Summary of the Results of the Cooperative Watershed Research Symposium, October 21-23, 2002 - Leavenworth, Washington

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Background

A variety of anthropogenic disturbances have led to the degradation of watersheds and aquatic habitats in the Pacific Northwest and contributed to the declines in Pacific salmon (*Oncorhynchus spp.*) stocks. Conserving and restoring these anadromous fish populations and their watersheds is a daunting task requiring cooperative multi-disciplinary research among organizations at a level and scale never seen before in the Pacific Northwest. Interdisciplinary research is particularly important in freshwater and estuarine habitats because they are affected by a variety of natural and anthropogenic processes occurring throughout a watershed and will require the integration of both broad and small-scale research. Broad-scale research is especially critical to establishing the linkage between habitat and Pacific salmon and will require cooperation and integration of research among disciplines and organizations.

To facilitate the level and scale of habitat research needed to restore and conserve Pacific salmon populations, the NOAA Northwest Fisheries Science Center Watershed Program invited research scientists from throughout the region to participate in the Cooperative Watershed Research Symposium in Leavenworth, Washington on October 21-23. Our objectives were to have open discussions about research needs, identify and prioritize areas for research, identify ways to collaborate, develop action plans for a handful of key collaborative projects, and outline proposals and potential funding opportunities for research projects. Our hope was that this initial symposium would serve as a springboard for future symposiums and as a catalyst for broad-scale collaborative research throughout the region. This report was prepared to provide a brief summary of the results of the symposium.

Symposium Format

We invited 65 scientists and managers from across the Pacific Northwest (Appendix A, attendees) to develop collaborative partnerships to address the complex relationships between habitat (headwater to near-shore) and Pacific salmon. Invitees were selected based on their expertise and affiliation in an effort to get a balanced representation of interests and expertise. We realized early on that we would have to limit the number of participants to 40 individuals to facilitate effective discussion. Moreover, we believed that participants could contact and relate findings from the symposium to other key individuals we may have overlooked or who were not able to attend. It is our belief that developing partnerships with other organizations would provide a framework for conducting habitat research at the appropriate scales for salmonid fishes. We organized the symposium around three broad research areas (which are also the three core-areas outlined in our Watershed Program research plan): 1) natural processes and human disturbance, 2) fish and habitat relationships, and 3) restoration 'effectiveness'. We used this only as a starting point and it should be noted that our aim was not to promote our own research interests, but to facilitate collaborative research projects that address questions critical to restoring and conserving salmon populations.

We hired Kathrine Friedman, a professional management and organizational consultant with several years experience in facilitating cooperative research and management meetings, to assist in the development and facilitation of the symposium. The symposium itself consisted largely of three breakout sessions with many sub steps that were achieved in breakout groups (Table 1). Breakout groups were limited to seven participants because we felt larger groups would have difficulty completing tasks in the given time. After completion of each task, the groups reported their products to all symposium participants for comment and discussion. Finally, we distributed a questionnaire at the end of the second day to get feedback on the success of the symposium and how it could be improved in the future.

Table 1. Abbreviated summary of three break out sessions used during Cooperative Watershed Research Symposium.

Breakout Sessions (Tasks)	Description of Tasks and Steps
Task 1	Identification of research questions (Steps included: silent brainstorm, vote and prioritize top 3-5 questions, report out)
Task 2	Addressing the research question (Steps included: clarify question, identify how to use existing information, define steps, driving forces and constraints, report out)
Task 3	Creating an action plan for proposal development (Steps included: identify topic, identify coordinator or lead, identify funding opportunities, outline draft proposal, report out)

Symposium Results

A total of 40 out of 65 invited scientists and resource managers from various public and private organizations attended the workshop. The majority (52%) of the affiliates were from federal organizations (Figure 1). The participants broke into five groups to brainstorm important questions in the three topic areas (natural processes and human disturbance, fish and habitat relationships, restoration 'effectiveness'). After working through a long brainstorming process (Task 1), participants in the five groups identified over 100 key questions within the three main research areas (fish-habitat, natural processes, and restoration) (see complete lists of questions in Appendix B).

These were then winnowed down to three to five high priority questions within each category for a total of 19 priority questions (Appendix B).

The next step (Task 2) was for breakout groups to clarify each question, and identify existing data sources, constraints, and funding opportunities. Participants went to the question or research area that they were most interested in, which resulted in discussions around seven key questions and thus there were seven groups for the second and third tasks (Table 2). Finally, in the last step of this brainstorming process (Task 3), participants generated action plans and pre-proposals for the seven questions (Table 3). Specific actions associated with the questions ranged from development of a pre-proposal which outlined methods, sites, collaborators, and research coordinators (Question 3) to setting dates for future meetings to develop action plans (Question 4).

The results of the survey we handed out on the last day were generally positive with most participants indicating that they thought it was a worthwhile exercise (Figure 2). The participants also provided useful written comments on the survey forms. The specific comments and recommendations of the participants are summarized Appendix C.

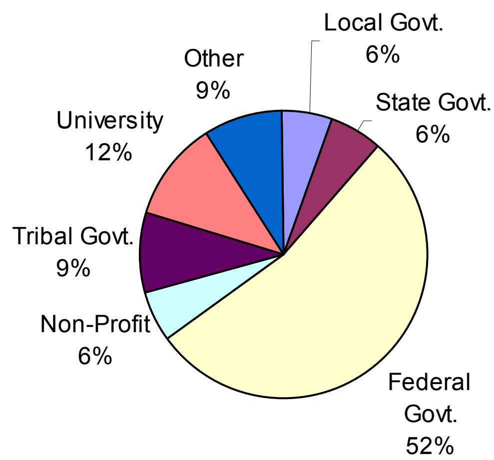

Figure 1. Affiliation of Cooperative Watershed Research Symposium participants.

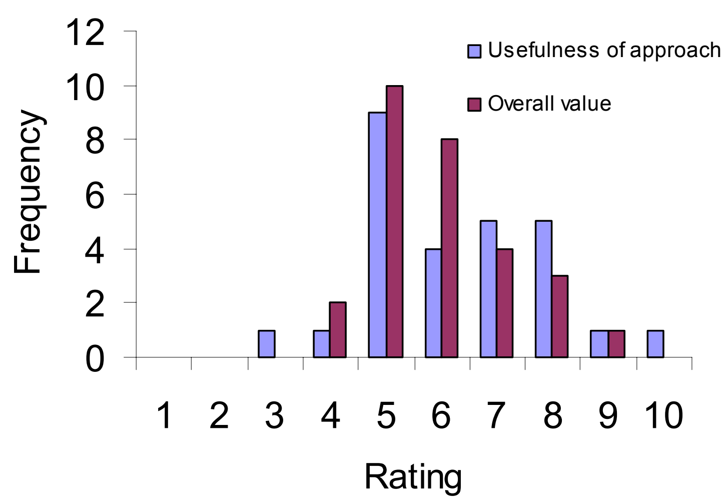

Figure 2. Results of the survey of participants on the overall value and usefulness of the approach of the Cooperative Research Symposium. The ratings are based on a 1-10 scale. For overall value a 1 = not valuable, 5 = a day well spent, 10 = one of the most valuable workshops in the past year. The average rating for overall value of the symposium was 5.96. For usefulness of approach a 1 = process not useful, 5 = some useful processes, 10 = extremely useful process. The average rating for overall usefulness of approach was 6.30.

Table 2. Seven questions that were refined in task 2 and 3. The questions generated from this process were the following:

1) How do estuarine habitat conditions affect the viability, persistence, and productivity of salmon populations?
   a) How do human alterations of estuarine habitat conditions affect the number, kinds, spatial and temporal distribution, relative abundance, and performance of different life history types associated with the populations?
   b) What are the relationships between aspects of estuarine habitat conditions, life history diversity and adult returns?
2) Compare and contrast existing egg-smolt and smolt-to-adult return survival data throughout the region.
3) Can we determine the biologically meaningful scales for restoration actions, and if so, how do we do this?
4) Can we link physical processes to salmon population processes to assess potential for population viability?
5) At multiple spatial and temporal scales, what biotic (food, predation, competition) and abiotic attributes have the greatest influence on fitness, productivity and carrying capacity of fish?
6) What are natural floodplain dynamics, how have they been altered, and what are the options for restoration?
7) What are the natural processes that affect salmonid diversity, abundance, and fitness? How have they been altered? How can we restore them?

Table 3. Summary of next steps from each workgroup (Task 3).

Group	Coordinator	Next meeting	Draft proposal	Sources of funding	Comments
Estuarine habitat conditions	Kurt Fresh, NWFSC	?	?	?	Identified three detailed steps to follow
Egg-smolt and smolt to adult survival data review	Russ Keifer, IDFG	?	?	NMFS, BPA, EPA	Project could be completed in one year
Meaning biological scales for restoration actions	Steve Ralph, EPA	?	In progress	EPA	Initial proposal being formulated by coordinator
Linking physical process to population processes	Ashley Steel, NWFSC	November 18th	?	?	Move forward with implementation of ideas on the Oregon Coast
Floodplain processes and alterations	Tim Beechie, NWFSC/Bob Wissmar, UW	November 1st	?	?	Develop 2 to 3 page proposal and send to group by December 8th
Watershed selection	Casimir Rice, NWFSC	?	?	ISST	Bob Bilby has developed draft concept paper
Food webs	Correigh Greene, NWFSC (?)	?	?	?	Will write up meeting notes.

Summary and recommendations

Overall, we thought the meeting was a success, as many important research questions were identified, and collaborative proposal outlines and actions plans for seven research projects were developed. Moreover, we thought that key steps were taken to develop broad-scale collaborative research and interagency partnerships that will be necessary to conduct habitat research important to the recovery of Pacific salmon. Whether the symposium is a success in terms of initiating projects is yet to be seen and will depend upon the ideas and projects developed being implemented over the next few years. Recognizing that many of these projects will require periodic meetings to assure that many of these projects move forward, we are looking for a forum in which cooperators could meet annually or biannually. Tentatively, we plan to provide a forum following our Annual Open House in the spring of 2003.

Finally, while we thought the symposium was a success, we realized both during the symposium and from participant feedback both verbally and on survey forms, there are a number of ways the process could be improved in the future. First, while we thought we clearly spelled out the objectives of the symposium there was some confusion as to the objectives of the symposium. A few participants thought that they were going to help us define our research direction as a program, while one or two others thought we wanted to control much of the research. Thus, it is clear that should we conduct another similar workshop in the future we should provide some additional information on the purpose. In order to keep the symposium brief, we didn't have a day where all participants provided an overview of their current research. We did summarize it by polling everyone on the second day. Thus, in the future we could survey all participants prior to the symposium and provide the information to participants prior to their arrival.

The process of prioritizing questions was a bit cumbersome and participants had difficulty prioritizing the initial questions identified in Task 1. This resulted in many groups distilling all their questions into three to five overarching questions in Task 2 rather than listing priorities. Some adaptation of the process we used is needed to assure that some of the specific research identified in Task 1 was not lost in this distillation. Specific criteria for prioritizing research needs would be helpful. We also planned the symposium so that it would include 1.5 days of meetings. In retrospect, two full days or

2.5 days might have allowed for more thorough discussion and interaction on some ideas and adequate prioritization of more specific projects.

Again, while the Cooperative Watershed Research Symposium was successful, the small improvements discussed above might make the process more efficient in the future. We recommend that any participants or others who have additional comments or ideas on how to keep these collaborative efforts moving contact us at nwfsc.watershed.program@noaa.gov. We hope to provide this and other periodic updates on cooperative research projects on our website at http://www.nwfsc.noaa.gov/ec/wpg/index.html.

APPENDICES

Appendix A. Participant contact information and list of major ongoing research projects or interests. The list of research interests and projects was compiled on the second day and information was not obtained for participants who were not present on second day of the symposium.

Xanthippe Augerot
Director of Conservation Programs
The Wild Salmon Center - The Natural Capital Center
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503-222-1804

- Development of international salmon monitoring protocol (international group, series of workshops, nested scales/resolutions of monitoring)
- Focal watersheds monitoring and research – Hoh, series of Kamchatka basins, basin to be determined in Tillamook Bay system
- Floodplain biocomplexity – diversity of salmonid life history types (Kamchatka) – Moscow State University, U of MT, WSC, Washington Trout
- International stock and status assessment & IUCN Red Listing of salmonids; WSC chairs the IUCN Salmonid Spcialist Group

Eric Beamer
Research Director
Skagit System Cooperative
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360-466-7241

Within a ocean-type chinook life stage model framework, we are conducting studies to parameterize the model for wild Skagit chinook. Specific studies include:

- Identification of juvenile life history types
- Estimate survival to adult of juvenile life history type
- Habitat formation and disturbance on estuarine and large river floodplain habitat
- Role of non-natal estuaries on Skagit chinook production
- Role of tidal delta on chinook production

Tim Beechie
Research Fishery Biologist
NWFSC
tim.beechie@noaa.gov
206-860-3409

- Dynamics of river floodplain/ecosystems
- Channel incision – causes and potential restoration
- Floodplain dynamics of Elwha River and after dam removal

Robert Bilby
Environmental/Aquatic Biology Team Leader
Weyerhaeuser
Bob.Bilby@Weyerhaeuser.com
253-924-6557

- Fish and Habitat Interactions
  - Fish community response to disturbance and patterns and rate of recovery
  - Effects of changing land use patterns on coho salmon abundance
  - Influence of spawning salmon on stream nutrient dynamics
- Forestry impacts on stream and riparian ecosystems
  - Dynamics of litter delivery to streams – effect of buffers of varying width
  - Effect of buffer width on streamside microclimate gradients
  - Tree growth rate and mortality in riparian stands. Response of riparian under story vegetation to upslope timber harvest
  - Effects of various buffer configurations on the structure/function of headwater streams

Pete Bisson
Research Fisheries Biologist
USFS, Olympia Forestry Sciences Lab
pbisson@fs.fed.us
360-753-7671

- Effects of very large natural distrubances (specifically fire) on the distribution of "biological hotspots" within watersheds over multi-century time periods
- Evaluation of alternative riparian management practices on very small (non-fish bearing) headwater streams, with particular emphasis on riparian-associated small mammals, amphibians, mollusks, aquatic invertebrates, and water quality and quantity.
- Evaluation of the effects of prescribed burning on surface and sub-surface stream water characteristics in the interior Columbia River Basin (Blue Mountains)
- Long-term ecosystem reassembly following the 1980 Mt. St. Helens volcanic eruptions
- Spatial influence of salmon carcasses on aquatic food webs (Wind R., WA).

Susan Bolton
Forest Resources Director and Associate Professor
University of Washington, Center for Water and Watershed Studies
(formerly the Center for Streamside Studies and Center for Urban Water Resources Management)
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206-685-7651
http://depts.washington.edu/cwws

John Buffington
Assistant Professor
University of Idaho - Dept. of Civil Engineering
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208-364-4082

- Hyporheic flow forced by pool and bar topography and in-channel obstructions (wood, boulders)
- Watershed-scale models for predicting spawning habitat as a function of channel hydraulics and sediment supply (input and routing)
- Bedload transport
- Effects of wood on channel morphology, hydraulics, sediment transport, and aquatic habitat
- Channel and habitat response to post-fire sediment inputs and floods
- Improved methods for sediment sampling

Jana Compton
Ecosystem Ecologist/Biogeochemist
EPA Statistical Group
compton.jana@epa.gov
541-754-4620

EPA Marine-derived nutrient project

- Effects of marine-derived nutrients
- Literature review examining the potential effects of nutrient additions to PNW streams
- Ecological consequences of the lack of marine derived nutrients for aquatic and riparian ecosystems
    - Consequences of nutrient additions as a salmon restoration practice
    - Comparisons of the relative importance of terrestrial and marine-derived nutrients
    - Influence of land-use/cover, and geology on nutrient delivery to streams, and consequences for aquatic productivity
    - Broad-scale analyses comparing stream physical and biological attributes with adult returns and juvenile outmigration in coastal OR.

Kurt Fresh
Research Fishery Biologist
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206-860-6793

- Studying how the landscape architecture of eelgrass beds affects how they are used by juvenile salmonids in space and time
- Evaluating spatial and temporal patterns of habitat use by juvenile salmonids in the Snohomish River Estuary

- Evaluating utilization of an urban inlet (Sinclair Inlet) by juvenile Chinook salmon
- Assisting in the development of a microacoustic tag for use in estuarine/nearshore areas

Joel Freudenthal
Fish and Wildlife Biologist
Yakima County Public Works -Surface Water Management Division
joel.freudenthal@co.yakima.wa.us
509-574-2322

- Channel meander zone analysis on Noches River
- Several fairly large-scale levee removal/pullback projects on Naches Yakima Rivers
- Channel network rehabilitation/restoration in irrigated watersheds

Jim Geiselman (not present)
RME Program Coordinator
BPA
jrgeiselman@bpa.gov
503-230-5732

Jamie Glasgow
Director of Science and Research
Washington Trout
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425-788-4208

- Floodplain restoration alternative modeling
- Use of underwater videography to document fish in their habitats
- Wetland/estuarine restoration – several projects

Visit http://www.washingtontrout.org/ for additional information.

Fred Goetz (not present)
Fishery Biologist
U.S. Army Corps of Engineers - Seattle District
frederick.a.goetz@usace.army.mil
206-764-3515

Correigh Greene
Postdoctoral Research Associate
NWFSC
correigh.greene@noaa.gov
206-860-5611

- Life-cycle model integrating habitats of Puget Sound
- Predicting the consequences of habitat restoration activities for population viability and life history diversity in the Skagit River
- Estimating the density dependent survival and growth in the Skagit River tidal delta
- Evaluating the role of tributary junctions for biological productivity and diversity

Chris Jordan
Math Biology and Systems Monitoring Program Manager
NWFSC
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206-860-3423

- Design of large-scale status monitoring programs for salmonid populations and habitat condition
- Landscape scale ecosystem assessment methods based primarily on remotely sensed data (e.g., satellite)
- Statistical approaches to the analysis of restoration projects

Russ Kiefer
Fisheries Biologist
Idaho Department of Fish and Game - Southwest Region
rkiefer@idfg.state.id.us
208-465-8404

- Life cycle survival for Snake River Sp./Su Chinook
- Smolt-to-adult return rates of Snake River steelhead
- Estimating SAR by mainstem migration routes
- Monitoring status and trends of W/n Chinook and steelhead
- Estimating length at ocean age of Chinook salmon carcasses

Peter Kiffney
Research Ecologist
NWFSC - Mukilteo Biological Field Station
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425-743-3307 x 226

- Natural processes driving large-scale patterns of physical habitat and aquatic biota – Skagit River, Cedar River
- Role of nutrients in limiting salmonid food webs – Salmon River, Idaho
- Riparian management experiment: Efficacy of riparian buffers in maintaining headwater stream structure and function – Malcom Knapp Research Forest, British Columbia
- Riparian vegetation effects on stream food webs & role of riparian alder – Olympic Peninsula, WA
- Re-introduction of Pacific salmon into the Cedar River, WA

Kim Kratz
Watershed Policy Coordinator
NMFS - Habitat Conservation Division
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503-231-2155

Robert Lackey
Chief (Acting) - Watershed Ecology Branch
U.S. Environmental Protection Agency, Corvallis
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541-754-4607

Estuarine Salmon Habitat Project (being designed)

- What is the most important and limiting salmon habitat in coastal Oregon watersheds?
- What is the most limiting habitat, freshwater or estuarine?

Gino Lucchetti
Senior Ecologist
King Co. Dept. of Natural Resources - Water and Land Resources
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206-296-8366

Doug Martin
Consultant
Martin Environmental
Martin1696@aol.com
206-528-1696

- Core Areas Project with King Co.
    - Watershed processes and essential habitat relationships
- Forest and Fish Adaptive Management and Research Program
    - Statewide monitoring of rule effectiveness to protect and maintain fish habitat and populations
    - Validation research for monitoring performance targets
- Mass Wasting Risk Assessment
    - Relating mass wasting at network scale to habitat and population response at population/network scale

Mike McHenry
TFW Biologist
Lower Elwha Klallam Tribe
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360-457-4012 x14

Todd Pearsons
Leader, Hatchery/Wild Interactions Unit
WDFW
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509-925-4467

- Hatchery/Wild interactions (benefits and costs of hatcheries)
- Biotic interactions
- Long-term monitoring – population dynamics
- Community ecology of fishes
- Risk assessment/containment/minimization

George Pess
Stream Ecologist
NWFSC
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206-860-3450

- Biological response of constructed logjams in large river systems. This includes both changes in fish distribution and abundance and primary productivity
- Use of electronic scour monitor to determine scour and fill mechanisms in two river systems
- Predictive model to determine the distribution and abundance of beaver ponds in large floodplains
- Biological response to boulder weirs in incised bedrock channels
- Development of baseline biological data to monitor "before condition" prior to dam removal in the Elwha river

Michael Pollock
Ecosystems Analyst
NWFSC
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206-860-3451

- The role of large wood in storing sediment in steep headwater streams (Olympic Peninsula, WA)
- Instream/Riparian monitoring of the effects of timber harvest activities on DNR lands in the Olympic Experimental State Forest
- Effects of incision on stream hydrology, sedimnet storage and riparian condition in streams of the interior Columbia River basin
- Relations between beaver ponds and coho production in the Stillaguamish River basin, WA
- Modeling inputs of small woody debris in conifer forests in the Pacific Northwest

Steve Ralph
Ecologist
EPA
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206-553-6364

Gordie Reeves
Team Leader - Corvallis Aquatic and Land Interactions
USDA Forest Service - Corvallis Forestry Sciences Lab
greeves@fs.fed.us
541-750-7314

- CLAMS (Coastal Landscape Analysis and Modeling Study)
  - Evaluation of the social, economic and ecological impacts of the aggregate of forest management policies in the Oregon Coast Range
- Treatment of Riparian Areas in Headwater Streams
  - Evaluation of the effect of different treatments of riparian zones on the habitat and aquatic biota in headwater streams
  - Identifying the natural disturbance regime of the Oregon Coast range
  - Determine the role of catastrophic disturbances on meadow formation in the Blue Mountains, Oregon

Reg Reisenbechler
Research Fishery Biologist
USGS - Seattle Sandpoint Lab
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206-526-6559

- Interactions between hatchery and wild anadromous salmonids (emphasis on genetics)
- Estuary utilization by juvenile salmon – duration, growth, life histroy diversity (emphasis on analysis of otolith microstructure)
- Relations between carcass density and stream productivity for Pacific salmon

Casey Rice
Research Fishery Biologist
NWFSC - Mukilteo Biological Field Station
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425-743-3307 x231

- Estuarine ecology of juvenile salmon in Puget Sound
- Restoration monitoring at several estuarine sites in Commencement Bay (Tacoma) Washington
- Effects of human activties (urban/ag development) on the biological condition of nearshore Puget Sound

Phil Roni
Watershed Program Manager
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206-860-3307

- Evaluation of instream restoration techniques
- Prioritization of watershed restoration
- Response of fish to off-channel restoration
- Techniques for monitoring and evaluating large and small-scale restoration

Jordan Rosenfeld
Fisheries Research Biologist
BC Fisheries Staff at UBC
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604-222-6762

- Effects of habitat structure on energy flow in streams
- Spatially explicit bioenergetic modelling of growth rate potential for stream fishes
- Ecological role of small streams
- Invertebrate drift dynamics
- Interaction of habitat and food availability – effects on juvenile salmon growth and habitat use

Mary Ruckelshaus
Research Fishery Biologist - Risk Group Team Leader
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206-860-3266

- Identification of salmon historical population structure within ESUs
- Population viability analyses for salmon (quantitative and qualitative)
- Linking landscape process analyses to predictions of population status/viability
- Analyzing indirect and direct effects of harvest, hatchery and habitat conditions on salmon population status

Dave Schuett-Hames
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Ashley Steel
Quantitative Ecologist
NWFSC
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206-860-3406

My current and future research interests:

- Quantifying spatial patterns in biological communities (fish) and relating to habitat patterns
- Variability (spatial and temporal) in water temperature patterns – relationship to habitat, anthropogenic changes of these patterns and methods to quantify and compare patterns in variability
- Modeling/estimating effects of habitat on survival of fish
- Describing uncertainty and including it in decision making

Russ Thurow
Research Fisheries Scientist
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208-373-4377

- Influence of habitat geometry (size, spatial arrangement, quality, connectivity) on trout and salmon persistence
- Fine scale population structure of chinook salmon through integration of demographic, ecological, and genetic information
- Validation of sampling methods, especially redd counts and detection of stream-dwelling salmonids
- Disturbance and physical processes (natural, fire, climatic)
- Roads: Watershed effects, calverts as barriers and identification of priorities for restoration
- Temperature models related to salmonid life stages
- Non-native fishes
- Dispersal, recolonization, and population structure of salmonids

Jim Wigington
Research Hydrologist
U.S. Environmental Protection Agency
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541-754-4341

- Freshwater Habitat Project – Examination of response of coho salmon and other native fish to stream network scale habitat. Field research conducted in West Fork Smith River, a 16,000 acre catchment in the Umpqua River System. PIT tagging coho and thorough habitat (multi-aspects) included. Project also includes development of coho and native fish assemblage models

Mark Wipfli
Research Ecologist - Aquatic and Land Interactions
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Overall interest is understanding trophic linkages in stream riparian food webs.

- Understand the trophic linkages (i.e. delivery of organic matter and invertebrates) between fishless headwater streams and downstream fish-bearing food webs
- Role of marine-derived biomass (salmon runs) on freshwater and riparian food webs: productivity, biodiversity, nutrition, demographics
- Role of terrestrial invertebrates in stream food webs

Robert Wissmar
Professor
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206-543-7467

- Use of floodplain and off-channel habitats by juvenile and adult salmon
- Historical and current land-use changes in river floodplains: spatial predictions
- Spatial identification of priorities for riparian restoration sites in floodplain landscapes
- Influence of land-use changes on flow regimes of tributary streams: application of a spatial hydrology model
- Influences of landscape-scale disturbances on floodplain habitat formation and recovery pathways

Appendix B. List of research questions and products from breakout sessions (Tasks 1-3).

Appendix B - Table 1. Key to Tracking Research Questions from Task 1 through Task 3

Research Direction	**Table**	**Top Questions from Task 1**	*Task 2*	*Task 3*
Fish and Habitat Relationships	A	1	Combined with Table F, #1 to form Table F, Page 44	
		2	Combined with Table B, #4 to form Table A, Page 38	Table A, Page 46
		3	Combined with Table B, #2 to form Table G, Page 45	Table G, Page 54
		4		
	B	1	Continued as Table D, Page 41	Table D, Page 50
		2	Combined with Table A, #3 to form Table G, Page 45	Table G, Page 54
		3	Continued as Table B, Page 38	Table B, Page 48
		4	Combined with Table A, #2 to form Table A, Page 38	Table A, Page 46
Restoration	C	1 Restoration	Continued as Table C, Page 39	Table C, Page 48
		2		
		3		
		1 Real World		
		2		
		3		

Blank cells indicate that no further action was taken during that task.

Research Direction	**Table**	**Top Questions from Task 1**	*Task 2*	*Task 3*
Natural Processes and Human Disturbances	E	1		
		2		
		3	Continued as Table E, Page 42	Table E, Page 51
		4		
		5		
	F	1	Combined with Table A, #1 to form Table F, Page 44	Not continued
		2		
				New Table F formed, Page 53

Blank cells indicate that no further action was taken during that task.

Appendix B – Table 2. Summary research questions and task results for each breakout group.

<u>TASK 1</u>:	**FISH AND HABITAT RELATIONSHIPS**
Table:	A
Recorder:	Tim Beechie
Group members:	Eric Beamer, Tim Beechie, Kim Kratz, Todd Pearsons, Casey Rice, Jordan Rosenfeld, Russ Thurow and Mark Wipfli.

TOP 4

1) **How do spatial structure and connectivity of habitats affect population productivity and persistence?** (Combined with Table F, #1 to form Table F, Task 2, Page 44)

2) **What is the role of estuaries in supporting salmon populations?**
    a. **Human alterations**
    b. **Species/stock interactions**
    c. **Life history**

    (Combined with Table B, #4 to form Table A, Task 2, Page 38)

3) **What is the role of food and habitat influencing life-stage specific survival and carrying capacity?** (Combined with Table B, #2 to form Table G, Task 2, Page 45)

4) **Evaluating assumptions of management plans for restoration**

A. Need for research into the role of habitat geometry influences persistence of salmon.
B. What are the variables that make habitat "connected"?
C. How has human alteration (urban, agriculture, development) of PNW estuaries affected the number, kind, and spatial and temporal distribution of salmon life history types?
D. What's the ecological role of small streams in a watershed (o.m. retention)?
E. How do upland non-fish habitats affect downstream fish and fish habitat? (Water, sediment, nutrients, organic matter, invertebrates).
F. To what extent have pathogens been amplified/introduced, and how have they impacted native fishes?
G. What's the relationship between the population and available habitat, and the habitat gap needed to support a viable population?
H. How do changes in stream temperature affect salmonids at the population level?
I. What are natural dispersal rates and how does dispersal influence persistence?
J. What are the physical and biological mechanisms that affect egg to fry survival? (Link to upslope processes).

K. What are the ecological interactions between salmon & other fish species in estuarine/nearshore habitat?
L. Identification of limiting or preferred habitats for different species? (as a template for restoration) – overlap with A
M. Role of nutrition (food quality) in population and community demographics. (e.g., affect of MDN on lips as they affect salmonid survival)
N. How do you measure current salmonid carrying capacity?
O. Development of criteria for determining effectiveness of habitat related actions. (e.g. How much IF is enough?
P. How do we measure stage-to-stage survival for ocean-type fish in fresh water?
Q. What is the fine-scale structure of Chinook populations?
R. What are the juvenile Chinook life history types? And what are their stage-to-stage survivals?
S. What are the environmental requirements/tolerances of estuarine forage fish species (especially the early life stages)?
T. What are the relative roles of physical habitat structure and food availability in determining productive capacity?
U. Understand what limits fish production in fresh water? (i.e. food, habitat, both, or other?)
V. Under what conditions do exotic fishes impact native fish abundance? (What is the impact?)
W. Spatial and temporal prioritization of actions to address (U).
X. Which sources of mortality for ocean-type fish are density-dependent vs. density independent?
Y. What are the influence of hatchery smolts on wild smolts in mainstem migration corridors and the estuary?
Z. What's the role of natal and non-natal estuaries in salmon productivity, survival, and abundance in Puget Sound?
AA. What are the impacts of hatchery operations of native fish of concern?
BB. Role of MDN in life stage survivals (e.g. egg to parr, parr to smolt, etc.)?
CC. Evaluate assumptions of current management actions (lg. Scale) (i.e. – w/large-scale adaptive management experiments)
DD. How transferable are fish and habitat relationships?
EE. What is (are) the survival of fish in different habitat types throughout a watershed? (Life stage specific survival) (P. Roni)
FF. Are we experiencing increasing rates of pre-spawning mortality? (J. Glasgow)

Themes:

1. Spatial arrangement of habitat: A, B, G, Z
2. Role of food: T, U, M
3. Life stage survivals: BB, H, J, P, O, X, R, EE, FF
4. Estuaries: Z, C, K, S
5. Life history types/spatial structure of populations: Q, R, C.

6. Species interactions (& hatchery)/pathogens: V, Y, AA, F, K
7. Evaluate assumptions – current management actions – CC, DD
8. Productive capacity: L, N, W
9. Role of Small Streams: D, E

<u>TASK 1</u>:	**FISH AND HABITAT RELATIONSHIPS**
Table:	B
Recorder	Correigh Greene
Group Members:	Robert Bilby, Pete Bisson, Correigh Greene, Russ Kiefer, Reg Reisenbechler, Dave Schuett-Hames, Ashley Steel

TOP 4

1. **Quantifying spatial-temporal variability in habitats and their effects on fish? How do we incorporate habitat variability into management goals?** (Continued as Table D in Task 2, Page 41)

2. **At multiple spatial scales, what habitat attributes have the greatest influence on productivity, fitness and capacity of fish? What methods can be used to identify these attributes?** (Combined with Table A, #3 to form Table G, Task 2, Page 45)

3. **Compare and contrast the two major components of life-cycle survival estimates throughout the region to identify habitat drivers?** (Continued as Table B, Task 2, Page 38)

4. **What is the importance of intertidal and estuarial habitat to salmon fitness and productivity?** (Combined with Table A, #2 to form Table A, Task 2, Page 38)

The questions above were synthesized from the questions and input to follow:

A. Linkages between headwaters and downstream fish/habitat relationships? B,E

B. At site site/watershed and regional geographic scales,
    a. What habitat attributes have the most influence on the productive capacity of fish? A, B
    b. What methods can be used to identify these attributes? A, B

C. Response of fish populations to stream network scale habitat? A, B

D. What are the relationships of growth movement and survival among different aquatic habitats? A, B, F

E. What are the effects of escapement on habitat productivity and life history attributes? A, D, F

F. Regional comparisons of smolt-adult return rate? A, B (Similar to question L)

G. To what extent is our understanding of fish habitat relationships colored by current/historic land use? C, B, D (related to question E)

H. Method to measure freshwater survival (cheap, easy, accurate!)? A

I. What are demographic and genetic relationships among western trouts and charrs? F,C,B

J. Interactions and relative importance of physical habitat conditions, trophic productivity and fish community composition on salmon survival and production. B, A

K. What is the importance of intertidal and estuarine habitat salmon and biological production? E, A, B

L. Estimate egg/smolt survival across streams areas where rearing and spawning habitat is limited. A, B

M. Effects of habitat quality (temp, flow, water quality) fish survival (life stage/species)? A

N. How is the " precautionary principle" applied to habitat management when habitats are known to be naturally dynamic and when the trajectory of long-term trends is not easily predicted? D, C

O. Quantifying uncertainty in fish habitat relationships and incorporating that uncertainty into decision-making? F, D, C, B

P. Classification of streams and watersheds into groups with different fish habitat relationships? B, A

Q. Fish/habitat response to eastside disturbance regimes? A, B, C

R. What should the goal of habitat management be? What are the ways in which science can help resolve this important policy question? D

S. Identification of sub-lethal effects of habitat on fitness. A

T. Quantification of natural patterns of variability (temp, flow, nutrients) in habitat conditions (quantity/quality) and effect of changes (land use, dams, climate) on fish populations (other biota). A, B, C

U. Should we start from the top down or the bottom up (at watershed scale) when "connecting the dots" of productive habitats? A, B, D

V. The role of hydrolic/precipitaion/temperature and its annual variability habitat relationships. A, C. (Comment: "Good one. Effects of peak flows on habitat structure and effects of low flows on extent of wetted habitat.")

W. Population response of different fish species to scour regimes. B, A

X. How does human land use in the watershed propagate through the estuary? F, A, E, B

Y. Interaction of extinction/colonization and fish/habitat relationships. A, B, C, D, F

Z. Importance of anadromous fish to freshwater spawning and rearing. B, A habitat.

AA. Constructing a life cycle model that integrates site specific data. A,B,F,D

BB. Effects of global climate change on fish/habitat relationships. C, A, D

CC. Fish population response to cumulative effects of watershed management. B, C, E, D, F, A

DD. Habitat/LWD relationships for stream-associated amphibians. A, B, F

THEMES

A. Survival (growth, sub-lethal effects, estimations) (suggested addition: "Water quality/pollution")
B. Spatial Scale
C. Temporal Variability
D. Uncertainty and decision making
E. Estuaries
F. Life history/variability

TASK 1: **RESTORATION**
Table: C
Recorder: George Pess
Group members: Jana Compton, George Pess, Mike McHenry, Jamie Glasgow, Chris Jordan

TOP 3 Restoration - Research

1. **Can we determine the biologically and politically meaningful scales for restoration action, and if so, how do we do this?** (Continued as Table C, Task 2, Page 39)

2. **How do we comparatively measure restoration actions, on a watershed scale, within or between watershed with differing baseline conditions?**

3. **If nutrient additions are a viable restoration practice, how do we best do this?**

TOP 3 Restoration – Real World

1. **Restoration $$ v. Protection $$**

2. **How do we best identify and prioritize restoration projects, and what is the most appropriate scale for restoration planning?**

3. **Do control or pristine habitats exist, and does it need to?**

Types of questions:

Research

- General = R-G
- Specific = R-S

Real world

- Prioritization schemes (biological sensitivity, cost-benefit, strategy) = P-S
- Monitoring tools = M-T
- Monitoring design = M-D
- Education = E
- *** = Real world

Planning is info limited
Monitoring generates info

<u>Assumptions</u>:

1. Salmon evolved under pre-settlement conditions.
2. Restore the conditions that gave us historical salmon abundance levels. <u>Conditions</u> – ecosystem characteristics and watershed processes
3. Information limited
4. Fish are not our problem

Page 1

1. What is the effectiveness of, and how do we measure, the biological response of restoration actions at the project-specific, reach and watershed-scale? How? R-G
2. Do changes in watershed processes and habitat resulting from restoration actions result in changes in growth, movement, productivity and survival? R-S
3. If nutrient additions are a viable restoration practice, how do we best do this? R-S
4. Determine spatial and temporal variance structure of habitat and population indicators. M-T, ***
5. Restoration $ vs. Protection $ (protection components are acquisition, enforcement, new policy) P.S., ***

Page 2

1. How do changes in watershed processes due to restoration actions affect salmonid survival? (Crossed out and combined with page 1, #2)
2. How do we separate changes in fresh\water survival resulting from restoration v. marine survival? R-S
3. How do biological and physical aspects of restoration actions interact? R-G
4. Generate cost/benefit assessment of restoration effectiveness by biological benefit vs. cost or socio-economic will. P-S, ***
5. Develop and refine tools for effectiveness, evaluation fitness, density, BIBI, process evaluation. R-S/M-T, ***
6. How do we comparatively measure restoration actions, on a watershed-scale, within or between watersheds with differing baseline conditions? R-S
7. What is the short and long-term effectiveness of riparian planting? R-S
8. What are the effects of road restoration on sediment and hydrologic regime at a watershed-scale? R-S

Page 3

1. Can watershed and ecological condition be restored with ongoing active land-use as a background noise? R-G
2. Does restoration effectiveness vary in a predictable way across the region? (Crossed out, lump with page 2, #6)
3. Is watershed process restoration better/worse than habitat characteristics restoration? R-S
4. Monitoring – how long is long enough? R-G

5. How do we comparatively measure site-specific restoration action with a watershed? (CROSSSED OUT – lump with page 2, #6)
6. Can restoration be done at a biologically meaningful scale?
7. Do control or pristine habitat exist? Does it need to exist? MD ***
8. How do we best identify and prioritize restoration projects? (EDT, LFA, historic)? Biological benefits? Whose? At what cost? Time? PS
9. What is the effectiveness of single v. multiple restoration actions? (Crossed out, lump with page 1, #1)

Page 4

1. How do we reconnect restored habitats with lost life-history trajectories? R-S
2. Cost-benefit of non-native vegetation control? R-S
3. How do we manage exotic vegetation in riparian ecosystems? R-S
4. Can perfectly functioning conditions emerge from the aggregate of reach-scale restoration? (Crossed out, lump with page 3, #6)
5. What is the role of outreach/education in restoration? *** E
6. Can riparian forests be restored or managed landscapes? (PFC) R-S
7. How do we restore to a moving target? (Crossed out - Lump with page 5, #5)
8. Can we restore floodplain connection? R-S
9. Is the assumption that you can restore or assess indirect ecosystems benefits valid? How do we measure associated ecosystem?
10. Can we predict habitat benefits from restoration of watershed processes? R-G
11. What is the most effective scale for restoration planning: site, reach or watershed? P-S ***

Page 5

1. How do we identify what restoration is needed and at what scale is it effective? (Lump with page 1, #1)
2. Need more emphasis on performance-based/realized function metrics (C. Rice), including life history (and perhaps genetic) diversity of target populations (R. Reisenbechler). M-T, ***
3. How do we assess a population's ability to respond to habitat change prior to the treatment itself? P-S, *** (J. Compton)
4. Develop methods of factoring climate change into habitat restoration planning
5. How do we develop restoration targets that allow for habitat variability/changes over time? (Lump with #4) R-S
6. Ask professional expert (i.e. AFS) to identify limiting factors (R. Kiefer). ***

TASK 1: **NATURAL PROCESSES AND HUMAN DISTURBANCES**
Table: E
Recorder: Phil Roni
Group Members: Susan Bolton, Gino Lucchetti, Phil Roni, Joel Freudenthal, Steve Ralph, Gordie Reeves, Doug Martin

TOP 5

1. **What is the variability (spatially, geographically) in natural and human disturbance regimes and biological responses?**

2. **How does altered hydrology (stormwater, water withdrawals, etc.) affect aquatic communities?**

3. **What are floodplain dynamics (including riparian areas) in low-gradient, urban, rural, residential, and ag. landscapes?** (Continued as Table E, Task 2, Page 42)

4. **Does water pollution matter, if so, how, in salmon recovery (Temp., metals, pesticides, sediment, etc.)**

5. **What spatial/temporal patterns of development minimize disruption of natural processes.**

D = Disturbance
H = Hydrology
WQ = Water Quality
FP = Floodplain
NP = Natural Processes

A. Comparison of natural and human disturbance regimes (water, soil, LWD) (Crossed out) **D**

B. How does alteration in flow regime affect the structure of aquatic biological communities. (Crossed out) **H**

C. Can we describe and project effects of land uses on aquatic ecosystems (Crossed out) **D**

D. Define the range of natural variability at different spatial scales in different geographic regions. (Crossed out) **NP**

E. Relating natural processes to habitat formation and function at watershed/network scale. **NP**

F. Floodplain dynamics in natural and altered systems for example what is the loss of habitat and fish production in diked and artificially constrained channels **FP**

G. The ability of aquatic, native, invasive species to survive disturbances **D**

H. What are the effects of land use on hyporheic zone size, function, and biota **H,D**

I. Understand role of stormwater runoff in disturbing aquatic ecosystems (Crossed out) **H**

J. Identify the effects of fire and related disturbances on fish habitat at watershed and landscape scale **NP**

K. Risk assessment approach for looking at landscape disturbances at the watershed scale **D**

L. Determining the plasticity of fish populations (Crossed out) **D**

M. What is the effect of different grazing strategies on aquatic habitat and biota at a reach and watershed scale **D**

N. Role of human infrastructure on (roads, pipelines, levees) in disrupting natural processes (Crossed out) **D**

O. What is the role of wood in low gradient agricultural streams **NP**

P. How do we develop an integrated monitoring program to support salmonid recovery (I.M.P)

Q. Identify the short and long term influences of landslides on fish habitat (Crossed out) **NP**

R. Relationship between fish populations at life history points other than spawning (Crossed out)

S. How are floodplain habitats created and destroyed an how long do they persist (Crossed out) **NP**

T. What spatial/temporal patterns of development and infrastructure (urban, rural, residential, ag.) minimize disruption of natural processes **NP**

U. What is the effect of tree species in riparian buffers and wood placement on biological and physical function (Crossed out) **NP**

V. Does water pollution matter in salmon recovery? What is the effect of water pollution on salmon fitness and survival (pesticides, mining, waste) **WQ**

W. The importance of fish themselves in maintaining habitat **NP**

X. What is the effect of water withdrawals on biotic production (Crossed out) **H**

Y. Riparian or agricultural lands (Crossed out) **D**

TASK 1:	**NATURAL PROCESSES AND HUMAN DISTRUBANCE**
Table:	F
Recorder:	Peter Kiffney
Group members:	Xan Augerot, John Buffington, Kurt Fresh, Peter Kiffney, Bob Lackey, Mary Ruckelshaus, Bob Wissmar

TOP 2

1. **What are the important natural processes that drive habitat formation and network patterns of:**

   a. **Biodiversity and productivity?**
   b. **Salmon population attributes?**
   (Combined with Table A, #1 to form Table F, Task 2, Page 44)

2. **How do land uses affect natural processes that drive habitat formation and network patterns of:**

   a. **Biodiversity/productivity?**
   b. **Salmon population attributes?**

HUMAN ALTERED

5. How do land-use effects in WS affect estuary and near-shore habitat?

7. How do land-use activities alter the movement and storage of sediment, nutrients, OM, water and energy throughout drainage networks?

12. How do climate changes affect natural processes?

13. What are the effects of wildfires and fire management on physical processes and aquatic habitat?

14. How does channel incision alter channel-floodplain dynamics and habitat condition?

15. How do exotic spp. Affect stream structure and function?

16. What are the legacy affects of 1800 fires on natural processes?

19. Do we fully understand the effects of people on natural processes and rivers and estuaries?

22. Relationship between cumulative small-scale modifications on flow and natural processes.

NATURAL PROCESSES

2. How do natural processes operate in "completely" undisturbed WS?

4. How does the phasing of natural disturbance regime (time/space) influence the formation of river systems at reach and habitat scale? (See 18+23 – subset of 4)

18. How do sediment-loading regimes to channels influence sediment-routing (e.g. deposition, erosion) in habitats?

25. What are natural rates of material #, energy storage and flow in different physiographics? (see #7)

BIOTIC RESPONSES

3. What is the life history diversity in "completely" undisturbed watersheds? (see #2)

6. What are the physical controls on habitat and popn structure at WS and regional scales?

8. What drives drainage network patterns in diversity and productivity?

9. Temporal and spatial dynamics in fish-process links (see #1).

11. How critical are the MDN in terms of quantity/quality and timing to abundance/diversity of aquatic biota?

17. Is it possible to select (protect) a sub-set of sites within a river basin and thereby conserve species and life-history diversity?

20. How important is the alteration of natural processes in conserving salmon popn? (See #1, #2)

21. What are the effects of re-introducing Pacific salmon on stream structure and function?

24. What is the role of near-shore riparian zones on salmon popn?

OTHER:

10. How does the alteration in nutrient levels affect natural processes? (crossed out)

Task 2:
Table: A
Recorder: Kurt Fresh
Group Members: Kurt Fresh, Casey Rice, Reg Reisenbechler

Step 2. How does estuarine habitat condition affect the viability, persistence, and productivity of salmon populations?

1. How do human alterations of estuarine habitat conditions affect number, kinds, and distribution (space/time) of life history types?
2. What do these results mean with respect to productivity, viability, persistence?

(See page 46 for Table A, Task 3)

Task 2:
Table: B
Recorder: Russ Keifer
Group Members: Russ Keifer and Dave Schuett-Hames

<u>Step 2- Clarify</u>: Compare and contrast existing egg-smolt and smolt-adult survival data throughout the region for each SRR.

Objectives:

- Identify stream-specific and regional differences
- For listed stocks, identify portions of the life-cycle that are limiting recovery
- Identify streams for researching habitat drivers of productivity
- Focus restoration efforts to those streams and habitat components that are likely to provide the most benefit

<u>Step 3 – Identify how to mine existing data/resources</u>: That is what this project is based on.

<u>Step 4 – Define Steps</u>:

1. Get project buy-in from major research groups
2. Pull together regional panel of experts to:

   a) Develop data standards
   b) Identify data sources
   c) Develop data structure to achieve objectives
3. Identify lead researcher(s)
4. Identify data gaps that could be addressed in short time frame
5. Put data into common structure for analysis
6. Conduct exploratory analysis
7. Pull together regional panel of experts to review and design detailed analysis

Step 5 – Driving Forces:

1. Need to develop effective recovery plans
2. Direct habitat research to the streams most likely to produce useable results
3. Helps foster collaboration

Constraints:

1. Data compatibility and gaps
2. ID, fund, and free up from current responsibilities personnel

(See page 48 for Table B, Task 3)

Task 2:

Table: C
Recorder: George Pess
Group members: John Buffington, Robert Lackey, Gino Luchetti, Mike McHenry, George Pess, Steve Ralph

Step 4: Define necessary steps for addressing the research question

1. Identify species and life history function
2. Identify factors limiting function
3. Did restoration actions occur at a scale that addresses the limiting function?
   a. HTP – There is a biologically meaningful effect
4. Scale – Restoration projects
   a. Project
   b. Reach
   c. Watershed
   d. Watershed/estuarine/nearshore
5. Scale – Fish Function
   a. Mircohabitat
   b. Habitat-unit scale
   c. Reach (habitat composition)
   d. Sub-basin
   e. Watershed/estuarine/nearshore

6. Scale – Watershed Processes
    a. Sediment
    b. Wood
    c. Water
    d. Energy
    e. External processes (climate, harvest, ocean con.)
7. Metrics – Biologic (What is most relevant to the fish?)
    a. Abundance and # of X (reach, ws)
    b. Diversity – Species richness, life history (reach, ws)
    c. Production – Growth/Survival (proj, reach, ws)
    d. Structure – Age, space (sub-basin, ws)
    e. Condition factor (proj, reach, ws)
    f. Presence/Absence (proj, reach, ws)
8. Metrics – Ecological
    a. BIBI (p,r)
    b. Stable isotope analysis (r,ws)
    c. Periphyton (p,r)
    d. Drift (p,r)
9. Metrics – Connectivity
    a. Up/Down link (r,ws)
    b. X-S link (r)
    c. Hydrologic – up/downwell (p,r,ws)
    d. Velocity diversity (p,r)
10. Metrics – Political
    a. $/Biological benefit
11. Study Design
    (function restoration scale, objectives) link between biologic, metric and restoration scale)
    - Before, after, control, treatment at all restoration scales – proj, reach, watershed/estuarine/nearshore
        - Do it at ecoregion level
            - 2/3 watershed per ecoregion
            - approximately 30 watersheds
            - Staircase design
            - Long-time period (10-30 years)
            - All restoration actions (e.g. riparian, sediment, instream, floodplain, nutrients, roads)

12. **Driving Forces**
    a. Economic efficiencies – public expectation
    b. Opportunities to showcase success and failure
    c. Opportunities for acquisition
    d. Sci – replication and repeatability

13. **Constraints**
    a. Education

b. Institutional inertia
c. No budget to do large-scale, long-term proj.
d. "Appropriate" opportunities (limited)
e. Time diminishing opportunities
f. Talent
g. Longevity (Professional)

(See page 48 for Table C, Task 3)

<u>Task 2</u>:

Table: D
Recorder: Gordie Reeves
Group members: Pete Bisson, Chris Jordan, Gordie Reeves, Ashley Steel

<u>Step 2</u>: What is the variability in features of different spatial scales that influence the persistence of salmon populations?

Assumption: Variability inversely related to scale
Oregon coastal Coho
Eastside steelhead/Chinook
Western Oly Pen

<u>Step 3</u>:

Existing data

a) Physical – OR coast (CLAMS)
b) Biological – OR plan (Coho
c) Models- parameterize Benda Miller models

<u>Step 4</u>:

a) Develop prototype for OR coast
b) Collect parameters- physical and biological for other areas
    a. identify what exists and what is needed
c) Develop models for areas other than OR coast

<u>Step 5</u>:

a) No current mechanism for incorporating known landscape dynamics into extinction risks and viability assessments
b) Uncertain about what is required to parameterize landscape model (Benda/Miller model)
c) Willingness of land management agencies to support efforts unknown
d) Time

(See page 50 for Table D, Task 3)

Task 2:

Table: E
Recorder: Roni and Bolton
Group members: Beamer, Beechie, Bolton, Freudenthal, Glasgow, Pollock, Roni, Wissmar

Step 2:
What are the natural floodplain dynamics, how have they been altered and what are the options for restoration?

Assumptions
- Law Gradient
- Unconstrained
- Large and small streams
- 3D (longitudinal, vertical, lateral)

Step 3:
Related projects
- Carrie Inman (Ph. D study)
- Jim Wigington (PA)
- Pollack/Beechie/Baker
- Sarah Morley
- Stanford
- Cedar (Wis.) – Land use, prioritizing riparian restoration, hydrologic responses to land use
- Beamer Coop – spatial patterns in Skagit flood plain
- Flood Plain Mining Study
- Pess 4 Elwha
- Brian Collins
- WA Trout – Cherry Creek
- Virginia Traurrs – Green River Tribe
- Julia Hall (Wis.)
- Frissell – flathead
- Wash. State University Extension

Existing Data
- Nord Coordinator (grad student, contractor)
- Rich Kang
- Central WA – Yakima County
- Flow gauges/cross sections
- Build up GIS expertise

Step 4:
A). Natural Processes
   - Sediment, H2O, Organic, Chemical, Temp.
   - Form, change persist
   - Spatial and Temporal patterns

- Ecosystem function and structure (including riparian)
- What are the current and historical spatial and temporal patterns in ecosystem structure and function including:
  - Riparian
  - Aquatic
  - Habitat Diversity
  - Stability
  - Persistence
- How did they come to be?

B) Alterations

How have human activities and land use altered these patterns and processes over time? (see above items)

Restoration

What are the options for restoring these patterns and/or processes?

C) Data Needs

- Air photos
- Other photos
- Topo Maps
- GLO
- Historic Accounts
- Land Use History
- Vegetation characteristics
- Flow info
- GW info
- Flow timing
- Lidar
- X-section data
- Satellite photos
- Baseline data on fish and aquatic insects
- Hyporheic information

Step 5:

Constraints

- Access to field sites
- Human resources and personnel
- Money and time
- Institutional barriers to cooperation
- Access to existing data
- Cultural barriers to recognizing dynamic nature of floodplains
- Many forms of data not digital
- Cultural gap of floodplain management/protection versus floodplain restoration

Driving Forces

- High potential for recovery potential

- Historically highly productive areas
- Floodplains have extensive other high value uses
- Many proposed large-scale restoration projects in flood plains
- ESA
- Tribal treaty rights

Institution Drivers

- E.g. USACE
- Old and new mindsets
- money

(See page 51 for Table E, Task 3)

Task 2:

Table:	F
Recorder:	Xan Augerot
Group members:	Xan Augerot, Peter Kiffney, Doug Martin, Mary Ruckelshaus, Russ Thurow

Step 2: What the processes that drive habitat formation and dynamics, and what are the essential habitat attributes (e.g., size of habitat, spatial configuration of habitats, habitat quality (both physical and biological)) that supports persistent salmonid populations?

Step 3: Identify data:

a) Current research
b) Buffington/Thurow-Idaho
c) King county core areas study- Martin
d) FS Fire research-Thurow
e) Benda research
f) Tributary junctions: hotspots of biological productivity and diversity? Kiffney and Greene, NWFSC
g) Juvenile distribution surveys- Martin in King County, Charlie Newberry (Ecotrust) in Nooksack
h) We need to synthesize and collaborate.
i) Fluvial geomorphological approach
j) Abundance, spp absence/presence
k) Food web dynamics

Step 4:

Identify existing research projects

a) Specify how these projects relate to this question- can results answer some of our question
b) Identify research sites
    a. Relatively unperturbed

    b. Sites representing a range of disturbance regimes- Eastside and fires and west side and debris flows
c) What salmon response variables to measure? Abundance, growth rate, tagging, snorkeling, redd counts
d) Task research proposals: who does what
e) Permits
f) Funding
g) Develop model that can predict how land use changes affects natural processes, habitat formation, and biological response

Step 5:

a) Driving forces
    a. Important conservation and management implications
    b. Large-scale question requires collaborative approach/critical mass
    c. Agencies interested: NWFSC, USFS, King County, NGOs
b) Constraints
    a. Large-scale, long term funding
    b. Bodies
    c. Permits

(No Task 3 prepared)

Task 2:

Table:	G
Recorder:	Jordan Rosenfeld
Group Members:	Bob Bilby, Jana Compton, Correigh Greene, Peter Kiffney, Kim Kratz, Todd Pearson, Jordan Rosenfeld, Jim Wigington, Mark Wipfli

Question

At multiple spatial and temporal scales, what biotic (food, predation, competition, etc) and abiotic attributes have the greatest influence on fitness, productivity, and carrying capacity of fish?

Existing Data

Abiotic databases available at large spatial scales (GIS) and likely at smaller spatial scales.

Food – biological prod. databases lacking at most scales

Approaches

Look at multiple scales:

1) Multiple watersheds
2) Within a watershed
3) Reach
4) Channel unit/mesocosm

Use large-scale correlative surveys of population estimates (e.g., egg-smolt survival) and watershed-scale attributes

Identify potentially limiting habitats using this approach

Examine smaller scales to address mechanisms that would influence attributes of the limiting habitats

1) Develop techniques to measure food availability
2) Nutrient fertilization experiments in channels, reaches, watersheds
3) Mesocosm experiments to test interactions between abiotic and biotic variables
4) Sample drift and fish stomachs
5) Model bioenergetics

Other experimental approaches
1) Fertilize restored vs. degraded reaches
2) Capitalize on existing initiatives (e.g., Peter Kiffney's studies)

Opportunities

Oregon index watersheds
Fertilization studies
Multiple agency interactions

(See page 54 for Table G, Task 3)

Task 3:

Table:	A
Group Title:	Estuarine Habitat Conditions and Salmon Population Persistence and Viability
Group Members	Eric Beamer, Kurt Fresh, Reg Reisenbechler, Casey Rice
Present Coordinator:	Kurt Fresh
Next Meeting:	????

Conceptual Question.
How do estuarine habitat conditions affect the viability, persistence, and productivity of salmon populations?

Research Questions
1. How do human alterations of estuarine habitat conditions affect the number, kinds, spatial and temporal distribution, relative abundance, and performance of different life history types associated with the population?
2. What are the relationships between aspects of estuarine habitat conditions, life history diversity and adult returns? (Hypothesis: Attributes of juvenile life history diversity and spatial distribution of the salmon population can be used as

surrogates of population viability, persistence, and productivity)

Research Approaches (3 Major Studies Would be Implemented)

1. For the Pacific Northwest (northern California to Central British Columbia), correlate estuarine habitat conditions, reasons why estuarine habitats have been degraded, life history use of estuaries, and adult success. The approach will be to collect comparable information on these relationships from a variety of estuary types over the Pacific Northwest that vary with respect to the extent and nature of their degradation. Steps:

    a. Stratify the Pacific Northwest by "ecoregion" (for example, Washington/Oregon Coast, Puget Sound/Georgia Strait Basin, West Vancouver Island) and large scale geomorphic types (delta, lagoon, presence of nearshore).
    b. Develop a systematic approach for selecting systems for study. This process should involve some basic level of data collection for all estuaries in the study area.
    c. Evaluate current and past estuarine habitat conditions of all systems.
    d. For each system, determine why estuarine habitat conditions have changed. Focus will be on identifying key "external" (i.e., those originating from the freshwater portion of the watershed) and "internal" habitat forming processes (changes within the watershed) that have been altered.
    e. Measure attributes of life history diversity of salmonids (emphasize Chinook but include other species if useful) using estuarine habitats including (but not limited to) (must account for hatchery vs wild fish use of estuaries):
        1) Kinds of life history types.
        2) Spatial and temporal distribution of life history types
        3) Abundance of life history types (e.g., smolt trapping).
        4) General distribution and abundance patterns in the estuary.
        5) Growth/size relationships of different life history types.
        6) Timing of movements
        7) Residence
    f. Correlate adult success with attributes of life history diversity and draw inferences.

2. In at least one estuary, make a large positive change in the habitat conditions and follow the effects of these changes over time (e.g., large scale positive perturbation) (possible candidate is the Nisqually River). We need to make enough a change in one system to detect a response in attributes of life history diversity. This type of project will require a long term commitment for study (e.g., 15 years).

    a. Select a system. This will likely be opportunity driven and based upon where we can make a large enough change. A possible candidate is the Nisqually due to a large upcoming restoration project.
    b. Collect pre change data on estuarine habitat, juvenile use of estuarine/nearshore habitats (e.g., life history types), and adult success.

c. Follow changes in habitat conditions.
d. Evaluate salmon responses of both juveniles and adults.

3. Temporarily "disturb" an estuary. Use a system of exclusion devices to keep fish from using different habitat types and monitor the response of the juvenile salmon (e.g., growth, timing, patterns of life history use). Weakness is that we cannot remove productivity, food web aspects, only use of habitats by the fish.

Task 3:
Table: B
Recorder: Russ Kiefer
Members: Russ Kiefer

Step 1 - Topic: Compare and contrast existing egg-smolt and SAR expected survival data throughout the region.

Step 2 - Coordinator to lead the project**:** Russ Kiefer

Step 3 - Key funding opportunities: NMFS, BPA, and EPA??

Step 4 - Outline of draft proposal**:** See Task 2, Step 2 (Page 38)

Step 5: Preliminary action plan**:** Initial analysis identified in Task 2, Step 4, #6 (Page 39) could be completed in a year if personnel identified and funded.

Task 3:
Table: C
Recorder: George Pess

Draft Proposal – (Option: Do as pilot in Strait)

Restoration Research Question:
Can we determine the biologically meaningful scales for restoration actions, and if so, how do we do this?

Background and Introduction:
- Billions of dollars spent on restoration and understanding of biological response
- Only place where this has occurred – Keough, Little Hood
- Need to understand biological response and benefits
- Multiple biotic measures, physical scales

Methods:
- Before and after at project, reach, watershed

➔Staircase design
➔Long term - 10 years +

- **Restoration Actions**:
  Strait of Juan de Fuca

  1. Deep Creek – all restoration by 2004
  2. East Twin – 25% restoration
  3. West Twin – Control
  4. South Fork Pysht

  Willapa

  5. Ellsworth Creek – Nature Conservancy long-term restoration

  Cascades and Snohomish

  6. Tolt
  7. Griffin ➔ Land Trust
  8. Tokul

  Puget Lowlands

  9. Carkeek
  10. Thorton
  11. Kelsey ➔ Urban
  12. Bear
  13. Norm

  Olympic

  14. Jimmy ➔ Agriculture
  15. Chimacum

Funding Opportunities:

1. SRFB
2. King County
3. The Nature Conversancy
4. NSF
5. The Land Trust
6. NMFS – Restoration
7. Moore Foundation
8. EPA 319 Grants

Implications:

1. Identify dollar response by scale, action type, region, time
2. Address:
    - Effectiveness of action and effects on populations
    - Where, when, what, and why to do action

Results:

R - Action

+		
	-	
=		

ACTION PLAN

OPTIMISTIC	CONSERVATIVE
1. Draft proposal completed by Steve R. by the end of 2002 2. Final by March 2003 3. Develop partners Spring/Summer 4. Finalize in Fall	1. Start proposal January 2003 2. Draft by March 2003 3. Final by June 2003 4. Partners by Summer/Fall 2003 Finalize - ?

Task 3

Table: D

Group Members: Russ Thurow, Chris Jordan, Gordie Reeves, Mary Ruckelshaus, Doug Martin, John Buffington, Peter Kiffney, Pete Bisson (Ashley Steel not present)

Redefined Question: Linking physical processes to population processes to assess potential for population viability

Step 1: Coordinator – Ashley Steel

Step 2: Spatially explicit population dynamics model that links physical processes to population processes

- Very data intensive
- Start someplace where there is lots of data to test viability of idea (proof of concept)
- Expand to 3-4 other locations as method develops
- Not practical to implement/attempt across entire region
- However: useful tool to guide recovery planning since results may be generalized
- Where we aren't building the big fancy model because

    - Data
    - Time
    - $ limitations
- Extract subsets of rules to test
- Develop alternative parallel approaches
    - inherent potential for watershed to provide habitat
    - capacity estimates to support viability w/o dynamics, link above

Comparison of two approaches will elucidate role of dynamics in determining viability

Action Plan: Continue these conversations, move forward immediately on Oregon coast

Task 3:

Table: E
Recorder: Phil Roni
Group members: Tim Beechie, Susan Bolton, Joel Freudenthal, Gino Lucchetti, Doug Martin, Steve Ralph, Gordie Reeves, Phil Roni

Step 2
Coordinators
Tim Beechie/Bob Wissmar

- We don't know what the effects of various alterations to floodplains are on the suite of ecological processes. We need to know this because of the amount of money spent on managing and restoring these systems.
    - Types of alterations
        - Infrastructure
            - Levees, hardening, roads, railroads
            - Diversion dams, dams
    - Altered watershed processes
        - Flow alteration
        - Morphological adjustments
        - Changes in sediment supply-routing
        - Land us, vegetation change
    - Exotics/hatchery interactions
        - fish
        - Vegetation

<u>Step 5</u>

- **Objectives**
  - Natural processes
    - Quantify magnitudes and variability of important drivers
      - Channel dynamics
      - Ecosystem processes
      - Sediment
      - Water
      - Tectonics
    - Quantify magnitude and variability of biological or ecosystem responses to drivers
      - Vegetation (terrestrial on floodplain)
      - Aquatic communities
  - Alterations
    - Quantify change in drivers by human alterations (by ecoregion)
      - See previous types of alterations
    - Quantify change in habitat, biological, or ecosystem responses to human alterations
  - Restoration/Mitigation
    - Quantify responses to actions
      - Experiments
    - Identify restoration options
- **Methods**
  - Study sites
    - Yakima
    - Skagit
  - Hypotheses?
  - Study Designs?

- **Action Plan**
  - Develop 1 page proposal to group (Wissmar/Beechie Nov 1.)
  - Develop 2-3 page preproposal (Beechie et al.)
    - December 8
  - Identify potential funding sources (Freudenthal)
  - Identify ongoing research and potential collaborators (ongoing)
  - Meet with larger group (February)
    - Scope project/proposal options
  - Try for full proposal by June 2003

Task 3
Table: F (Focal Watersheds)
Recorder: Xan Augerot

Questions:

What are the natural processes that affect salmonid diversity, abundance, fitness?
How have we altered them?
How can we restore them?
Money must be directly linked to agency mandates

Tasks:

1) **Watershed Selection**
    - Biogeographic representation for range of pacific salmon (CA to AK)
    - Range of intactness – anthro disturbance (for intactness – ideally want some basins without hatching influence)
    - Represent range of existing research – places with existing activities (map existing activities)
    - Question-driven
    - Watershed size – ideally large enough to encompass all habitats required to complete FW and early marine rearing (with exception for ID representation)
    - Access to private lands

2) **What Is The Organizational Landscape That Would Support Or Inform This Effort**?
    - Feed listing of salmon-relevant for research (Interagency Salmon Science Team) – available as of 2000, federally funded only
    - Mapping of restoration activities?
    - Identify existing research networks

3) **ID funding –** see below

4) **Fundamental Measures (year-round, multi –year, beyond salmon only)**
    - Juvenile out migration
    - Adult returns
    - Meteorological station
    - Stage monitoring
    - Satellite imagery – landscape intactness/ change over time
    - Internal movement between habitats (tagging, snorkeling, videography)

Funding Opportunities / Action Plan
- ISST Office of Science and Technology as a vehicle – should be their ownership

- Watershed Group @NWFSC to float this concept (2 pager) to Usha Varanasi sooner rather than later
- NMFS –Usha
- USGS – Frank Shipley?
- FS – Bob / Jack Wade

<u>Objective</u> Get ISST to give one of the agencies an assignment to carry to next stage
Bob – has draft conceptual argument
WSC – has draft "biostation" proposals –

Dates for Carrying Concepts Forward: ??

<u>Task 3</u>
Table: G
Recorder: Jordan Rosenfeld
Group Members: Jana Compton, Correigh Greene, Peter Kiffney, Kim Kratz, Todd Pearson, Jordan Rosenfeld, Mark Wipfli

Results from Task 3 are forthcoming

Appendix C. Summary of specific comments on Cooperative Watershed Research Symposium provided on survey forms.

What worked?

- Small focus groups
- Group brainstorming in a large group (not a sub group)
- Openness of process
- The quality of the people present
- Ice breaker, venue, facilitator
- Enjoyed development of key research questions in Task 1
- Ability to pick your own group
- Letting people move around and the knock rule kept things moving
- Meeting people and hearing about their interesting work
- Informal atmosphere
- Opportunity for dialogue
- Getting to the point of action plans
- Opportunity to interact with people working on common issues
- Final discussion was useful
- Letting things follow their own path within constraints

What can we improve?

- Start with what effort, resources and information we currently have. This may function as an initial first step.
- Provide draft themes, concepts, and ideas beforehand.
- Have more specific objectives or broader ones.
- It would be useful to focus more on real world questions (have another group give questions to this group)
- Be clearer about the questions and their scale
- Have a large group debate/discussion of questions and brainstorm
- Have more time for each task (**mentioned several times**)
- More time to hang out, perhaps evening sessions so we could enjoy the location more (**mentioned several times**)
- Distribute biographies and research interests for all participants prior to the symposium
- More background on the meeting before arrival
- The participants need to be more focused.
- In task 2, focus more on brainstorming and less on constraints
- Have fewer logistics and more science-based issues
- Have a clear direction from the onset and develop clear objectives/outcomes the research should address.
- Felt the groups were forced – the questions should form naturally.
- Describe what should happen now – can we track and sustain momentum.
- Be cautious of a vote without criteria and since there was a poor geographic coverage of the region

- Have the opportunity to participate in more than one group
- Need to focus on key objectives in a more rapid fashion and identify specific topics.
- Concern that emerging topics to research are more relevant for management – need some synthesis of what managers need to best do their job.
- Discussion to prioritize projects before going ahead on proposal development.
- In choosing the top 3 questions, we lost much detail due to the marriage of several concepts/questions into one larger umbrella question.

Feedback for NMFS

- Don't be spokespeople
- Did we come up with the right questions and are they useful for salmon conservation?
- Question identification seemed to inhibit collaboration
- The goals were squishy – it wasn't clear why we were there.
- It wasn't clear what role the workshop and its products will play in meeting agency needs.
- Missed an opportunity to develop a community position statement and action plan for larger PNW.
- Over ambitious
- A meaningful output would have been a good peer-reviewed prioritized list of the most critical questions.
- "Painful" because of the diverse audience
- You have a long hard job to rebuild trust because of what happened to the collaborative PATH results and your agency's Snake River recovery plan that we (State of Idaho) had no buy-in with.
- The process was great
- A useful product would have been just the questions
- Enjoyed the diverse group
- Good dealing with complex issues in a short amount of time
- Very valuable
- Great service to the PNW salmon science community
- Do this every year – keep it coming Great generation of ideas and confirmation of needed approaches
- Appreciate the effort
- Kudos to the planning team
- If you continue to push this it will actually improve the effectiveness to solve problems.
- Coordinating research in focal watersheds is key. Even if little money is available, NOAA (or someone) should take a lead role.
- With practice, we'll get better at doing this.
- Good illustration of regional convergence of research topics
- Thank you for organizing and funding the effort

<u>*Feedback for Facilitator*</u>

- Great job – good balance of flexibility and staying on task
- Be more flexible
- Good job of keeping a room full of independent-minded scientist in line and on track
- Good job keeping us on task even though some didn't always improve
- Very good
- Too overbearing and disruptive.
- Give groups more time to report so the their effort isn't lost or not fully explained/articulated
- The process worked
- Did a good job with a short time frame, complex issues and a diverse group
- Excellent patience
- Relying on buzzwords (report out, action plan) can sometimes undercut your authority and attention
- A difficult task nicely done