to biological opinions and subsequent statements and permits from NMFS. Fisheries are co-managed under the lawsuit US v. Oregon and sharing agreements between the states, treaty Indian tribes, and the federal government. The non-Indian fishery share is further allocated between sport and commercial fisheries. Columbia adult salmon and steelhead returns have rebounded in the last five years. Returns now number 1.5–3.0 million compared to 0.7 – 1.0 million in the previous five years. Very favorable ocean conditions for salmon survival since the late 1990's are credited with much of the recent run size increases. Returns are still dominated by hatchery-produced fish. Fisheries are managed to limit impacts to wild salmon and steelhead stocks. Impact limits for various species range from 2 – 31 ¼ percent. The treaty Indian fisheries are afforded the majority of impacts. Non-Indian fisheries are currently limited to ½-8 ¼ percent impact levels. Non-Indian sport fisheries are mark selective to hatchery spring and summer chinook, coho, and steelhead with retention of adipose fin-clipped only allowed. Commercial fisheries for these species are either mark selective or regulated with time, area, and gear restrictions. Fall chinook fisheries are focused on hatchery chinook and strong Hanford upriver bright chinook returns. Sockeye seasons are usually closed. The sturgeon population is strong below Bonneville Dam and limited in the reservoirs. The 2003 shad return was a record high 4.7 million. Little commercial use has been found for shad. Smelt returns have rebounded to former high levels.

***Margaritifera falcata* Mortality Associated with an Excessive Degree of Shell Erosion in Low-Hardness Waters of the Siuslaw Watershed, Oregon**

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The freshwater mussel, Margaritifera falcata, is prominent in this habitat and provides an important component for salmonid ecologic health by sequestering ocean-derived-nutrient (ODN) and providing water filtration. Decline of nutrient retentive stream structure is recognized as an important limiting factor that is driving much of the salmonid habitat recovery effort. River mussel populations have declined historically with land use habitat degradation, consequently the nutrient retentive resiliency of the system has lessened. Spawner supplied fish fertilizer flushes out of the system too fast to be utilized by all of the species that support this salmonid habitat. Habitat restoration activity to restore stream complexity is ongoing and will provide increased mussel habitat, however these mussels appear to be rapidly declining due to premature mortality from a perforating shell degradation condition of all age classes. There is very little evidence of adequate recruitment to re-establish colonies in restored habitat. All post-mortem valves have shown a specific type of damage; an extensive dissolution of calcium from the exterior of the valves that exceeds the degree characteristic of the species. As the erosion spreads out from the umbo region to extend over the posterior adductor anchor points the valves perforate, causing premature mortality of all age classes. Mussel preference for water hardness (as CaC03) has been characterized as 8 to 75, while current ambient H is at the extreme low end of this range (6 to 18). Available ambient calcium may have dropped below prehistoric levels due to greatly reduced ODN. Buffering capacity in the water may have lessened. Calcium utilization disruption by elevated levels of lead from lost fishing sinkers, documented in these waters, may possibly play a causative role. If M. falcata now is at risk of greatly increased rate of population decline, the loss of this calcium sequestration

pool could be a huge blow to the general aquatic health resiliency. The study, in progress, explores potential contributing factors, including elevated ambient lead levels, in the M.falcata habitat. Early life stage salmonids may plausibly be subject to calcium utilization changes as well. A new study is designed to assess shell degradation rates and resultant potential for rapid rate of population decline of Margaritifera falcata.

The Effect of Environmental Factors Associated with the Introduced Three spine Stickleback, (*Gasterosteus aculeatus),* and its Parasite, (*Schistocephalus solidus)*, in the Upper Deschutes Basin

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The Pseudophyllidean tapeworm, (*Schistocephalus solidus)*, is a parasite that requires both copepods and fish, mainly the three spine stickleback (*Gasterosteus aculeatus*) as intermediate hosts, and birds as its final host to complete its life cycle. A rapid increase in the abundance of both the non-native stickleback and the tapeworm in the Upper and Middle Deschutes Basin began about five years ago. To determine environmental factors that cause higher infection levels, I collected fish and water quality data at 77 sites using a stratified random sampling program based on a modified Environmental Monitoring Assessment Protocol. The sites at which sticklebacks have parasite infection were concentrated in the reservoir area. Multiple regression and logistic regression analysis showed average size of fish, Catch Per Unit Effort, conductivity, and water flow are significantly related to prevalence (the percentage of hosts that are infected with the parasite) and mean intensity (average number of parasite per fish). I calculated the mortality of fish by parasite load based on a negative binomial distribution curve, and a differential equation model was used to evaluate the degree of parasite burden to fish mortality. These results may be applicable to other systems for predicting local infection level of *S. solidus* and for predicting stickleback risk for mortality.

Habitat Use and Movement of Sea-Run Cutthroat Trout in the Salmon River Estuary

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Sea-run cutthroat trout, *Oncorhynchus clarki clarki*, populations in Oregon have undergone a significant decline in the past decade. While sea-run cutthroat trout often migrate extensively and are thought to be highly dependent on estuaries, their life history and habitat requirements are poorly understood. The goal of this research was to determine the role that the estuarine environment plays in the life history of sea-run cutthroat trout. We used both PIT tag and acoustic tracking techniques to monitor the movement and growth of individuals in the estuary. Over the course of 18 months, approximately 750 fish were PIT tagged and 42 were tagged using acoustic transmitters. The combination of methods has allowed us to identify at least two life history types: an estuarine resident form that does not migrate to the ocean but, rather, resides in the estuary for many months and exhibits strong site fidelity while doing so; and an ocean migrant form that migrates through the estuary and out to sea and, upon return, may potentially spend a number of months in the estuary before migrating upstream. The large number of PIT tagged fish that were recaptured enables us to infer growth rates of estuarine residents versus ocean migrants.

The Relative Quality of Habitat: Juvenile Chinook Salmon in the Metolius River Basin, Oregon

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As part of efforts to reestablish spring chinook salmon runs above the Pelton–Round Butte Hydroelectric project in Central Oregon, this project was initiated to investigate the relative quality of habitat available to juvenile chinook salmon and develop an approach for improvement of existing habitat capacity models or development of new models. The Metolius River Basin was historically the main spawning area for chinook salmon in the Upper Deschutes Basin. In March 2002, approximately 54,300 hatchery spring chinook fry were released into five streams around the Metolius River Basin. In 2003, approximately 140,000 chinook fry were released in the same locations. Each of the study streams examined exhibit a unique combination of habitat availability and temperature regime, including spring-fed, riffle dominated streams (Spring Creek and Heising Spring), a spring-fed riffle/pool stream (Canyon Creek), a lake run-off stream (Lake Creek), and the headwaters and mainstem of the Metolius River. In both years, seasonal snorkeling surveys were conducted to quantify the relative differences in distributions and habitat associations of these juvenile salmon. Data collected include habitat type and availability at multiple spatial scales, continuous water temperature, and invertebrate drift. Preliminary results indicate that juvenile spring chinook salmon in the Metolius River basin are not limited to strictly pool habitat, as is suggested in literature. In all seasons, densities were highest near release sites. It appears at this stage of analysis that Lake Creek and the Metolius Headwaters may be able to support more juvenile Chinook salmon than the other systems. However, this is based on anecdotal evidence and is still tentative and preliminary.

Capture-Related Stressors Impair Sablefish Immune System Function: Implications for Discard Mortality

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Sablefish, *Anoplopoma fimbria,* is a valuable North Pacific Ocean species that when not targeted in various commercial fisheries is often a part of discarded bycatch. Predictions of the survival of discarded fish are dependent on understanding how a fish responds to stressful conditions. Our objective was to describe the immunological health of sablefish exposed to capture stressors. In laboratory experiments designed to simulate the capture process, we subjected sablefish to various stressors that may influence survival: towing in a net, hooking, ecologically relevant temperature of seawater and air, and air exposure time. Following the imposition of stress, the *in vitro* mitogen-stimulated proliferation of sablefish leukocytes was used to assess the function of the immune system in an assay we validated for this species. The results demonstrated that leukocytes from stressed sablefish regardless of fishing gear type or exposure to elevated temperatures of seawater or air times did not respond to the T cell mitogen concanavalin A or the B cell mitogen lipopolysaccharide. These data suggest that immunological suppression occurs in sablefish subjected to capture-related stressors. Further studies are needed to

determine if delayed mortality in sablefish discards can be caused by increased susceptibility to infectious agents resulting from stress-mediated immunosuppression.

Great Basin Redband Trout Habitat Improvement Using Felled Western Juniper

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Efforts to manage stream temperature have focused on maintenance or improvement of streamside vegetation through riparian fencing and vegetation planting projects. This project investigated the use of felled western juniper (*Juniperus occidentalis*) as a fencing alternative for the improvement of streamside vegetation and the amelioration of summer stream water temperature on a Great Basin redband trout (*Oncorhynchus mykiss newberrii*) inhabited stream. Study objectives were to 1) determine if western juniper cover moderates summer stream temperatures, 2) determine if western juniper placed over streamside willows shoots is an effective protective structure for reducing ungulate herbivory, and 3) describe the movement and distribution of native redband trout in relation to placement of western juniper over the stream channel. The study reach was located on a headwater stream, approximately 100 km south of Burns, Oregon. The reach was divided into 4 contiguous blocks of 304.8 m in length. Each block was assigned two (152.4 m) treatments: (1) felled western juniper trees placed over the stream channel, and (2) open. Data for redband trout movement, willow volume, and hourly water temperatures were collected pre-treatment during summer 2002 and post-treatment during summer 2003. Cover of felled juniper placed over the stream channel was documented by low-level helium blimp aerial photography. Passive Integrated Transponders (PIT tags) and swim-through PIT tag antennae gates tracked the movement of fish between treatment locations. Summer stream temperature results and discussion will be presented.

Save Our Bays Initiative 1960s-70s

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Soon after the Oregon Chapter was formed in 1964, members involved with management of coastal areas expressed concern for the continuing loss of estuarine areas to diking and filling. In 1967, the Estuaries Committee (now the Estuary Conservation and Development Committee) was formed. Known informally as the SOBs (for Save Our Bays), the Committee launched a public education campaign and kept an eye on estuarine developments. For example, in 1972, the SOBs met on Tillamook Bay and held an on-site review of the Tillamook Bay Development Plan. In that same year, the SOBs reviewed a plan for dredge disposal in Coos Bay. These activities resulted in a member of the SOBs being officially appointed to the Advisory Committee of the Oregon Coast Conservation and Development Commission. Also in the early 1970s, the SOBs collaborated with the Oregon State University Extension Marine Advisory Program to produce "Crisis in Oregon Estuaries." This 4-page pamphlet provided a capsule view of specific problems in each major Oregon estuary, and made strong recommendations for action. Boldly, the pamphlet identified overlapping jurisdiction followed by indiscriminate and unilateral planning among 40 local, district, county, state and federal agencies as a particularly acute problem. At the 1975 business meeting of the Oregon Chapter, the Estuary Conservation and Development Committee presented a resolution that called for all involved and potentially involved agencies and

organizations to meet and form a Joint Estuary Research Committee for the purpose of coordinating all estuarine research. In conjunction with the Wildlife Society, a 17-minute narration and slide show was developed highlighting the value and vulnerability of Oregon's estuaries. Copies were distributed to various state and university offices along with a list of biologists who could help in presenting the program. Over the years, this presentation was given hundreds of times to civic, fishing, and resource-conservation, and government groups. In the late 1970s the SOBs, in cooperation the Oregon Department of Fish and Wildlife and the Pacific Northwest River Basins Commission developed the pamphlet "Oregon's Fragile Few…Estuaries". Education efforts greatly increased public and political awareness of the value of estuaries. In 1976, Estuarine Protection was included as one of the primary goals of Oregon's new Comprehensive Land Use Plan. Federal clean water legislation and coastal zone management guidelines strengthened protection. Early members heavily involved in the Estuary Committee included Bill Wick, Howard Horton, Dave Heckeroth, Willy Breese, Dale Snow, Glen Carter, Dean Marriage, Bob Borovicka, Bill Clothier, Bob Loeffel, Erland Juntunen, Ed Chaney, Bill Saltzman, Del Skeesick, Felix Smith, Ed Mains, Bob Corthell, Dick Angstrom, Rollie Rousseau, Monty Montgomery, Chuck Whitt, Robert Vreeland, Jim Hutchison, Marvin Yoshinaka and Jerry MacLeod. This effort by the Oregon Chapter to further protection of then-vulnerable important Oregon aquatic resources started a tradition of resource responsibility outside of normal jurisdictions that continues in the Chapter today.

Evaluation of Adult Pacific Lamprey Bypass Designs at Bonneville Dam

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Radiotelemetry studies indicate that adult Pacific lamprey (*Lampetra tridentata*) migration is delayed at lower Columbia River dams and that lamprey exhibit poor passage efficiency relative to salmonids. In particular, lamprey are delayed and fall back downstream at the serpentine weirs near the top of the Bonneville Dam fishways. The lamprey also regularly enter makeup water channels (MWCs), which provide no ready outlet to the dam forebay. In 2002-03 we conducted studies to address this problem. We deployed and tested two prototype bypass structures to aid lamprey passage into the forebay from the MWC. The first design featured a submerged entrance collector that directed lamprey into a rectangular tube (enclosed tube design). Attraction flow was created by pumping water out from the top of the collector. The second design had an inclined plane at the entrance with water passing along the entire surface to attract lamprey into the bypass tube (open ramp design). Bypass collector performance was evaluated by trapping lamprey at the top of each device. Lamprey were also marked with a unique silver nitrate brand and released into the MWC to estimate bypass efficiency. Both the number of lamprey captured and the collector efficiency were higher in 2003 than in 2002. A total of 5,458 lamprey were captured in the bypass trap during the course of these evaluations in 2003, with a maximum of 269 lamprey/night. Modification of the enclosed tube collector improved efficiency. Both this design and the open ramp had estimated efficiencies of 15-20%. These experiments indicate that bypass collectors of this type will be effective aids to lamprey passage at dams.

The 1987 Oregon Chapter AFS Review of the Siskiyou National Forest Plan

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During the late 1980s the Forest Service was logging large amounts of old growth forests that was placing spotted owls and other creatures in jeopardy of extinction. A former timber industry executive was Secretary of Agriculture in charge of the Forest Service. Ronald Reagan was President, soon to be succeeded by George Bush. National forests across the nation were in a planning phase to replace outdated forest plans. The Siskiyou National Forest was the first forest in the Pacific Northwest to produce a forest plan. Myself, Chris Frissell, Bruce Hanson, Brendan Hicks and others were at OSU doing various fisheries research. We were all painfully aware of the damage to streams being caused by logging. We met weekly to discuss the plan and ferret out weaknesses. Eventually Chris Frissell gathered up what we had and wrote a lengthy comment letter exposing the inadequacies of the timber dominated forest plan. Oregon Chapter President, Steve Smith, signed the comments in a transmittal letter to the Forest Service. Doug Cramer had a stack of the AFS comments to give out at the annual meeting in February. The AFS comments were used by Headwaters and National Resources Defense Council to appeal the Siskiyou National Forest Plan. Federal logging was halted on all Pacific Northwest forests in the early 90s due to the spotted owl. President Clinton convened a forest summit to resolve the crisis. The Aquatic Conservation Strategy in effect since 1994 corrected many of the deficiencies identified by AFS in the original forest plans.

Pacific Salmon at the Crossroads

Willa Nehlsen, Jack Williams and **Jim Lichatowich***, National AFS Endangered Species Committee

In the late 1980s, Pacific salmon were in general decline and there was talk about reviving an earlier petition to list Snake River stocks of salmon under the federal Endangered Species Act. At that time, Jack Williams urged Willa Nehlsen to expand her earlier report on the status of Pacific salmon stocks in the Columbia Basin to cover all the stocks in the states of California, Oregon, Washington and Idaho. Both Willa and Jack started the project as members of the AFS Endangered Species Committee. A little later Jim Lichatowich was asked to join the project. The project received invaluable information from a large number of biologists throughout the region. In addition Oregon AFS provided moral support for the project as well as financial support to print additional copies of the crossroads issue of Fisheries (March-April 1991). There were opponents to the project, but their opposition rapidly faded after the paper was published and it was clear that it was well received.

Fire In Riparian Zones: A Reconstruction of Historical Fire Occurrence in Riparian Forests of the Blue Mountains and Southern Cascades of Oregon, and an Evaluation of Crown Fire Potential in Riparian Forests of the Blue Mountains, Oregon

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Despite the ecological importance of fire in Pacific Northwest forests, its role in riparian forests is only beginning to be investigated. Two riparian fire studies were initiated in 1997, a fire history study and a crown fire potential study. The riparian fire history study reconstructed the historical occurrence of fire within riparian forests in three different national forests in Oregon. Two study areas were located in mostly dry, low-severity fire regime forests in the Blue Mountains, and the third study area was located in more mesic, moderate-severity fire regime forests on the western slopes of the southern Cascades. Fire was common historically in the riparian zones of all three study areas. Riparian forest Weibull median probability fire return intervals (WMPIs) in the Blue Mountains study areas ranged from 13 to 36 years, whereas the upslope forest WMPIs ranged from 10 to 20 years. It appears that forest type and slope aspect play a larger role than proximity to a stream when it comes to differentiating historical fire regimes in these study areas, and stream channels did not necessarily act as fire barriers during the more extensive fire years. Riparian WMPIs in the southern Oregon Cascades study area were somewhat longer (ranging from 35-39 years) than upslope WMPIs (ranging from 27-36 years), but these differences were not significant. The crown fire potential study evaluated the potential for crown fire initiation (torching) and active crown fire spread in current riparian and upslope forests of the Blue Mountains. Torching potential was high in the *Pinus ponderosa / Pseudotsuga menziesii*, *Abies grandis*, and *Abies lasiocarpa* forest series, and in both riparian and upslope forests under 90 percentile fire weather. The potential for active spread of crown fires was considerably less (in only 15 of 76 stands), with two-thirds of the susceptible stands in the *Abies lasiocarpa* series. Based on the results from the fire history study, it is evident that restoring fire, or at least conducting fuel reduction treatments, will be necessary to protect riparian forests in comparable forest ecosystems. Treatment to reduce crown fire potential should prioritize low elevation forests, and should focus on the reduction of surface fuels and increasing height to live crown.

Using PIT Tags to Monitor Black Rockfish Population Trends

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Oregon's primary recreational groundfish fishery targets the nearshore species, black rockfish (*Sebastes melanops*). Previous assessments relied on the relative CPUE trends derived from recreational fishery sampling programs. These data are not robust to problems of sampling bias or changes in fishing distribution, and can result in errors in the trend of relative population abundance. The need to independently estimate exploitation for black rockfish off Oregon prompted us to investigate the use of passive integrated transponder (PIT) tags for a mark-recapture program. Because PIT tags are invisible to anglers, there is no tag non-reporting problem, and tag detection rates can be estimated directly. We tagged 2,550 fish in 2002, and 3,000 fish in 2003 (29 – 54 cm) with PIT tags (12mm x 2mm) during 20 days of fishing each year near Newport, Oregon. Tags were injected in the hypaxial musculature below the gill arches, determined to be the best site by a previous PIT tag retention study. At tagging,

categorical barotrauma symptoms were noted and each fish was recompressed by immediate submersion in a cage and release at depth. During the fishing seasons (May–October), carcasses of almost all black rockfish landed by charter vessels in Newport and Depoe Bay were counted by samplers and electronically scanned for tags. We have had good recoveries each year (52 and 86) and exploitation rates are within expected assessment values of approximately 5%. This program design will integrate well with the current tagging program used by Washington state and may result in a valuable abundance index for a combined Oregon–Washington assessment.

Techniques for Enhancing Stream Flow Where Water Quantity is a Primary Limiting Factor to the Carrying Capacity of Aquatic Habitat

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The 1987 Instream Water Rights Act provided a legal mechanism for increasing stream flow by allowing senior water rights to be beneficially used instream through temporary lease, allocation of conserved water, or by a time-limited or permanent instream transfer. In 1993, a diverse group of Oregonians formed the Oregon Water Trust, America's first water trust, to utilize the provisions of the "Act" through a voluntary, free-market approach to stream flow enhancement. The Oregon Water Trust has been pioneering flow enhancement projects under a variety of circumstances over these last 10 years - working closely with many AFS members - including the first permanent transfer of a water right to instream use, the first instream lease, the first instream allocation of conserved water, and the first split season use instream lease. These tools and others such as non-generation agreements, water use agreements, source switching, and point of diversion changes have practical application in many stream systems in Oregon. By sharing lessons learned through case studies, identifying opportunities for future project implementation, and documenting the benefits of increased flow on aquatic habitat we can make further progress toward improving the first quality of water—quantity.

Demystifying Sturgeon: Remote Telemetry Provides Insight into the Daily Life of White Sturgeon in the Lower Columbia River

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A yearlong deployment of a radio-acoustic telemetry array near river mile 30 in the lower Columbia River provided information on the movements and habitat associations of white sturgeon. The array provided geographic coordinates of fish tagged with acoustic transmitters at intervals as short as 1 minute. Individual behaviors are evident in plots of geographic coordinates of fish locations. White sturgeon were constantly moving, even though density plots revealed that fish showed fidelity to relatively discrete areas. Depth profiles confirmed the hypothesis that fish move shallower at night. Analyses of density plots also suggest positive as well as negative social interaction among individuals. An analysis of river channel features showed that white sturgeon were associated with a variety of habitats, and showed greater association to areas with steep slopes and variable river bedforms.

An Evaluation of Fresh Water Recoveries of Fish Released from National Fish Hatcheries in the Columbia River Basin, and Observations of Straying

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Approximately 80 million anadromous salmonids with coded-wire tags have been released from National Fish Hatcheries in the Columbia River Basin. The U.S. Fish & Wildlife Service operates fish hatcheries throughout the Basin, many of which are located hundreds of miles from the ocean. Spring Chinook (*Oncorhynchus tshawytscha*) is the most widely raised species. Coho *(Oncorhynchus kisutch*), steelhead (*Oncorhynchus mykiss*), and both tule and upriver bright fall Chinook are raised at fewer locations, with fall Chinook being raised only in the lower basin. Releases have produced over one hundred thousand observed recoveries, seventy-five thousand of which were in the Columbia River Basin. Although tagging was initially inconsistent, practically all groups of fish released since brood year 1989 have been coded-wire tagged. In spite of uncertainties in the coding of recovery locations, and inconsistencies in the sampling and reporting of returning coded-wire tagged fish, recovery patterns can be distinguished. Fish released from National Fish Hatcheries in the Columbia River Basin generally have a high fidelity when returning to spawn, although there are notable exceptions. Recoveries in fresh water outside of the Columbia River Basin are extremely rare. The location of a hatchery relative to the main stem of the Columbia River is an important determinant of the recovery pattern, both for fish from that hatchery, and for fish migrating by, or near that hatchery. Spring Chinook from hatcheries in the Snake River Basin are recovered in smaller basins located further up the Columbia River than the Snake River, while spring chinook from those same basins are not recovered in the Snake River Basin. Natural and artificial barriers, and other features, are also important in determining recovery patterns. Over 43 million coded-wire tagged fish have been released during the brood years considered in this paper, resulting in less than one thousand recoveries in dead fish and spawning ground surveys.

Use of Turbulent Flow to Guide Anadromous Juvenile Salmonids

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Juvenile anadromous salmonids evolved in turbulent riverine environments and may use turbulence to help guide their downstream migration to the ocean. However, the slow-moving waters created by dams lack turbulent cues, which could contribute to the migration delay often observed upstream of dams. One hypothesis is that providing turbulent cues near dams may help guide migrating juvenile salmonids to safe routes of passage and reduce migration delay. Therefore, the goal of our research was to determine the efficacy of induced turbulence to guide anadromous juvenile salmonids into the surface collection system at Cowlitz Falls Dam, Washington. We applied turbulent flow within 30 ft of surface collection entrances using a manifold with 4 jet nozzles powered by a 4-hp mixer. As response variables, we quantified the effect of induced turbulence on 1) the number of fish collected, 2) spatial patterns of water velocity and turbulence, and 3) the spatial distribution of juvenile salmonids in response to turbulence. Measurements with an Acoustic Doppler Velocimeter showed that the jet manifold induced turbulence near the fish collection entrances. Using an acoustic camera, we found the highest concentration of fish in low-turbulence areas and along the edges of high turbulence. However, we found induced turbulence did not increase the number of fish collected. Although turbulence appeared to affect the spatial

distribution of fish, background turbulence was on the same order of magnitude as induced turbulence, which may have contributed to the lack of effect on fish collection.

American Shad in the Columbia River

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American shad *Alosa sapidissima* from the Hudson River (New York) were introduced into the Sacramento River (California) in 1871, and were first observed in the Columbia River in 1876. American shad returns to the Columbia River increased greatly between 1960 and 1990, and recently 2-4 million adults have been counted per year at Bonneville Dam (river kilometer 235). Returning adults migrate as far as 600 km up the Columbia and Snake Rivers, passing as many as eight large hydroelectric dams. Spawning occurs primarily in the lower river and in several large reservoirs. Returning adults were 2 to 6 years old and about one third of adults were repeat spawners, although the sample size was small. Larval American shad are abundant in plankton and in the nearshore zone. Juvenile American shad occur throughout the water column during night, but school near the bottom or inshore during day. Juveniles consume a variety of zooplankton, but cyclopoid copepods were 86% of the diet by mass. Juveniles emigrate from the river during August through December. Annual exploitation of American shad by commercial and recreational fisheries combined is near 9% of the total count at Bonneville Dam. The success of American shad in the Columbia River is likely related to successful passage at dams, good spawning and rearing habitats, and low exploitation. The role of American shad within the aquatic community is poorly understood, although they are known to supplement the diet of resident predators and may be altering parts of the food web.

Influence of Season and Water Quality on the Movements and Distribution of Adult Lost River and Shortnose Suckers in Link River and Keno Impoundment 2002/2003

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Distribution and movement patterns of adult endangered Lost River (*Deltistes luxatus*) and shortnose (*Chasmistes brevirostris*) suckers were monitored in Link River and Keno Impoundment, April-October, 2002-2003. A total of 21 Lost River and 36 shortnose suckers were captured from Keno Impoundment or Upper Klamath Lake (UKL), surgically implanted with radio transmitters, and released in Keno Impoundment, April 2002 and 2003. In spring, 27% (10 of 37) in 2002 and 18% (6 of 34) in 2003 moved up Link River apparently to spawn or attempt passage into Upper Klamath Lake (UKL). None were located in the fish ladder or moved over Link River Dam (LRD). Hydraulic conditions under some flow regimes may restrict passage up to LRD. If passage conditions are improved, some adult suckers will likely move from Keno Impoundment into UKL, however, migration rates may vary depending on species, the origin of the fish, and size. Of those suckers moving up Link River, most were shortnose (10 of 13), those originally collected from UKL were over-represented (6 of 9 UKL, compared to 4 of 28 Keno Impoundment in 2002), and those passing Link Falls were smaller (mean FL 398mm) compared to non-migrators (mean FL 468mm). We observed high mortality of tagged suckers in both years, which likely related to poor water quality, tagging effects, and/or predation. In summer, low dissolved oxygen

levels (DO; < 2 mg/l) in Keno Impoundment severely restricted their distribution. Survivors with active transmitters (12 in 2002; 8 in 2003) remained in Link River until conditions improved in fall. Adult suckers moved into Keno Impoundment within days of improved DO conditions, suggesting adult suckers utilize the impoundment when conditions are suitable.

Effects of a Removable Spillway Weir on the Migration of Radio-Tagged Juvenile Hatchery and Wild Steelhead

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From 1996 to 2003, we evaluated juvenile fish migration behavior at Lower Granite Dam, Washington, by surgically implanting radio transmitters into 2,316 hatchery and 2,132 wild steelhead (*Oncorhynchus mykiss*). Under current operations for Lower Snake River dams, spill is one of the preferred passage routes, generally resulting in fewer fish through the turbines and higher survival. During 2002 and 2003, a surface bypass structure, the removable spillway weir (RSW), was installed and tested on the upstream face of the spillway. We found the RSW to be the most effective passage alternative recently tested, passing about 62-69% of fish with just 7-8% of the discharge. Prior to installation of the RSW, median passage times and the percent of fish traveling upriver from the dam was high during the day and increased as discharge decreased. Comparatively, in 2002 and 2003 when the RSW was tested, median passage times and the percent of fish traveling upriver from the dam were low and did not vary over the diel period or range of discharge. Thus, the RSW can pass a large percentage of fish with less water than passage through spill. The RSW can also reduce migration delays associated with dam passage; especially when river flow is low. As a result, both hydroelectric operations and migrating fish may benefit from using the RSW as a management tool.

Response of white sturgeon to pipeline and hopper dredge operations

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White sturgeon were monitored in the lower Columbia River near river mile 30 with an acoustic positioning system to ascertain responses to pipeline and hopper dredge operations. Fixed kernel density estimations were used to determine if shifts in fish locations occurred among three time periods categorized by before, during, and after dredging operations. Mean movement (m) and depth (m) were also compared to see if differences existed among the three time periods. Pipeline dredging consisted of cutting and flowlane disposal within the area monitored by the acoustic positioning system, while hopper dredge operations included only flowlane disposal. We found that white sturgeon did not depart the local area during either type of operation. Kernel density estimation was an effective method of describing the reaction of tagged sturgeon to dredging operations, and showed mixed results of fish moving towards and away from the disturbance.

Adult Pacific Lamprey Migratory Behaviour at Two Mid-Columbia River Dams Using Radio-Telemetry

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The Pacific Lamprey, a jawless anadromous fish, is indigenous to the Columbia River and is reported to be an important fish of cultural, utilitarian, and ecological significance (Close et al. 2002). Pacific Lamprey populations of the Columbia River have significantly declined in abundance in recent years as evidenced by counts at dams on the lower Columbia and Snake rivers (Close et al. 1995, Vella et al. 1999, Close et al. 2002). Specific reasons for this decline are not fully understood, but have been related to similar factors contributing to the decline of Pacific salmon. The life history of Pacific Lamprey is similar to salmon, in that spawning migrations are necessary to complete their life cycle. Adult lamprey migration past dams and through reservoirs has been investigated in the lower Columbia River, however, information for the mid-Columbia River is limited. Pacific Lamprey were captured and radio-tagged from July to September (2001-2002) at Priest Rapids Dam on the mid-Columbia River. In total, 125 lamprey were implanted with radio-tags and their movements were monitored to determine passage timing and passage success at both Priest Rapids and Wanapum hydroelectric projects.

Fish Distribution Above and Below Culverts in the Portland Metropolitan Area

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The Portland metropolitan area contains numerous urban streams, many of which contain several fish species including salmonids. The majority of these streams have been altered by culverts or pipes as a result of urban growth. Although fish survey data is available, little research has been done on the impact of culverts on fish distribution in the urban streams of Portland. The objectives of this study are to examine fish distribution around culverts in the Portland metropolitan area and to investigate characteristics of these culverts that may make them impassable to fish. Five urban streams in the cities of West Linn and Wilsonville were surveyed for the presence or absence of fish in the summer of 2003. A single electrofishing pass was conducted in 20% of the fast water units, glides and pools throughout each stream reach. All five streams are impacted by urban growth and contain one or more culverts, for a total of twelve culverts. In four of these streams fish are located in the lower reaches but are nonexistent after the stream passes through one or more culverts. Four of the five streams contain juvenile salmonids. Diversity indices of fish assemblages above and below each culvert are compared. Each culvert is then considered for the ability of salmonids to pass through them by examining several characteristics such as design, slope, and substrate.

Federal ESA Petition to List Snake River Chinook Salmon

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The demise of anadromous salmon and trout populations in the PNW was not widely recognized or appreciated until the publication of the paper “Salmon at the Crossroads” by Willa Nelson, Jack Williams, and Jim Lichatowich in 1991. The authors presented their results at the 1990 Oregon Chapter AFS meeting. Following the meeting Chapter Officers were approached by Oregon Trout and asked if

the Chapter would join them and other groups in petitioning the National Marine Fisheries Service to consider Snake River Chinook for listing under the Endangered Species Act. Only the Sacramento Winter Chinook was being considered for listing at the time. The Executive Committee of Oregon AFS felt that it had an obligation to support the petition. The 1989 and 1990 meetings which focused on ethics and professionalism seemed to have confirmed that Chapter should be active in fish issues and that it was a conduit for professionals to express views that they may not be express in their job. The ExCom held lengthy discussions on the petition at the monthly Executive Committee meetings. It was unable to poll the membership on whether the Chapter should sign the partition because of a shortened schedule for the petition. Members were apprised of the petition via the newsletter and were asked to contact ExCom members to voice their opinion. The decision was supported based on the responses. However, it was not unanimous; there were some members who felt it was not appropriate for the Chapter to be supporting the petition. The reasons for this varied widely, ranging from concerns that it would have on them in their jobs to believing the Chapter would be labeled an advocate and potentially loose it exempt tax status. The credibility of the Chapter did not appear to have been affected by its participation. However, some members who did not support the signing left the state chapter and became affiliated with the Portland Chapter. Snake River Chinook were federally listed under the Endangered Species Act on April 22, 1992. This listing has significantly changed management of the Columbia and Snake River systems to benefit passage for these fish.

If You Build It, Will They Come? Evaluating the Response of a Large Warmwater Fishery and its Users to Intensive Habitat Enhancement Projects.

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Since 1989, over 15 hectares of warmwater fish habitat have been enhanced in Applegate Lake by building structures and planting willows. In 2003, a fishery analysis was conducted in order to describe the Applegate Lake warmwater and coldwater fisheries and their users, and to evaluate the benefits of prior habitat enhancement projects to the warmwater fishery. Long term population surveys demonstrated that habitat structures attracted warmwater fishes, and that their growth rates, population sizes, and age structures were acceptable. Sunfish and large bass were more abundant in areas that had been enhanced. Intensive creel surveys indicated that only 11% of the total angling effort in 2003 targeted warmwater fishes, while 58% targeted trout, and 31% was not directed at any particular fish species. Bass catch rates and sizes were relatively high, while bass harvest rates were low. Less than half of all anglers surveyed were aware of habitat enhancement projects. Bass anglers had the highest awareness of habitat projects, although they could only identify about 20% of the enhancement area locations. Mail-in surveys determined that the most important reasons why all anglers fished at Applegate Lake were related to aesthetics, not catch or harvest. Bass anglers believed that habitat enhancement was the best way to improve their fishing experience. It was estimated that over 11,000 anglers fished Applegate Lake in 2003, spending over $300,000 to catch about 10,000 bass and 40,000 trout. Results suggest that the warmwater fishery has benefited from habitat enhancement, and is a productive but potentially under-utilized fishery resource.

Ecology of the Spiny Dogfish (*Squalus acanthias*) off the Oregon and Washington coasts: Life History

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This study examined the life history traits for the "offshore" population of Pacific spiny dogfish, *Squalus acanthias*, and if those traits differ from the "coastal" population. The "coastal" population is considered to inhabit Hecate Strait, Straits of Georgia and Puget Sound waters. The "offshore" population is considered to be spiny dogfish inhabiting the open ocean waters. Previous studies examined Pacific spiny dogfish life history traits, from the "coastal" population and how fishing affected the population (Ketchen, 1975; Saunders and McFarlane, 1993). An important life history trait identified was the average age at first maturity because it indicates how long a population takes to respond to environmental changes or mortality fluctuations. Average age at first maturity for female spiny dogfish, from the "offshore" population, is 31.2 years (confidence interval = 30.45 to 31.95 years) and for male spiny dogfish it is 23.5 years (confidence interval = 22.96 to 24.04 years). A fecundity of 8.48 pups/2 years was determined from pregnant females taken during the sampling period (April 2002 – October 2002). These life history values were incorporated into the age-structured matrix model. This is a female-based model because females are the limiting factor. Annual survivorship of the "offshore" spiny dogfish population is 0.91/yr, with an instantaneous population growth rate of 8% per year ($\lambda = 1.078$). Sensitivity (elasticity) analysis demonstrated that juveniles are the most important life history stage to protect (0.027 = fecundity, 0.81 = juveniles and 0.16 = adults). When fishing mortality is added to the model, the affect depends on the minimum size at entry of the fish into the fishery. Population growth rate decreases faster with higher fishing mortality rates and smaller minimum entry sizes. This study demonstrates that the "offshore" population of spiny dogfish is a long-lived, slow growing, late maturing species and if this population is to be exploited, precautionary measures need to be incorporated into the management scheme.

How Do Landscapes Organize Fire Effects on Channels? Lessons from the 1996 Tower Fire North Fork John Day, Oregon

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Following wildfires rapid gully incision in steep headwater channels may have rapid long-lasting and difficult to predict physical effects on larger channels and aquatic habitat. Topography of fresh burns strongly affects the potential for rapid erosion to deliver large bursts of sediment and affect aquatic habitat kilometers downstream. Across landscapes the distribution of sensitive topography may in turn organize where and how erosion after fires or other disturbances affects aquatic habitat over time scales ranging from individual fire – storm events to centuries. Landscape scale relationships between fires, rapid erosion events and aquatic habitat in the Blue Mountains are poorly understood and existing models are not well suited to examine them. Analysis of rapid gully erosion and channel dynamics in the Upper Cable Creek area after the 1996 Tower Fire in the North Fork John Day suggests that topography organizes significant differences in short-term (post1997) and long-tern (thousands of years) sediment routing patterns through four basins in the study area ranging in size from 74 – 246 ha. A simple empirical approach to modeling topographic sensitivity of 2nd to 3rd order basins to concentrated gully erosion and rapid channel changes after fire is presented. Potential habitat implications of high spatial and temporal variability in long-term sediment routing patterns at the landscape scale are discussed in the context of forest fuel management and strategies to conserve and restore aquatic habitat in the fire prone mountainous regions of Northeastern Oregon.

Use of PIT Tags to Evaluate Predation by Colonial Waterbirds on Juvenile Salmonids

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Juvenile salmonids (*Oncorhynchus* spp.) tagged with passive integrated transponders (PIT) have been released into the Columbia River Basin since 1987 to answer a variety research questions. When piscivorous birds prey upon tagged fish, the tag is often regurgitated intact with the bone pellet. The tags are often subsequently deposited in a localized area, such as a nesting colony. Sufficient tags may be present to provide estimates of predation, prey vulnerability, and effects of migration on prey susceptibility. Since 1998, we have detected over 300,000 juvenile salmonid PIT tags on colonial waterbird nests in the lower Columbia River and estuary. Data from these detections have shown juvenile steelhead (*O. mykiss*) to be more vulnerable to avian predation than other juvenile salmonids, with the exception of juvenile salmonids that migrate from streams and rivers that empty directly into the Columbia River estuary. For these fish, fall chinook salmon (*O. tshawytscha*) were more vulnerable than other salmonids. In addition, juvenile salmonids transported and released downstream from Bonneville Dam were generally less susceptible to avian predation in the estuary than their in-river-migrating cohorts. Finally, hatchery chinook salmon were more vulnerable than wild chinook salmon, while hatchery and wild steelhead were equally vulnerable.

Are Stream Crossing Culverts a Barrier to the Movement of the Pacific Giant Salamander (*Dicamptodon tenebrosus*)?

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Barriers to the movement of aquatic organisms can increase the genetic and spatial isolation of populations. Focus on culvert passage issues has increased as federal agencies attempt to inventory and replace road-crossing stream culverts that are barriers to the movement of anadromous fishes. The effect of stream crossing culverts on the movement of other aquatic organisms, however, is not known. In a mark-recapture study on fourteen 3rd and 4th order streams (one 75m reach per stream) in the Oregon Coast Range, we examined summer and overwinter movements of larval Pacific Giant Salamanders (*Dicamptodon tenebrosus*) in streams with and without culverts. A total of 2,223 *D. tenebrosus* were uniquely marked. Among streams, salamander abundances ranged from 0.3 to 3.2 larvae/m. Recapture rates declined overwinter from an overall recapture rate of 35% in August 2002 to 11% in July 2003. Movement distances were small. Mean movement distances were 3m upstream and 7m downstream, for summer and overwinter movements respectively. Passage was limited in culverts and use and movement through culverts appeared to vary with culvert type (e.g., pipe vs pipe arch with stream bottom). Integrated analysis of range of movement, directionality, and movement frequency through culvert type will contribute to regional dialogue on culvert design for effective passage.

Natural Resource Recreational Estuary Use Along the Oregon Coast

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The estuaries of the Oregon Coast have a long history of utilization by both commercial and recreational interests. As access to the Oregon Coast has improved, the coast developed into a substantial tourist and vacation destination. Many of those visiting the coast have as part of their itinerary the harvest of natural resources from the estuaries. The opportunities are as varied as the "tourists" and "locals" who are participating. From angling for returning fall chinook to digging for clams in the mud to pumping bait shrimp for steelhead, this presentation will provide an overview of the types of the recreational natural resource extraction activities that are currently popular along the Oregon Coast. Summaries of species being targeted and harvested, primary destinations, and seasonal trends will also be presented.

Data Standards: What Are They and Why Do They Matter?

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Data standards don't matter if, and only if, data are collected and used only on a local basis. But more holistic approaches to fisheries management, and the need to respond to range wide declines of ESA listed species with comprehensive management approaches, require that data be analyzed and used at scales well above just the local level where they originated. Modern database management systems make sharing and using data across wide areas feasible and efficient, but only if data standards and protocols are established and used. Without data standards, it is difficult to combine data meaningfully from different sources or locations. Field data collection protocols are needed to assure equivalent data are being collected, data definitions are needed to assure recorded values mean the same thing regardless of source. Data coding must be consistent, or at least compatible, so data coded under different systems can be combined and compared effectively. Failure to follow data standards makes it difficult to analyze data on a range wide basis, makes some data incompatible, and increases the workload on field biologists as others request local data and then call back to clarify what the data really mean. Some of the requirements can be met through data translation (crosswalk) applications, but developing most data standards will require collaborative efforts to agree on standards on a multi agency, wide scale or regional basis.

A Brief History of the Oregon Chapter's Activism on Behalf of Bull Trout

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The Oregon Chapter has played an active role in the protection and conservation of bull trout since 1989 with the sponsorship and organization of the Gearhart Mountain Bull Trout Workshop, where biologists gathered to share information and to conduct surveys in the Klamath Basin. The Natural Production Committee collected information on status of bull trout and on land management activities affecting bull trout in 1989–1991, and the proceedings of the Gearhart workshop was published in 1992. After presentations on status and threats to bull trout, members of the Chapter voted at the 1992 annual meeting to file a petition on bull trout in Oregon, and several months later the focus of the petition was narrowed to the Klamath Basin bull trout. The petition was filed with the U.S. Fish and Wildlife Service

in January 1993. Congressional and USFWS actions delayed the listing process for several years, during which time members of the Chapter met with USFWS to push for a listing, and continued to collect information on population viability, critical habitat, and recovery strategies. Bull trout were listed as threatened in 1998, and the Klamath bull trout were recognized as a distinct population segment. Although filing a petition on bull trout was at times considered a controversial action, the primary objectives of Chapter activities were to elevate the visibility of bull trout and their precarious status, and to advocate for increased protection and conservation of the species.

Do Airborne Contaminants Affect Fish in the Lakes of Western U.S. National Parks?

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Researchers have detected airborne contaminants in snow, lake sediment and water, and fish in alpine aquatic ecosystems in Canada and Europe. However, little information exists for similar occurrence in alpine areas of the U.S. despite the suspected preferential deposition of some airborne contaminants in high-elevation ecosystems. Therefore a multidisciplinary study, called the Western Airborne Contaminants Assessment Project, was initiated to assess the levels and potential effects of contaminants in alpine aquatic ecosystems in eight western U.S. national parks. To determine if airborne contaminants adversely affect alpine aquatic ecosystems, salmonid fishes were captured in the summer of 2003, from five total lakes in Sequoia, Rocky Mountain, and Olympic National Parks to be analyzed for contaminants, health, and reproductive potential. Contaminants were found in lake waters and the fish contaminant analysis method will be described. Upon capture, each fish was examined macroscopically for pathology with nothing unusual noted. As indicated by otolith examination, fish age distribution ranged from one to ten years which will assess if the contaminants accumulate in older fish. Condition factor and length-weight relationships indicate some between lake differences. Sex steroids, plasma vitellogenin, and histopathological examination of the tissues levels will be discussed.

Does Wildfire Favor Invasion of Nonnative Fishes?

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Many studies have documented rapid recovery of fish populations following wildfire disturbance. However, it is not known if wildfire effects can tip the balance in favor of nonnative fishes. Therefore, we are testing the hypothesis that increases in stream temperature, sedimentation, and reduced habitat complexity following wildfires favor nonnative trout in mixed native and nonnative salmonid communities. We are conducting the study in the upper Bitterroot River drainage in western Montana, the site of a 1,440 km^2 wildfire complex in 2000. Westslope cutthroat trout, bull trout, and brook trout are patchily distributed across the drainage. Pre-fire fish population data for many basins in the watershed allow unique comparisons of changes in fish species composition and abundance among sites varying in fire severity, presence of fire-induced debris flows, and distance to source populations for colonization of defaunated reaches. We found that mean daily temperatures in reaches affected by high-severity fire increased by 3.7°C compared to 0.9°C in unburned reaches. Following initial fire-induced

population declines, reaches in high-severity burns averaged a 110% increase in fish abundance from 2001 to 2002. In contrast, populations in reaches affected by debris flows increased little from 2001and averaged only 8% of pre-fire abundance in 2002. Although analyses of 2003 data are preliminary, brook trout abundance appears to be increasing relative to native bull trout and westslope cutthroat trout in reaches with fire-induced sediment and temperature increases.

Behavior of Bull Trout *in situ*: Alone, With Native Rainbow Trout, and With Brook Trout

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Multiple laboratory and field studies have documented negative impacts on growth of bull trout from introduced brook trout, but few offer insight into mechanisms mediating these impacts. To address behavioral mechanisms, we undertook observational studies in replicate, large in-stream enclosures housing identical densities of like-sized trout in three community structures (allopatric bull trout; bull trout with rainbow trout; bull trout with brook trout). Diel patterns of bull trout feeding and social behavior were quantitatively and qualitatively different when interacting with conspecifics, native rainbow, and brook trout. Increased diurnal social behavior is proposed as a mechanism resulting in chronic stress and decreased weight gain for bull trout in the presence of brook trout.

Restoration of Ecological Processes in the Tenmile Creek Watershed on the Central Coast of Oregon

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This presentation is part 1 of 2 consecutive presentations about a cooperative 10-year restoration and monitoring project among several cooperators including private landowners, National Audubon Society, Oregon Department of Fish and Wildlife, and Siuslaw National Forest in the Tenmile Creek Watershed on the central Oregon coast. Basin wide restoration activities include land acquisition, road decommissioning, road drainage improvements, riparian planting, release of understory conifers, plantation thinning and large wood additions to stream channels. Most of the 241 pieces of large wood (30-36 inches in diameter and 80-140 feet long) added to stream channels came from live trees that were felled on nearby ridges and flown with a helicopter into 54 sites along 3.5 miles of Tenmile Creek in 1996. Each piece of wood added to Tenmile Creek was tagged and mapped so that wood movements and functions could be assessed through time. An overview of the restoration activities, wood placement and wood movements will be presented, while the following talk, by Steve Johnson, will present salmonid monitoring results.

Oregon Chapter American Fisheries Society and Senate Bill 397: Oregon's Riparian Protection Legislation

Steve Smith*, Consultant and Jim Newton*, Consultant, Oregon Chapter AFS Legislative and Stream Habitat Committees

In 1980-1981, the Oregon Chapter of the American Fisheries Society (ORAFS) successfully sponsored legislation to provide tax incentives to protect privately owned riparian lands throughout Oregon. The Chapter's Legislative Committee and Stream Habitat Committee teamed up with Nancy Duhnkrack of the Oregon Wilderness Coalition to draft and support the passage of Senate Bill 397 through multiple committees of the Oregon Senate and House. The need for legislation was stimulated by the then emerging science concerning the importance of riparian areas to aquatic habitat and fish populations. Chapter members provided the scientific basis, economic analysis, grass-roots political support, lobbying, and testimony that allowed this milestone piece of environmental legislation to pass in its first legislative session. The Bill was unique in its broad appeal to both urban, liberal legislators and rural conservatives. ORAFS credibility as a scientific, non-political organization was important in our success. A key element in the Bill's passage was the visual effect achieved by a series of simple "before-and-after" photos documenting riparian protection.

The legislation included a full property tax exemption for riparian lands, up to 100 feet in width, and a separate, 25% tax credit for costs incurred in improvements to fish habitat. The inclusion of a sunset clause required the Chapter to return to Salem in 1989 to successfully testify for its continuance. The resulting Riparian Tax Incentive Program, administered by the Oregon Department of Fish and Wildlife, has had limited effect. Participation in the Program has been very low. This is likely a result of the limited economic effect the legislation was allowed to exact on state and local revenues. The tax incentives were also allowed only on low-taxed agricultural and forest lands, and not riparian lands within higher-taxed urban growth boundaries. The Bill though is believed to have raised public awareness of the importance of riparian land protection and resolved a critical objection to riparian protection – paying taxes on land removed from agricultural production. With the recent emphasis on restoration of fisheries habitat generated by the Oregon Plan and listings under the Endangered Species Act, perhaps its time for ORAFS to review the state's riparian legislation and seek tax incentives for protected lands within urban growth boundaries. The tax credit for investments in fisheries habitat could also be increased to reflect the greater emphasis on fisheries habitat in public policy.

Warm Springs National Fish Hatchery Spring Chinook Salmon (*Oncorhynchus tshawytscha*) Program: An Integrated Tool Balancing Harvest, Supplementation and Conservation of Wild Populations

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The spring Chinook salmon (*Oncorhynchus tshawytscha*) program at Warm Springs National Fish Hatchery was initiated in 1978 with wild, native fish from the Warm Springs River. At the outset, an operational plan was cooperatively developed between the U.S. Fish and Wildlife Service and the Confederated Tribes of the Warm Springs Reservation of Oregon. The goal was to cooperatively

manage hatchery operations to enhance harvest opportunities while protecting wild fish populations and their inherent genetic resources. Harvest, escapement, recruitment, survival, run timing, age and size at return, and juvenile production characteristics of hatchery and wild populations have been monitored by Deschutes Basin comanagers for over 25 years. The hatchery operation plan is updated every five years based on this monitoring. The 2002-2006 plan includes 100% AD-CWT marking of hatchery production for stock identification in fisheries and brood stock management, selecting hatchery brood based on wild fish run timing and incorporating wild fish into the hatchery brood using a sliding scale, limiting upstream escapement of hatchery fish, operating a volitional automated passage system for wild adults, manipulating the rearing environment to provide juveniles more natural conditions, assessing ecological interactions between wild and hatchery fish, and determining the reproductive success of hatchery adults outplanted in a nearby stream.

Biological Indicators Used to Measure Pesticide Effects on Steelhead in Hood River, Oregon

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In 1998, Hood River Basin steelhead (*Oncorhynchus mykiss*) were listed as threatened under the federal Endangered Species Act. The causes of steelhead population declines were unknown, but pesticide use from orchard activity was identified as one potential stressor. Hood River has approximately 15,000 acres of orchards primarily pears, apples, and cherries. In 2001-2003, biological indicators were used to measure direct and indirect effects to juvenile steelhead from summer applications of pesticides, primarily the organo-phosphate insecticide azinphos methyl in several streams associated with orchard activity in Hood River. In 2001-2003, composite macro-invertebrate samples (8/samples/site) were collected before and after azinphos methyl applications using a Hess sampler. In 2002-2003, juvenile steelhead were held in cages *in-situ* during azinphos methyl applications, sampled, and analyzed for brain acetylcholine esterase (AChE) activity from each site once per week (n = 10 fish/site/week) for three weeks to measure effects from different exposure intervals. Water samples collected downstream from orchards during pesticide applications, had detections of azinphos methyl above state water quality standards in 2001, 2002, and 2003 (DEQ). Multi-variate analysis of macro-invertebrate samples (2001) before and after spray applications showed significant differences between impact sites and reference sites (ANOSIM results global R = 0.742, p value = 0.003. In 2002 and 2003, mean brain AChE activity (nmol/min/mg protein) at Lower Neal creek and Lenz creek were significantly different from the reference site Upper Neal creek and Hatchery controls. This investigation indicates that pesticides may be adversely affecting threatened steelhead directly and indirectly in the Hood River Basin.

Effect of Drought on Two Mussel Species at the Sycan Marsh, OR

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The drought of 2001 was one of the severest on record in the Klamath Basin. We conducted mussel surveys at the Sycan Marsh Preserve (Klamath Basin headwaters) to monitor effects of the drought. *Margaritifera falcata* (particularly the salmon nacred) was in higher gradient streams with coarser substrates, cooler temperatures and a high groundwater component. *M. falcata* was not observed stressed or dying in any location. *Anodonta oregonensis* was estimated killed in over 50% of its range on the

Preserve. *A. oregonensis* was found in warmer, lower gradient streams and rivers with fine substrates. Although stressed, *A. oregonensis* remained alive in small, isolated pools until the pools dried up in late August. *A. oregonensis* present in rivers were more likely to survive the drought, were larger and more inflated than those found in small streams, although it has yet to be proven if this represents two distinct species. *A. oregonensis* was gravid in the late summer, although no host fish were observed infested. This may make *A. oregonensis* even more susceptible to the negative effects of drought than *Margaritifera falcata*, which releases glochidia in the spring. At one desiccated location, 300 *A. oregonensis* were transplanted approximately 0.25 mi. upstream to a pool. The impact of the drought was much greater on *Anodonta oregonensis* than *Margaritifera falcata*. Reportedly, Sycan Marsh contained one of the stronger reproducing populations of *A. oregonensis* in the region. The long term effects of drought may reduce the range of *Anodonta oregonensis*, increase fragmentation, and isolate the species, key factors that may eventually result in species extinction.

Association of a Rare Color Form of *Margaritifera falcata* and Native Trout with Stream Habitat Complexity

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Sycan Marsh is located in the headwaters of the Upper Klamath Basin, an area of great aquatic animal diversity and endemism. One of only a few known populations of *Margaritifera falcata* with salmon colored nacre occurs in Long Creek, a tributary of the Sycan River. There, approximately 1 of 50 mussels has purple nacre, with the ratio reversed in the Sycan River. Concurrent with mussel surveys, measurements were taken of reach scale channel form. Latitudinal transects showed mussel densities varying with respect to stream channel characteristics. In this low gradient stream, shallow, wide segments (which are considered degraded habitat for trout) were also found to be poor habitat for *M.f.* Young mussels (<4 yr.) were often found in sand and silt deposits along margins and point bars, but were not found where there was erosion or large amounts of loose deposits. The largest, densest groups of older mussels were significantly associated with the deepest point in pools. A functional, low-gradient stream with good mussel habitat would therefore have a narrow, meandering channel, with deep pools and shallow riffles as well as point-bars efficient for deposition. We have also found native trout biomass to be positively associated with these habitat indicators. Mussel transects and simple habitat measurements may be a cheaper, easier and less invasive way to monitor habitat recovery beneficial to native salmonids than traditional fish surveys. Methods that measure effective channel function and the presence of mussel beds could therefore be used as a way to document habitat recovery.

Fish biomass as a function of discharge: A 2D meso-habitat approach to IFIM

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The question of how much water should be retained in streams and rivers for the benefit of fish during periods of water scarcity remains a question of considerable interest to river managers and biologists. While instream flow methodologies have been around since the 1970's, no method has been widely accepted for use on large warm-water rivers because of high species richness and generalized fish habitat

use patterns. We developed a method for predicting adult fish biomass as a function of minimum discharge. The method uses two-dimensional flow models to calculate water depths and velocities at six sites on three Colorado rivers over a range of discharges. Habitat usability is determined by comparing meso-habitat species abundance with calculated water depths and velocities. Using this method, we have been able to predict adult fish biomass as a function of discharge for two of the native fish species (*Catostomus discobolus* and *Catostomus latipinnis*). Validation against recent flow data suggests the method performs reasonably well. Results suggest that for other species, indices of habitat heterogeneity may be better predictors of total biomass than habitat availability.

Freshwater Mussels of the Owyhee River Basin—a Prehistoric Perspective

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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. Only one mussel species, *Gonidea angulata,* was encountered, but the species was widespread and multiple age-classes were present. 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. 2000 years b.p. Because *M. falcata* relies on salmon and trout for hosts, its absence or scarcity in the 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 unknown, although this species is likely to be less host specific than *M. falcata* and, therefore, less vulnerable to changes in fish assemblages.

Elements of Supplementation

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Supplementation is an aquaculture tool used for the purpose of increasing the naturally spawning population. The role of supplementation, from a conservation perspective, is to provide protection for a stock that is declining by increasing the recruitment of salmon to the spawning grounds. Though this strategy does not address the causes for decline, it does offer a solution for the detrimental effects of a declining population. An Artificial Production Policy (APP) should offer guidance yet be flexible enough to recognize the needs of individual natural populations and also must recognize the different goals of hatcheries operating in the basin. Supplementation is designed to work in concert with natural selection using broodstock from the target population to amplify the life-history types that are most likely to be successful in the local environment. A successful supplementation program integrates the hatchery and natural components into a single genetic population through proper breeding protocols, minimization of differences during juvenile development, acclimatization of juveniles to target adult return locations, and maintaining or improving population abundance. The goal for supplementation in the case of Pacific salmon is to decrease the risk of extinction while maintaining the unique genetic, phenotypic and ecological characteristics of the target population by releasing fish that are biologically, genetically and ecologically suited to their receiving environments. A strong Monitoring and Evaluation (M/E) program would be necessary to provide the data required to refine the supplementation program to achieve

optimal production in an integrated system. Artificial production is malleable and can be adjusted to fit the goals of a hatchery program. In this paper, we describe the tribal vision of a comprehensive supplementation program, including policy and scientific components. We will also discuss the merits of supplementation as a tool for restoration of fish populations, associated monitoring issues, successful supplementation programs, and findings from recent research.

Effects of acute and chronic stressors on the migratory behavior of juvenile hatchery steelhead (*Oncorhynchus mykiss)* in Abernathy Creek, Washington

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Field investigations were conducted to determine the effects of acute and chronic stressors on hatchery reared juvenile steelhead (*Oncorhynchus mykiss)* released into Abernathy Creek, Washington. Biotelemetry was used to monitor migratory behavior and residence time of all experimental fish released into Abernathy Creek. Experimental fish were surgically implanted with either radio transmitters or PIT-tags. Fish in the chronic stress treatment received were held in low water depth and exposed to daily chasing for 9 days prior to release. Fish in the acute stress treatment received 6 hours of crowding stress prior to release. Control fish received a brief transport stressor during the release process. Our biotelemetry data indicates that the propensity to migrate was less in fish from the acute stress treatment. During the night following the first release, fish from the control treatment migrated downstream to the Columbia River Estuary faster than fish that were stressed. This work was supported by grants from the US Army Corps of Engineers (Walla Walla division).

Project Abundance, Passage, Conversion, and Return Rates from Steelhead (*Oncorhynchus mykiss*) kelts Passing Lower Columbia River Dams (2001-2002)

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The downstream passage and return rates from steelhead (*Oncoryhnchus mykiss*) kelts in the Columbia River Basin are not well understood. Because steelhead trout have the potential to spawn multiple times, information regarding abundance, emigration timing, travel, passage routes, conversion (i.e., survival), and return rates are needed to better adapt hydro facilities and project specific operations to complement the life histories of these fishes. The goals of this study are an examination of steelhead kelt abundance at McNary and John Day dams, downstream travel times, passage routes, attrition through the lower Columbia River dams, and the returns rates from these fish. To acquire such data ultrasound was employed for kelt identification, whereas, radio-telemetry and adult Passive Integrated Transponder (PIT) detection technologies were used to estimate kelt travel, passage, attrition, and return rates. In 2001-2002, facility abundance estimates from McNary and John Day bypasses averaged 2,005 and 2,117 kelts, respectively. Travel rates observed in the free flowing reach below Bonneville Dam were greater than those observed in impounded reaches. Project passage routes were predominately through surface bypass routes and via spillways when such conduits were provided. Returns rates from good and fair condition kelts PIT-tagged in 2002 at McNary and John Day dam bypass systems were 6.0% (21/352)

and 11.1% (63/568), respectively. Current information suggests that improvements being made to the lower Columbia River hydro-system will prove beneficial for the survival of steelhead kelts.

A Natural History of an Urban Stream: Education and Outreach in the Johnson Creek Watershed

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In the fall of 2003, the Johnson Creek Watershed Council in Portland, OR, launched an education program focusing on the history, ecology, and conservation of Johnson Creek. Johnson Creek primarily flows through agricultural lands, low- and high-density residential areas, and urban areas; and is therefore vulnerable to cumulative effects of land use. To increase public awareness of the watershed, the council invited landowners, community members, and other interested parties to attend an evening slideshow and half-day outdoor workshop. Activities included a discussion of historical land use decisions and their impacts on the watershed, an exploration of the creek's ecological resources through benthic macroinvertebrate sampling and identification, and visits to riparian restoration sites in the watershed. The underlying motive for the class was to provide context for the large amount existing information about the watershed, and to provide a springboard for community members to initiate their own investigations. This is an ongoing effort—future plans include developing curricula that can be adapted for different age groups as needed. We plan to present workshops to the Portland Waldorf School (January 2004), Portland Parks & Recreation (Spring 2004), and to other groups upon request.

IBI Metric Development for Streams and Rivers in Western Forested Mountains and Arid Lands

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In the western USA, development of metrics and indices of vertebrate assemblage condition in streams and rivers is challenged by low species richness, by strong natural gradients, by human impact gradients that co-vary with natural gradients, and by a shortage of minimally-disturbed reference sites in mid- to low-elevation streams, and medium to large rivers. The indicator development process benefits by an evaluation of assemblage data at sites representing the least- disturbed and the most-disturbed conditions along the range of natural gradients. We compare and contrast vertebrate assemblages from least-disturbed and most-disturbed sites sampled by EMAP-Western Pilot in the Forested Mountains and Arid Lands ecoregions. These sites include the range of elevations, slopes and stream sizes in those regions. In small, mid- to high-elevation streams more often than not, no vertebrates were collected, regardless of stream condition, making assemblage-based metrics unreliable. For medium-sized streams in the forested mountains ecoregions, metrics should reward sites with numerous native salmonids along with one or two moderately intolerant native benthic fish species, and in some areas, an amphibian species. Metrics should downgrade sites with few or no native salmonids and tolerant native sucker species, or non-native and/or land-based amphibians. For large rivers, metrics should reward sites with one or more native salmonids, and upwards of five other native species which include intolerant or moderately intolerant benthic species, while downgrading sites with large numbers of non-natives, and tolerant species, as well as a lack of native salmonids.

Geographical Variation in Genetic and Meristic Characters of Coastal Cutthroat Trout

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We examined the geographic variation in genetic and meristic characters of coastal cutthroat trout (*Oncorhynchus clarki clarki*) based on samples from 55 populations across their distributional range (northern California to Prince William Sound, Alaska). Populations exhibited extensive variation in meristic characters across their range with populations at the southern end of the range exhibiting phenetic affinity despite rather significant meristic differences within this regional area. Meristic characters did not reveal a latitudinal cline, although they suggest population structure at large spatial scales. Regional clustering of populations from the southern portion of the range was in contrast to populations from the central and northern periphery of the distributional range, which did not show phenetic affinity. Analysis of genetic data revealed geographic concordance of populations at the northern and southern extent of the range, and demonstrated isolation-by-distance (IBD) at regional scales (< 800 km). The strength of IBD differed among regions and was strongest in the northern and southern portions of the distributional range. The primary structure of coastal cutthroat trout populations occurred at the individual stream level, and there was genetic affinity among populations at a regional scale. Our data suggest that compared to other species of Pacific salmon and trout, coastal cutthroat trout are characterized by many smaller, genetically diverse local populations that act in a more independent, isolated nature over short time frames (<100 years).

Death, Monsters, Healthy Forests, and You

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This presentation will start by exploring commonly held images of wildfires, and the risks they pose to life and property in the western United States. That image will then be used as a springboard for examining several points about fish and fire. For example: Are fires really burning with greater speed and intensity than ever before? Was the 2003 fire season one of the worst in modern history? Under normal conditions… do fires really tend to burn at ground level? Also to be considered: How does the front page of *The Oregonian* stack up against The HFI and against the wildfire statistics published by the NIFC? And does any of this have anything to do with you? This talk is not intended to answer fundamental questions of fire ecology and forest management, but rather, to kindle discussion of the ways in which the public's perception of wildfire relates to land management policy.

Choosing your Battles and Lessons Learned; The Politics of Fisheries Science

Krystyna Wolniakowski*, Pacific Northwest Region, National Fish and Wildlife Foundation, Portland, OR; and Don Ratliff, Biologist, Portland General Electric, Madras, OR (Oregon Chapter AFS Past Presidents)

In the mid- to late 1980's, the Oregon Chapter of AFS underwent a significant change in direction. Under the leadership of the then-Presidents and their Executive Committee officers, and with the support of many (but not all) the members, the OR Chapter became much more involved and vocal about fisheries policies and pending state legislation that affected fish and habitat management in the state. It was a time when we began to see the serious decline in salmon populations as well as other species. As scientists with a broad range of expertise within our membership, we began to testify at hearings, write position papers that were based on the best science; and to send letters to decision makers to share our knowledge of the impacts to the resources from various management practices and policies. Although it is considered common practice today with the establishment of scientific review panels, 15 to 20 years ago it was a revolution in the evolution of our Oregon Chapter. We emerged from a role of sharing our expertise with each other as fellow scientists and managers, and expanded our involvement to help inform key resource leaders. This paper will present some case histories such as the petition to list the Snake River Chinook under the Endangered Species Act and pressing for use of the proper stocks in STEP egg programs-lessons learned, turning points, and new paths forged from the perspective of two past Chapter Presidents.

Removing Livestock from Riparian Areas—Is It Necessary?

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The debate whether or not livestock should be allowed to graze in riparian areas continues throughout the country. This small component of watersheds was considered “sacrifice areas” for many years. Grazing management based only on objectives for uplands does not often maintain or improve riparian areas in the same pasture. Land use plan objectives and management prescriptions must accommodate specific riparian area features while considering the needs of the entire watershed. A grazing prescription that does not address one of the other may be doomed for ecological and economic failure. In fact, riparian area improvement often occurs due to the improvements made in the upland areas of a watershed. Simply fencing off all riparian areas to exclude livestock grazing is often impractical due to topography, size, expense, and may be unnecessary to achieve riparian area condition objectives. Specific grazing strategies that are developed to meet the objectives for a particular riparian area may need additional management practices to facilitate riparian area maintenance or improvement. These practices include techniques that attract livestock away from riparian areas, restrict livestock use of riparian areas, and herd management and animal husbandry practices that promote distribution. Land managers throughout the country have developed management strategies that improved riparian area conditions. The use of grazing strategies along with the development of off- site water, supplementation, water gaps, rest, fencing, herding and culling, as well as other practices have been shown to improve and maintain riparian area vigor. The single common denominator among all riparian areas inventoried in Montana as functioning properly or at least being on an improving trend, was continual involvement on the part of the operator or manager (Erhart et al, 1998).

Can Non-Native Species Transform Oregon Estuaries? Some Examples and Predictions for the Future

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As global travel and trade intensify, non-native species are arriving in our estuaries at an ever-increasing rate. More than 100 non-natives, representing all taxa, all life history traits and all ecological roles reside in Oregon estuaries (http://science.orst.edu/~yamadas/). Oysters from the Atlantic coast and Japan brought with them over 20 undesirable hitchhikers. Ships with fouled hulls, rock ballast and ballast tanks have brought many more. Not only do alien species displace natives, they also alter habitat structure and energy flow through ecosystems and may aid in the establishment of other non-natives. For example, the Atlantic marsh grass *Spartina alterniflora* spreads by runners and traps sediment in its roots. Over time, this invader can transform a mudflat to a high marsh. In addition, *Spartina* adds detritus to the food web and aids in the establishment of the European green crab, *Carcinus maenas*, by providing juveniles with shelter. This crab preys on small native clams, worms and juvenile flatfish and competes for food with native crabs, fishes and migratory seabirds. Right now, our estuaries need to be closely monitored to determine the status of a number of potentially devastating non-native species for two reasons: 1) to curtail their spread and 2) to understand the invasion process on our coast. What we have learned from dispersal, growth and recruitment patterns of the European green crab can be applied to predict the invasion process of other non-native species with planktonic development.

Movements of Coastal Cutthroat Trout (*Oncorhynchus clarki*) in the Lower Columbia River

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Timing and speed of juvenile coastal cutthroat migration was investigated using both active and passive radio and acoustic telemetry in the springs of 2002 and 2003. Actively migrating cutthroat in Mill, Abernathy and Germany Creeks (tributaries of the lower Columbia River; rkm 87, 88, 91 respectively) were captured by screw trap and implanted with either a radio transmitter or acoustic pinger and monitored. The data suggest that migrant cutthroat trout leave the tributaries and make rapid, directed movements into seawater, often within 5 days of entry into the main-stem environment. In the spring of 2003, the telemetry effort emphasized gathering specific high resolution movement data on cutthroat trout leaving these three Creeks. A similar pattern of rapid downstream migration was observed. Movement data suggests that there is no diel or tidal pattern of non-directed activity. As might be expected, however, directed downstream movement was correlated with outgoing tidal flows. Additionally, downstream movements were greatest just after dawn and dusk. These migratory patterns, together with physiological data (increased gill Na,K-ATPase and increased seawater tolerance during the spring) supports the assertion that the smolting process and migration patterns of cutthroat trout are comparable to other salmonids. Because of these similarities, anthropogenic activities and management actions in the main-stem Columbia River that influence salmon smolts are likely to affect anadromous coastal cutthroat trout in a parallel fashion.

ABSTRACTS OF POSTERS

In alphabetical order by primary author's last name

Student presenters **underlined and in bold**

* Indicates presenter if multiple authors are listed

Predicting the Distribution of Coho Salmon Habitat in the SONCC Recovery Domain

Aditya Agrawal, NOAA Fisheries, Southwest Science Center, Santa Cruz Laboratory, 110 Shaffer Rd., Santa Cruz, CA, 95060, 831-420-3916, Aditya.Agrawal@noaa.gov; R. G. Szerlong, M. Goslin, E. Bjorkstedt, R. Schick, **T. Williams***; and B. Spence, NOAA Fisheries, Southwest Science Center, Santa Cruz Laboratory, Santa Cruz, CA

As part of the recovery planning effort of threatened coho salmon in the Southern Oregon/Northern California Coast Recovery Domain (SONCC), estimating the quality and extent of historical habitat across the domain is necessary for assessing population and ESU viability. Because georeferenced spatial data on habitat and fish distribution at the regional-scale are lacking, we adapted methods of the Coastal Landscape Analysis and Modeling Study (CLAMS) to implement a GIS approach in modeling the intrinsic potential of stream reaches to support juvenile Pacific salmonids. The model measures potential for development of favorable habitat characteristics for coho salmon as a function of the underlying geomorphological and hydrological attributes, expressed as the weighted geometric mean of indices for average annual discharge, channel gradient, and channel constraint. These variables are derived from a 10 m DEM and PRISM precipitation data; therefore, the model predicts patterns of relative productive potential expected in the absence of human disturbances. To apply the model appropriately in this region, we investigated the proposed coho specific weighting functions (developed by CLAMS) using values available in the literature and found the functions to be appropriate. Because patterns in precipitation and runoff vary across latitudes, we used gage station data in a linear regression model to better estimate mean annual discharge from drainage area and precipitation. Results of this effort are being used in conjunction with other models for salmon recovery planning activities including analyses of population structure, population and ESU viability, and may prove useful in identifying key areas for restoration.

Impacts of the Tapeworm *Schistocephalus solidus* on Fish and Wildlife in Central Oregon

David Banks, Jessica Coyle, **Victoria Cronin***, Mark George, Randall Linden, Justin Miles, and Barbara Shields, Department of Fisheries and Wildlife, Oregon State University, Corvallis, Oregon, 97331, 541-758-2120, croninv@onid.orst.edu

The tapeworm *Schistocephalus solidus* has become established in the Deschutes Basin as a result of invasion by a non-native fish, the three spine stickleback, *Gasterosteus aculeatus*. The impacts of this parasite on fish and wildlife communities have not been well documented in North America. A captive diet study was conducted on largemouth bass, *Micropterous salmoides* and on mallard ducklings, *Anas platyrhynchos* during August and September of 2003. We assessed behavioral differences, growth and development in both study species. In the ducks, a diet including tapeworms resulted in statistically significant differences in weight gain, bill-vent length, and temporal plumage emergence. In the fish, growth rates were depressed in the experimental group and we observed a higher mortality rate on a diet of tapeworm infected stickleback. These experiments indicate the potential for serious impacts on health and fitness of fish and wildlife throughout the range of these invasive species with unknown ecosystem-wide consequences.

Emergence of Aquatic Insects from Intermittent Headwater

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Little is known on how timber harvest practices influence dynamics of aquatic insect communities in small headwater streams. Streams of this type are either perennial or seasonally intermittent, depending on location in the watershed, annual climatic cycles, and modifications of hydrological patterns by human activities. We measured aspects of the invertebrate fauna of small, intermittent headwater streams in the central Coast Range of western Oregon. Channels that were moist or flowing were expected to have higher number of emerging adult aquatic insects compared to dry streams. In the late summer and early fall of 2003, adult insects were collected from several summer-dry headwater streams in the central Oregon Coast Range. Four emergence traps, covering 0.19 m^2 (2 ft^2) each, were arranged in a 40-m reach in each stream. Samples were collected every two weeks. Watersheds of the sampled streams were completely clear-cut within the last two years and left with no riparian buffer. Aquatic and terrestrial insects were captured in both seasons. Preliminary results indicate that number of emerging aquatic insects in early-August (moist channels) were more similar to mid-November (after fist freshets) than to late-October (dry channels). Future analyses will compare intra- and inter-seasonal assemblages under different land cover (clear-cut vs. canopy-closed) and stream flow (perennial vs. intermittent).

El Nino Effects on the Reproductive Condition of Female Black Rockfish, *Sebates melanops*

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The gonadal index of black rockfish off central Oregon declined in and 1997-1998 as a result of strong El Nino events. These events were characterized by above normal Spring SST indicating weak upwelling of nutrient rich water. Weak upwelling events result in low productivity in near-shore reef habitat where black rockfish rear and mature. During events of low productivity, highly planktivorous fishes, like the Black rockfish experience lower prey density and availability. The availability of food resources has been directly correlated with the reproductive condition of females. Black rockfish diets are composed of up to 57% omnivorous zooplankton, and therefore depend heavily on cool nutrient rich currents. Relatively poor ocean conditions for the past two decades may have reduced recruitment and success in some California-Oregon species (AFS). Black Rockfish is an important component of the sport /charter fishery of the central coast of Oregon. . The negative correlation of condition indices during El Nino events needs to be considered when regional management decisions are made regarding allowed fishing mortality on an affected population.

Depth-dependent Catches of Longnose Skate (*Raja rhina*) and Big Skate (*Raja binoculata*) Before, During and After a Strong El Niño

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The purpose of this project is to compare catches longnose skate (*Raja rhina*) and big skate (*R. binoculata*) in a range of depth strata before, during and after strong El Niño years. Data for this project were collected by the National Marine Fisheries Service during triennial ground trawl surveys. I compared catch per unit effort (measured as hectares trawled) for each species in 1980, 1983, 1986, 1995, 1998 and 2001, dividing the data by depth strata of 100m. I hypothesized that both longnose skate and big skate CPUE would increase at deeper depths during ENSO events relative to their distributions during non El Niño years due to downwelling. My analysis indicated that skates did not show a significant change during a strong El Niño year. In order to better understand what is happening with longnose and big skates before, during and after a strong El Niño year more research needs to be conducted, due to the small samples sizes available for this analysis.

Stratification of Salmonid Species in Abernathy Creek

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As part of an ongoing study in Abernathy Creek (a tributary of the Lower Columbia River: 76 Rkm) we electro-fished approximately 9km of the upper watershed during the Fall of 2002 and 2003. All cutthroat and steelhead > 100mm were tagged with individually coded 23mm PIT tags. Stationary antennas recorded movements past river kilometer three and six. During the summer of 2003 the study area was interrogated with a mobile PIT-packing device and fish which had not migrated in the spring of 2003 were detected. Throughout the electro-fished reach, all salmonids encountered were recorded in relation to creek location. Additionally, three multi-pass depletion sections were electro-fished within the system (approximately 100m). Species stratification and abundance are considered in the context of river location and habitat.

Summer Stream Temperatures, Juvenile Coho Condition Factors and Black Spot Infection in the Oregon Coast Range

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We monitored stream temperatures at 35 locations throughout the West Fork Smith River watershed in the Oregon Coast Range during the summer of 2002. Between July 24 and August 24, maximum seven-day moving average high daily temperatures ranged from 21.8 °C near the catchment mouth to 17.5 ºC in the upper main stem and from 16.8 °C to 17.2 ºC in the lower reaches of three major tributaries. Presence of juvenile coho black-spot infections, tentatively identified as the trematode *Neascus* spp., was more frequently noted in main stem reaches than in adjacent lower tributary reaches. Condition factors were

computed for groups of coho juveniles in three lower tributary reaches and the corresponding main stem stream reaches. We investigated possible statistical relationships among black-spot occurrence/severity, high summer temperatures, and condition factors in the West Fork Smith River watershed.

Bottoms-up Salmon in the Wind River

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To determine if decomposing salmon carcasses add marine-derived nutrients to the food web and increase algal and benthic invertebrate productivity, we compared two stream-reaches (one with and one without salmon) in the Wind River of Washington state. The lower reach receives annual spawning fall Chinook (*Oncorhynchus tshawytscha*), while spawning salmon do not occur in the upper reach. For stable isotope analysis of 15N we collected samples of red alder leaves, epilithic algae, benthic macroinvertebrates, sculpin, and juvenile steelhead. In July 2002, before Chinook spawned, there was no difference in average delta-15N values of these samples between the two sites indicating that marine-derived nutrients from the previous year were not maintained in the food web. In October 2002, after Chinook spawned and decomposed, there were significant increases in delta-15N from the algae, invertebrate and juvenile steelhead samples from the lower reach with salmon. This suggests that uptake of marine-derived nutrients is a seasonal response only. We found no evidence, however, of increased algal and invertebrate production when salmon carcasses were present. Epilithic algae biomass, standing stock chlorophyll-a, and P/R ratios did not differ significantly between the two sites. Benthic macroinvertebrate density was similar between sites, while biomass was dramatically greater in the upper reach without salmon. Our research continued in the summer 2003 by assessing local nutrient uptake in an experiment measuring algal and invertebrate biomass and stable isotopes above and below added carcasses in three streams.

Skeletal Deformities and Parasites in Newberg Pool Fish

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Over the past decade, vertebral anomalies have been found commonly in native fishes in or near the Newberg Pool in the Willamette River. In 2002 we radiographed about 15,000 fish from a 100 mile section of the Willamette River to determine the spatial and temporal pattern of deformities in a variety of species. The Newberg Pool again showed the highest deformity rates. Deformities also showed seasonal patterns with fish born early and late in the year having fewer deformities than those born in the middle of the season. In 2003 we cleared and stained larvae to examine the relationship between deformities and a digenean parasite. Preliminary analysis of chiselmouth larvae from Newberg Pool showed about 90% of skeletal deformities were physically associated with the parasite. Future studies need to better understand why parasite infection rates are so high in Newberg Pool.

Stream Networks, Spatial Scales and Analysis

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Current spatial analysis of stream networks often neglects the important concepts of scale and spatial autocorrelation. This is especially common in analysis that includes a Geographic Information System (GIS) approach, where it is easy to overlook the scale of underlying digital data. Not only is the scale of the digital data important, but also the scale at which patterns in biological and physical characteristics are manifested. For an analysis to achieve meaningful results the concept of scale must be carefully considered. Spatial autocorrelation that is inherent in landscape data is manifested in a unique way in stream networks. Currently, spatial statistical tools used for interpolation along stream networks are unavailable. However, there are possible applications of Bayesian hierarchical modeling or traditional kriging techniques that may evolve into viable statistical choices for spatial interpolation. This poster presents some of the positive and negative aspects of spatial statistical analyses of stream networks.

A Comparison of Stream Invertebrates in Small, Old Growth and Second Growth Forested Catchments in the H. J. Andrews Experimental Forest

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Timber harvest alters dominant overstory and riparian vegetation. In small streams, riparian vegetation often composes the food base for many aquatic invertebrates. We are interested in how invertebrate assemblages may differ in streams influenced by coniferous vs. deciduous vegetation at various elevations. How also might invertebrates respond to seasonal drying in small streams? Preliminary results from summer sampling indicate differences in benthic abundance ($\mu_{\text{old growth}} = 2515$ vs. $\mu_{\text{second growth}} = 7194$; $p = 0.047$), but not in benthic taxarichness ($\mu_{\text{old growth}} = 32.3$ vs. $\mu_{\text{second growth}} = 39.0$; $p = 0.160$), between old growth and second growth sites. Ordination techniques reveal differences in benthic invertebrate assemblages between treatments. How might these comparisons/contrasts differ seasonally?

Distribution and Habitat Preference of Larval Lamprey within the Lower Deschutes River Basin

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In 2003 we began a project to inventory larval lamprey (ammocoete) distribution within the lower Deschutes River basin. The project objectives are to determine lamprey species composition, distribution, and habitat preference. We conducted surveys in 13 streams, including the Warm Springs River, Shitike, Mill and Beaver creeks mainstem and tributaries, for ammocoete presence. Sampling was conducted in a three-tier sampling design. Sixty meter reaches were randomly selected every 10 Rkm starting from the mouth and working upstream. Within the 60-m reach, transects were marked every 10-mperpendicular to flow, and along each transect two, 1-m^2sub-samples were electrofished. At each sub-sample, two 90-s backpack electrofishing passes were conducted using an AbP-2 backpack electrofisher to determine ammocoete presence. At each tier habitat data was collected to describe water quality and channel characteristics. Ammocoetes were collected in four streams including the Warm Springs River, Beaver, Badger and Shitike creeks. To determine the end of distribution in each creek, electrofishing

was conducted upstream from the last sub-sample where ammocoetes were present. We collected131 ammocoetes within the electrofished sub-samples. All were identified as Pacific lamprey (*Lampetra tridentata*). The greatest percent of ammocoetes were collected in riffles (42.8%), followed by pools (26%), alcoves (16%), and glides (15.7%). The greatest proportion (.84) of ammocoetes collected in riffles were located along stream margins in depositional areas. No significant relationships were found between ammocoete presence and the habitat perimeters we collected.

An Analysis of Steelhead Returns to the Warm Springs River at Warm Springs National Fish Hatchery

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The Warm Springs River is a major tributary of the Deschutes River in north-central Oregon that supports a population of wild summer steelhead (*Oncorhynchus mykiss*). Warm Springs National Fish Hatchery, located at Rkm 16 of the Warm Springs River, collects information on adult steelhead returning to a barrier dam and fish ladder located adjacent to the hatchery. We analyzed the adult steelhead data collected at the hatchery between 1978 and 2003. Annual wild steelhead returns ranged between 81 and 880, with a median return of 332. In order to preserve the genetic integrity of wild steelhead populations in the Warm Springs River, only wild steelhead are allowed upstream of the hatchery. All hatchery steelhead entering the fish ladderare considered to be strays and are removed from the population. The number of stray hatchery steelhead entering the Warm Springs River has increased substantially since 1987. Strays made up an average of 13.6% of the total annual steelhead run in the Warm Springs River prior to 1987. Since 1987, strays have accounted for an average of 50.9% of the total run. The hatchery of origin, based on coded-wire tag recoveries, could be determined for 37% of the hatchery strays and the majority of these fish (87%) were reared at Irrigon Hatchery. Due to the lack of a comprehensive coded-wire tagging program for hatchery steelhead in the Columbia River basin, a thorough analysis of straying in the Warm Springs River could not be completed.

Life History Monitoring of Salmonids in the West Fork Smith River, Umpqua Basin, Oregon

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As a life-cycle monitoring basin for the Oregon Salmon Plan, the Oregon Department of Fish and Wildlife has estimated adult returns of coho salmon and winter steelhead, and smolt outmigration of coho salmon, chinook salmon, cutthroat trout and winter steelhead in the West Fork Smith River since 1998. In 2001/2002, the Environmental Protection Agency and USFS,Pacific Northwest Research Station initiated research to assess factors influencing juvenile salmonid movement, distribution and growth within the basin. Objectives of this research are to 1) quantify seasonal movement between tributary and mainstem habitats, 2) quantify timing and magnitude of passage through culverts in relation to environmental conditions, 3) relate seasonal movement to dynamic habitat conditions, and 4) relate movement and habitat quality to growth and survival of juvenile salmonids. All three agencies are collaborating to track the movements and growth of juvenile salmonids implanted with PIT tags

throughout the basin. PIT-tagged fish are monitored with stationary PIT tag readers located in three tributaries and with portable PIT-tag readers throughout the watershed. These data will be used to determine seasonal movement, habitat utilization, survival and growth in tributaries and mainstem reaches of the West Fork Smith River. Empirical field data will inform spatially-explicit models of coho salmon life history-habitat interactions, and will help guide habitat protection and restoration of critical freshwater habitats for salmonids.

The Influence of Summer Low-Flow and Female Escapement on Summer Steelhead (*Oncorhynchus mykiss*) Smolt Production

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Many biotic and abiotic factors can influence the ultimate number of summer steelhead (*Oncorhynchus mykiss*) juveniles that survive to leave a river system. Summer low-flow explained 39% of the variation in summer steelhead smolt production in the Umatilla River ($P = 0.03$) and female escapement explained 75% of the variation ($P = 0.01$). This analysis suggests that summer low-flow and female escapement levels may affect the production of summer steelhead in the Umatilla River due to a limited amount of suitable rearing habitat and high metabolic costs associated with intra-specific competition; however, other density dependant and independent factors may also influence smolt production.

An Innovative Technique for Estimating Survival of Outmigrating Columbia Basin Juvenile Salmonids using PIT tag Detections

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PIT-tagging studies are a valuable technique to evaluate survival and passage timing of outmigrating anadromous juvenile salmonids. Survival estimates are generated by relating downstream detections of tagged outmigrants to upstream releases. The critical uncertainty with current PIT tag data evaluation techniques is in estimating probability of detection at fixed detection sites. Understanding how detection probability changes over time enables expansion of detections according to time of passage, and thus more accurately estimate survival. S.P. Cramer & Associates and consulting statistician Doug Neeley have developed an analysis technique that incorporates the changing detection probabilities at detection facilities over time, and allows for use of a much larger data set to estimate detection probability than is allowed by other analytical techniques. This analysis technique has been packaged in a software application that enables statistically robust, easy, and flexible analyses of PIT tag data by users. The software allows users to estimate survival and identify passage timing while controlling variables including: release location, release date, rearing origin (wild/hatchery), brood year, length at tagging, and capture method.

Range and Density of Alien Fish in Western Streams and Rivers, USA

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Alien fish have become increasingly prevalent in Western U.S. waters. The EPA Environmental Monitoring and Assessment Program's Western Pilot (11 western states), which is based upon a probabilistic design, provides an opportunity to make inferences about the range and density of alien fish in streams and rivers across the west. Reported data includes sites sampled during 2000 –2001. Fish status (native/alien) was determined using specie ranges identified in literature (Page & Burr, Lee et al), and was confirmed from voucher specimens. Alien presence and density, grouped by political and ecoregional boundaries, and by stream size is presented. Approximately 32% of the West's stream length contains alien fish with California harboring the most collected alien species (18). Proportionally, 5th order streams are more likely to contain aliens than 1st order streams (75% vs. 25%). Carp are the predominant alien both in range and density. Other common aliens include green sunfish, fathead minnow, and rainbow trout. Three ecoregions were evaluated (Western Forest, Xeric and Plains). The Xeric region contained the fewest alien species (18) while the Western Forest and Plains contain 25 and 26 species respectively.

Evaluation of Visible Implant Elastomer (VIE) Tags Used to Batch Mark Juvenile Chinook Salmon: Retention Rates and Effects on Growth and Condition

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Visual implant elastomer (VIE) tags (Northwest Marine Technology, Shaw Island, WA), are a relatively new method of marking animals. The tag consists of a fluorescent elastomer material injected as a liquid that cures into a pliable, bio-compatible solid. Because of its ease of use and application, it can be used to tag small fish and other invertebrates. In this laboratory experiment, we marked 120 juvenile Chinook salmon on either the snout or jaw with one of six unique VIE tags. Sixty juvenile Chinook salmon were unmarked and used as controls. The fish are of hatchery origin, and were held in six two-foot tanks (30 fish per tank) at the Smith Farm Fish Performance and Genetics Laboratory in Corvallis, Oregon. The goals of this experiment were to investigate the retention of VIE tags, and to determine if there were any detrimental effects on growth or condition of the fish. The fish were weighed, measured, and checked for tag retention every two weeks from May to November, 2003. Preliminary results indicate that there were no significant differences in growth or condition between marked fish and control fish, and the majority of the fish retained their tags throughout the life of the experiment.

Implications of Escape Rings for the U. S. West Coast Sablefish Pot Fishery

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In recent years, the use of escape rings in sablefish pots has become prevalent in the U. S. West Coast sablefish (*Anoplopoma fimbria*) fishery. Escape rings are made of steel or plastic and are sewn into the mesh to create an escape hole or "vent". These vents allow sablefish under a certain body size to escape the pot. Size-sorting of small sablefish then occurs when the pot is on the sea floor, rather than on the deck of a fishing vessel. The sablefish fishery has changed from a derby-style fishery, as short as six days, to a quota-based fishery with a much longer period for harvest. This allows fishers to soak the pots for a longer duration, giving the smaller fish time to take advantage of the escape rings. Stock assessment models estimate the average selectivity curve parameters for the fishery over time. The use of escape rings could cause a change in the selectivity of the pot fishery, which should be specified in the model. If so, new selectivity curves should be estimated to incorporate the current fishery selectivity using escape rings. This project surveys sablefish pot fishers to determine when they began using escape rings, how effective they are, and to collect related data such as ring size and reason for use

Pacific Lamprey Redd Densities in the Illinois River Basin of Southwestern Oregon

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Lamprey declines have been documented in the industrialized areas of the Northern Hemisphere, primarily in the United States and southern Europe, but none of the 34 species have become extinct. Similar to Pacific salmon species, Pacific lamprey (*Lampetra tridentata*) show a declining trend in the southern and eastern portions of its range where human impacts to freshwater habitat are severe and cumulative. Lamprey redds in the Illinois River basin in southwestern Oregon were concentrated in lower reaches of tributary streams on private lands with perennial flows and often in stream reaches with stream temperatures too high for optimum salmonid rearing. Lamprey redd densities were about ten times lower in headwater areas where salmonids are abundant on public lands. Extended freshwater rearing of larval lamprey for up to 6 years and lack of mobility makes this species extremely dependent on perennial flows throughout the summer rearing period. Redd densities suggest that perennial flow is the most critical factor for juvenile lamprey rearing in streams prone to losing surface flow due to drought or water withdrawal.

10, 000 YEARS: A Historical Perspective of the Columbia River Indian Fishery

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The Columbia River Indian fishery is more than 10 thousand years old. The most popular fishing site was Wyam or better known as Celilo Falls. This place was one of the greatest trading sites in North America. The tribes traded for **"Nusook"** (salmon). It was the great "meeting place" for the region. The tribes used many methods of fishing gear. On Sunday, March 10, 1957 the gates of The Dalles Dam closed and 6 hours later Wyam (Celilo Falls) was flooded. Within a few years a fishery was established within the area known as the Zone 6 Indian Fishery. This portion of the river lies between Bonneville and

McNary Dams. A set gillnet fishery is the main method used today, with some dipnetting being used. Fish is used for subsistence (personal use), ceremonial (religious) purposes, and caught commercially to provide income. The runs of salmon, steelhead and other fish are not what they once were. In modern times, the reliance on hatcheries has become very important in sustaining the Indian fishery. With trust responsibilities of the United States government has with the treaty tribes to provide opportunities to fish and the inability of the Columbia River to sustain itself, relative to natural production, the need for artificial production of salmon and steelhead is necessary and will continue. Whatever the future brings, in terms of natural and hatchery production of salmon and steelhead in the Columbia River, the heritage of the Indian people and the fish will prevail for future generations.

Techniques for Enhancing Stream Flow Where Water Quantity is a Primary Limiting Factor to the Carrying Capacity of Aquatic Habitat

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The 1987 Instream Water Rights Act provided a legal mechanism for increasing stream flow by allowing senior water rights to be beneficially used instream through temporary lease, allocation of conserved water, or by a time-limited or permanent instream transfer. In 1993, a diverse group of Oregonians formed the Oregon Water Trust, America's first water trust, to utilize the provisions of the "Act" through a voluntary, free-market approach to stream flow enhancement. The Oregon Water Trust has been pioneering flow enhancement projects under a variety of circumstances over these last 10 years - working closely with many AFS members - including the first permanent transfer of a water right to instream use, the first instream lease, the first instream allocation of conserved water, and the first split season use instream lease. These tools and others such as non-generation agreements, water use agreements, source switching, and point of diversion changes have practical application in many stream systems in Oregon. By sharing lessons learned through case studies, identifying opportunities for future project implementation, and documenting the benefits of increased flow on aquatic habitat we can make further progress toward improving the first quality of water—quantity.

Adult Lost River Sucker and Shortnose Sucker in Link River and Keno Impoundment, Klamath River Basin, Oregon 2002/2003

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Distribution and movement patterns of adult endangered Lost River (*Deltistes luxatus*) and shortnose suckers (*Chasmistes brevirostris*) were monitored in Link River and Keno Impoundment, April-October, 2002-2003. A total of 21 Lost River and 36 shortnose suckers were captured from Keno Impoundment or Upper Klamath Lake (UKL), surgically implanted with radio transmitters, and released in Keno Impoundment, April 2002 and 2003. In spring, 27% (10 of 37) and 18% (6 of 34), respectively each year moved up Link River apparently to spawn or attempt passage into Upper Klamath Lake (UKL). None were located in the fish ladder or moved over Link River Dam (LRD). Hydraulic conditions under some flow regimes may restrict passage up to LRD.
If passage conditions are improved, some adult suckers will likely move from Keno Impoundment into UKL. However, migration may vary depending on species, the origin of the fish, and size. Most suckers moving up Link River were shortnose (10 of 13), suckers originally collected from UKL were over-represented (6 of 9 UKL, compared to 4 of 28 Keno Impoundment), and those passing Link Falls were

smaller(mean FL 398mm) compared to non-migrators (mean FL 468mm). In summer, low dissolved oxygen levels (DO; < 2 mg/l) in Keno Impoundment restricted the distribution of suckers. Survivors with active transmitters (12 in 2002; 4 in 2003) remained in Link River until conditions improved in fall. High mortality of tagged suckers may have been related to poor water quality, tagging effects, and/or predation. Adult suckers moved into Keno Impoundment within days of improved DO conditions, suggesting suckers utilize the impoundment when conditions are suitable.

Dietary Overlap Between Juvenile Chinook Salmon and Yellow Perch in the Lower Willamette River

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As part of a study to document the effects of riverbank development on resident and anadromous fishes in the lower Willamette River, we compared the diets of juvenile Chinook salmon *Oncorhynchus tshawytcha* and introduced yellow perch *Perca flavescens*. In our area, Chinook salmon are listed as threatened under the federal Endangered Species Act, and little is known about the nature and consequences of resource competition between outmigrating Chinook salmon and resident fish species. Yellow perch were chosen for this comparison because they are seasonally abundant and similar in size to juvenile Chinook salmon. Using boat electrofishing and gastric lavage, we collected 400 stomach samples from Chinook salmon and 200 stomach samples from yellow perch during August 2002 - July 2003. Chinook salmon diets had very low diversity (Shannon-Wiener Index = 0.417) and consisted primarily of *Daphnia* spp. (96% by abundance and 72% by wet weight). Yellow perch diets were more diverse (Shannon-Wiener Index = 1.719); preferred food items included calanoid and cyclopoid copepods (59% of food items) and chironomids (24% of food items). Schoener's Index (0.061) and Morisita's Index (0.044) indicated a low level of dietary overlap between juvenile Chinook salmon and yellow perch. Our study suggests dietary competition with yellow perch is not a limiting factor for Chinook salmon in the lower Willamette River.

The Distribution of Native and Non-Native Fishes in the Keno Impoundment, Klamath Basin, Oregon

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The Keno Impoundment is the uppermost 25 miles of the Klamath River downstream of Upper Klamath Lake. Concern over the lack of connectivity imposed by dams and irrigation canals, poor water quality, and habitat degradation prompted a study to explore the distribution and habitat utilization of endangered shortnose suckers, *Chasmistes brevirostris*, and Lost River suckers, *Deltistes luxatus.* Historically, this section of the Klamath River provided seasonal connectivity to Lower Klamath Lake and the Lost River Basin. Suckers leaving Upper Klamath Lake could have found refuge in Lower Klamath Lake and returned to Upper Klamath Lake during high spring flows. Currently, the connectivity between Upper and Lower Klamath Lakes has effectively been lost for fish utilization. The fish ladder on the Link River Dam separating the Keno Impoundment from Upper Klamath Lake is believed to be impassable to the endangered suckers. The distribution of suckers, as well as other native fishes was found to be solely related to the proximity to Upper Klamath Lake, while many non-native fishes displayed distinctly different patterns of distribution.

Development of a Maternally Transferred Progeny Marker for Salmonids

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This study was undertaken to determine if intraperitoneal cavity injections of strontium can be used to mark the otoltihs of progeny of adult *Onchorhynchus mykiss* prior to spawning. Twenty-one adult females from Wallowa River, OR were evenly divided between a control group and two treatment groups. Maternal parents received 1cc/500 g of body weight of a physiologically isotonic solution (0.9% saline) containing concentrations of 0 (control), 1000, and 5000 ppm of strontium chloride hexaydrate. A distinct external tag identified each maternal parent within each treatment group. All females were maintained in a single holding tank until spawning. After fertilization, developing embryos were divided according to treatment and family, incubated, hatched, reared, and sampled (length, weight, and otolith extraction). The ratio of strontium to calcium in sagittae otoltihs was used to distinguishing the progeny of each treatment group. If successful, than a tool may be used for distinguishing the progeny of hatchery and naturally produced salmonids by analyzing otolith microchmistry.

Relationships Between the Distribution and Prevalence of the Salmonid Parasite *Ceratomyxa shasta* and its Invertebrate Host in the Klamath River

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A study on the prevalence of *Ceratomyxa shasta* infections and the distribution of the parasite's invertebrate alternate host, *Manayunkia speciosa*, was conducted in the Klamath River. Objectives of the study were to determine how disease prevalence and distribution is affected by changes caused by hydroelectric projects on the river and to provide practical management information to enhance survival of juvenile Chinook salmon outmigrants. To determine parasite distribution, sentinel fish were held for 4 d at 13 locations between Beaver Creek and Keno Reservoir in April, June, July, September and October. The fish were then returned to holding facilities and monitored for development of disease. During the summer exposures, *C. shasta*-related mortality occurred only in fish held at 3 locations, all in the free flowing reaches of the river. Prior to July, sentinel fish received a low level of exposure to *C. shasta*, as evidenced by the predominance of sub-clinical infections. However, infection was detected in all groups using molecular techniques. Benthic samples of various substrates from different habitats were collected to ascertain the distribution and habitat requirements of *M. speciosa*. Eighty-eight samples were collected during three sampling efforts in early and late July and late August. Polychaetes were most abundant in the riverine sections of the reservoirs and were not found in the lucustrine zones of the reservoirs where sediment was primarily mud and organic material. In all cases, the polychaete was associated with fine particulate organic matter (FPOM). The substrate microhabitat of the worm was found to be fine sand/silt in deeper slow flowing water or within the short-branched periphyton attached to cobble in moderate flows.

Student-led Research Comparing Historic and Current Species Diversity Due to Changes in Abiotic Conditions in Yaquina Bay, Oregon

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Yaquina Bay estuary is critical habitat for a variety of marine species. Observing fluctuations in species diversity of vertebrate and invertebrates along with temperature and salinity over time may show associations with changes in the Yaquina bay habitat. Comparing the changes in the habitat of Yaquina bay due to changes in temperature and salinity with a 1968 study by the Environmental Protection Agency (EPA) will show responses to natural and anthropogenic stressors over time. Marine Team is a student-led research program through the Department of Fisheries and Wildlife at OSU and is funded by grants from the OSU/NMFS Cooperative Institute for Marine Resources Studies (CIMRS). Over the past year Marine Team has conducted monthly trawl surveys in five locations on Yaquina Bay, Oregon to collect information on biotic conditions and species diversity. The objective is to monitor changes in abiotic factors (temperature, salinity) which, in combination with habitat alteration over time can cause changes in the diversity and abundance of the aquatic fauna of the bay.