American Rivers * American Whitewater * Idaho Rivers United * Institute for Fisheries Resources
The Lands Council * NW Energy Coalition * Oregon Natural Desert Association
Pacific Coast Federation of Fishermen's Associations * Pacific Rivers Council * Save Our *Wild* Salmon
Sierra Club * Washington Wildlife Federation * Washington Wild Rivers * WaterWatch of Oregon

July 25, 2014

Re: Comments on Draft Fish and Wildlife Program

Via online submittal form: https://www.nwcouncil.org/fw/program/2014-03/comment-form/

Dear Council Members:

Thank you for the opportunity to comment on the draft Northwest Power and Conservation Council Fish and Wildlife Program. These comments are submitted on behalf of American Rivers, American Whitewater, Idaho Rivers United, Institute for Fisheries Resources, The Lands Council, NW Energy Coalition, Oregon Natural Desert Association, Pacific Coast Federation of Fishermen's Associations, Pacific Rivers Council, Save Our *Wild* Salmon, Sierra Club, Washington Wildlife Federation, Washington Wild Rivers, and WaterWatch of Oregon. The Council's Fish and Wildlife Program has an important role to play to meet the fish restoration mandate of the Northwest Power Act and to help further equitable treatment for fish and wildlife under the Northwest Power Act. As many of our organizations have noted in previous comments and recommendations, we hope that the Council will exert its statutory authority and obligations more forcefully on these issues when this process is complete.

I. Background

The Northwest Power Act requires the Council "to protect, mitigate and enhance the fish and wildlife … particularly anadromous fish which are of significant importance to the social and economic well-being of the Pacific Northwest and the Nation." 16 U.S.C. §839 (6). To meet this goal, the Council's Program must contain measures to "provide for improved survival of such [anadromous] fish at hydroelectric facilities… and; …provide flows of sufficient quality and quantity between such facilities to improve production, migration, and survival of such fish as necessary to meet sound biological objectives." 16 U.S.C. § 839b(h)(6)(E)(i)-(ii).

The Power Act's goals are different than (though complementary to) other federal agencies' duties to avoid jeopardizing the continued existence of species (i.e., appreciably reducing their chances of survival or recovery) under Section 7 of the Endangered Species Act ("ESA"), 16 U.S.C. § 1536(a)(2). Despite the Council's general statement that the Program should be "broader" than the ESA, Draft at 60, the 2014 Draft Program does not contain any specific measures to achieve the Power Act's separate objectives and hydrosystem requirements. Instead, the Council merely notes that "[m]ainstem dam operations for listed species are addressed in the 2014 Supplemental Federal Columbia River Power System Biological Opinion." Draft at 21. *See also id*. at 60. But as some of our organizations explained in comments on the

recommendations, these measures do not comply with the ESA, let alone satisfy the Council's independent legal duties under the Northwest Power Act.

Like its predecessors upon which the Council's previous Programs have been based, the 2014 BiOp does not comply with the ESA and has once again been challenged in court. The 2014 BiOp applies the same contrived jeopardy standard as its illegal predecessors and relies on unidentified, uncertain, and unproved habitat actions to meet even this low bar; fails to account for or deal with the additive harmful impacts of climate change; dismisses or downplays unfavorable data on the status of the stocks and the poor track record of actions to date, while consistently choosing the most optimistic interpretation of other data; and allows the federal agencies to curtail both the amount and timing of current levels of spill.[1]

Moreover, for all of its other flaws, NOAA does not conclude in the 2014 Supplemental BiOp or its predecessors that the mainstem hydrosystem measures from the BiOp that the Council proposes in the Draft Program are adequate by themselves to avoid jeopardy under the ESA. Rather, even with these mainstem measures, there is a large survival gap that must be filled to meet even NOAA's weakened jeopardy standard. NOAA attempts to fill that gap by relying on actions in the other H's – mostly tributary and estuary habitat. But the Courts, the ISAB, the Council, and independent scientists, have all concluded that these measures are unlikely to produce the predicted survival improvements that NOAA believes are necessary to avoid jeopardy. *See generally*, *NWF v. NMFS*, 839 F. Supp. 2d 1117 (D. Or. 2011). Indeed, in its review of the 2009 Fish and Wildlife Program – which is virtually indistinguishable from the Draft 2014 Program and from the 2014 BiOp – the ISAB concluded that:

> It is highly uncertain that habitat restoration will be successful as presently configured . . . quantitative objectives for habitat, an unambiguous assertion of biological potential, and a route to achieve the potential through habitat restoration actions, are not yet available, . . . it is important to further state that the biological potential is uncertain . . . and that the scope of restoration and improvement required to achieve the vision remains unknown . . . .

[1] Particularly given the reductions in spill operations permitted by the 2014 BiOp – and that the past nine years of spill and transport operations have been mandated by court order, not by the result of leadership from the Council or the federal agencies – it is difficult to understand the Council's assertion that "[f]or more than 30 years, the program measures have altered system operations for the benefit of improved habitat conditions and fish passage survival. As relevant to listed species, these measures have largely been incorporated into FCRPS biological opinions and are well accepted in the region." *Id.* at 59. To the contrary, as the Ninth Circuit observed in 1994, the Program has consistently failed to be the source of adequate measures to protect salmon and steelhead. *Nw. Res. Info. Ctr., Inc. v. Nw. Power Planning Council*, 35 F.3d 1371, 1395 (9th Cir. 1994) ("The Council's approach seems largely to have been from the premise that only small steps are possible, in light of entrenched river user claims of economic hardship. Rather than asserting its role as a regional leader, the Council has assumed the role of a consensus builder, sometimes sacrificing the Act's fish and wildlife goals for what is, in essence, the lowest common denominator acceptable to power interests…."). Indeed, these fish were driven on to the list of Endangered Species on the Council's watch. The Council's apparent willingness to follow the lead of the federal agencies and adopt mainstem measures that cut back on vital protections continues this disappointing trend.

ISAB, Review of the 2009 Fish and Wildlife Program at 40 (Mar. 2013).[2]

The Council has an independent duty to adopt measures that will protect, mitigate, and enhance salmon and steelhead populations. The mainstem measures included in the 2014 BiOp (by themselves or as supplemented by actions in other H's) will not fulfill that duty. The Council's duty to ensure that the Program includes the measures necessary to achieve the fish restoration purposes of the Power Act is not constrained or guided by the FCRPS BiOp or any other associated contractual agreements between BPA and other entities. It is both a legal and policy error for the Council to default to the measures in the FCRPS BiOp in this Fish and Wildlife Program. It should be abundantly clear by now that relying on the measures in the 2014 BiOp – measures that will not even avoid jeopardy under the ESA – will not satisfy the Council's separate obligations to "enhance" anadromous fish populations.

II. Spill Experiment

The Draft Program does not include the recommendation for an experimental spill operation from the State of Oregon and the Nez Perce Tribe; and the Council does not explain why this recommendation was excluded. As we and others have noted, there is strong, region-wide scientific support for this test of expanded spill based on the long-running, independent, collaborative Comparative Survival Study (CSS) that has modeled the impacts of expanded spill on Smolt-to-Adult Return ratios. There is a documented clear link between greater spill (i.e., spill provided under court order since 2006) and recent higher rates of juvenile salmon survival and adult returns. The projected increased probability of meeting the SAR levels required for survival and possibly even recovery from increased spill is technically feasible and achievable within the current configuration of the hydrosystem. As the ISAB noted when reviewing this recommendation, recent operations and configuration of the FCRPS and other actions have been insufficient to achieve the SAR goals defined by the Council. ISAB 2014-2 at 5. Where we know that current efforts are insufficient, we must pursue such a promising opportunity to help the region either achieve the goals of the Power Act, or at least to gain a greater understanding of the measures needed to stabilize, rebuild, and restore these imperiled stocks. Where there is potential to meet the Council's SAR goals with new actions such as a spill experiment, those actions should be pursued. Instead, the Draft Program contemplates defining down those goals because they are perceived as "unattainable," when the evidence from the CSS suggests the opposite.[3]

---

[2] ISAB 2013-1, "Review of the 2009 Fish and Wildlife Program," *available at* http://www.nwcouncil.org/media/5950466/isab2013-1.pdf. Rather than address the ISAB's comprehensive critique, the Council mischaracterizes this review as affirming that "habitat work to date has been largely successful." Draft at 20.

[3] The Council's SAR goals have served as the goalposts for actions to restore the Columbia's fishery for decades. We strongly oppose any effort to move those goalposts closer to the ball in lieu of working to actually achieve the healthy, sustainable, recovered salmon runs envisioned by those SARs.

To the extent that the Council has not included this measure based on NOAA's terse critique in the 2014 BiOp, that critique is not based on the best available science as detailed in others' comments and presentations during this amendment process.[4] Indeed, while the ISAB identified additional detail needed to complete a fully developed study design, it did not determine that the points raised by BPA and its third-party contractor would preclude the implementation of the spill experiment. To the contrary, the ISAB explicitly determined that the proposal had merit and warranted testing, and simply sought additional study design and details necessary to do so. ISAB 2014-2 at 5, 7, 12. The Council should address those findings explicitly and hard-wire the spill experiment into the Program conditioned on the completion of the study design work. This measure should include a brisk timeline (no more than six months) for completion of that design and access to the ISAB or other resources necessary to complete this work. The Council's vague statement that it may "think about it again" sometime in the future if multiple other preconditions are met does not satisfy the Council's responsibilities. *See* 16 U.S.C. § 839b(h)(6)(E)(i)-(ii).

Moreover, notwithstanding whether the Council's multiple conditions are all based on valid concerns, we note that the Council does not apply its skepticism consistently to all measures included in the Program. For example, the region is currently in its second decade of a speculative attempt to mitigate the decimation caused by the hydrosystem by restoring tributary habitat.[5] As multiple scientists – including the ISAB in its review of the 2009 Program – have pointed out, this framework is based only on a general premise that repairing damaged habitat is good for fish that does not translate to the specific outcomes the Council and the federal agencies rely on it to provide.[6] But the Draft Program and the 2014 BiOp it mirrors are

---

[4] *See, e.g.,* Fish Passage Center Memo to Tom Rein, ODFW, "Review of BPA/COE/Skalski presentation to the Independent Scientific Advisory Board on January 17, 2014" (Jan. 27, 2014); available at http://www.fpc.org/documents/memos/10-14.pdf. We incorporate this memo by reference in these comments.

[5] It is worth repeating that no one contends that habitat restoration is detrimental – of course we should repair habitat damaged or destroyed by other actions. But remediation of past harm is not the point of the current effort to credit habitat improvements to backfill the harm caused by the hydrosystem. One need look no further than the situation facing the Snake River stocks (many of which return to some of the most intact habitat in the lower 48 states but are still in decline) to understand the critical shortcoming of the habitat-based mitigation approach that the Council and the federal agencies continue to pursue.

[6] As demonstrated in the documents included in Attachment 1 to these comments and in the record for the *NWF v. NMFS* litigation, the independent scientists NOAA asked to examine this approach (that forms the basis of both the program and the FCRPS BiOp), concluded that "the numerical gain in survival from a given effort in habitat is unknown" and that "[we] can't link magnitude of effort to [change] in survival or extinction risk." Another observed, "for 40 years [we] have engaged in habitat restoration but no corresponding [change] in population status has been observed." Yet others said that, "the habitat data [was] weak" and that "[a]ssumptions about . . . habitat may not be justified and so some of us do not agree with optimism" about survival improvements from habitat actions and lacked "confidence that [the] RPA will achieve [its] goals." Particularly for tributary habitat, they commented that the analysis "lacks connections between habitat actions and conditions and, more important habitat conditions and survival." In response to a proposal for additional research to "improve[] understanding of relationships between habitat quality and fish response," one reviewer noted that "this is a career research topic." Moreover, NOAA's own analysis continues to confirm that the agencies will not be able to detect whether many of the survival benefits they have predicted from habitat actions accrue for decades, if ever. *See, e.g.,* 2014 BiOp at 244; 2010 BiOp 2-127.

completely based on this untested and highly uncertain scientific foundation; lack any clear study design(s), measurable results, or accountability; gloss over or ignore issues raised by independent scientific review; involve huge capital and other costs; and do not comply with the Endangered Species Act or the Power Act.[7] It is extremely doubtful that the current habitat-based program would pass the bar the Council is holding out for hydrosystem-based management experiments that do not suffer from anywhere near the same level of uncertainty.

Finally, despite the Council's demonstration in the Sixth Power Plan that the region could shut down its existing coal generation and remove the lower Snake River while still lowering customer bills, the draft program is largely silent on this action to benefit fish. Indeed, the Council's only statement addressing this measure simply "assumes that, in the near term, the breaching of dams in the mainstem Columbia and Snake rivers will not occur," Draft at 60. But again, the Council's obligation in the Program is not to passively accept whatever others decide to do; its duty is to set forth a Program that will achieve the Northwest Power Act's goal of restoring anadromous fish runs. 16 U.S.C. §§839b(h)(5)-(7); (h)(1)(a). In the absence of <u>any</u> new mainstem measures –a test of expanded spill, dam removal, or flow improvements – the Council is again poised to violate the Power Act. *See supra* at n.1.

III. BPA costs

It is disappointing that the Council is again relying on BPA's method for evaluating the alleged "costs" of Fish and Wildlife Program Measures to determine whether the program will impact an adequate, reliable, and economical power supply. Draft at 228-229. It has been nearly a year since the Ninth Circuit found that the "Council's implicit endorsement of a cost estimate of fish and wildlife measures that is more than double the estimate produced by an alternative methodology is directly relevant to the fundamental balance that the Power Act commands the Council to achieve. Whether those measures cost $750 million annually rather than $300 million annually will quite likely affect where that balance is struck when the Council and the region's stakeholders develop future fish and wildlife programs and power plans." *NRIC v. NW Power and Conservation Council*, 730 F.3d 1008, 1021 (9th Cir. 2013) (requiring the Council to reconsider its use of BPA's estimates, make a new decision based on a transparent reviewable record). The Council's failure to address the Court's decision before developing the Draft Program is troubling and there is no rational basis for the adoption of BPA's fictional and harmful description of the "costs" of fish and wildlife measures in the Draft Program.

The Council rationalizes presenting only BPA's view by stating that *how* total costs are calculated doesn't matter, because even at BPA's inflated estimates, the Council believes that the power system remains economical. *Id.* at 229. The Council's dismissal, however, confuses

[7] *See, e.g., NWF v. NMFS*, 839 F.Supp.2d at 1127 (finding that "NOAA Fisheries' analysis fails to show that expected habitat improvements—let alone the expected survival increases—are likely to materialize,"); *id.* at 1129-30 (noting that "the lack of scientific support for NOAA Fisheries' specific survival predictions is troubling," and that the government's own scientists, "the independent experts who reviewed [the plan], and the Independent Scientific Advisory Board ("ISAB")[,] have expressed skepticism about whether those benefits will be realized").

total "costs" with the measures those costs are incurred to pay for. For reasons that many others have explained, "foregone revenue" is not the same as capital or other actual expenditure. While we contest whether many of these expenditures are currently directed to the right/best projects, there is less controversy that such spending is a "cost" of the Program. Foregone revenue is simply money that could be generated if BPA were not obligated to comply with the Power Act, the ESA, or many other laws. Compliance with the law is not a "cost." If the region were truly *spending* all of what BPA counts as the total cost of the Program on capital projects or other mitigation, that would be one thing. But as the Ninth Circuit noted, simply relying on BPA's total estimates in many years makes it appear that the region is spending almost twice as much as it actually is. Backing out the "foregone revenue" from this calculation would radically change the perception of how much the region is spending to protect fish and wildlife and could lead to different or additional recommendations (and different decisions about those recommendations) for how the Council can achieve the fish restoration requirements of the Power Act. If the region can truly afford to be spending $750 million/year without jeopardizing and economical power system, but is actually spending only $300 million/year, there would be room for far more and different measures than what has been proposed in the Draft Program.[8] The Council's treatment of this issue in the Draft continues to ignore the chilling effect that BPA's inflated figure has on the Program and on regional discourse, violating the Council's duty to inform the public with accurate information.

IV. Protected Areas Program

The Protected Areas Program is a major achievement of the Fish and Wildlife Program that helps keep functional rivers, streams, and associated fish and wildlife habitat intact around the Pacific Northwest to help mitigate for the impact of federal hydropower development in the region. It's also highly valued by the conservation and recreation communities -- the overwhelming majority of the comments and recommendations sent to the Council last fall recommended that the Protected Areas Program remain without an exception mechanism. We urge the Council to reconsider its decision to include an exception program, as exceptions from Protected Areas defeat the purpose for which the program was designed.

Should the Council decide to adopt an exception process in spite of this broad opposition, we recommend that the standard be strengthened beyond that in the Draft Program. We recommend that the Council define what constitutes a hydropower project's "exceptional benefit" for fish and wildlife in a Protected Area and clarify that mitigation activities cannot tip

[8] We recognize, of course, that these numbers fluctuate year-to-year based on market power prices and other factors. The Council's most recent draft report to the region's governors, which also adopts BPA's cost estimates, shows that BPA attempts to claim less for "foregone revenue" for 2013. These short-term fluctuations, however, do not mask that over the past 30+ years, BPA has cumulatively claimed over $3 billion in "foregone revenue" as a "cost" of the Program; a figure that nearly matches its direct program spending over that same period. *See* Draft Report to Governors at Figure 1A.

the balance in favor of excepting a Protected Area from a prohibition on hydropower on the basis of such "exceptional benefits."

Finally, some of our organizations recommended that consideration is given to expanding Protected Areas designated as critical habitat for bull trout or above dams or culverts that have been removed or modified to allow fish migration above a former barrier. We request that the Council create a process to assess and protect these areas as appropriate.

V. Columbia River Treaty

The potential overlap of the Columbia River Treaty with issues addressed by the Council's Fish and Wildlife Program is left unaddressed in the Draft Program. Areas of overlap or potential overlap with the Program include fish passage above currently impassable dams including Chief Joseph and Grand Coulee, improved flows, and flood management modifications. We encourage the Council to pledge to work with the U.S. Entity, the State Department, Northwest states, and Columbia River Tribes to facilitate public dialogue about how the Treaty can be negotiated and implemented to help improve the health of the Columbia River and its tributaries, and to seize opportunities to build on and flesh out preliminary commitments to include an "Ecosystem Function" as part of the Treaty and generally improve the status of the Columbia Basin's fish and wildlife.

VI. Toxics

The Draft Program includes a commitment to monitor, assess, and map potential impacts of hydropower on toxic contamination in the Columbia River and conduct research to better understand the impacts of such contamination on the health and productivity of native fish. We support these activities and urge the Council to pledge to take action to address issues revealed by these monitoring, assessment, mapping, and research activities.

Thank you for considering these comments.

Sincerely,

Michael Garrity
Washington State Conservation Director
American Rivers

Tom O'Keefe
Pacific Northwest Stewardship Director
American Whitewater

Kevin Lewis
Conservation Director
Idaho Rivers United

Glen Spain
Northwest Regional Director
Pacific Coast Federation of Fishermen's Associations and Institute for Fisheries Resources

Mike Petersen
Executive Director
The Lands Council

Dan Morse
Conservation Director
Oregon Natural Desert Association

Joseph Bogaard
Executive Director
Save Our *Wild* Salmon

Steve Phillips
Treasurer
Washington Wildlife Federation

John DeVoe
Executive Director
WaterWatch of Oregon

Sara Patton
Executive Director
NW Energy Coalition

Greg Haller
Conservation Director
Pacific Rivers Council

Rhett Lawrence
Conservation Director, Oregon Chapter
Sierra Club

Andrea Matzke
President
Washington Wild Rivers

ATTACHMENT 1

From:	John W. Ferguson
To:	Usha Varanasi
Cc:	John Stein
Subject:	review comments
Date:	Friday, August 07, 2009 2:58:00 PM
Attachments:	Indep scientists review BiOp AMP for Dr L_anon.docx

---

Hi Usha - I have been waaaaaaay up on the side of my house painting and unable to get to the computer these past few hours. We now have all 4 sets of comments. Overall they are positive and constructive. JES talked to Barry, and they agreed that I'm to send the attached comments to Bruce and work with him to get the comments incorporated into the Ad. Mgt. Plan. I'll send them now so they can get started, and work with the RO to incorporate them on Monday with Rich's help and maybe others. The attached comments for the RO is the "anonymous" version.

If Dr L. wants to see them directly, let me know I will make up another file that lists the reviewers actual names so she knows who said what, and I will forward that file to you so that you can email it to her.

So you know:

Reviewer 1: Joe Travis
2 - Bob Bilby
3 - PK
4- Dan Simberloff

--
John Ferguson, Ph.D.
Director, Fish Ecology Division
Northwest Fisheries Science Center
Seattle, WA 98112

P 206.860.3287
C 206.321.2075
F 206.860.3267

From: Michelle McClure
To: Bruce Suzumoto; Lynne Krasnow; John E Stein
Subject: [Fwd: Re: Notes from Biological Opinion workshop on July 7 and 8, 2009]
Date: Friday, March 26, 2010 11:42:13 AM
Attachments: FCRPSWorkshopNotesJuly7&8.doc
IndividualReportNotesJuly8.doc

-------- Original Message --------
Subject: Re: Notes from Biological Opinion workshop on July 7 and 8, 2009
Date: Fri, 26 Mar 2010 08:31:59 -0400
From: Joseph Travis <jtravis@fsu.edu>
To: Michelle McClure <Michelle.Mcclure@noaa.gov>
References: <4BABBF0D.4040402@noaa.gov>

Michelle,

I've attached two files. The file "FCRPS..." is a record of notes I took over the two days July 7 & 8 at the meeting. Normal text are notes of what others said; italicized text reflects thoughts running through my head. The end of this file contains an outline of what became the next file, "Individual Report..." The file "Individual Report..." is the guide I used in my oral report in the late afternoon of July 8; I more or less read from this document in my oral report. I have no reservations about sharing these notes or letting them be read by others.

I don't think I'll have time to review the notes you sent unless that's more important than slogging through the remand references.

Joe

----- Original Message -----
From: Michelle McClure <Michelle.Mcclure@noaa.gov>
Date: Thursday, March 25, 2010 3:53 pm
Subject: Notes from Biological Opinion workshop on July 7 and 8, 2009
To: Peter Kareiva <pkareiva@tnc.org>, mantua@atmos.washington.edu, Mary Power <mepower@berkeley.edu>, "Simberloff, Daniel" <tebo@utk.edu>, Joe Travis <travis@neuro.fsu.edu>, Bob Bilby <bob.bilby@weyerhaeuser.com>, Pete Bisson <pbisson@fs.fed.us>, Mary Ruckelshaus <Mary.Ruckelshaus@noaa.gov>

> Apologies for the double-mailing -- this got bumped for a number of
> you
> and wanted to make sure that you all got it.
>
> Michelle
>
>
>
> Dear Mary, Dan, Mary, Nate, Peter, Pete, Bob and Joe:
>
> We are in the process of compiling a written record that describes the
> content of the workshop (for the hydropower Biological Opinion) in
> whichyou participated on July 7 and 8, 2009, and are looking for
> notes taken
> during that workshop. Would you be willing to share any such notes
> thatyou might have?
>
> Similarly we have attached notes taken by Michelle McClure during the
> workshop. Notes from the final, wrap-up session with Dr. Jane
> Lubchencobegin on page 9 of MMcClure doc.pdf and attendance for
> that session is
> in the file McClure doc 2.pdf. Would you be willing to review these
> andlet us know if these notes match notes you have and match your
> recollection of the discussion? We see these as a starting point and

> want to add anything you have that improves them as a an accurate
> account of the discussions. In other words this is just a draft
> that can
> be altered as you see fit.
>
> Thank you so very much for your time.
>
> Michelle and everybody else at NOAA
>
> --
> Michelle McClure, Ph.D.
> Team Leader
> Integrated Watershed and Nearshore Ecology
> Conservation Biology Division
> Northwest Fisheries Science Center - NOAA Fisheries
> 2725 Montlake Blvd. E.
> Seattle, WA 98112
>
> phone: 206-860-3402
> fax: 206-860-3335
> email: michelle.mcclure@noaa.gov
>
>
>

Joseph Travis, Dean
College of Arts & Sciences
and Lawton Distinguished Professor of Biological Science
Florida State University
110 Longmire Building
Tallahassee, FL 32306-1280
Phone 850-644-4404
Fax 850-644-8029

--
Michelle McClure, Ph.D.
Team Leader
Integrated Watershed and Nearshore Ecology
Conservation Biology Division
Northwest Fisheries Science Center - NOAA Fisheries
2725 Montlake Blvd. E.
Seattle, WA 98112

phone: 206-860-3402
fax: 206-860-3335
email: michelle.mcclure@noaa.gov

NOTES: JULY 7 & 8 2009

Jane wants our guidance on a few key issues. We are free to add additional comments relevant to those questions but these questions are particularly useful. NOAA is interested in areas where there is strong agreement, areas where there is agreement but with some dissent, all the way to areas where there is no agreement. Individual view of each question. We should focus on the science but of course the scientific and legal aspects of the issues are intertwined.

We are talking about preventing extinction, not fostering recovery (these are different issues).

Mark Eames discusses the jeopardy standard, which asks "will the species survive" and "is there adequate potential for recovery." The litigation is focused on the latter part, how much progress one needs to make toward recovery. "Potential for recovery" is critical but that is not the same as a full recovery or a recovery plan.

Mark presents the legal issues. Quoting ESA §7(a)(2), the "jeopardy" statement:
"Each Federal agency shall…insure that any action authorized, funded, or carried out by such agency…is not likely to jeopardize the continued existence of any endangered or threatened species." There is a "listing" requirement and a "recovery" criterion in the ESA. Individual members of a protected species are protected from being "taken," meaning harassed, harmed, pursued, killed, trapped, etc. "Take" can be authorized if activities that do the "taking" meet the jeopardy standard. The Reasonable and Prudent Alternative (RPA) are actions that substitute for an action that would cause jeopardy and so must meet the jeopardy standard. At one end, the "take" provisions act on the individual organism; at the other end, the listing and delisting work at the level of the entire unit. Biological Opinions (BiOps) are aimed at the scale of the action (timber sale, FCRPS, etc.). The BiOp is not a recovery plan or an attempt to delist the species; it evaluates the effects of the proposed action and uses recovery planning in evaluating the jeopardy standard.

Our objective is to understand the relevant science. Applying the jeopardy standard raises science issues, understanding mechanisms of risk inducement and magnitude of additional risk. It is a policy issue to determine how much risk constitutes "jeopardy." Mark discusses how science and policy are interwoven throughout the language.

"Jeopardize the continued existence of" means to engage in an action that reasonably would be expected directly or indirectly to appreciably reduce the likelihood of both survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution.

"Determine whether the species can be expected to survive with an adequate potential for recovery (e.g. trending toward recovery) under the effects of the proposed or continuing action. the effects of the environmental baseline, and any cumulative effects."

NOAA believed that "trending toward recovery" is a more rigorous application of the jeopardy standard.

Michelle McClure gives overview of recovery planning. In interior Columbia, only 50% of the historically available habitat is available. This does not account for small irrigation dams and other impediments to flow that do not emerge on GIS databases. Portion of Columbia flow exported onto land is only about 8%; however, diversion occurs in summer when flow is naturally low and diversion is non-random wrt location (some basins are heavily drained, others not at all). Mary asks about evaporative loss from reservoirs compared to evaporative loss from the streams that were displaced.

How do you estimate density (number per 100 m) when the numbers are 1.0 or fewer?

An ESU is viable when its MPGs are viable: two or 50% viable, all major LHs present, etc.

Dan asks how density-dependence is incorporated. Graphs of spawner-parr relationships that were used to estimate Beverton-Holt relationships. These data do span the range of ocean conditions so variability due to ocean growth/survival incorporated into the functions. Michelle reviews empirical foundations of the overall life cycle modeling. Current operations elevate R/S compared to baseline and the projected BiOp will elevate them further except for Snake River Steelhead, which benefit from transport around the dams. Chinook do not like being transported in barges but steelhead do better. Projected BiOp will reduce levels of transport so chinook will fare better but the steelhead will fare worse. Snake River chinook are the only listed ESU in the system that migrates out as yearlings. Residualization also occurs in steelhead; if they revert to parr they do not go out to the ocean.

Habitat actions were not designed in terms of "how many dams" an ESU must cross but were designed overall to enhance potential for recovery.

Dan points out that there are extensive data for some ESUs, few data for others, and yet there were few comments about the ESUs with few data and few if any comments on the issues of heterogeneity in data amount, quality, etc.

A-run fish migrate out younger, stay in ocean less, return younger and breed at lower elevations.

RPA should emphasize data collection for B-run steelhead and other MPGs and ESUs for which the data are scarce.

Mary asks how the decision process is affected by the high variation among ESUs in data amount and quality; Chris responds that they assume that the available data are representative of the rest.

When climate is good, populations responded more to hydro operation help.

Proportional gaps are large, for the most part. And the BiOp by and large models one factor at a time, whereas recovery (ICTRT) analyses do some modeling of two factors together.

Chris Toole will walk through the Biop; what is the RPA and what is it supposed to accomplish.

Four dams in lower Columbia, four in lower Snake do not store water but create backwater. Several dams store water (e.g. Grand Coulee) and regulate water. The "action" being analyzed is the operation of the dams - how to route water and fish, how to produce power, how to manage flood control. Dams have adverse effects on fish and offsite mitigation is designed to offset the effects of the dams.

The 2000 FCRPS proposed action = jeopardy and adverse modification for 8/12 listed.
The 2008 BiOp proposes a RPA that does not jeopardize the 13 listed units (prior actions were rejected by the court). We will talk about the seven populations above Bonneville Dam, six of which have lots of data.

Prong One: can't appreciably reduce survival and elevate risk of extinction. So the technical translation is that time scale relevant is 24 years and calculate the risk over the next 24 years; use a 5% or lower risk of extinction over the next 24 years as a reasonable technical definition.

Prong Two: translate adequate potential for recovery to trend toward eventual recovery with R/S or lambda greater than one and the log of abundance increasing.

The RPA is to reduce mortality associated with dam operation; additional offsite mitigation to increase survival in other areas (various); monitoring and adaptive management.

There is no abundance criterion for meeting the jeopardy criteria but there is an implicit abundance threshold for recovery. Dan asks if a de facto abundance criterion is defined by the use of the QET(50).

Reviews the extinction risk issue: QET(50) for 24 years <= 5%. The TRT criterion uses 100 years.

Some discussion of the "recovery trend" prong of the jeopardy standard vs. the criteria for lasting recovery. To avoid jeopardy, the ESU must have a low risk of short-term extinction and be trending toward recovery; not all populations or MPGs need to meet criteria. In contrast, for recovery, all MPGs must be at low risk of extinction and each MPG must meet five low risk criteria.

Discussion of the QET(50) @24 years criterion and method. Positive autocorrelation worsens the extinction risk because populations who enter a trough tend to stay there. Mary asks why not calculate probability of achieving a particular λ rather than QET(50). Peter points out that the λ method has the advantage of better estimation than the QET(50).

JT concern about using a projection time far beyond the period of assumed past stationarity.

Discussion of the "potential for recovery" prong of the jeopardy criterion. Gave greatest weight to R/S, although it lags because it's a cohort measure. Log abundance has immediacy and the λ

method tends to be intermediate in information content. Challenge is to define the base period; too short tends to underestimate natural variation but too long will violate a stationarity assumption. Discussion of the decision not to include a time horizon (abundance target of X by year Y) and discussion of "recovery" vs. "tending to recovery." The actions will take most of the populations to a $\lambda > 1$; provide confidence limits and Pr ($\lambda > 1$).

Is there evidence that the northern pikeminnow bounty program is actually reducing salmon mortality? Where is the evidence that removing pikeminnows increases salmon survival?

Questions on hatchery fish and incorporation of hatchery effects. Peter asks about the evidence that hatchery steelhead reduce survival of wild chinook. This was not taken into account.

In discussion of habitat, Mary asks how one knows whether some mitigation action moves the system along the qualitative axis of "habitat quality." This uncertainty then propagates into the relationship between "habitat quality" and survival rate. So we have two maps, each of which is plagued by considerable uncertainty. Mary asks how the environmental baseline for habitat is determined; a static baseline was assumed.

Discussion of uncertainty and key assumptions in the BiOp. Analyses were done at the population level. No specific criteria were used to extrapolate up to the MPG or ESU levels. The conclusions were therefore qualitative at that level. Nate Mantua suggests that treating populations as independent may be misleading (are populations within MPGs synchronous, are effects correlated). Section 8.3 illustrates this for Snake River chinook and addresses the extinction as well as the trending to recovery criteria through the "roll up" to the MPG and ESU levels.

The climate change simulations actually picked a random starting date and used the subsequent string, rather than using a distribution of years, a particular autocorrelation. They say "we wanted to preserve the autocorrelation structure" but their method doesn't really explore the parameter space.

Rich Zabel suggests preserving diversity in LH within and among populations is perhaps the best hedge against the uncertainty surrounding net effects of climate change. The Crozier, Zabel, and Hamlet paper (2008, Global Change Biology) assumes 2040 conditions (FW reduction, lower productivity, etc.) and offers some predictions.

Notion of populations within a MPG as a metapopulation system in which even small simple locations like Sulphur Creek play a role as connectors among larger, more complex habitats. Thus not every population within a MPG needs to satisfy the extinction part of the jeopardy criterion (as stated in the BiOp). Discussion of the fact that the entire MPG cannot be permitted to go extinct.

Spatial autocorrelations and connections among populations within a MPG are not taken into account in the analyses.

Suggestion that we ought to offer Jane some practical, low-level recommendations about specific data collection needs, research on quantifying high-elevation steelhead, etc. beyond the RPAs.

JT concerns re climate change:
1. Full parameter space not explored in simulations
2. Steelhead encountering substantially warmer thermal regimes because they migrate earlier and a greater disconnect between winter/spring temps in future and past (less disconnect for summer thermal regimes) exacerbated by timing (their cues are for cooler temps than they will encounter).

Under present conditions, all spring/summer chinook Snake R populations are in high risk.
Under proposed RPA,
warm climate assumption: majority move to moderate risk, others in high risk
recent: most in moderate risk, a couple in high and a couple in low
cool: none in high, some in moderate, majority in low, and a couple in very low
THIS DOES NOT TAKE FW EFFECTS INTO ACCOUNT

Jeopardy Criteria:
Base: 4/17 have QET50 <= 5%
RPA: 7 to 9/17 have QET50 <= 5%, with some having also safety net hatcheries

Survival gaps for QET50 very large for some MPGs/population, negative for a few.

Base: 8/23 have R/S > 1, 13 to 19 lambda > 1, 15/22 log abund > 1
RPA: 19/23 R/S > 1, avg 1.5, 18 to 22/22 lambda, 15 to 18/22 for log abund

The prospective 20-year R/S CI are asymmetric around the average, suggesting a skewed distribution with more probability mass at the lower end. Is this the case?

With respect to the viability of the MPGs on spring/summer Snake chinook,
Base: none
RPA: no MPGs expected to be viable because no populations are expected to be highly viable
2/5 MPGs will meet the jeopardy criteria
Not all populations meet the jeopardy criteria
With respect to the ESUs, similar conclusions?

For other ESUs, Chris says by and large the majority of Snake River fall chinook and steelhead populations meet the jeopardy criteria, particularly the A-runs. Snake River sockeye are in trouble and won't be helped. Middle Columbia River steelhead are in best shape of any; with exception of the upper Yakima population, populations meet the jeopardy criteria. Majority or most populations will be likely to have R/S > 1 under the BiOp.

Dan asks which RPA actions that are favorable for some populations will be detrimental to others? That is, where are the conflicts? Spring transportation: more spill helps in-river fish but you collect fewer fish for transportation (steelhead do better with transportation), so more spill helps the chinook (who don't benefit from transportation) but harms the steelhead because you

collect fewer of the fish that would benefit from transportation. But when done early in the year, the effect on steelhead is less pronounced. Chinook do better in transport when transport is later in the year so the recommendation is to rely on spill early and transport later.

Dan raises the notion that interspecific interactions were completely ignored. Peter shows that hatchery coho have five times the density effects than natural fish - so wild vs. hatchery fish have different density-dependent relationships. The hatchery fish show stronger density effects than wild fish and it is more pronounced in bad ocean years. (Peter refers to this paper). Eric Buell is the author…

Upper Columbia steelhead are kept going by hatchery fish but the genetic diversity is being compromised. The current genetic signal of the Upper Columbia above Grand Coulee is such that populations are indistinguishable as a legacy of the commingling at the early years of the Grand Coulee dam. Some populations have as few as 25 breeding fish. The hatcheries avoid demographic risk but the proportion of hatchery origin fish is so high that if you stopped the hatcheries the populations would go extinct.

Mary asks if the hatchery output could be separated in space and time from the wild fish so that they can be segregated in a way that allows harvest to the tribes and fishers but gives the wild fish the opportunity to get head starts, etc.

Segregation of hatchery fish…give wild fish a head start in body size

Dan raises again the issue of interspecific interactions in the ocean…

John (Ferguson) raises the idea that in an ideal world, hatchery production would be decreased in years when ocean conditions will be poor. ***THIS COULD BE DEVELOPED AS A NICE EXAMPLE OF THE IMPORTANCE OF BASIC RESEARCH FOR AN APPLIED PROBLEM THAT MIGHT NOT HAVE BEEN ANTICIPATED AT THE OUTSET.***

Cormorants and terns take 12-14% of steelhead, 2-4% of coho, 1-2% of spring/summer chinook. The effect on steelhead is about 2% drop in lambda. There is discussion that shad could be helping predators and then enhancing predator effects on salmon (indirect effects of interacting species in the food web).

The technology to separate species is not refined.

Interspecific interactions are an area in which what we know is enough to suggest that they are important, that actions could be taken to help, that this is an area ripe for further research, that adaptive management must keep an eye on this topic, that the RPA doesn't take them into account, and that alternatives to the RPA might profitably focus on this area.

The Yakima tribe wants to reintroduce coho via hatcheries into one of the systems from which they have gone extinct.

Dan asks about competitive release in habitat as a result of ESU local extinction. None reported. However, there is some evidence for anadromous/ resident fish interactions over habitat. As anadromous fish go down, resident fish expand into their breeding habitats.

Mary raises the issue of population resilience as conferred via life history polymorphism/phenism.

JT asks about the thermal regime issues. There is one dam where thermal regimes can be adjusted (Dworshack dam). Dam operation will reserve as much water as possible in winter and spring. Dworshack operation seems to be doing the best possible job, at least for fall chinook where there could be a problem of water availability and stream flow.

There is no specific plan in the RPA for acting in tributaries/streams for habitat modification for thermal issues arising from climate change. Several planned actions in tributaries will be useful for climate change issues but may not be well linked in text. No monitoring is actually required but it is left to local groups to monitor. But there are flow meters and thermal meters all over the place…flow and thermal measurements/monitoring not well coordinated. Also need to match monitoring of fish with monitoring of abiotic environment.

While the BiOp says "fish in and fish out must be measured" there is insufficient justification of what the questions are, how those measurements will be used, why they ought to be matched to other measurements, etc.

Some discussion ensues of water withdrawals and how they affect seeps and the requirements for water transactions. Mary asks about groundwater heat and water budgets as a way to understand thermal regimes; the thermal seeps are the lifeline for salmon and other fish.

The habitat modification plans are really describing an expert panel process through which such modifications would occur. But there are specific projects in the Action Agencies Biological Assessment that are already underway. Peter asks if the plans include any kind of experimental or quasi-experimental component that would enable assessment as to effectiveness. Biological Assessment Appendices described (JT examines, Chris posts on screen, etc.).

Mary asks about whether the trigger for adaptive management includes fish data. Mary asks that we be walked through the process of "triggering." This process is described in the Action Agencies' Biological Assessment.

Tom raises the problem of how difficult it will be to determine if the actions are working. This intersects with the "fish in/fish out" data collection problem. This is at the heart of one of our questions. ***More effort is needed to gather data on juveniles, estuary survival, etc., to separate FW effects from ocean effects and identify whether things are working and/or why. Emphasis on requiring data collection, collation, and coordination.***

Peter raises the issue of whether we could use previous conditions as the expectation. That is, if run numbers drop down to the levels of mid-90's even while ocean conditions remain good, then this should trigger a wholesale reassessment. Again, the data collection, collation, and

coordination is important. Mary points out that there is a danger of false positives: ocean conditions can be causing improvement even while FW conditions contribute to downturn. The danger is that as soon as ocean conditions turn, collapse ensues.

Mary raises the issue of whether there will be monitoring of the diversity of life histories. There are some plans to do so.

JT asks about hatcheries and BMPs. The BMPs are specified, the hatchery group has reviewed practices, hatchery by hatchery, and it is clear which hatchery programs need reform. The RPA does anticipate RME for effects of hatchery fish and hatchery reform. Discussion revolves around presumed effects of hatchery supplementation.

Peter raises the issue of non-native species (Beth Sanderson's paper in BioScience in March). Dan wishes to hold off until Executive Session. Smallmouth bass are swarming in the John Day Creek, northern pikeminnow, etc., and these fish are warm-water predators and so the future effect could be substantial.

The Harvest RPAs are RME efforts applied solely to in-river fisheries. Of the seven ESUs above Bonneville, only Fall Chinook are affected by mixed-species ocean harvest. The others have virtually all harvest as in-river. The average in-river harvest for spring chinook has been 8-9%. The harvest managers are exerting inadvertant selection for later run when run is actually low.

Question One

a) Was it a great scientific analysis? Yes.

Hydro and harvest data and analyses are relatively strong

Habitat and hatchery data weak

Single species models; interspecific interactions and invasive riparian species were not taken into account

b) Is the RPA likely to be effective? Do we agree with the interpretation of analyses and diagnosis and effectiveness?

Assumptions about hatchery effects and habitat may not be justified and so some of us do not agree with the optimism. We simply cannot be sure.

Tributary habitat (absence of data): lacks connections between habitat actions and conditions and, more important, habitat conditions and survival.

Hydro relies upon the will to execute in hard times.

Effectiveness of the RPA is really going to be heavily influenced by climate change and land use change, two issues not well addressed in the RPA.

Question Two

Not only has the baseline been changing so are the surrounding context variables like land use and climate. Should look for change in status, not absolute values; e.g. listed ESU is in trouble if abundance of wild fish declines for n straight years (n could be 4); see IUCN analysis. We're not sure how to integrate relative abundance.

Declines in juveniles coming out must be monitored to avoid the false positive and distinguish effects in ocean from effects in FW. We're not sure what changes in these counts should trigger action because of inability to distinguish progeny of hatchery fish. Some sampling of size for age and condition of juveniles could be early warning.

Physical conditions like multi-year droughts should be triggers for close examination

Observations of spread of pathogen, novel pathogen, novel illnesses etc. should trigger close examination and rapid action. RME ought to assay for such things.

Question Three

If things really get bad, examine in-river harvest because it is the most quick and effective action one could take.

Reduce hatchery output when ocean conditions predicted to be bad b/c density-dependence; time frame could be relatively short.

JT thinks hatchery practice needs considerable additional reform, giving wild fish size-advantage, migration advantage, etc. etc. Time frame will be longer because of considerable change that is needed.

Should examine opportunities to re-establish extinct runs to reduce ESU extinction risk

More aggressive effort to control/eradicate introduced predatory fish and a broader, more creative effort to control.

Breaching the dams can be considered (bad in short run, good in long run; Snake used to offer 50% or more of the historical salmon biomass)

Question Four

Uncertainty about so many issues indicates that the adaptive management triggers should be set in a precautionary manner, that is, jump sooner rather than later. The thresholds for action need to be set lower.

Increased coordinated monitoring and assessment of combined flow, thermal regime, and fish numbers. The IMS could be complemented by a more widespread program of monitoring fish in/fish out, flow, and thermal regime, choosing a design based on predicted sensitivity to climate change.

Tributary habitat responses and marine environment responses

Critical need for studies on interactions on multiple factors: thermal regime, habitat structure, pathogens, density, etc. The study of interacting forces leads to understanding cumulative effects, which are NOT LIKELY TO BE ADDITIVE.

Explicit spatial modeling is needed, rather than considering populations as independent units that add to a MPG which add to an ESU.

Someone needs to understand effects of wells, subterranean water withdrawals, and other water-use actions on flow, thermal regime, etc.

Systematic inventory of cool water refuges throughout the basin (forward looking infrared).

Study of the integrated water resources to examine how to shape water flow through the entire system. Proposed changes are subtle and coordinated for hydropower production and flood control, not salmon.

Impact of individual introduced species on particular ESUs to really understand which ones pose the most danger and offer the most worthwhile cost-benefit effort.

WE CAN LINK THESE TO SPECIFIC OBJECTIVES….

NOTES ON INDIVIDUAL REPORTS FROM INVITED SCIENTISTS

Question One

This question has two parts that must be answered separately.

a) Is the scientific analysis credible?

Yes. The scientific analysis was a cutting-edge analysis of single species demographic models. The analysis used the best collection of available data and cutting-edge methods. The execution was rigorous and the analysis was thorough in its coverage of the issues to the extent that data made coverage possible. There is considerable uncertainty in the operation of many driving forces, particularly the future effects of climate change, and the analysis took a reasonable approach to taking that uncertainty into account. Obviously other reasonable approaches are possible.

The data on hydro operation and harvest effects are strong and so the analyses of these factors are the strongest in the collection and inspire confidence.

The data on habitat and hatchery effects are not as strong and the analyses of these factors is correspondingly less strong.

Two factors likely to be important, interspecific interactions (particularly among salmon species and between salmon and native competitors/predators) and introduced fish predators (e.g. smallmouth bass) were not considered because robust data on these factors are scarce at best.

b) Is the RPA likely to be effective?

The actions described for hydro operation and harvest are likely to be effective. The major factors that could compromise that effectiveness are climate change and land use changes. If changing climate brings a multi-year drought, the effectiveness of the RPA will depend on how hydro operations respond to prolonged drought, that is, whether hydro operations can be performed in ways that enhance the environment for the fish as described in the RPA.

The actions described for tributary habitat effects and hatchery effects rely heavily on assumptions made about those effects in the absence of compelling data. These assumptions may not be justified and there may not be as much cause for optimism in these areas as the RPA contains. There are no strong data that reveal the precise relationships between habitat actions and habitat quality and, more importantly, between habitat quality and salmon survival and growth. While the direction of the effect of proposed actions in the RPA on salmon survival and growth is clear (i.e. we know which habitat features are qualitatively "good"), the numerical gain in survival from a given effort in habitat is unknown and thus the effectiveness of the RPA in this area depends wholly upon the assumptions made in the analysis.

The same story can be told for hatchery effects.

Finally, the effectiveness of the RPA will be influenced heavily by climate change effects. This is important because such effects could conceivably mask the effectiveness of actions described in the RPA, leading to a misleading diagnosis of failure. Alternatively, favorable ocean conditions could enhance salmon populations regardless of actions and lead to a false diagnosis of success. More or different monitoring schemes will be necessary to allow a sharper diagnosis of effectiveness in this light and distinguish action effectiveness from other uncontrollable effects.

Question Two

In answering this question it is important to acknowledge two challenges. First, salmon population numbers, like most animal populations, are inherently variable from one year to another. Second, the baseline condition used in the scientific analysis has in fact been changing. Stationarity (assuming that conditions have not changed over the last n years) is demonstrably false. These challenges indicate that determining whether an ESU is in trouble should be based on change in status, not absolute values. A listed ESU ought to be considered "in trouble" if abundance of **wild** fish declines for m straight years (m could be 4); this reflects the recent analyses and actions of the IUCN that led to changing its classification scheme. Relative abundance should be integrated into this diagnostic algorithm (e.g. a consistent drop from 1,000 fish to 990 fish over four years is not as alarming as a drop from 50 fish to 30 fish) but how precisely to do this requires more thought. In any case, a consistent decline in absolute abundance should become a trigger for action.

Declines in juveniles coming out of selected reaches and watersheds must be monitored to help distinguish effects of ocean regime changes from effects of the RPA or other effects occurring in freshwater. We're not sure what changes in these counts should trigger action because of inability to distinguish second or third generation progeny of hatchery fish from pure wild fish. However, including knowledge of numbers of hatchery fish added should allow the numbers of juveniles moving out to be interpreted wisely. Some sampling of size for age and condition of juveniles could be early warning of developing problems.

Catastrophic physical conditions like multi-year droughts, widespread wildfires, etc. should be triggers for close examination

Observations of sudden changes in biotic factors like an outbreak of insects that can strip foliage of riparian vegetation, appearance of a novel pathogen or invasive species, sudden spread of a pathogen that had been restricted in range and prevalence, etc. should trigger close examination and rapid action. RME ought to assay for such things.

Question Three

Suggestions arranged roughly from measures that can be implemented quickly and whose effects could emerge quickly to those that would take longer times to implement and much longer times for the positive effects, if any, to emerge:

Examine in-river harvest; adjusting this factor is the quickest and most effective action one could take. The effects of in-river harvest on R/S or λ are substantial.

Reduce hatchery output when ocean conditions predicted to be unfavorable for salmon survival and growth. There is a growing body of evidence for density-dependence in the ocean and in this light, producing high densities of juveniles will be counterproductive.

Should examine opportunities to re-establish extinct runs in reaches that are accessible. Increasing the number of populations within a MPG and ESU will reduce ESU extinction risk and enhance the potential for recovery.

There must be a more aggressive effort to control/eradicate predatory fish, especially introduced predators, and that effort should embrace a broader, more creative set of strategies beyond the bounty system. Advances in genetics and endocrinology in other systems offer illustrations of how this could be done.

Breaching the dams can be considered. The short-term effect of breaching could be very bad for all ESUs but the obvious long-term effect will be positive, presuming that listed ESUs survive through the short-term deleterious effects.

Question Four

Uncertainty about so many issues surrounding climate change, along with the rapidity with which the effects of climate change could unfold, indicates that the adaptive management triggers should be set in a precautionary manner. In other words, the thresholds for action need to be set lower. In addition, the Action Agencies need to develop a "rapid response" mechanism. This mechanism could combine "citizen science," using people to monitor particularly straightforward warning signs like introduced species, whirling disease, etc. so that early warnings are more easily obtained, with a plan for responding quickly to those warning signs.

There should be an increase in the coordinated monitoring and assessment of flow patterns, thermal regime, and fish numbers in critical reaches and tributaries. The IMW (intensively monitored watersheds) could be complemented by a more widespread program of monitoring fish in/fish out, flow, and thermal regime, choosing a sampling design based on predicted sensitivity to climate change. This might be done by reallocating current effort rather than a large increase in investment.

There should be a commitment to gathering experimental data on the effects of habitat actions on habitat quality and the precise relationship of habitat quality and salmon survival and growth. Correlative data are helpful but rigorous experimental data are necessary.

There is a critical need for studies on the synergistic effects of multiple factors: thermal regime, habitat structure, pathogens, density, etc. Data in hand for many animals indicates that the effects of one factor depend upon the state of another (e.g. virulence changes with temperature). The study of synergisms or statistical interactions is vital for understanding cumulative effects

because those effects are not likely to be additive and so studies of one factor at a time will be grossly misleading about cumulative effects.

Explicit spatial modeling of populations within MPGs and ESUs is needed, rather than considering populations as independent units whose effects are simply added up to reveal the effects on MPGs and ESUs. Extinction risks and recovery potential estimates could be changed in some cases by models that incorporate what is known about the connectivity among populations.

We need a much better understanding of the effects of water-use actions (e.g. wells, irrigation canals) on riverine and hyporheic flow and thermal regime of streams. Subterranean flows, with emergence as seeps and springs, create thermal refuges for salmon that will be increasingly important as the climate changes and understanding the distribution of these refuges and how water-use actions affects them is important. This also leads to a call for understanding how water flow through the entire system ought to be shaped for salmon in the face of climate change.

There is a great need for precise data on the effects of particular introduced species on particular ESUs. Precise data would enable diagnosis of which invasive taxa pose the most danger and which ESUs are most vulnerable, which would lead to a more cost-effective effort in targeting the biggest problems for remediation.

Independent scientist comments on draft FCRPS BiOp Adaptive Management Plan issue papers and trigger documents

August 7, 2009

A. Reviewer #1's comments on climate change, reintroduction, life-cycle modeling, and triggers:

The "reintroduction" sheet looks good, meaning it captures what the independent scientists were suggesting and translates that suggestion into a thoughtful approach. I like it.

The "life cycle modeling" sheet looks OK. On the positive side, it says the right things and does capture the broad sense of what the independent scientists were suggesting. On the negative side, it doesn't state clearly, under "spatially explicit modeling" what the scientists had in mind. As I read it, the text says "we'll add more populations" but what the scientists were suggesting was incorporating explicit knowledge of population location into the modeling. The point about spatially explicit modeling is that knowledge of relative position could change outcomes. For example, adjacent populations might be expected to experience conditions more similar to one another (stream productivity, predator densities, competitors, etc.) but that as populations become more widely separated, the correlation between them in extrinsic factors decreases. The cumulative effect is to tie populations together so that instead of having an ESU consist of n distinct populations doing their thing independently, correlations and correlation structures could create m groups, where m < n and each unit m is larger than a single population and so outcomes could be different. In other words, modeling connected populations with explicit correlation structures could lead to different conclusions about extinction risk than modeling the same number of independent populations. Anyway, I don' think the text as written captures the "why" of spatially explicit modeling and could be read as merely advocating trying to add more populations to the model.

I don't think I can do much more today.

B. Reviewer #2's comments on climate change, IMW's, and RME:

I think the documents look pretty good. Once implemented, these actions should be very helpful in focusing and coordinating salmon research in the basin. If there isn't already thorough description of the adaptive management process that will be used to incorporate findings from the RM&E, IMWs and climate change research into management actions, adding some specificity to this process may be a worthwhile addition to the Biop. I would think that a Biop Issue Paper that outlines a well-defined Adaptive Management process would reinforce that there

is a clear pathway from the science components to implementation on the ground, thereby increasing the probability that the program will be successful. A few additional suggestions:

1) One of the big challenges the IMWs will face is the implementation of enough habitat actions over a short period of time to be able to detect a response at the fish in/fish out level. A indication that support will be available both for the continuation of data collection as well as implementation of the habitat treatments would help ensure that these projects provide meaningful results.

2) In the RM&E document, you might add a line that indicates that the broader RM&E efforts will be coordinated with the IMWs so that IMW results can be more reliably extended to non-IMW watersheds.

3) I think the first sentence in the Climate Change document is a bit harsh regarding current research of climate change: "No monitoring actions are currently implemented under the FCRPS BO to detect specific impacts of a changing climate on fish population processes;...". Although there may be no FCRPS supported projects that are designed solely to examine potential climate change effects on fish populations, as indicated later in the document, many of the ongoing RM&E efforts are collecting data that are relevant to understanding possible climate change impacts. You might consider introducing this topic by indicating that relevant information is being collected and the need is to compile this information and interpret it in light of predicted impacts of climate change on the Columbia Basin.

4) It would also be worthwhile to indicate that some of the enhancements proposed in the RM&E document will provide information important for addressing climate change impacts. In particular, the inventory of the cold-water refugia will be very important.

Hope these comments are useful.

C. Reviewer #3's comments on climate change, life-cycle modeling, triggers, and RME:

I read everything you sent my way. The steps these documents outline represent an ambitious and commendable investment in monitoring and analyses that could help insure salmon viability. The breadth, general thinking, and comprehensiveness of actions described are on target. I do have some concerns—most likely reflecting the lack of details. These documents and plans were obviously prepared under a tight time schedule, so the absence of detail is understandable.

1. There has been extensive research trying to link habitat features (and that includes things like water flow variability) to salmon productivity and, to my knowledge, there has been little success. Yet, the life-cycle modeling is saying it is going to link climate variability to salmon productivity. Models such as these will need to acknowledge the uncertainty that still exists about how climate and habitat affects populations. Given the decades of life-cycle modeling already completed, it is important this line of work be focused -- what exactly new and different is going to be done?

2. "Faster, more efficient reporting of annual adult returns (at population and MPG level)", is an extremely important objective. Even better, it will be simple to determine whether this objective has been met.

#3 "Expanded habitat status and trend monitoring (e.g., flow, temperature, sediment, channel complexity, riparian area/composition, floodplain connectivity, habitat access, land use conversion, etc.)" This is certainly reasonable. But it is my experience that already there is a ton of data collected that is never used. The key here is investing in and enforcing coordination and open-access sharing of the data. Part of this coordination is the establishment of some uniform metrics. Without region-wide and multi-agency coordination this will be money for naught.

#4 "Improved understanding of relationships between habitat quality and fish response (e.g., stream/watershed- and population-scale estimates of juvenile outmigrants per adult spawner; size and condition of juveniles, etc.)" This is a research career topic. I assume this is going to be sharpened to a series of answerable questions in some sort of logical sequence.

#5 "Effects of non-native predator/competitor species in mainstem reaches and tributaries:" which is then followed again by a series of points most of which are 5-10-yr research goal. Again, a series of research career topics. Again I assume this will be sharpened into a series of questions with some notion of priorities and sequence.

#5. Spatially explicit modeling" is not just a matter of adding populations—the explicitness needs to consider spatial correlation in dynamics (can be estimated) and straying or dispersal (harder to measure but can be varied in a simulation). Currently the risk analyses tend to be one index stock or subpopulation at a time—the whole point of this spatially explicit modeling is to get a sense of risk for the ESU as a whole.

In sum, I would say my major comment is that obviously this thinking needs some sharpening in terms of more specific questions, and most of all, this will be worthwhile only if the monitoring in coordinated region-wide, and only if data are much more accessible and freely shared than is the current situation.

Turning to the trigger document:

1. My main point here is that even though it is smart to seek simple, transparent triggers that the public can easily understand, underlying those simple triggers should be some deeper peer reviewed science that examines their implications. I do not think NOAA is quite there yet—but I am confident given the scientific talent they have at NWFSC, the appropriate quality analyses could be done. To be more constructive, let me give some idncation of the type of analyses that need to be done. The trigger document states: "A Beverton-Holt production function was fit to Lower Granite Dam natural adult abundances during the 1978-1994 period and then projected forward 24 years." I've never seen a study that showed you can distinguish between one production function from another with salmon data. Thus using only a Bev-Holt is not reasonable. When this analysis is done for real, different production functions should be compared. A density-independent model needs to also be used since unless the population is clearly fluctuating around some level, you can't distinguish the dynamics from random walk.

2. I also bet that the likelihoods on the parameters of these density-dependent models are flat or ridge like, meaning a bunch of forms of the model can fit the data fairly equally. If the threshold is sensitive to the parameter values, then I'd be very suspicious of that trigger level. It is also not clear how this initial analysis accounted for parameter estimation uncertainty so I'm guessing they might have used the point estimates of the parameters. Some decision has to be made how to deal with parameter uncertainty.

3. It would also pay to look more carefully at the empirical-based exceedence curves. Specifically I would subsample different time-series lengths, and ask to what extent the exceedence curves change as a function of whether 20, 25, 30, 35 or 40 years of data are used to generate them. If the exceedence curves have not stabilized by 40 years of data, then one would want to account for that instability.

4. Triggers are nice in that they are simple. But just an abundance level trigger seems too conservative. Imagine the population declined every year for 23 years and then hit the trigger in year 24. Well, it was hardly an "unexpected" severe decline. It was in fact completely expected. So I think unexpected consecutive declines would also be a good trigger. You can also do the probability of 2, 3, 4, 5, etc consecutive years of decline and come up with a number of consecutive declines that is unexpected.

5. Lastly this trigger idea is very important practical work, and is likely going to be an approach needed for many species, populations, and systems beyond salmon. NOAA has a chance to lead on this. Understandably, given the short time period allowed, what has been done thus far is a bit “seat-of-the-pants”. It is essential this be treated like a serious research topic and is published in peer

reviewed journals. The science will be better, and the science will be available to a world that is going to need a lot of "trigger-type" adaptive management approaches given the pace of global change.

D. Reviewer #4's comments on non-indigenous species, monitoring for new pathogens and disease outbreaks, and triggers:

This is great; it is exciting to see the Plan tweaked in these important ways. I see you had to work very quickly and have made good progress nevertheless. I have a few comments below on 2 of the documents. These are meant to be constructive. Possibly you've already thought of much of what I say below and decided on the basis of better knowledge not to move in these directions.

Contingency framework

Adult triggers

I applaud the development of the 2 triggers, and especially the Unexpected Severe Decline (USD) trigger, as a great addition to the management plan – in fact, I think this should become a model for management plans for other T&E species. Having said this, and recognizing that you are working under tremendous time constraints, I think the triggers, or at least the justification of the specific USD triggers for particular species, could be strengthened. I'm made nervous by the use of 4-year rolling averages, though I understand the concern to avoid false negatives. The problem, though, is that averages can mask a lot. I would ask you to consider this: For actual data, for what X would a run of X straight years of decline **not** give false negatives? That is, examining the data year by year and run by run, can you identify such an X (need not be the same for each run of each species), or for all species and all runs are the data so variable that it's just not possible? You are certainly in the ballpark of the IUCN recommendations, but even these recommendations don't mandate that it has to be 4 years.

A related point – You can use the distribution of runs of your models, with all their warts, to see for what X it would be surprising to see X straight years of decline, and also what is the short term fate of populations in runs that experience X straight years of decline. What fraction of them recover as opposed to crash? Is there some threshold X such that for X or more straight years of decline, a crash is likely, but for fewer than X, recovery is likely? I think your runs could help select and fine-tune your triggers, and the triggers would not have to be identical for each species.

I can see why you are developing these USD triggers for entire ESUs, but ultimately it would be much better to develop them for MPGs, and maybe even populations. It is entirely conceivable – in fact, it has happened – that particular

MPGs decline while others are stable or increase. Of course the ESU is the sum of the MPGs, but the real action that causes a decline, and the actions that might redress it, will usually be at the MPG level, I think, so since the whole idea of triggers is to be able to be proactive, this is the level at which they can have the biggest impact. Even if not all the MPGs have adequate adult abundance level data, some do, and these should be used as triggers.

The exceedance curve approach is cool and easy to interpret, granted. I'm not so sure that your prospective analyses with fitted Beverton-Holt production functions really provide that much support to the use of exeedance curves, at least as presented. How robust are resulting trajectories to variation in parameter values?

The hard and soft triggers seem like a good idea, but, as above, I'd be interested in what the various model runs actually showed, probabilistically, particularly for the level at which to set the hard trigger. That is, for example, if X were the hard trigger, for what fraction of runs that reached the X trigger did the population crash in the short term after that?

The early warning (EW) trigger seems like an excellent idea, but, as above, it should be construed at the MPG level whenever data are possible, because that is where the triggered actions are most likely to have an effect. Of course, steps 2 and 3 are crucial here, and you haven't given details, but maybe that's impossible to do in general anyway because of the great number of possible indicators. It might be good at least to list them specifically. In essence what you are doing with EW and USD triggers is exactly the reasoning that went into the formulation of the 2 categories "threatened" and "endangered" in the ESA.

Future juvenile triggers – great idea.

<u>BiOp Issue paper on non-indigenous species</u>

Every single thing listed in this document is not only reasonable but important and urgent. However, it would be good if you can be more explicit about the linkage between the ongoing research and overall modeling, and triggers, that govern the actual activities on the ground now and in the near future. That is, there is every reason to think in light of Sanderson et al. 2009 and what you've written that NIS are already a major factor in some cases and will increasingly be major factors in many. Are there data already in hand (e.g., Levin et al. 2002) that could actually be incorporated into predictions and triggers now, for some ESUs and, one hopes, MPGs? Once all the work outlined in the BiOp Issue paper is well underway and some is completed, how exactly will that information be integrated with other factors in implementing actions on the ground? All this is to say that these appear to be both tractable and important research areas, and I'm sure you'll do them or get them done right, if they are funded as planned. But what then, exactly? And what can be done (or is being done) now? I've often

worried that just because “invasive species” doesn’t start with an H, it is sort of a stepchild in both modeling and planning. How will it be integrated with other factors in both arenas?

BiOp Issue paper on climate change and disease monitoring

Looks fine to me. I have no specific comments.

From:	Michelle McClure
To:	Mark Eames; Lynne Krasnow; Bruce Suzumoto
Subject:	[Fwd: Re: [Fwd: Re: notes from wrap up session]]
Date:	Thursday, April 01, 2010 7:02:34 PM
Attachments:	MMcClure wrap up notes.pdf

Here are the notes I sent to Pete for review. I believe that they are already in the record, but this will make it clear exactly what I sent.

Michelle

-------- Original Message --------
Subject: Re: [Fwd: Re: notes from wrap up session]
Date: Thu, 01 Apr 2010 13:24:23 -0700
From: Mark Eames <Mark.Eames@noaa.gov>
To: Michelle McClure <Michelle.Mcclure@noaa.gov>
References: <4BB4399B.2080207@noaa.gov>

Michelle,

This is helpful. Can you forward your notes that Pete reviewed? Also copy Lynne and Bruce for the record.

Thanks,

Mark

Michelle McClure wrote:

> -------- Original Message --------
> **Subject:** Re: notes from wrap up session
> **Date:** Wed, 31 Mar 2010 15:49:42 -0700
> **From:** Pete Bisson <pbisson@fs.fed.us>
> **To:** Michelle McClure <Michelle.Mcclure@noaa.gov>
>
> Hi Michelle,
>
> I think your notes are accurate. I can't think of anything significant to add. Good job.
>
> Pete
>
> **********
> Peter A. Bisson
> USDA Forest Service
> PNW Research Station
> Olympia Forestry Sciences Laboratory
> 3625 93rd Avenue SW
> Olympia, WA 98512-9193

Office – (360) 753-7671
Fax – (360) 753-7737
pbisson@fs.fed.us
****

Michelle McClure
<Michelle.Mcclure@noaa.gov>

To Pete Bisson <pbisson@fs.fed.us>
cc

03/30/2010 03:05 PM

Subject notes from wrap up session

--
Michelle McClure, Ph.D.
Team Leader
Integrated Watershed and Nearshore Ecology
Conservation Biology Division
Northwest Fisheries Science Center - NOAA Fisheries
2725 Montlake Blvd. E.
Seattle, WA 98112

phone: 206-860-3402
fax: 206-860-3335
email: michelle.mcclure@noaa.gov

[attachment "MMcClure wrap up notes.zip" deleted by Pete Bisson/PNW/USDAFS]

--
Michelle McClure, Ph.D.
Team Leader
Integrated Watershed and Nearshore Ecology
Conservation Biology Division
Northwest Fisheries Science Center - NOAA Fisheries
2725 Montlake Blvd. E.
Seattle, WA 98112

phone: 206-860-3402
fax: 206-860-3335
email: michelle.mcclure@noaa.gov

--
Michelle McClure, Ph.D.
Team Leader
Integrated Watershed and Nearshore Ecology
Conservation Biology Division
Northwest Fisheries Science Center - NOAA Fisheries
2725 Montlake Blvd. E.
Seattle, WA 98112

phone: 206-860-3402
fax: 206-860-3335
email: michelle.mcclure@noaa.gov

MHM
7/8/09 ①

July 8, 2009 - Science Workshop Finale

present: Coby, Barry T, Usha, Tom C., Rich H, Kitchie G, Kate Burkett, Kim K., Jeff Stier, Chris T., Pat Pitts, Mark Eames, Kelly Dent, Bruce Suzumoto

Rick Satt, Jane Cabrera, Steve Wright, Ted Bowling, Marion Medina, Craig ___ (Army)

Pete Bisson, Bob Bilby, Mary Ruckelshaus, Joe Travis, Dan Simberloff

phone: Nate Mantua, Peter Kareiva

phone: Mary Beth Ward, Rick Hogan, John Ferguson, Lynn Krasnow, — Dave, Eileen, birth of folks, Corps, Bob R, Don J

Lori, Bob, John Hurley,

Jen Castriza
Martin Cohen
Tanya Dobinski
Jean Williams

MHM
7/8/09 (2)

1. Uses of SI analysis + effectiveness of RPA in B.Op

a. SI Analysis — yes, quite good
hydrof/harvest → strong (due to data)
hab/hath → data weaker, analytical method ok
great SI analyses of single spp effects

Improvement
① Interspecific interactions
② Role of invasive spp

b. RPA — harder to answer
analysis of effects
assumptions of hab + hathery may not be justified
weakness of data
lack of certain connection b/w actions → conditions → survival
"not clearly demonstrated"
don't share optimism in BOp

hydro effects — will depend on will to execute during hard times
effectiveness
will be heavily influenced by land use Δ + climate Δ

MMH
7/8/09 (3)

Simberloff → interspecific interactions
lots of detail on effects of density-dependence
no treatment of interspecific interactions
guessing that could be substantial
introduced spp. → not dealt w/ sufficiently
lessens confidence in effect of RPA

Korman — hab conclusions optimistic, but not
unreasonable — lack of solid data
lots of data about degradation, but not
linked to survival (data not there to
show "if you do it what will happen"

Bilby — what we don't know is quantitative response

Bisson — needs improvement in program to monitor
status & trends of habitats at large scales

Mantua — gauging effectiveness will be hard to
disentangle from annual variation in climate
effects

Ruckelshaus — land & water use demands add to
uncertainty — challenge ability to disentangle
effects

RockSalt
Q — will hab improvements lead to ↑ in smolts?
Bilby — need studies to do that to link
quantitatively actions → survival
Simberloff - yes, would expect that,
Travis — can't link magnitude of effort to
Δ in survival or extinction risk

MMH
7/8/09 (4)

baseline is changing → effect of improvements might be masked by Δ in land use

Rock Salt – may be able to alter land use patterns

Bilby – land use not explicitly considered except as static in the baseline

Barry Thom – riparian invasives vs. invasive ~~pred~~ obs spp?

Suberkropp – riparian habitat gap steel, brook trout, bass

Zabel – recommendations?

Travis – coming in 2, 3, 4

distinguish great analyses from confidence that RPA will achieve goals

Lubchenco – RPA is reasonable & prudent

how much less certain are we?

Travis/Ruckelshaus → lack of confidence in effectiveness

Lubchenco – above b/w D & 100%

Ruckelshaus – higher confidence in hydro/flow than hab/habitat

Bisson – agreement that for 40 yrs have engaged in habitat restoration but no corresponding Δ in pop status has been observed partly due to lack of empirical data

Karuza – no one would bet houses, but all reasonable actions to take

MHM
7/8/09 (5)

Mantua - 50/50 chance of climate driven movement up or down (in ? status) rather than these actions
climate impacts greater than impact of RPA
Ruckelshaus - spatial heterogeneity in effectiveness of RPA & climate
Varanasi - if climate trumps RPA, what would be effect of climate w/o RPA?
Mantua - difficult to tell whether our actions have changed productivity given climate variability

2. Info required to determine that an ESU is in trouble? How to identify

Baseline has been changing
Deciding where its in trouble has to be done in that context → prudence very important

- Need to monitor closely - note Δ in relative status
  - abundance of wild spawners fish declines for a generation (4 straight yrs)
  - relative abundance needs to be incorporated
  - declines in # of juveniles
    need to distinguish ocean conditions from fw effects
    ideally - hatch vs. wild offspring

MHM
7/8/09
(6)

- counts of juveniles critical
- sampling for size, condition of juveniles
- physical conditions requiring investigation of status
- novel pathogen, multi-year drought esp important for Hinode Δ — it could be synergistic of disease, other factors

Simberloff -
decline in numbers trigger motivated by IUCN investigation of data ⇒ they changed their criteria to Δ in #s instead of specific #s
Mace et al.

Karieva - instead of focusing on confidence on effectiveness, focus on explicit triggers; make them precautionary

Bilby - large disturbance events could be a trigger, too (insect outbreaks)

4 triggers
- decline in species
- decline in outstanding species
- environmental input (volcano, forest fire)
- bio input (invasive spp., pathogen, etc)

Lichtenberg - what's the action
Jones - tied to cause
find source
Ruckelshaus = possibly in context of remediation

MMM 7/8/09 (1)

Travis – climate likely to make things change rapidly
so watch closely : look @ easy

Brian – possibility of catastrophic event
recognize need for planning in advance
of large perturbations

Travis – don't take #s blindly → in context
of pops, MPAs, ESCs

Emma – scale? would triggers be watershed, MPG, pop or ESU?

Travis – don't link to habitat issue, regardless of cause of trouble
this was what information period
rapidly acquirable data @ any scale
that could inform pert assessment

3. What options in addition to BDP RPA?
How effective would they be?
Series of options (quick to long to see effect)
1. In-river harvest – quickest, most certain effect
2. Coastwide fisheries – reduce output when ocean conditions are expected to be bad
3. Examine opportunities to re-establish runs now extinct (but hedging strategy)
4. More aggressive effort : more creative effort to get rid of introduced spp. potential

Longer term

MHM
7/8/09 (8)

5. Breaching dams – long time & negative effects in the short-run

Ruckelshaus – contingency planning & rapid response team
Bisson – better integration recovery actions for each H (i.e. across Hs)
Simberloff – reestablishing extinct pops → might take a good while, but could have a large impact on both jeopardy prongs
McClure – which dams?
Travis – generic "dams"
Simberloff – reference to Lower Snake River
Salt – estuarine habitat?
Travis – typically focused on trib, recognized that for some estuary will be imp.
focus due to likelihood that trib. primarily affected by climate change
D.S. – those reasons, + B.O. lists larger # of kinds of trib actions in RPA
P.B – some feel that NOAA has well-guided/monitored estuary program
Wright – how to deal w/ invasives
D.S. – bounty is a "primitive" technology used to be
- sea lamprey in Great Lakes → lampricides; dams, transformed by disruptive aggregation pheromone attracts all adult lamprey

HMM
7/8/09 (9)

Travis- greater effort : more creativity
look for new ways to deal w/ these
sex reversal? (Trojan fish)

Graves- in mainstem, where?
Answer: everywhere
both predatory & competitive spp.
D.S. - intro spp could also subsidize a predator

4. Climate Δ - additional monitoring for adaptive mgt

- Need to have rapid response
- Need to be [redacted] eager e.g. test
- Adaptive mgt triggers set in a precautionary manner
- Monitoring Specific Recommendations
  - increase in coordination flow, temp, fish # monitoring (fish in / fish out)
    design by predicted sensitivity to climate Δ
  - understanding rel'n b/w fish dd & habitat quality (also growth, density, survival)
  - marine environment effects
    quantify rel'n hab quality & fish response
  - interactions b/w multiple factors
    how does temp, dens depend., predation interact?
    also virulence of pathogens

MMH 7/8/09 (10)

- Explicit spatial modeling on MPGs, ESUs
  - ↳ extraction analyses ↑ potential for recovery
  - ↳ roll up to MPG/ESU somewhat ad hoc
- Effects of water use actions on flow, temp, hyporheic flow ↑ systematic inventory of cool water refuges
- How water flow thru system is shaped by natural ↑ anthropogenic conditions?
- Understanding individual impacts of introduced spp ~~&~~ on salmonid pops/ESU
  - cost-benefit analyses of controlling them

Bilby – use of IMW to response to land actions

Bilby is a big proponent

but has been pushback – lag time for results ↑ not take results ↑ extend to other locations?

should have put in place 20 yrs ago

issue of IMW – substantial support to conduct RS ↑ implement treatments

Karen – NOAAS modeling really good

would like to see more system-wide application of modelling

Bisson – reinforce groundwater as a defense against climate Δ

don't have region-wide assessment of ground water resources

MHM 7/8/09 (11)

Varanasi — more on response teams? need tools for application

Ruckelshaus — rapid assessment — get public involved

D.S. - contingency planning team
game problem of rapid response to invasive spp or other issues
float solution before problem happens

Scott (CoE)
helpful, interesting

Ted Bowling CEQ → thanks

Laura (Interior) → thanks

Bill McDonald (Reclamation)
D.C. NOAA use best available data?
B. Ray — all data were used? habitat data aren't available
Travis - best possible
excellent analysis
thoughtful
other ways might be worse
assumptions made reasonable, well-supported
alternative assumptions may also have been reasonable

MMM
7/8/09

(12)

Wright – thanks
Climate change – how to predict on a regional/subregional level
Ruckelshaus – other recommendations (e.g. things to monitor ? precautionary triggers ? thresholds) also address climate change
Mantua – nothing out there that's being missed at this point

DOJ (Eileen,)
thanks
Commerce – no comment

Lubchenco – Each Scientist / Most Important Thing

Travis – watch closely, move fast
climate change ? synergy will require

Sunderlin – monitoring / research related to interagencies interactions

Bibby – Allow us to investigate improved understanding hab cond ⟶ Steward

Busson – develop contingency plans for large scale env. effects

HMH
7/8/09
13

Martha – expect to see things that weren't part of recent past
be prepared to deal w/

Karen – use analysis of climate vulnerabilities to sharpen monitoring

Rick – remember declining baseline when making adaptive mgt decisions

From:	Nathan Mantua
To:	Michelle McClure
Subject:	amip review
Date:	Tuesday, April 20, 2010 9:45:09 PM
Attachments:	AMIP Review NM.doc

Michelle, my AMIP review is attached. I didn't provide any comments on the reviews provided by the AFS or Martin-Chapman in my letter. Did you want feedback on those?

Basically, I found the AFS review to be constructive and generally well-supported in areas that I'm most familiar with. I am not familiar with the spill vs transport issue so wont get into any of that.

The Martin-Chapman letter asks for a redo of the climate analysis in the BiOp, and as I've indicated in previous discussions I think the BiOp handled this issue in a scientifically justified manner if the focus is on the 2008-2018 period. I agree with their request for adding site-specific actions to combat climate change, and climate uncertainty and risks more generally, and I've described that issue in more detail in my comment letter. And if NOAA can organize water temperature data and make it available in the Columbia Basin I would love to see that too.

I hope this is helfpful.

Nate Mantua, Co-Director
JISAO/CSES Climate Impacts Group
Research Associate Professor of Aquatic and Fishery Sciences
University of Washington
ph: 206.616.7041
email: nmantua@uw.edu

<<...>>

AMIP Review
Nate Mantua
University of Washington
April 20, 2010

Below please find my comments on the 2009 Adaptive Management Implementation Plan for the 2008 Biological Opinion regarding the Federal Columbia River Power System. There are three main areas of concern that I've identified in the current AMIP. First is a focus on more research and model improvement to improve forecasting skills and reduce uncertainties surrounding the ability (I think) to predict changes in future habitat and productivity for ESA-listed salmon and steelhead in the Columbia Basin. I think this kind of focus is a recipe for inaction, and I think it stems from an unwarranted assumption that improved management of the FCRPS with respect to ESA-listed salmon and steelhead rests on reducing uncertainties surrounding complex issues like hatchery-wild salmon interactions, spill versus transport, and predicting the future climate and ocean conditions for the Pacific Northwest and North Pacific, respectively. Instead, I believe that a focus on identifying vulnerable habitats, stocks, and ESUs, and identifying actions to reduce those vulnerabilities, offers a more promising and immediately available pathway for improving the status of the Columbia Basin's salmon resources. Second, I believe that there are immediate actions and contingency plans surrounding the operation of production hatcheries that would strengthen the AMIP. And finally, I'm surprised that a "*science driven study of breaching Snake River Dams*" is listed as a long-term contingency action only to be implemented after a significant decline in Snake River salmon status. Massive declines in the status of multiple Snake River population groups have already happened, and such a study will surely take years to complete. It seems to me that carrying out scientific and economic studies of Snake River Dam breaching should be carried out now to better inform stakeholders and decision-makers of the costs and benefits of such actions.

My specific comments and suggestions for improving the AMIP are provided below.

Comments:

P 21, Section III A, part 1: Climate – Sensitivity of Species. Rather than focus on identifying the species most sensitive to climate variability, I think a higher priority is to identify habitats and population groups that are expected to be most vulnerable to natural climate variability and projected future changes in climate due to human-caused global warming. This assessment should be directed at identifying climate-related weak links in the life cycle for ESA listed stocks (and their habitats), and should support the development of restoration and/or protection plans that increase habitat, stock, and ESU resilience to climate change. A more explicit description for how this kind of assessment would be carried out, along with a timeline for project milestones, seems warranted.

P 21, Section III A, part 2: Climate – Adaptive Management. Applying historical climate and environmental data to life-cycle models for selected salmon populations is an important element in improving and validating those models. Likewise, using this approach in a "forecasting" mode for salmon returns one or two years into the future

presents a more formidable test for the generality of these models. The text of this paragraph states that "… *models will produce near-term (1 to 2-year) predictions of population performance based on short-term weather forecasts and current abundance levels"*. I believe that "short-term weather forecasts" are mislabeled here. Weather forecasts are generated for lead times of a few hours to 10-to-14 days in advance. What I think this text is arguing for are seasonal to interannual (a few months to a few seasons) lead time climate forecasts, commonly characterized as "seasonal climate forecasts". It should be noted that seasonal climate forecasts are probabilistic in nature, and the track record of using climate and environmental information (even observed information) to actually predict salmon returns has a very weak performance record. Tracking sibling returns along with environmental conditions, and applying that information to pre-season run-size forecast models should minimize the risk for major surprises in salmon returns like what happened with California's Central Valley Chinook in 2007 or Fraser River sockeye in recent years, and perhaps that message could be made more explicitly as one of the goals of improved monitoring and life-cycle modeling applied to 1 or 2 year lead time forecasts.

P 22, Section III A, part 3: Hatcheries. I'm surprised and disappointed that the research into hatchery effects described here is limited to modeling studies. Given the complex set of unknowns involved in hatchery/wild salmon interactions, I think it makes more sense to design and implement large-scale controlled experiments aimed at better understanding and reducing the impact of hatchery/wild interactions. For example, have the agencies operating hatcheries ever attempted to determine if there are density-dependent impacts of hatchery releases on wild and/or hatchery smolt-to-adult return rates? With the increased understanding for environmental impacts on ocean conditions, and the results of studies finding evidence consistent with interactions between ocean conditions and competition between wild and hatchery Chinook, it seems like there is an opportunity to implement year-to-year modifications in hatchery production designed to limit negative interactions between wild and hatchery stocks in years of poor ocean conditions.

On page 36 *hatchery reform* is listed as one option under the suite of long-term contingency actions, yet hatchery reform is something that should be pre-emptively implemented as soon as possible in order to both reduce the risks that hatcheries pose to wild fish and to improve the economic returns to stakeholders in the region. Under the current harvest management and hatchery operation system, years with large returns of hatchery fish do yield improved harvest opportunities. However, because of non-selective mixed-stock fisheries large numbers of hatchery fish are not caught and end up either straying onto spawning grounds or collecting in excessive numbers at hatchery facilities. Clearly this system can be improved with some combination of harvest reform (specifically, a move to much greater selectivity in harvest fisheries) and hatchery reform.

P 25, Section III F: Climate Change Monitoring and Evaluation

Habitat and ocean conditions: What is NOAA's commitment to "*enhanced tributary habitat and ocean research"*?

Forecasting and Modeling: How does NOAA intend to use new climate change information to improve regional hydrological models? Or is the intent here to develop a more comprehensive suite of hydrologic change scenarios in order to better understand hydrologic trends and uncertainties for specified periods in the future? I ask this because new climate change information isn't likely to aid in the improvement of hydrologic models. Instead, using existing hydrologic models (and other habitat models) to translate future climate change scenarios into freshwater habitat impacts can improve the understanding of expected trends in the future, should aid managers in better anticipating emerging climate change impacts issues, and should help identify the most and least vulnerable watersheds and habitat types.
Another dimension to this line of research is the stated intent to "*reduce forecast error and improve forecast reliability*". It isn't clear here what kind of forecasting this section is focused on, and why accurate forecasting is required for improving the future prospects for ESA listed salmon and steelhead in the Columbia River Basin. That said, improving model forecasts for climate, hydrology, or ecosystem endpoints is typically a slow moving process that is not likely to yield major benefits for resource managers in the near or distant future. A better investment for improving the future for ESA listed Columbia Basin salmon and steelhead is to focus on identifying and reducing vulnerabilities for existing habitats, stocks, and ESU's, and to do so in a way that recognizes that there will always be large uncertainties with respect to future climate and its impacts on ocean, estuary, and freshwater conditions. As noted above, existing data and modeling tools allow for vulnerability assessments that do not require great improvements in forecasting tools or reductions in the existing uncertainty that will always be part of any discussion about future decades. Said another way, a high priority in the AMIP should be the development of decision-making processes and implementation of actions that are resilient in the face of the uncertain future.

Page 31 Section IV, 2. Significant decline trigger for Chinook salmon and steelhead
The focus on the historical period since 1980 may be necessitated on the fact that the best data is confined to this period of record, however much of this period is characterized by extremely poor productivity and abundance for the ESA listed stocks in the Columbia Basin. I am concerned that using this as the historical baseline sets a very low bar for triggering mitigative actions.

Page 32-34, Section IV B: Rapid Response Actions

I consider production hatcheries to be among the big levers that the action agencies have control over in the Columbia Basin, and I believe that this suite of rapid response actions would benefit from additional actions aimed at altering hatchery production after a significant decline trigger is tripped. As noted previously, there is evidence for density dependent interactions between hatchery and wild Chinook in periods of especially poor ocean conditions. If an extended period of poor ocean conditions contributes to sustained abundance and productivity declines, there should be contingency plans for substantially reducing smolt releases from production hatcheries to mitigate negative interactions between hatchery and wild fish.

Section IV C: Long-term Contingency Actions

6. Hatchery reform: While implementation of some hatchery reforms will require long-term commitments, some hatchery reforms should be implemented quickly and preemptively if current operations are found to pose unacceptable risks to ESA-listed wild populations. Likewise, because of the complex nature of hatchery-wild interactions large-scale experiments should be designed now and implemented as soon as possible in order to be better prepared for the next sustained downturn in productivity for endangered and threatened populations that might result from natural or anthropogenic changes in climate or some other large-scale event. The AMIP language included in this section would benefit from more specific statements about NOAA's commitment to not just encouraging action, but actually requiring action to reduce unacceptable risks associated with current hatchery programs.

8. Breaching Lower Snake River Dams: I'm surprised that a "*science driven study of breaching Snake River Dams*" is listed as a long-term contingency action only to be implemented after a significant decline in Snake River salmon status. Massive declines in the status of multiple Snake River populations have already happened, and such a study will surely take years to complete. It seems to me that carrying out scientific and economic studies of Snake River Dam breaching should be carried out now to better inform stakeholders and decision-makers of the costs and benefits of such actions.