



Independent Scientific Review Panel

for the Northwest Power & Conservation Council
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Memorandum (2021-10)

December 7, 2021

To: Guy Norman, Chair, Northwest Power and Conservation Council

From: Stan Gregory, ISRP Chair

Subject: Review of WDFW Response and Revised Proposal “*Piscivorous Fish Status and Trend Monitoring in the Columbia River Upstream of McNary Dam*”

Background

On November 2, 2021, the Northwest Power and Conservation Council asked the ISRP to review Washington Department of Fish and Wildlife’s (WDFW) revised [proposal](#), titled “*Piscivorous Fish Status and Trend Monitoring in the Columbia River Upstream of McNary Dam*” (Project #2020-001-00). The revised proposal was developed to address the ISRP’s concerns with the original proposal ([ISRP 2021-3](#)). The intent of this new project is to determine the abundance, trends, and consumptive impacts of non-native fishes upstream of McNary Dam in the mainstem Columbia River. The project intends to monitor and use predator population abundance and growth rates to evaluate the effectiveness of current (i.e., deregulating harvest) and future management actions designed to increase juvenile salmon survival, with the ability to identify significant changes in predator population status.

In our initial review ([ISRP 2021-3](#)), we requested a response and provided the following summary:

“This proposal addresses significant predation threats that may limit survival and recovery of Endangered Species Act (ESA) listed salmon and steelhead in the Columbia and Snake river basins. The proposal responds directly to uncertainties identified by the ISAB and ISRP in past project reviews and demonstrates important significance and connectivity to the Fish and Wildlife Program and other regional plans. The project is forward looking and could provide important information related to predator responses to climate change in the mainstem Columbia River. The proposal has many strengths; however, additional information on organization, content, and details is needed. The ISRP requests the proponents revise the proposal to address ... seven concerns.”

Our review below is organized by our initial seven review concerns and the proponent’s point-by-point responses.

ISRP Recommendation

Meets Scientific Review Criteria

The ISRP recognizes and appreciates the effort it took to provide a major rewrite of the proposal, especially the improvements of the Objectives and Methods sections. The revised organization of methods by objective and sub-objective provided much needed connectivity and continuity between the goals, objectives, and methods. In addition, the methods were much improved in both clarity and scientific rigor by emphasizing the area sampled (vs. CPUE), by strengthening the habitat classification and stratification effort, by including primary and secondary non-native predators, and by establishing desired precision standards (i.e., CVs of the abundance estimates). The general responsiveness to the ISRP suggestions was much appreciated, and the revised proposal should serve well to guide the project into the future.

ISRP Comments on Proponent Responses to ISRP Initial Comments

1. Problem Statement

- a. **Proponent Response:** *Smallmouth Bass, Walleye, Northern Pike/minnow, and Channel Catfish are believed to be the primary apex predators on juvenile salmonids above McNary Dam. However, we will also examine the diets of presumed less common non-native piscivores such as Largemouth Bass, Yellow Perch, and Black Crappie. These species have been found to entrain into the Columbia River from the Ringold and Esquatzel wasteways (WDFW, unpublished data). However, their presence and distribution in the river is unknown.*
- b. **Proponent Response:** *The ESA listed ESU's potentially impacted by predation include the middle and Upper Columbia spring Chinook salmon and steelhead, Snake River sockeye, steelhead, and spring and fall Chinook populations.*

ISRP final comments: While channel catfish were not mentioned in the leading sentence of the Problem Statement (“*What is the annual abundance (status) and population growth (trend) of NPM, SMB, and WAL, upstream of McNary Dam and what is the impact (predation) on juvenile salmonids?*”), it became clear later in the Problem Statement and in the Objectives that channel catfish have been included for evaluation by this project.

Although the proponent’s response is reassuring that “*diets of presumed less common non-native piscivores such as Largemouth Bass, Yellow Perch, and Black Crappie*” will be examined, these species are not explicitly mentioned in the Problem Statement or in the relevant Objective 5, and the wording added to the revised proposal under Objective 5 is vague about what will be evaluated [p.26: “*Less common non-native fishes (e.g. Largemouth Bass, Yellow Perch, Black Crappie) will be collected and evaluated for predatory impact on salmonids*”]. In the next annual report, the ISRP would like to see more explicit descriptions of what work has

been conducted or is planned to evaluate the potential impact of these less common, non-native, and potentially predatory fishes.

The proponent added requested clarification about ESA-listed ESUs that might be affected by these predators. The ISRP encourages the proponent to seek and use additional methods to differentiate impacts at the DPS, MPG, and population levels.

2. Goal Statement

- a. **Proponent Response:** *The goal of this project is to better understand population abundance trends of fish predators and their predatory impacts on juvenile salmon and steelhead populations in the Columbia River above McNary Dam, and evaluate the effectiveness of current (e.g., deregulating harvest) and future management actions designed to increase juvenile salmon survival by decreasing predator population abundance over time and space. This project will not directly determine predatory impacts to specific stocks. Instead, our goal is to evaluate ways to proportionately infer consumptive impacts to specific stocks and hatchery versus wild fish by evaluating parameters such as prey size, consumption over time and space, and stock specific PIT tag return ratios at McNary Dam.*

ISRP final comments: The goal statement was revised as requested and now contains a clearer set of appropriate qualitative desired outcomes for the project. The existing statement suggests that future management actions will be evaluated by this project. Depending on the nature of those future changes, the proposed methods may not be adequate. It is, however, within the scope of this project to evaluate the need for future management actions. This goal statement should be modified in the next annual report.

3. Objective

- a. **Proponent Response:** *Objectives, including some sub-objectives, were added to this section. Objectives were also listed in the methods section ahead of each set of associated tasks for better organization.*

ISRP final comments: The addition of a formal list of seven objectives largely met the requested SMART Objective format and directly supported accomplishment of the revised goals. The wording of the sub-objectives could be significantly improved. As is, some are incomplete statements that read like titles rather than descriptive statements. For example, Sub-objective 1.2 could be changed from “Sample site selection” to the more descriptive “Select sample sites using a spatially balanced generalized random tessellation stratified (GRTS) draw.” These sub-objective titles should be developed into descriptive statements in the next annual report and included in future proposals.

4. **Methods** (specific questions with subsequent answers follow)

- a. **The proposed methods primarily target smallmouth bass. Although the proponent states that variable mesh gill netting in offshore, deeper areas may be needed to adequately assess the walleye population, this method is not incorporated in an Implementation Objective.**

***Proponent Response:** Gill netting has been removed from the proposal due to concerns of bi-catch of ESA listed species and net loss. Deploying gill nets in low flow can still be problematic based on past WDFW attempts.*

ISRP final comments: With the elimination of gill netting (for a good reason), the problem of species selectivity may be exacerbated. Capture probability of boat electrofishing will likely be low for walleye and channel catfish. This would lead to a limited number of marks applied, few recaptures, and imprecise estimates of abundance, leading to similarly imprecise estimates of predation impact. As indicated in the methods for Objective 1, it will be imperative to track the CV of the abundance estimate for each of the primary species to gauge if electrofishing shorelines (perhaps after adjusting length or number of sites) is, by itself, adequate for estimating abundance of each of the predator fish species with the level of precision the proponent indicates is targeted in Objective 1 (CV <30% for smallmouth bass and northern pikeminnow; CV < 50% for walleye and channel catfish). In that the CVs achieved by McMichael (2018) presented in Table 1 tend to be higher than those targeted in this proposal, it is not clear how the proponent derived these CV targets and how the proponent expects to achieve them. It is likely, however, that achieving the targeted levels of CV will be essential to effectively assess predation. A methods assessment for achieving the targeted CVs should be completed as soon as adequate data are available.

- b. **The ISRP encourages the proponents to consider alternative approaches for addressing predator abundance in some of these habitats, such as tributaries and sloughs.**

***Proponent Response:** The confluence stratum contains the tributaries, back waters, and sloughs. These areas all are available for selection under the GRTS draw. Although we will not sample into the tributaries, the confluence will be available for the GRTS draw (e.g., first draw has a site in the Yakima delta, west of Bateman Island). Islands within each stratum are also available for GRTS draw. The use of PIT tag detectors in the tributaries is an excellent idea to evaluate marked fish vacating the sample site between mark and recapture events. However, the allotted budget for this project will not allow us to implement this idea.*

ISRP final comments: Inclusion of tributaries, backwaters, and sloughs in the confluence stratum partially addresses the concern. While the proponent emphasized that there are limited alternatives largely based on budget constraints, new and additional methods will likely need to be considered and invoked in the future as the data are evaluated.

c. The linkage between habitat and site selection was not described

***Proponent Response:** We will do a GRTS design to select 8 sites per stratum in year one. Since habitat classification will be finished in year one, each site will represent one or more habitat classes. More sites will be selected if not all habitat classes are represented. Fish will be held separately for each habitat type when more than one habitat class is present in a sample site.*

ISRP final comments: The proponent's response adequately clarified the linkage between habitat and site selection.

d. The proposal should include more detail on the level of effort required to quantify habitat characteristics adequately for the analysis of habitat relationships and modeling.

***Proponent Response:** Habitat classification has begun and will be finished after year one of this project. We are using a combination of Google Earth and maps, and foot and on water surveys to classify all the habitat into pre-defined classifications (Table 3) along with using the USGS habitat model (Hatten et al. 2009). All spatial habitats will be entered into a GIS database.*

ISRP final comments: The proponent's response provided adequate detail.

e. It was not clear if the sites used for mark-recapture would be contiguous

***Proponent Response:** The sites will not be contiguous, but rather "spread out" from each other to represent differing habitat classes. The GRTS is generally the most flexible design when we have no information on density, but the stratified design can improve precision of the estimates if stratification helps reduce the variance in density between sites. The 1.0-1.5 km sites will be sub-divided to reduce sampling to every 200 m, where fish will be processed and released.*

ISRP final comments: The proponent provided the additional information and clarity requested.

f. The proponents should consider this issue when making decisions on logistics and the amount of time used to measure habitat characteristics. For example,

a second boat and crew that processes and redistributes fish would allow an increase in the number of sites sampled per night. Time consuming habitat measurements should be avoided if they reduce the number of sites that can be sampled.

***Proponent Response:** Habitat classification will be completed prior to sampling; therefore, it will not cut into the time spent sampling. Second crews are something we have done during past fish sampling events; however, the budget allocated to this project will not afford the cost of a second boat/crew to work-up fish simultaneously to the electrofishing crew. If additional sites are needed to meet objectives, then more focus and time will be spent in each stratum prior to moving to others.*

ISRP final comments: The proponent provided the additional information requested.

- g. Will holding studies be conducted to evaluate mark-loss via tag shedding or post-release mortality? This might be worth the effort in the first study year.**

***Proponent Response:** Based on the literature, tag retention is $\geq 98\%$ when PIT tags are applied in the peritoneum cavity. We will also apply a fin clip on all tagged fish to evaluate tag retention upon recapture.*

ISRP final comments: It appears that mark-loss holding and post-release survival studies will not be conducted, but the proponent provided helpful additional information about mark-loss assumptions. Mark loss can be substantial for some technicians. The assumed high retention rate ($>98\%$) may not apply to all technicians, especially in the field and at night. As pointed out by the proponents, the double-tagging approach will allow estimation of mark loss after 24 hours at mark-recapture sites. A PIT tag scar would be visible within 24 hours, so those fish that shed tags within 24 hours would be classified as NewSheds. In contrast, recaptures of fish that have shed their tags from previous sampling occasions within the year, or across years, would not have a visible PIT scar and could be classified as OldSheds. This assignment would allow estimation of site-specific or trip-specific shed rates should that be needed.

While not mentioned in our previous review, the ISRP would like the proponent to ensure that direct mortality of electrofishing and handling will be tracked and evaluated. This should be documented in annual reports.

It was not clear whether the same randomly selected sites for mark-recapture will be sampled on both the first (mid-May) and second (early/mid-June) sampling sessions within a year or will be sampled again in subsequent years. Keeping the same sites (at least across occasions within a year) could provide valuable information on growth and perhaps even allow estimation of survival and abundance via an open population model for more abundant species. Selecting

new sites each sampling occasion and year eliminates these possibilities. Sampling the same sites within a year may offer the best compromise.

- h. Methods should be provided to “identify year class strengths/failures, recruitment, growth, annual mortality, or compensatory predator response.” What size or age of fish, by species, is expected to be fully recruited to the sampling gear? For example, will all smallmouth bass shocked and seen by the netters be targeted no matter how small? Will there be an analysis of the catch to determine if a minimum size needs to be declared for inclusion in the population analysis?**

***Proponent Response:** All sizes of predator fish will be netted allowing a construction of relative age frequencies. We will utilize a suite of tools to help identify year class strength and total mortality. Age and length frequency will help determine year class strengths, especially since angler harvest is not restricted to length slot restrictions. Linear catch curves will be used to estimate annual and cohort specific total mortality over time. Age-1 predator fish are expected to recruit to the sampling gear with abundance estimates starting with fish >100 mm due to PIT tagging size limitations and when predators begin piscivory.*

ISRP final comments: The proponent provided the additional information requested.

- i. Much detail is lacking for Task 3.0 – Predator Consumption Rates by Species and Size Class. The method description indicates predation impacts can be assigned to “specific populations or groups of populations (i.e., ESU or DPS).” However, there is no description of the specific populations or groups for which estimates will be obtained.**

***Proponent Response:** Although we recognize that predation likely occurs on all salmonids, this project will not directly determine predatory impacts to specific stocks. Budget limitations will not allow the use of genetic and isotopic analysis to differentiate between Chinook and steelhead prey when whole fish and/or diagnostic bones are absent in the diet. Our goal is to evaluate ways to proportionately infer consumptive impacts to specific stocks and hatchery versus wild fish by evaluating prey size, consumption over time and space, and stock specific PIT tag return ratios at McNary Dam.*

ISRP final comments: The proponent modified the proposal and provided some of the additional clarity requested. It will be important “to evaluate ways to proportionately infer consumptive impacts to specific stocks” in a consistent manner and to fully document progress in annual reports.

Will predators be scanned for a coded wire tag (CWT)? This approach might provide additional data to estimate predation rates given that the number of CWT hatchery-origin juveniles released is known.

- j. **The first year of the study will be a critical learning period for understanding what can be done with the available funding, and what should be carried forth or changed for ensuing years. In the spirit of learning as much as possible in the first year, the project would benefit from exploring a more complex habitat classification scheme, testing the use of gill-netting or other methods for walleye, testing for PIT tag retention, testing for how well assumptions for mark-recapture are met, and understanding the effects of movements of smallmouth bass on the abundance assessment.**

***Proponent Response:** We agree that much can be learned during the first year of the project and will embrace this time to test methodologies. The GRST approach along with the HBM will allow us to learn fish density by habitat that can be used to expand into habitat stratified abundance models in future years. We will complete the habitat surveys in GIS and link with other layers for depths and velocities already collected in the study area. Gill netting has been abandoned as a method to collect predator fish at deeper depths during the risk of bi-catch and net loss. Angling can be tested to collect Walleye for diet analysis, but experience with angling showed many of the stomachs were empty. PIT tag retention studies in the literature showed high retention if tagging in the peritoneum. We will also fin clip all PIT tagged predators to assess tag loss. We will evaluate sample site length and recapture times to better understand tagged fish movements within the site. Sampling 100 m above and below each site during the recapture event will also help define movement.*

ISRP final comments: The proponent adequately addressed and incorporated most of the ISRP suggestions into the revised proposal. The ISRP strongly questions that “sampling 100 m above and below each site” will be adequate to assess if the assumption of population closure is met for the mark-recapture estimator. In addition, lateral movement to deeper habitat, not just longitudinal movement, will likely need to be assessed. The ISRP encourages use of additional methods to assess movement of predators between mark and recapture efforts, such as 1) looking for tagged fish elsewhere and more intensively, and 2) tagging fish above and below sampling sites to see if these fish move into the sampling area. The use of PIT-tag detectors is an obvious step but an expensive tool that may require imaginative partnering to opportunistically fund.

- k. **The proposal should describe the WDFW “internal proposal...to reduce the number of predators in McNary pool” more thoroughly and explain how the**

proposal links with this proposal and how the scheduled timeframes for implementation are related.

***Proponent Response:** This has been reworded as the WDFW does not have an internal proposal, but rather are partners in implementing management actions to lift harvest regulation on non-native predator fishes.*

ISRP final comments: The proponent provided the additional clarity requested.

- I. A potential confounding factor not addressed is that sampling of smallmouth bass in May and June will be during the most likely time for movement associated with spawning. As observed by Montgomery and Fickeisen (1978) and Petersen et al. (2000), these migrations to spawning areas can be extensive and possibly into non-sampled areas such as the sloughs and the large tributaries that feed the Columbia River in the study area above McNary Dam (Walla Walla River, Snake River, and Yakima River), potentially making a large portion of the smallmouth bass population inaccessible to the described sampling plan in May and June. Is sampling happening at the time of high or low spatial overlap between predator and prey? In that smallmouth bass captured will be PIT tagged, to what degree might existing or new PIT tag detectors in these off-channel habitats and tributaries be used to help estimate the degree to which smallmouth are inaccessible to the sampling plan? There may be need of an additional Implementation Objective to evaluate this confounding factor (e.g., concomitant boat electrofishing or netting in the tributaries; PIT tag detectors at slough entrances).**

***Proponent Response:** There will be two sampling periods for this proposal and will occur when there is greatest overlap between predator fish and juvenile salmonids. The first will occur during the first half of May to evaluate predation (i.e., stomach content analysis only) on age-1 Chinook and steelhead smolt, and in early to mid-June to capture predators during the age-0 Chinook smolt outmigration. The second sampling event will occur in June and will include the mark-recapture study to estimate abundance. Some overlap between the first and second sampling event will occur to encompass the subyearling outmigration period. As discussed previously, we will evaluate metrics to help define or extrapolate stocks and species of salmonids found in predator fish diets. We understand that sample timing overlaps with post spawn for WAL and current to post spawn for a portion of the SMB population. In essence, we will be estimating the density of predators responsible for mainstem predation. Further scope and funding could allow for investigations in the proportion of SMB moving into spawning tributaries in the spring. Sampling later to include all post spawn SMB is not realistic. Two factors limit our sampling window which include high flows*

(post HRFCPA (July) and warm water temperatures >18°C which tends to occur in mid-July. Therefore, mark-recapture surveys must be conducted in June.

ISRP final comments: The proponent has not fully addressed this ISRP concern. Assumptions need to be fully tested about what portion of the predatory population is present during sampling versus what proportion is accountable for the predation. The transitory nature of fish movement and migration timing as well as sampling timing may need to be annually reexamined based on factors such as temperature and flow.

- m. The Columbia River Biological Opinion calls for reduced boat electrofishing, and the Office of Protected Resources of NMFS currently is recommending reducing boat electrofishing on the Columbia River in its permitting decisions. Will the proposed research be affected by this decision? If so, will the project obtain adequate data to accomplish its objectives?**

***Proponent Response:** We have been and are continuing to work with BPA and NOAA staff on a biological assessment formal consultation process to evaluate effects of boat electrofishing on ESA listed salmonids in the Columbia River. We believe this process will lead to obtaining a section 7 permit to allow allocated take and begin sampling in the spring 2022.*

ISRP final comments: The ISRP appreciates the complexity imposed by this issue and recognizes that the efficiency of a stratified sampling design helps reduce the amount of electrofishing that would have been done under other sampling designs. Project challenges that result from permit issues should be documented in annual reports.

- n. In Section 8, the proponents suggest that the “Project work will indirectly act as a detection program for Northern Pike in the Middle Columbia River.” A specific Objective should be stated about early detection of northern pike and other potential fish predators. Will a broader assemblage of non-native fish species be observed and documented in the detection sampling effort (e.g., largemouth bass, yellow perch, crappie, carp, etc.)? While these other non-native fish may not be important predators of juvenile salmonids, they can have important influence on food webs and may signal emerging predation concerns.**

***Proponent Response:** We reworded the Northern Pike detection statement since it is not an objective of this project. However, we will report any capture of Northern Pike to management agencies in the basin. We will capture all non-native fishes to evaluate their predatory impact on salmonids.*

ISRP final comments: As stated in comments above under the Problem Statement, the wording added to the revised proposal under Objective 5 is vague about how the predatory impact will be evaluated for other non-native fish such as largemouth bass, yellow perch, and crappie. Additional clarity is needed and should be provided in the next annual report.

- o. Assessing impacts to recovery of listed populations will require relating results to current ESA population status assessments, including integrating predation impacts and survival benefits into population productivity and abundance estimates. The ISRP strongly encourages the proponent to coordinate and share information with ongoing modeling efforts by others doing work in the Columbia Basin.**

Proponent Response: Findings from this work will be shared as need with other groups involved with salmon recovery in the Columbia basin. Coordination and communication will ensure data collection collaboration with others engaging in research above the McNary Pool.

ISRP final comments: The addition of Objective 6 helped to explain how WDFW intends to share valuable project results and information. It will be important to contact those having past experiences with predator-prey projects in the Columbia Basin for consultation and critique.

5. Project Evaluation and Adjustment Process

Proponent Response: We removed “adaptive management” as we agree that it is too early for management. Instead, we will evaluate methods each year and make adjustments to improve the study design (e.g., adjust sample site lengths) and analysis to accurately estimate the abundance of predatory fishes and their consumption of juvenile salmonids above McNary. Understanding first year results for site length, time between mark and recapture, and tagged fish movement within sites will help reduce within or between year adjustments to the methods.

The WDFW will be the principal investigator and will coordinate and communicate with others conducting salmon recovery in the basin. A management or decision framework will be established once we refine and finalize field methods and modeling analysis.

ISRP final comments: Although the proponent provided the additional clarity requested, it is important to recognize that adaptive management processes apply at many levels from within-project adjustments up to major management changes. The project should use an adaptive management framework at all appropriate levels. Progress of and changes to this management framework should be presented in annual reports.

6. Potential Confounding Factors

Proponent Response: See in Methods above. [See revised proposal]

ISRP final comments: The identified issue about smallmouth bass migrations was adequately addressed under 4.m. above.

7. Timeline

Proponent Response: We revised to the timeline to match objectives and sub-objectives.

ISRP final comments: The revised timeline was much improved and provided the necessary detail to understand the short- and long-term schedules for each objective.