Independent Scientific Review Panel
for the Northwest Power & Conservation Council
851 SW 6th Avenue, Suite 1100
Portland, Oregon 97204
isrp@nwcouncil.org

Memorandum (ISRP 2009-21) **June 11, 2009**

To: W. Bill Booth, Council Chair

From: Eric Loudenslager, ISRP Chair

Subject: Final review of the Columbia River Fish Accord proposal, Sea Lion Predation Rate Estimation and Non-lethal Hazing (200800400)

Background

At the Council's May 19, 2009 request, the ISRP reviewed a response received from the Columbia River Inter-Tribal Fish Commission (CRITFC) regarding our December 15, 2008 review of the Columbia River Fish Accord proposal titled Sea Lion Predation Rate Estimation and Non-lethal Hazing (200800400). In our December 2008 review, we found that the proposal did not provide sufficient information for our technical review and thus did not meet scientific review criteria (see attachment). We requested a response on several issues including non-lethal hazing (proposal objective 1), video monitoring (objective 2b), and acoustic telemetry (objective 2a). CRITFC sent a response covering each of these issues.

Recommendation

Meets scientific review criteria in part (qualified)

Objective 1 – *does not meet scientific review criteria*

Objective 2a, Acoustic Telemetry – *meets scientific review criteria (qualified)*

- Qualification: The ISRP recommends collaboration with the ongoing BPA-funded Pacific Ocean Shelf Tracking (POST) project (2003-114-00) and the U.S. Army Corps of Engineers-funded acoustic tracking projects.

Objective 2b, Video Monitoring – *meets scientific review criteria (qualified)*

- Qualification: the ISRP recommends limiting the trial to one location, specifically at Bonneville Dam, where visual observations are being made by the Corps and ground-truthing is possible.

Summary Comment

The proponents responded to only a few of the ISRP's review comments. The proponents' may have viewed the comments they addressed to be our key comments, but a more satisfactory response addressing our comments in detail would have been more helpful. In addition, it would have been helpful if the response concerning monitoring and evaluation (M&E) was highlighted for each objective. We specifically raised M&E issues in our initial review. Components of M&E are mentioned, but details, such as how the incoming data will be archived and made available for others, were not provided.

The proponents could have addressed many of our questions with existing data in the weekly reports by the Corps, e.g., Stansell, S. Tackley, and K. Gibbons. 2009. Status report- pinniped predation and deterrent activities at Bonneville Dam, 2009. Fisheries field Unit, U.S. Army Corps of Engineers, Bonneville Lock and Dam, Cascade Locks, OR 97014.[1] For example, in 2009 peak abundance of California sea lions at Bonneville Dam was 26 animals (average daily number 10.4 animals; lowest abundance since 2002). Stansell et al. (2009) attribute the sharp decline in California sea lions in 2009 to removal programs by the states (10 of 20 trapped animals were euthanized; 4 were relocated to aquariums/zoos; 6 were tagged with acoustic transmitters for research ODFW/CRITFC). In their response, the proponents failed to make a strong scientific case for proposed expansion of non-lethal hazing activities. In addition, the proposal would have been greatly improved if information was provided showing that the proponents had consulted and collaborated with experts in pinniped biology, ecology, and population dynamics, as well as with ongoing BPA-funded and Corps-funded acoustic tagging projects.

Specific Comments

Objective 1, Non-lethal hazing

The proponents' response provided additional regulatory information. The ISRP understands the regulatory background with respect to the NOAA ruling, but we were interested in the proponents' understanding of the science behind the regulation. This was not provided. If the scientific evidence is inconclusive or very preliminary, the project may not be scientifically supportable whether NOAA requires it or not.

The response did not address any of the following questions from the ISRP:

- The proposal would be improved by further explanation of fate of the sea lions to be hazed, e.g., are these the animals that are going to be killed?
- If animals are going to be removed anyway, what is the point of hazing?
- How are individual animals identified?
- How is predation by an individual sea lion documented?
- Do sea lions resume feeding on weekends and at other times beyond the proposed 6 hr per day/5 days per week hazing schedule?

[1] www.nwd-wc.usace.army.mil/tmt/documents/fish/2009/sea_lion_hazing2009.html

- How many adult salmon would the hazing project potentially save?
- How many "naïve" sea lions would be deterred and saved?

A field report by Brown et al. (2007) on activities at Bonneville dam estimated that two to four percent of the salmonids were eaten by sea lions. However, they also consumed sturgeon and shad, and other species (pikeminnow? lamprey?). The report concluded that "hazing was ineffective at temporally moving sea lions." While regulations require more intensive and complete hazing before (approved) removal, results showed that "intensive hazing was unsuccessful." While the science to date does not support the hazing policy, the ISRP repeats its previous recommendation (Dec. 15, 2009) that the effects of non-lethal hazing on feeding behavior of sea lions could be studied through responses of acoustic tagged individuals, as an element of Objective 3. This recommendation was mentioned in the proponent's response, but no details were provided.

A NMFS technical memorandum published 12 years ago indicated sea lions numbered less than 160,000 and were increasing at about five percent per year (National Marine Fisheries Service. 1997. Investigation of Scientific Information on the Impacts of California Sea Lions and Pacific Harbor Seals on Salmonids and on the Coastal Ecosystems of Washington, Oregon, and California. U.S. Dep. Commerce, NOAA Tech. Memo. NMFS-NWFSC-28, 172 p.). This memorandum identified elements of a research program to assess impacts of pinniped predation on depressed salmonids. From what is presented in the proponents' response to the ISRP, it appears this research program still requires development and review, or the program was not referenced adequately. The objectives here may form a part of a broader research plan, but the linkage to this broader plan was not clearly explained.

Pinniped species, including the California sea lions, Steller (or northern) sea lions, and the Pacific harbor seals, are natural predators of salmon and other fish species in rivers and estuaries (e.g., Roffe and Mate 1984 – J. Wildl. Manage. 48(4):1262-1274). A high abundance of hatchery fish and physical structures such as dams will invariably attract pinnipeds and other salmon predators. The ISRP advises that an ecosystem-based trophic model is required here to direct the research plan and to assess the potential benefits of predator harassment and/or removal. Currently, there is no indication that intensive hazing or lethal removal, as are currently being implemented, will result in reduced predation overall, nor have a significant benefit to salmonid survival.

Objective 2b, Video monitoring

This part of the proposal was improved. More details on methods were provided, some of which further pointed out the uncertainty of the method. The ISRP understands this is a proof-of-concept objective. With this in mind, the ISRP recommends limiting the trial to one location, specifically at Bonneville Dam, where visual observations are being made by the Corps and ground- truthing is possible.

The proposed method for estimating sea lion predation rates by expanding attack tallies is technically and analytically weak, and does not account for many potential sources of variation in the estimates. The ISRP recommends that the proponents consult with experts to develop a statistically valid experimental design and estimation procedure. As noted in the previous section, an ecosystem-based trophic model is needed to evaluate variation in predation rates with respect to key variables. The ISRP recommends a scientific review after the first year of results have been presented in a progress report, before the proponents move the system to another location. Both the proposed proof-of-concept estimates and Corps' estimates are based on observations of surface feeding on large prey (sturgeon and adult salmon). However, pinnipeds feed on small prey without coming to the surface. Future work might address whether underwater video monitoring could be used to determine whether sea lions are feeding on salmon or steelhead smolts at Columbia River dams.

Objective 2a, Acoustic telemetry

More details have been provided on the rationale for acoustic telemetry studies. The area immediately below Bonneville Dam ("fine scale") is a recommended study area to work out techniques. The proponents cite use of the methods in the Alsea estuary as justification for their work. However, as the Alsea River is considerably narrower than the Columbia River below Bonneville, a different array and configuration of receivers may be needed.

It appears the three listening stations further downstream are going to be opportunistic, but the ISRP advises that the project mentioned for collaboration (2007-401-00 – kelt reconditioning) is still under review. The ISRP recommends collaboration with the ongoing BPA-funded Pacific Ocean Shelf Tracking (POST) project (2003-114-00) and Corps-funded acoustic tracking projects.

Attachment: ISRP Review Comments December 15, 2008

ISRP December 2008 Recommendation:

Response Requested - Does Not Meet Scientific Review Criteria

The proposal is insufficient for technical review. The ISRP finds that none of the proposed project objectives have been technically justified (see comments in sections B-D, below).

The ISRP recommends the elimination of the proposed non-lethal hazing of sea lions (Objective 1) as a stand-alone objective. The ongoing cooperative hazing activities have not been justified by any documented positive results of reducing predation on salmonids. However, the effects of non-lethal hazing on feeding behavior of sea lions could be studied through responses of acoustic tagged individuals and therefore, could be incorporated as an element of Objective 3 – see below.

The ISRP also recommends eliminating the video monitoring portion of the proposal (Objective 2). The rationale for the proposed video monitoring to estimate sea lion predation is weak (i.e., the study design is incomplete and metrics undefined), and to attempt estimates outside the current observation area below Bonneville Dam (~150 river km) may take years to develop with a high risk of failure in collecting quantitative data.

However, the proposed acoustic telemetry project (Objective 3) is a good idea, and the ISRP encourages further development of this part of the proposal. To accomplish this, a much more detailed study design is needed, including methods and monitoring protocols for acoustic tagged sea lions, and some specific statements of how the resulting data will be applied towards management of this predation problem (see comments in section F, below).

ISRP December 2008 Comments:
1. Technical Justification, Program Significance and Consistency, and Project Relationships (sections B-D)

Technical Justification.
The issue of California sea lion (*Zalophus californianus*) predation on spring Chinook salmon and steelhead below Bonneville Dam since 2001 is reasonably documented in the Technical Background section. The proponents attempt to justify three approaches to address this issue and quantify the extent of the predation by: (1) non-lethal hazing, (2) video monitoring near and outside the dam tailrace, and (3) using acoustic tagging to better understand the feeding behaviors and movement patterns of sea lions in this area. In general, technical and scientific background on these approaches was insufficient, as discussed in the following sections.

Non-lethal hazing. As the proposal states, non-lethal hazing has not been documented to reduce California sea lion predation on salmon and steelhead. This proposal did not convince ISRP reviewers that a continuation of hazing would be of any benefit in reducing or solving the problem. The only justification for using this approach is that problem animals cannot be removed or terminated unless previously subjected to non-lethal hazing (NOAA 2008a).

Using hazing to control of predatory sea lions below dams to protect endangered salmon stocks is difficult to justify scientifically, given that behavioral changes in the sea lions from hazing are not completely understood. In addition numerous factors besides mortality at the adult stage can influence salmon survival and recovery of endangered ESUs.

The proposal would be improved by further explanation of fate of the sea lions to be hazed, e.g., are these the animals that are going to be killed? As stated on page 3: "As a prerequisite for removal, California Sea lions need to be individually identifiable, be observed feeding on salmonids below Bonneville Dam and must be subjected to non-lethal hazing activities (NOAA 2008b)." If animals are going to be removed anyway, what is the point of hazing? How are individual animals identified? How is predation by an individual sea lion documented?

In this project, the proponents tend to rely on the conclusions of other agencies working in the Columbia River basin, specifically NOAA, to support the need for predator control. They state on page 2: "Deterrent activities using non-lethal hazing were initiated in 2005 by the state, federal and tribal agencies and have been ineffective at eliminating the fish predation problem (Norberg et al. 2005, Wright et al. 2007, Brown et al. 2007) but were shown to modify sea lion behavior (Tackley et al. 2008)." The sponsors do not give evidence that modified sea lion behavior can lead to less predation.

It would be helpful if the sponsors could provide an estimate or overall assessment of the effectiveness of hazing as a mitigation action; i.e., how many adult salmon would the hazing project potentially save? On page 3 the sponsors claim (based on WDFW report) that 13,000 salmon (species not given) were eaten by sea lions in the 150 mile reach below Bonneville Dam, but do not give details on what of model was used to develop this number. On the same page, they give a figure of 1,494 hazing events, each involving a predation, even in a 6 mi reach. Simple extrapolation to the 150 mi reach suggests 37,350 salmon could be saved if hazing was adopted in the entire lower river. A stated purpose of the boat-based hazing of sea lions is to deter "naïve individuals" (p. 3). How many naïve sea lions would be deterred and saved?

Video monitoring. As the proposal indicates, the observation area immediately below Bonneville Dam is the only area where somewhat quantitative data on sea lion predation is recorded by the US Army Corps of Engineers (USACOE). The large area of potential sea lion predation on salmonids is about 150 miles of the lower river and the extent of predation is unknown. A video monitoring system is proposed to better quantify sea lion predation in the immediate area below the dam and also estimate the extent of predation

outside the dam zone. No references or technical information on the existing video fish counting technology and software are provided. The proponents do not adequately justify the expense needed to set up a video monitoring system in the dam zone, when observers with data sheets could efficiently continue to make these counts. The proposal does not indicate how such a system could reasonably or practically be extended to monitor a huge area of 150 river miles.

Acoustic telemetry. While this may be a worthwhile effort to undertake, the specific needs for these behavioral data are not justified in this part of the proposal.

Program Significance.
The proposal indicates that several BiOp Alternatives, Pinniped-Fishery Interaction Task Force recommendations, and draft salmon recovery plans all support sea lion hazing activities and efforts to better understand and reduce sea lion predation on adult salmon and steelhead below Bonneville Dam and in the river below the dam.

Relationships to other projects.
The relationships to other related or collaborative projects are only described in the most general terms. Project #s are lacking and details on what those projects are doing is almost totally lacking. There is no description of how CRITFC's proposed hazing efforts will be coordinated with or add to hazing efforts already ongoing by the states of Oregon and Washington. Some aspects of their project might be valued added components of a collective effort, but more specific information would be helpful.

2. Objectives, Work Elements, and Methods (section F)

General. This section is poorly organized. The specific methods and work elements for each objective should immediately follow the objective and not be separated. Also the sub-elements following work elements seem to sometimes be randomly organized, and they are so general that they have little meaning.

Objective 1. Non-lethal hazing is not adequately justified and seems to be an add-on activity to support similar ongoing efforts by the states and USACOE. Data to be gained during this hazing are only generally described and are not measurable. It is not clear from the technical justification that hazing stops predation or significantly reduces feeding. California sea lions modify their behavior by stopping feeding to cope with the hazing. Do they then resume feeding? Hazing is only going to occur for 6 h per day, 5 days per week. The sea lions will still have about 5 h of daylight to feed (in March) and the weekends. It seems more research is needed to determine the efficacy of hazing (at least with the timetable proposed) as a method to reduce predation.

Objective 2. Video monitoring is proposed, "for estimating sea lion predation outside of the Corps observation area"… and "one video system would be deployed to observe river surface activities in known areas of the river." This is far too vague for a study design and needs a much more detailed explanation. A second video system is proposed to be deployed in the areas on/near the dam as shown in Fig. 1. Video monitoring in this area

could be more efficient than by human observers, but the case is not made why this is needed. The proposal states that the main need is to survey the area outside the current observation area. Until a better survey design and rationale for such a video monitoring system is developed Objective 2 is not supported.

The proposal would be improved by more detail on the technical aspects of the video system, as it is not clear how effective the system would be for observing and enumerating sea lions. The system is not ready for deployment and requires considerable research and ground-truthing before it can be applied, especially in a large river like the Columbia.

According to the literature (two papers published in the 1990s by Hatch et al. cited) the video system has been used to enumerate salmon. However, video monitoring of escaping salmon has apparently not been widely adopted as a method on large rivers, indicating there is some concern about its usefulness. Even at the large Columbia River dams, the human eye and a data sheet are still used.

Objective 3. This proposed acoustic telemetry study might provide useful data on the feeding behavior of individual sea lions (including distributional shifts with changes in dam operation changes, diurnal patterns, preferred areas, etc.) that may have some direct benefits for reducing this problem. However, the study design is way too general (i.e. only large circles on a large scale map are provided to show hydrophone arrays) to be of much use, methods are lacking (i.e., "This project will use similar methods to Wright et al. (2007)", and description of the data to be collected is far from complete "… record data on sea lion movements and foraging behaviors, download data from hydrophones."

The coarse movements of tagged sea lions might yield some research results on home ranges of the animals. The lower river below Bonneville Dam and estuary is an open ecosystem so the boundaries for this study are arbitrary until these data are available. The home range data might also be used in conjunction with physiological data in an attempt to estimate food requirements in relation to salmon consumption (i.e., how many salmon are needed to support a sea lion).

Under Objective 3, the proposal states the animals will be tracked as they migrate between the ocean and Bonneville Dam and on the same page the proponents state that tracking will be done between the dam and Buoy 85 – is that buoy near the estuary?

Acoustic tagging might be used to document the pre- and post-hazing feeding behavior of individual sea lions. This could be a promising avenue of applied research.

3. M&E (sections G and F)

The proposal does not break out M&E in the Sections F and G. Instead the proposed M&E is scattered throughout previous sections. For all three of the subprojects an M&E plan is yet to be developed. However, reports are promised. An important goal of M&E

for this project would be to identify what parameters are needed to predict quantitative responses of sea lion populations to predator control at Bonneville Dam.

4. Overall Comments - Benefit to F&W (all proposal)

The proposal lacks any specific goals for potential reduction in sea lion predation events (in any of the three objectives).

Some of the proposal is applied research (video, acoustic tagging) and some of it is "on the ground" predator management (hazing), but the efficacy of the latter is not clear. In the long run the applied research, notably the acoustic tag work, might benefit predator management.

The proposal would be improved by discussion about how the hazing work fits in with the proposed culling project. This issue seems to be hung up in the courts, so perhaps this is not possible. However, an explanation of how all the predator control work fits together (hazing, culling, and even the northern pike minnow on smolts program, assuming there is one at Bonneville) would be very useful. All these projects are supposed to be increasing salmon survival.

The proposal also does not consider potential positive benefits of the proposed project on other species of fish and wildlife in the Columbia River Basin, such as white sturgeon.