PREDATION WORKSHOP

Review, Evaluate, and Develop Strategies to Reduce Non-Native Piscivorous Predation on Juvenile Salmonids

September 24, 2008

At the
Oregon Zoo

Hosted by:

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Introduction

The Bonneville Power Administration (BPA) and the Columbia Basin Fish and Wildlife Authority (CBFWA) co-hosted a workshop on September 24, 2008 to address predation on juvenile salmonids in the Columbia River Basin by non-native predatory fish. The focus of the workshop was to review, evaluate, and develop strategies to reduce non-native piscivorous predation on juvenile salmonids.

Background

Although managers and others have long been interested in evaluating and reducing predation by non-native fish, the specific impetus for this workshop was the 2008 Biological Opinion for the Federal Columbia River Power System. The Biological Opinion includes various predation management strategies, and, specifically, Reasonable and Prudent Alternative (RPA) 44: Develop strategies to reduce non-indigenous fish. The RPA specifies that "formation of a workshop will be an initial step in the process."

Management of non-native fish predators requires both technical and policy considerations. Technical concerns may be limited to determining effective methods of reducing predator abundance and consumption while minimizing negative impacts on native species. Policy concerns include, but are not limited to, financial and social impacts of potential actions (e.g., impacts to and response by angling groups, relative cost effectiveness of potential actions, etc.).

Workshop Summary

The workshop included technical presentations, a panel discussion, and facilitated discussions. Five technical presentations were designed to provide attendees with the current state of knowledge of fish predation in the Columbia River Basin. Presentations included (1) an overview of predation research and food webs, (2) a summary of information on predation by northern pikeminnow, a native predator, to provide some perspective, (3) an overview of research and findings on smallmouth bass in the Pacific Northwest, (4) an overview of predation research and findings in the lower Snake River, and (5) an update on predation by smallmouth bass in the Yakima River.

After all presentations were completed, the presenters took part in a panel discussion – question/answer period. Common themes from the presentations and panel discussion included:

- Nutrients provided by juvenile American shad in the fall may serve to increase condition and survival of predators, therefore increasing predation on juvenile salmonids.
- Juvenile Pacific lamprey may have once served as a predation "buffer" for juvenile salmonids, but depressed abundance of Pacific lamprey has removed this buffer.
- Smallmouth bass are locally abundant, and may have localized impacts on juvenile salmonids (especially subyearlings); however, removal programs are unlikely to be effective. Restoring normative flow, turbidity, and habitat conditions are more likely to reduce predation by smallmouth bass.

- Much remains to be learned about abundance and predation by walleye and channel catfish.

Topics for facilitated discussions included (1) potential management strategies that are technically feasible, and (2) policy considerations and perspectives. Many strategies were mentioned, but those that received considerable attention included:

- Providing normative river conditions (hydrograph, turbidity, and habitat)
- Implementing reservoir draw-downs to hinder reproduction of predators
- Excluding American shad
- Restoring Pacific lamprey
- De-regulating sport fisheries
- Site-specific or systemwide removal efforts
- More research

Most policy-level attendees agreed that system-wide approaches should take priority. Exploring the exclusion of American shad from passage at dams was deemed a viable option. All supported evaluating the potential benefits of proposed strategies.

The workshop concluded with a discussion of possible next steps. Attendees developed (1) a problem statement with goals and objectives, (2) a list of additional information needs, and (3) a list of necessary partners for future discussions and planning.

Workshop Record

Welcome and Introductions

Hosts Dave Ward, CBFWA and John Skidmore, BPA, welcomed everyone to the workshop. They noted that they were encouraged by the large number of attendees for this workshop and referred to the agenda for the day. They noted that the last time a predation workshop was held (ten years prior) there was not enough time for open discussion and option generation. Ward and Skidmore introduced Facilitator Donna Silverberg, who was brought in to assist with the discussion portion of the workshop. Silverberg referred participants to a handout describing the purpose and protocols for the workshop, noting the general goal for the day was to listen to each other, think and work together as regional scientists and partners.

Presentations

The morning portion of the workshop was devoted primarily to presentations, with limited time for questions following each presentation. Each presentation is briefly summarized below, along with the questions and answers that followed. Links to each presentation are also provided (not available on hard copy).

The more things change, the more they stay the same: predation on juvenile salmonids in the 21st century
Matt Mesa, U.S. Geological Survey

Mesa gave an overview on the history of predation studies and data regarding smallmouth bass, walleye, channel catfish and American shad. He said the one thing he hoped participants would remember from his presentation was the need to address predation in a community, food web context. Mesa reviewed slides that highlighted differences between pre-settlement and modern day predator-prey interactions, noting the profound effects of the hydro-system and introduction of non-native species. He noted a general lack of literature on predator/prey interactions in the mid-Columbia River and indicated that planning was underway for an upcoming study above Priest Rapids Dam. Mesa noted that in reviewing historical temperature/passage data, trends indicate that warmer weather conditions have contributed to an extended growing season for predators. He also discussed the possibility that availability of juvenile American shad in the fall may enhance survival and growth of predators. Mesa said that the increase in size of juvenile salmonids released by hatcheries has created a bias toward predation on smaller wild fish. He also noted the decline of Pacific lamprey, which may have served as "prey buffers". As to the question of when to take action and intervene in predator/prey interactions, Mesa quoted Ray Beamesderfer in describing his criteria of asking first: "Is the problem significant? Can something biologically be done? Is that action acceptable?" Mesa said the answer to all three questions has to be 'yes' to proceed with intervention actions.

- **Question**: is the smallmouth bass data more relevant than the data on the other species? **Answer**: additional data is needed before a hypothesis can be made - but yes, the data is eye-opening.

Northern pikeminnow-the native predator
Erick Van Dyke, Oregon Department of Fish and Wildlife

Van Dyke's presentation focused on the northern pikeminnow; he noted that after evaluating four dominant piscivorous predators, the northern pikeminnow was determined to be the greatest contributor to predation on juvenile salmonids in John Day Reservoir. He said the northern pikeminnow is most abundant and effective in its predation during low flow conditions, hence their ability to flourish in the hydro-system environment. Van Dyke said predation reductions have gradually increased since 1991, due mostly to the sport-reward fishery.

- **Question**: has the overriding goal of altering the size of the pikeminnow been achieved – and has the smallmouth bass population compensated for pikeminnow removal? **Answer**: there is not enough data to say conclusively, but it appears that the mean size of fish caught has decreased.

A review of smallmouth bass predation on juvenile salmonids in the Pacific Northwest
Tom Friesen, Oregon Department of Fish and Wildlife

Friesen's presentation referenced over 40 publications on smallmouth bass abundance, distribution, diet and consumption of juvenile salmonids. He noted that salmonid predation by smallmouth bass has increased over the past 20 years. They have a negative impact on naturally produced ocean-type Chinook salmon in the Yale Lake area; however, they have a minor impact in the Lake Washington system. He noted that management strategies that improve salmonid migration (such as increased turbidity and lower temperatures) also reduce smallmouth bass predation. Friesen added that smallmouth bass and Chinook salmon have common food sources and that smallmouth bass have expanded their range in the Pacific Northwest. Friesen acknowledged that late migrating salmonids are at increased risk of predation by smallmouth bass. Friesen said that although a need exists to quantify system-wide losses, there is enough existing data to inform predation management decisions.

- **Question**: given that they are a predatory fish, do you expect the smallmouth bass to be major predators on summer/fall migrants? **Answer**: yes, in certain places.

Native and non-native fish predation in the Snake River: musings for fish predator management
David Bennett, University of Idaho

Bennett's presentation centered on study areas in Lower Granite and Little Goose reservoirs and the Hells Canyon reach of the Snake River. Work focused on smallmouth bass and northern pikeminnow. Bennett indicated that large sample sizes were needed to adequately describe diets of predator fishes and said that 60% of the species in the Snake River are non-native. Channel catfish were the surprising predators in Little Goose Reservoir in the early 1980s' study. Northern pikeminnow predation on Chinook salmon in Lower Granite Reservoir was slightly lower on a per surface area basis than results from the John Day Reservoir studies. Several other graduate projects were reviewed mostly covering smallmouth bass predation; findings during the low flow years of the early 1990s revealed up to 7% of the naturally produced subyearling Chinook salmon were consumed by smallmouth bass in Lower Granite Reservoir. During higher flow years smallmouth bass predation was considerably lower. Other studies revealed that smallmouth bass and northern pikeminnow both prefer higher temperatures and are 'sight feeders' and thus more effectively prey on juvenile salmonids in clearer water. Life history research on northern pikeminnow abundance suggests vulnerability in the Snake River system—particularly in the embryo to larval stages. Lower water temperatures and higher flows incur a negative impact on northern pikeminnow survival. Bennett suggested that restoration of natural habitat and hydrograph offer the best options for predation management. Modeling results suggested that sport fishing afforded little potential for smallmouth bass population reductions and thus, little effect on reducing juvenile salmonid predation. Bennett's data suggested using a creative approach to predation reduction strategies is needed, such as use and timing of turbidity.

The effects of predator and prey size on the consumption of salmonids by smallmouth bass in the Yakima River
Anthony Fritts, Washington Department of Fish and Wildlife

Fritts' presentation was based on data from a 1998-2002 study conducted in the lower Yakima River that focused on predator-prey size relationships. He noted that smaller smallmouth bass (150-300 mm fork length) tended to be the most predaceous, with recruitment to predator size within two years. Smallmouth bass also tended to consume the smaller naturally produced fall Chinook salmon rather than hatchery-produced yearlings. Fritts also noted that a lot of people really like bass fishing, so there could be substantial opposition to removal. Another consideration is that high levels of toxins have been found in these fish so we should be cautious about promoting a fishery.

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- **Question**: can you speak to the effects of restoration efforts on water quality in the lower Yakima? **Answer**: The warmer water temperatures have been attractive for smallmouth bass spawning activity so lowered temperatures could reduce movement into the Yakima and could also reduce overall consumption by decreasing the metabolic rate. Increased irrigation drain water quality (i.e. decreased turbidity) has increased aquatic macrophyte growth, resulting in unknown changes to predator/prey dynamics.

Question and Answer/Panel Discussion

After all presentations were finished, additional time was provided for a question/answer panel session with each of the presenters fielding questions from the audience. In addition to the presenters, Tom Poe of the Northwest Power and Conservation Council's Independent Scientific Advisory Board joined the panel.

- **Question**: Can you say more about the bias/limitations regarding channel catfish? **Answer**: In terms of electrofishing, yes – they are very hard to catch. Gill nets would be the best method of catch. We don't have a good handle on abundance in the Snake River. Channel catfish are very abundant in the Yakima River; tens of thousands have been tagged and field researchers have been struck by the size/weight of large channel catfish.
- **Question**: Can you say to what degree fish prey on live vs. dead juvenile salmonids? **Answer**: Although we can't say to what degree, we have found smolts in bellies of predators 20 miles downstream from dams. Northern pikeminnow were found to select somewhat, but not overwhelmingly for, dead fish over live.
- **Question**: Can you say more about the unique aspects of obtaining data regarding smallmouth bass predation? **Answer**: Part of the challenge has to do with the gear bias, and the timing of day/season. Bigger bass tend to eat fewer salmonids, but are more likely to be caught. More detailed studies, around dams especially, would be helpful – sampling from boat restricted zones over the last four years showed an increasing trend for smallmouth bass predation, but the data is affected by accessibility (or lack thereof.)
- **Question**: for other areas in Oregon (such as the John Day and Umpqua rivers), is it fair to say that healthy anadromous populations exist because conditions are

closer to natural? **Answer**: yes, it would be – any major changes to ecosystems and/or the food web are a recipe for loss of native species.

- **Question**: What data exist to show smallmouth bass and juvenile American shad are a huge source of biomass? **Answer**: A bigger, broader, regional-scale study is needed – and it is encouraging to know of the impending mid-Columbia study. Would also suggest that a predator/prey study during the fall season would be good, to build on the merits of initial results. We need more support for comprehensive research efforts in the Columbia River ecosystem and are hopeful that discussions like the one planned for this afternoon can generate ideas about what efforts will garner the data we need. We get good 'bang for the buck' by evaluating the negative impacts and their resulting effects on predators.
- **Question**: Regarding 'prey-switching', are there strict relationships? **Answer**: We have observed smallmouth bass preference for crayfish; however, as we have examined their stomachs, we've found that they take an "opportunistic" approach to feeding.
- **Question**: Regarding the influence of invasive plants, is there potential for affecting abundance? **Answer**: There is a definite potential for effect on abundance by reducing favorable habitat for non-native fish species.
- **Question**: Another species with a chance for direct positive influence to reduce predation on salmon would be lamprey – what kind of sampling would be useful? **Answer**: There may be enough data that exists already and supports the idea that lamprey is an important piece of the puzzle (alternative prey).
- **Question**: what about the comparisons between piscivorous and non-piscivorous predation? **Answer**: The location and timing of avian predation needs more attention. A University of Washington study on predation helped increase the ability to predict numbers of prey and seasonal prey shifts. Regarding predation by mammals on adults, it is important to relate the data to estimated smolt losses.

Predation Management Strategies

Following the lunch break, Silverberg divided the workshop participants into small groups for a discussion and brainstorming session on technically feasible methods for managing non-native piscivorous predation. The following section captures the small group reporting:

- Walleye sampling – address gear bias.
- Make changes to manage the Columbia as a normative river with increased spring flows, cooler water, and increased turbidity (naturally or artificially).
    - Use temperature and/or flows to control recruitment of non-native fishes.
- Modify reservoir operations (draw downs) and flow regimes to hinder predators and affect spawning patterns.
    - Use site-specific management opportunities for exploitation of smallmouth bass – there is strong potential for population impacts by manipulation of water levels during spawning periods, more water for some nest builders like smallmouth bass and removing water from other species like walleye.

- Implement a system-wide predation study of the Columbia River with multiple agencies and tribes involved.
- Need more data collection on non-native species.
- Increase research, monitoring and evaluation around dams.
- More data collection and information is needed on channel catfish; specifically on consumption rates and overall abundance in the reservoirs, particularly in the lower Snake River where they appear to be most abundant.
- Note that direct management actions on predators that include removals by angling and electrofishing are options, but are politically unrealistic and biologically unsustainable (need annual exploitation rates of >60%).
- If American shad are a problem at projects, exclude them, and possibly use carcasses to enhance nutrients in tributaries.
- Examine the levels of predation that are additive vs. compensatory.
- Focus efforts on smaller predators.
- Bring back Pacific lamprey with population-boosting strategies.
- De-regulate sport fishery (if consider this, need to make the case!); suggest rewards for non-native predator catch.
    - Target commercial fisheries for American shad to reduce the potential interactions between adults during passage periods in the fish ladders and also to reduce the production of juveniles and their competition impacts with juvenile salmonids in the estuary.
- Size of hatchery released fish – need a strategic focus on smaller size.
- Decrease amount of time juveniles spend around dams.
- Need to consider life-cycle impacts any management action might have by asking:
    - Is it significant?
    - Can anything biological be done about it?
    - Is that action acceptable?

Policy Considerations and Perspectives

Silverberg asked those with policy level positions to identify themselves and address the potential strategies listed above. The following representatives provided their feedback as they considered which ideas seemed viable or non-viable, and what additional technical information might be needed from a policy perspective:

- Ritchie Graves, NOAA Fisheries Service – A good viable option would be to focus on reducing and restraining American shad (whether at one or more reservoirs at once is debatable.) Another viable option is the creative use of turbidity, which makes it harder for predators to do their job and can be effective on multiple species. Would suggest focusing on a few target species in target areas, as a "wholesale" removal approach would not be a viable option.
- Mark Bagdovitz, U.S. Fish and Wildlife Service – All the above are worth discussing and the significant shifts in predation over the last ten years makes the case for targeting certain areas. The fish protection measures already in place will continue to be valuable as we work toward predation deterrence.

- Stacy Horton, Northwest Power and Conservation Council – The John Day Reservoir drawdown idea seems the most viable, and would suggest that focus be placed on funding resources. Would also suggest that workshops like these be convened more often.
- Tony Nigro, Oregon Department of Fish and Wildlife – It will be important to illustrate predator reduction strategies in a context that relates to other current viability efforts – and highlight mainstem vs. tributary issues. There is an upside to exploring the dynamics of populations. Suggest defining issues/problems, as best we can, to generate clearer understandings among decision makers. Is most skeptical of a site-specific approach, as far as forebay vs. tailrace conditions based on past experiences.
- John Skidmore, Bonneville Power Administration – Considering the biological and technical aspects, agrees it would indeed be difficult to focus on a site-specific approach. The American shad management idea is interesting and seems viable. Regarding exploitation efforts, there will need to be clear end-point benefits identified and articulated.
- Michael Newsom, Bureau of Reclamation – The system-wide approach is the best option and would support further consideration of impacts of American shad.
- Paul Heimowitz, U.S. Fish and Wildlife Service – Suggests measuring the benefits of proposed strategies against those that are already underway for other species and support efforts that keep conditions as close to historical as possible.

Discussion on Next Steps

Given all the presentations, ideas and option generating that had transpired during the workshop, Silverberg asked participants to describe what some of the next steps for predation management might be. As a large group discussion unfolded, Silverberg identified three distinct areas of focus for next steps: (1) development of a "problem statement", (2) identifying additional information needs and (3) identifying the partners needed to help make progress. Participants broke into three workgroups and developed the following information as a first step. After reviewing what was developed, all agreed this is a first and useful 'draft' of ideas that will need to be integrated and refined:

Problem Statement/Goals and Objectives

The following goal and objectives were developed as a place to start next steps:

- Goal: Increase survival of juvenile salmonids in the mainstem Columbia River Basin by modifying non-native piscivorous predation dynamics.
- Objectives:
  1) Determine if reduction in American shad abundance increases the survival of juvenile salmonids by ____ (date.)
  2) Determine if reduction of invasive macrophytes increases juvenile salmonid survival by reducing favorable predator habitat by ___ (date.)
  3) Determine if increased turbidity increases juvenile salmonid survival by ____ (date.)
  4) Determine if reservoir operations can reduce reproductive success of non-native predators.
  5) Determine if increasing abundance of native "buffer" species decreases predation on juvenile salmonids.

6) Determine if reducing the average size of hatchery-released juvenile salmonids (thereby closer to the size of wild fish) reduces impacts to naturally-produced fish.
7) Determine if predator impacts can be lowered by focusing on site-specific removals.
8) Determine if changes in angling regulations for predators can impact the survival of juvenile salmonids.

Additional Information Needed to Increase the Likelihood of Success

The following information gaps were identified:

- Define distinct populations (if appropriate – potential alternatives include management units) of predators.
- Evaluate interaction of predators and prey;
    - What affects predator selection?
- Information on predator distribution and life history, if unknown;
    - What biological factors affect predators?
- Basic food web analysis, prioritized.
- Data on hydro-system operations' effects on predators, prey, and primary/secondary production.
- Data on interaction with exotic plants (e.g. Eurasian milfoil.)
- Actual magnitude of predation – healthy vs. unhealthy salmonids.
- Risk analysis by species, race, stock, size, and origin (risk from predators and risk from potential management actions).

Partners Needed to Make Progress with Any Future Effort

The following partners were identified as necessary to include/invite to future discussions if any effort to reduce predation is to be successful:

- Fishery management agencies – state, federal, tribal.
- NGO's that will balance and support predation management.
- Sport fishing stakeholders such as Trout Unlimited, Save Our Salmon, Native Fish Conservancy, Bass Angler Sportsmen Society, Northwest Sport Fishing Industry Association, warm water fishing entities.
- Utilities and PUD's
- Researchers
- Academic institutions
- State invasive species management entities
- Irrigation districts
- Various resource users/industry representatives that can help address goal/problem statement.
- Water quality agencies
- Resource agencies
- Land managers

Conclusion

The workshop was concluded with John Skidmore thanking all who attended and participated in the discussions; he acknowledged that notes from the workshop would be

developed by Silverberg's team at DS Consulting and sent out via email. A few participants suggested that a follow-up conversation/group be convened to build on the momentum generated by the workshop. Other suggestions were to include notations and bibliographies associated with the presentations when they are posted to the web and to allow for additional discussion time directly following presentations. Participants were invited to leave their name, contact information and an indication of what they personally could contribute to future efforts; that data was collected and transcribed into a spreadsheet for Skidmore and Ward's reference as they help develop the next regional conversation regarding predation (Appendix B).

These summary notes were developed by the facilitation team at DS Consulting, a private, independent facilitation firm in Portland, Oregon. If you have questions or comments about these notes, we welcome your feedback via email at ehalton@cnnw.net or you can call us at 503-248-4703.

Appendix A

Selected References Regarding Predation by Smallmouth Bass in the Pacific Northwest; Tom Friesen, Oregon Department of Fish and Wildlife

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**Citation included in presentation. Other references may be of interest to workshop participants.*

Appendix B
Commitment to Future Contributions

Name	Employer	Contact info provided?	Commitment - as written on the feedback card
David Bennett		no	Would be happy to provide information on research findings on fish predation in the Snake River Reservoirs. Would also be willing to participate in another activity (meeting, discussion, etc.)
Tim Counihan	USGS	no	Could contribute to data needs future and past, suture strategies, etc.
Mike Faler	Dworshak Fisheries Complex, FWS	4147 Ahsahka Rd., Ahsahka ID 83520 michael_faler@fws.gov 208-476-7242	We can conduct studies, monitoring and evaluation for identified objectives and information needs associated with predation issues in the Snake River. We can also assist with the development of management actions and research needs and implementation of actions and needs.
Chris Fisher	Colville Tribes	509-422-2121 or email chris.fisher@colvilleribes.com	I am sincerely interested in this topic and want to remain involved. However, some of these topics/issues may require approval at a policy level. Thus, I may have to secure approval before I continue. I am also a member of the invasive species advisory committee - a committee that provides advice to the National Invasive Species Council, which in turn provides direction to the federal agencies.
Gary Fredricks	NOAA	no	I will participate in future meetings. Am willing to provide NOAA BiOP perspectives and Fisheries Manager perspectives.
Tom Friesen	ODFW	503-947-6232 or email tom.a.friesen@state.or.us	I am willing to communicate progress with the Fish Division, to co-author a paper describing predation by Bass, to provide a bibliography on my presentation and to possibly participate in future meetings.

Name	Employer	Contact info provided?	Commitment - as written on the feedback card
Keith Garner	Grant County PUD	509-431-0589 or email kgarner@gcpud.org	I would like to be involved in future meetings.
Jim Geiselman	BPA	no	I will consider this information in the next steps of implementation of BiOP research, monitoring and evaluation and the review of the Fish and Wildlife Program RM&E projects, priorities and gaps.
Ritchie Graves	NOAA	no	I would like to be involved in future meetings and can advocate for actions and research both in regional processes and within NOAA Fisheries. I am also willing to discuss these issues and help refine them.
Rulon Hemingway	USFWS, ID Fishery Resource Office	4147 Ahsahka Rd., Ahsahka ID 83520 rulon_hemingway@fws.gov 208-476-3315	I would be willing to investigate research needs, provide monitoring and evaluation, and assist in the implementation of management plans. Specifically, I would like to develop projects to address predator issues in the Snake River.
Brandy Humphreys	Confederated Tribes of the Grand Ronde	PO Box 10 Grande Ronde, OR 9734 brandy.humphreys@grandronde.org 503-879-2423	Would like to be involved further in this process. Can contribute historical perspective, alternative management ideas.
Paul Heimowitz	USFWS	503-736-4722 or email paul_heimowitz@fws.gov	I can help with efforts to connect this issue with aquatic species groups/programs in the Columbia River Basin. I am interested in future conversations.
Brad James	WDFW	360-906-6716 or email jamesbwj@dfw.wa.gov	Please notify me of next session.

Name	**Employer**	**Contact info provided?**	**Commitment - as written on the feedback card**
Matt Mesa	USGS	509-538-2299, x246 or email mmesa@usgs.gov	I am interested in future predator-prey meetings regarding research.
Blaine Parker	CRITFC	no	I am willing to prepare the small group notes for Donna! Please include me in future discussions on this topic.
Tom Rien (and Christine Mallette)	ODFW	no	I am willing to participate in further development of goals and objectives, problem statements.
Shane Scott	Utilities, other river users	360-576-4830 or email sscott06@earthlink.net	I am willing to contribute by representing funding sources for corrective actions and also provide technical support and coordination for control actions. I would like to take part in future discussions.
Jim Uehara		no	Dave, Neil - please keep me in the loop.
Erick VanDyke	ODFW	no	I would like to participate in future activities
Bruce Watson	ICF-Jones and Stokes	206-463-5003 or email bwatson@jsanet.com	I would be interested in helping with elaborating on the ideas and processes coming out of this workshop.
David Wills	USFWS	360-604-2500 or email david_wills@fws.gov	I am interested in participating in future meetings and discussions.
Eric Winther	WDFW-Predator Control Program, Columbia/Snake Rivers	2108 Grand Blvd. Vancouver, WA 98661	I can contribute data on recreational angling related to predator removal.

Appendix C
List of all Registrants

No.	Last	First	Agency	Email
1	Allen	Chris	USWFS	chris_allen@fws.gov
2	Annamalai	Maler	USACE	
3	Arterburn	John	CCT	john.arterburn@colvilletribes.com
4	Bagdovitz	Mark	USFWS	mark_bagdovitz@fws.gov
5	Bellerud	Blane	NOAA	blane.bellerud@noaa.gov
6	Bennett	David	Univ. Idaho	davidhbennett@adelphia.net
7	Bettin	Scott	BPA	swbettin@bpa.gov
8	Burchfield	Stephanie	NOAA	stephanie.burchfield@noaa.gov
9	Burgess	Dave	WDFW	burgedsb@dfw.wa.gov
10	Chane	Ian	USACE	ian.b.chane@usace.army.mil
11	Clugston	David	USACE	david.a.clugston@usace.army.mil
12	Counihan	Tim	USGS	tcounihan@usgs.gov
13	Domingue	Richard	NOAA	richard.domingue@noaa.gov
14	Faler	Mike	USFWS	micheal_faler@fws.gov
15	Fellas	Christy	NOAA	christina.fellas@noaa.gov
16	Filardo	Margaret	FPC	mfilardo@fpc.org
17	Fisher	Chris	CCT	chris.fisher@colvilletribes.com
18	Fredricks	Gary	NOAA	gary.fredricks@noaa.gov
19	Friesen	Tom	ODFW	tom.a.friesen@state.or.us
20	Fritts	Anthony	WDFW	frittalf@dfw.wa.gov
21	Garletts	Doug	USACE	douglas.f.garletts@usace.army.mil
22	Garner	Keith	Grant PUD	
23	Geiselman	Jim	BPA	jrgeiselman@bpa.gov
24	Graves	Ritchie	NOAA	ritchie.graves@noaa.gov
25	Griffith	David	USACE	david.w.griffith@usace.army.mil
26	Halton	Erin	DS Consulting	ehalton@cnnw.net
27	Harris	David	ODFW	dave.a.harris@state.or.us
28	Haskett	Kirk	ODFW	kirk.a.haskett@state.or.us
29	Heimowitz	Paul	USFWS	Paul_Heimowitz@fws.gov
30	Hemmingway	Rulon	USFWS	rulon_hemingway@fws.gov
31	Hemstrom	Steve	Chelan PUD	steven.hemstrom@chelanpud.org
32	Hevlin	Bill	NOAA	bill.hevlin@noaa.gov
33	Horton	Stacy	NPCC	shorton@nwcouncil.org
34	Humphreys	Brandy	CTGR	Brandy.Humphreys@grandronde.org
35	Jackson	Steve	WDFW	
36	James	Brad	WDFW	jamesbwj@dfw.wa.gov
37	Johnson	Jeff	USFWS	jeff_johnson@fws.gov
38	Johnson	John	NOAA	john.k.johnson@noaa.gov
39	Jones	Tucker	ODFW	Tucker.a.jones@state.or.us
40	Keesee	Barry	Chelan PUD	barry.keesee@chelanpud.org
41	Keller	Lance	Chelan PUD	lance.keller@chelanpud.org
42	Klatte	Bernard	USACE	Bernard.A.Klatte@usace.army.mil
43	Kock	Tobias	USGS	tkock@usgs.gov
44	Kruger	Rick	ODFW	rick.kruger@state.or.us
45	Lee	Chuck	Spokane Tribe	chuckl@spokanetribe.com
46	L'Heureux	Andre	BPA	alheureux@bpa.gov
47	Liedtke	Theresa	USGS	tliedtke@usgs.gov
48	Mackey	Tammy	USACE	Tammy.M.Mackey@usace.army.mil
49	Mallette	Christine	ODFW	Christine.Mallette@state.or.us
50	Mclaughlin	Lisa	EWEB	lisa.mclaughlin@eweb.org

No.	Last	First	Agency	Email
51	McMichael	Geoff	PNNL	geoffrey.Mcmichael@pnl.gov
52	Mesa	Matt	USGS	matt_mesa@usgs.gov
53	Meyer	Ben	NOAA	ben.meyer@noaa.gov
54	Moyers	Sam	ODFW	samuel.w.moyers@state.or.us
55	Mullan	Anne	NOAA	anne.mullan@noaa.gov
56	Munn	Nancy	NOAA	nancy.munn@noaa.gov
57	Newsom	Michael	USBR	mnewsom@pn.usbr.gov
58	Nigro	Tony	ODFW	tony.nigro@state.or.us
59	Nine	Bret	CCT	bret.nine@colvilletribes.com
60	Parker	Blaine	CRITFC	parb@critfc.org
61	Peters	Ron	CDT	rlpeters@cdatribe-nsn.gov
62	Petersen	Kristine	NOAA	kristine.petersen@noaa.gov
63	Peven	Chuck	Peven Consulting	pci@nwi.net
64	Poe	Tom	ISRP	tpoe8@earthlink.net
65	Polacek	Matt	WDFW	polacmcp@dfw.wa.gov
66	Rerecich	Jonathan	USACE	jonathan.g.rerecich@usace.army.mil
67	Rien	Tom	ODFW	tom.a.rien@state.or.us
68	Scott	Shane	S. Scott & Associates	sscott06@earthlink.net
69	Setter	Ann	USACE	ann.l.setter@usace.army.mil
70	Shrier	Frank	USACE	
71	Silverberg	Donna	DS Consulting	dsilverberg@cnw.net
72	Sims	Gary	NOAA	gary.sims@noaa.gov
73	Skidmore	John	BPA	jtskidmore@bpa.gov
74	Statler	Dave	NPT	daves@nezperce.org
75	Sweet	Jason	BPA	jcsweet@bpa.gov
76	Swenson	Larry	NOAA	Larry.Swenson@noaa.gov
77	Tackley	Sean	USACE	sean.c.tackley@usace.army.mil
78	Takata	Howard	ODFW	howard.k.takata@state.or.us
79	Taki	Doug	SBT	dtaki@shoshonebannocktribes.com
80	Talabere	Andrew	EWEB	andrew.talabere@eweb.org
81	Taylor	Greg	USACE	gregory.a.taylor@usace.army.mil
82	Uehara	Jim	WDFW	ueharjku@dfw.wa.gov
83	Van Dyke	Erick	ODFW	Erick.S.Vandyke@state.or.us
84	Wagner	Paul	NOAA	paul.wagner@noaa.gov
85	Waknitz	Bill	NOAA	bill.waknitz@noaa.gov
86	Ward	Dave	CBFWA	dave.ward@cbfwa.org
87	Ward	Neil	CBFWA	neil.ward@cbfwa.org
88	Watson	Bruce	Mobrand-Jones & Stokes	bwatson@jsanet.com
89	Weaver	Michele	ODFW	Michele.h.weaver@state.or.us
90	Welch	Dorie	BPA	dwwelch@bpa.gov
91	White	Erik	NOAA	erik.white@noaa.gov
92	Wills	Dave	USFWS	david_wills@fws.gov
93	Winther	Eric	WDFW	winthew@dfw.wa.gov
94	Zyndol	Miroslaw	USACE	miroslaw.a.zyndol@usace.army.mil