Independent Scientific Review Panel
for the Northwest Power & Conservation Council
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Memorandum (2021-3) **March 19, 2021**

To: Richard Devlin, Chair, Northwest Power and Conservation Council

From: Stan Gregory, ISRP Chair

Subject: Review of New WDFW Proposal "*Piscivorous Fish Status and Trend Monitoring in the Columbia River Upstream of McNary Dam"*

Background

On January 21, 2020, the Northwest Power and Conservation Council asked the ISRP to review Washington Department of Fish and Wildlife's (WDFW) proposal titled "*Piscivorous Fish Status and Trend Monitoring in the Columbia River Upstream of McNary Dam*" (Project # 2020-001-00). The intent of this new project is to determine the abundance, trends, and consumptive impacts of non-native fishes on salmonids upstream of McNary Dam in the mainstem Columbia River. The project proposes to monitor predator population abundance and growth rates and measure changes in predator population status. The project will use this information to evaluate the effectiveness of current harvest deregulation and future predator management actions designed to increase juvenile salmon survival.

ISRP Recommendation

Response requested

The ISRP requests a response in the form of a revised proposal and brief point-by-point responses to our seven recommendations, including, as appropriate, a summary of how changes to the proposal addressed our concerns. We believe the proponents can address our concerns in a short-time period.

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 the following seven concerns. The ISRP

Comments section provides additional detail about these seven concerns and other comments intended to provide guidance in developing a response.

1. The Problem Statement should clearly identify the specific predators that will be fully or partially assessed in the study. Various predators are mentioned in different sections of the proposal (e.g., smallmouth bass, northern pikeminnow, walleye, channel catfish). In addition, the proposal should identify the specific ESA-listed ESUs, DPSs, MPGs, and populations of prey that will be assessed to understand the magnitude of potential impact of the predators.

2. The Goal statement should be revised to represent the ultimate desired outcomes and benefits of the project in qualitative terms. We provide examples in the Comments section below.

3. The Objectives section should be revised to provide clearly defined SMART biological, implementation, and monitoring objectives. Each objective should be quantifiable, have explicit timelines, and provide metrics that will be used to evaluate the research through adaptive management. Biological, Implementation, and Monitoring Objectives are scattered throughout the document and should be consolidated in the Objectives section. In addition, the proponents should include objectives for 1) information sharing, education, and outreach and 2) reporting and publication.

4. Extensive Methods are presented; however, the organization of the methods was difficult to follow, and some methods were not presented. Methods should be aligned with each Subobjective. The response should thoroughly describe all methods and state explicitly what will be measured and how it will be analyzed.

The proposal should clearly describe which specific predators it will assess and the methods that will be used. Many predators are mentioned at various points, including smallmouth bass, walleye, northern pikeminnow, channel catfish, and northern pike, but the section on Fish Sampling only specifies smallmouth bass and walleye. Explain how, where, when, and which predators will be assessed in each Subobjective.

The proposal should clearly explain the methods for estimating predator consumption rates on different species and populations. The proposal should explain how seasonal measures of total predation will be used to evaluate the potential predation rates on specific populations or species and how the consequence of those estimates of predation on the populations or species will be evaluated quantitatively.

The proposal should explain how genetic analyses might be used to quantify predator impacts on juvenile salmonids at the population or population group level. Would genetic analysis demonstrate the occurrence of predation on a specific population or species, or would the project use this information to estimate predation rates on a specific population or species?

5. A detailed Adaptive Management process should be described that includes entities involved, general issues that will be addressed, regular schedule for the adaptive process, and a structured decision framework. Will adaptive management be applied to both the research effort and the management of predator populations? How will information be shared with managers, documented, and incorporated into an adaptive management decision process?

6. The following Potential Confounding Factor should be addressed: Smallmouth bass will be sampled in May and June during a time of spawning movement. Will restriction of sampling in May and June be adequate to assess the smallmouth bass population, and how will the project account for this potential movement pattern?

7. A revised Timeline is needed for all Objectives and Subobjectives. The current Timeline is based on Tasks, which should be modified with the new list of Objectives and Subobjectives.

ISRP Comments on Proposal Sections

Problem statement and significance to the Program (Section 1)

The proposal identifies "to what extent does predation by non-native fishes limit growth of ESA listed salmonid populations?" as a key question for the project. To assess the extent that predation limits recovery and growth of ESA-listed populations, the project will need to assess the impact in a manner that allows for inference at the population scale, as this is the basis for assessing viability, status, and recovery (i.e., population status rolled up for ESU and MPG status). The proposal should clearly indicate the degree to which it will attempt to estimate predation rates for specific ESA-listed ESUs, DPSs, MPGs, and populations. The proponents will sample during specific seasons that are designed to coincide with the presence of groups of populations and species. The proposal should be clear that it will estimate predation rates that could occur for those groups but will not develop separate estimates of predation rates on specific populations. Stomach samples will demonstrate the occurrence of predation on different populations, species, hatchery, or natural origin fish, but it will not provide sufficient information to calculate separate estimates of predation on these groups. The proposal should clearly identify what will be measured, what estimates will be developed, and how they will be used to determine the potential effects on groups of populations (i.e., ESU or DPS). It should also be clear about what it will not be able to measure and the limits on the conclusions it will be able to make. If the proponents believe they will be able to develop more specific rates of predation and their consequences for specific populations, ESUs, or DPSs, the proposal should clearly explain how those rates will be estimated. The ISRP recognizes the project will face budget and/or technological limitations, and we ask the proponents to describe those in the proposal.

While it may not be possible to determine population-specific predation rates from stomach samples, the project might be able to develop a rough estimate based on modeling. For example, based on the number of prey from each stock detected at a dam (for those with PIT tags) and the run-timing curves (e.g., their Fig. 3), the project could estimate the relative availability of prey items over time (week) and space (reservoir), and apply these estimates to the total prey consumption estimates to estimate consumption by stock. This assumes that the different stocks have similar vulnerability to being eaten, which may not be valid. For example, larger steelhead smolts may likely be less vulnerable than Chinook fry. The ISRP encourages the proponents to consider such an approach or describe an alternative approach for estimating population-specific predation rates.

The term "population" is used inconsistently throughout the Problem Section and the document, which results in confusion, particularly related to the scale at which predation impacts will be determined. The

proponents should consider using the formal definition and population delineations adopted by co-managers and published in approved ESA recovery plans.

Clarification of the specific predators that will be sampled is needed. While it is clear that smallmouth bass will be targeted, it is not clear to what extent walleye, northern pikeminnow, and channel catfish will be targeted and how extensive an effort would be required to fully incorporate these species for abundance estimates in other sampling areas and in subsequent years.

Goals, Objectives, Methods, Project Evaluation and Adjustment Process, Confounding Factors and Timeline (Sections 3-7)

The general plan of the proposal is to develop reliable estimates of predator abundance (via a two-staged closed population model) so that the efficacy of future removal efforts can be evaluated. This is a worthwhile plan as it is well recognized that simple counts of the number of fish removed is a poor method for evaluating benefit to juvenile salmonid survival and the effectiveness of removal programs. A large concern is that the sampling design is limited to sampling select predator fish in shoreline areas in May and June, which largely may reduce the scope of the project to assessment of smallmouth bass. The proponent recognizes that the proposed project potentially would provide information on predators such as northern pikeminnow, channel catfish, and northern pike (when and if they get below Chief Joseph Dam) that would meet needs identified in the 2019 FCRPS Biological Opinion and would be helpful to other BPA-funded projects. However, the stated Tasks (i.e., Objectives) do not sufficiently explain how it would do so. The type of diet and bioenergetic studies that are proposed will likely provide useful context to help evaluate the impact of non-native predators on juvenile salmonids.

Goals

The proposal's goal statements represent objective-level descriptions. They should be restated as broader longer-term aspirations beyond their near-term objectives. The ISRP provides the following as examples of statements of broader goals rather than specific objectives:

1. Develop a better understanding of the population abundance trends of fish predators and their predatory impacts on salmonid populations in the Columbia River above McNary Dam.

2. Evaluate the effectiveness of current and future predator management actions to increase juvenile salmon and steelhead survival, increase salmon and steelhead population viability, and to assess changes in predator population status.

Objectives

This section needs revision to compile and develop clearly defined SMART biological, implementation, and monitoring objectives., i.e., *(1) **S**pecific and clearly defined, (2) **M**easurable (quantifiable), 3) **A**chievable and testable, (4) **R**elevant and applicable to the Program with benefits to fish and wildlife, and (5) **T**ime-bound with clear milestones and end dates*.

This RM&E project presents one central research question, which appears reasonable, but details are requested on such issues as the scale at which estimates of predation mortality will be assessed (e.g.,

species, ESU, population, mixtures, hatchery, natural). More importantly, biological, implementation, and monitoring objectives are presented throughout the document in different sections and in different terms. Such objectives should be presented and consolidated into the Objectives section in consistent terms. In addition, the proponents should include planned Objectives and/or Subobjectives for years 2-5 of the project, and for participation in information sharing and adaptive management, reporting and publishing, and public engagement and outreach, which are all important to project success.

It is unclear what specific outcomes would trigger the described adaptive management changes. Many of these concerns can be addressed by recasting the Task statements as SMART Quantitative Objectives. In turn, Subtasks should be recast as Implementation Objectives under the appropriate Objective and should describe the specific steps needed to achieve the Quantitative Objective. The proposal should explain how the project will determine the level of detectable change in the predator abundance, CPUE, and PSD that is desired or expected. Examples of the possible versions of Tasks 1-4 as Quantitative Objectives are provided below:

- Objective 1: Estimate an index of annual abundance (*e.g., number of fish in area sampled, fish/rkm—see below*) of the primary non-native predator fish in sites above McNary Dam with the following precision: a CV of <xx% for smallmouth bass and a CV of <xx% for walleye (*and northern pikeminnow—see below*). FY2021-2025.

- Objective 2. Estimate catch per unit effort (CPUE) and proportional stock density (PSD) of the primary non-native predator fish in sites above McNary Dam with a CV of <xx% for both smallmouth bass and walleye. Annually, FY2021-2025.

- Objective 3. Estimate annual predatory fish consumption rates, total juvenile salmonid biomass (kg) consumed, and total number of juvenile salmon and steelhead consumed by species, and size class in reaches above McNary Dam with a CV of xx% for smallmouth bass and walleye. FY2021-2025.

- Objective 4. Provide information and outreach to the public and interest groups by placing xx signs and conducting xx public meetings per year. Annually, FY2021-2025.

The ISRP recommends developing Objectives that address the partitioning of assessment of predation impacts for specific populations or groups of populations and address the assessment of recovery of these populations and groups. The proponent specifies that they will address the following question, “Is this mortality…preventing the recovery of ESA listed populations in the Columbia and Snake Rivers?” This is an important question that is very complex and challenging. It requires assessment of predator impacts on productivity and abundance for individual salmon and steelhead populations against a background of factors independent of the predators, such as factors that influence salmon productivity as well as factors linked indirectly to predation (e.g., temperature, discharge, turbidity). While answering this question may be beyond the scope of the project, the information produced by the project will contribute to the answer and likely be especially useful to ongoing efforts such as life cycle modeling by NOAA Fisheries. It will be important to coordinate with ongoing efforts and share the information to highest degree possible. If such collaborations are planned, the proposal should describe the anticipated evaluations.

The proponent stated that "In future years, the study design will be used in other river reaches on a rotational basis (i.e., lower Snake or Columbia reservoirs)," but no Objective includes information as to when this would happen or what would trigger the change of sampling location. There should be a specific Objective(s) and/or Subobjective(s) to state what new aspects will be taken on in future years. There should also be an Objective stating when analyses and reporting tasks will be completed, and what the reports will include. The Objectives should be clear about expectations, metrics for success, and timelines.

The proposal does not provide specific enough information about the targets and thresholds that will initiate adaptive change in methods. If precision levels targeted in Objectives 1-4+ are not met, when will new and or more intensive sampling methods be invoked (e.g., during an early methods development phase, annually, within field seasons)?

Statements that resemble objectives are presented throughout the document in different sections. Objectives should be clearly articulated in the Objectives section and subsequently identified by number or descriptor. Following are a few examples of the objective-type statements in the document by section that were not articulated as Tasks (i.e., Implementation Objectives) or Subobjectives:

Short Description Section

"Under an adaptive management approach, predator population abundance and growth rates will be monitored and used 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 over time and space. "

Problem Statement Section

"Monitoring specific predator densities by habitat type will provide a more detailed geographical distribution, which could assist in modeling impacts of potential range expansion under future climate change scenarios."

Significance to Fish and Wildlife Program and other regional plans Section

"unlike most salmonid species, the life history, migration patterns, spawning locations and habitat requirements of these nonnative species is less known within the Columbia Basin. This project will examine these critical uncertainties within the project area such that future targeted management actions (i.e., hypotheses) may be developed and implemented as part of the project."

"Other indicators to evaluate predator population status and trends is age and length frequency and proportional stock density (PSD) which can help identify year-class strengths/failures, recruitment, growth, annual mortality (Anderson and Gutreuter 1983; Gabelhouse 1983), or possibly indicate a compensatory predator response. These metrics will be monitored over time and will become an increasingly important indicator of population response when management actions are implemented to reduce predator abundance."

New and revised SMART Objectives will serve as the basis for revised methods and timeline sections. The existing Task level descriptions in the Methods should be used to create and revise Objectives.

Methods

Extensive methods are provided; however, the organization of the methods is difficult to follow because Objectives are not specified or linked with methods, and the organization is based on Tasks that are not described in the Objectives section. The Methods section should be revised after the SMART Objectives are revised. Additional details and clarification are needed in the Methods. For example, how will age- and length-frequency analyses and PSD analysis be used to "evaluate predator population status and trends?" How "will year-class strengths/failures, recruitment, growth, annual mortality" and "compensatory predator response" be identified?

The proponents state that "Although smallmouth bass have a higher capture rate and are likely to be more susceptible to the sampling gear than walleye, both predators will be the focus of this project," which suggests that the proponent will not have success with the assessment of the walleye population with the proposed methods. 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. Even if it is not implemented in the first year, it should be described clearly in the proposal.

It appears native predatory northern pikeminnow will be captured, sacrificed, and evaluated for stomach contents only. Northern pikeminnow likely will be captured with the nearshore boat electrofishing methods, as shown by Petersen et al. (2000). Why are northern pikeminnow not included in the CPUE and mark-recapture effort? The project's population assessment could be paired with the planned diet analysis to better understand pikeminnow's predatory effect in the sampling area. Could variability and changes in northern pikeminnow populations be related to some of the variability expected in habitat-specific and total populations of smallmouth bass and walleye? Northern pikeminnow are not included in the population analysis. Was this because of a budgetary constraint or for another reason?

In the first year, habitat classification will be constrained to one level of stratification to include four classes (reservoir, confluence, transition, river). Montgomery and Fickeisen (1978) documented that sloughs and backwaters are an important stratum, and Petersen et al. (2000) found that island complexes and tributaries (i.e., not just at their confluences) are common habitats in the intended sampling area. Furthermore, these studies showed a high degree of seasonal movement and connectivity among these habitat classes. The ISRP encourages the proponents to consider future alternative approaches (if funding or collaborative projects become available) for assessing predator abundance in some of these habitats, such as tributaries and sloughs. For example, PIT tag detectors might be possible to use in some locations to record the entry, residence time, and departure of already PIT-tagged predators from the mark-recapture effort.

The proponent states that incorporation of a potential stratification based on a substrate factor is reserved for future years. Information presented by Petersen et al. (2000) would suggest it prudent to use a substrate factor right from the start because it could be difficult or impossible to tease out this factor post-hoc. It could be as simple as ensuring sites were relatively uniform for fine (sand and gravel) versus coarse (cobble, boulder, and bedrock) substrate. Habitat classification may explain some of the variability in capture probability or fish density across sites and can be incorporated in the abundance estimation model. However, the linkage between habitat and site selection was not described. Are investigators planning to select sites that are uniform with respect to habitat characteristics or will

habitat characteristics for each site be calculated in a post-sampling step? Some quick, simplified methods for sampling substrate characteristics can have substantial error. The proposal provides no details of how these characteristics would be measured. 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. The proponent is highly encouraged to coordinate with personnel conducting similar work on smallmouth bass in Lower Granite Reservoir (e.g., Ken Tiffan of the USGS, BPA project 2002-032-00).

The proponent did not indicate what outcomes would initiate the adoption of other sampling strata in future years. It should be made clear in a specific Objective what metric will be used to judge the need for additional strata, such as a threshold of desired CV for the population estimate.

Sampling effort in each site should record both the meters of shoreline sampled as well as the number of electrofishing seconds. Estimates based on distance sampled likely will be preferable because of the hyper-stability in time-based effort (Marcy-Quay et al. 2019). The basic problem is that as fish density increases, boat speed is often reduced to give netters more time to retrieve stunned fish. As sites will be georeferenced for repeat sampling, there would be little cost to using a site length-based effort measure.

It was not clear if the sites used for mark-recapture would be contiguous. This would be beneficial, as it would allow better estimation of the mark-recapture closure assumption (proportion of marked fish emigrating from the site). It also would be beneficial to subdivide each 1-1.5 km site, and to process and release fish in each subsection. This would allow a more detailed look at dispersal distances between marking and recapture sessions providing additional information on closure, and perhaps even allow estimation of parameters to estimate mark loss due to movement. This approach may also reduce stress levels of captured fish by limiting holding times and densities, potentially reducing post-release mortality and the resulting negative bias in capture probability. The ISRP recognizes that the project will stratify its sampling based on major habitat types. The proposal should clearly identify the initial habitat strata that will be used, potential strata that might be added after the first year, and the degree of contiguity that can be included while adequately representing major habitat types.

The time between marking and recapture sessions was not specified in the proposal. A short period between sessions may not allow fish captured and marked on the first session to mix with and behave like unmarked fish, providing a more reliable estimate of capture probability. However, a longer period between sessions might increase the probability of mark-loss due to movement out of the sites or mortality. As described in our comments below, conducting a 4-5 session mark-recapture effort in the first study year would provide useful information on this use and be used to identify the appropriate time between marking and recapture sessions in later years. Potential issues with the mark-recapture method are: 1) not having a closed population, and/or 2) not having enough time between capture and recapture events to allow mixing of the marked and unmarked groups. These could substantially limit the utility of the mark-recapture approach. The proposal should therefore include an Implementation Objective(s) to address and test these factors.

The linkage between the abundance and CPUE elements of the proposal were not well described and needs to be clarified. We think that the CPUE data provide the index site data that will be expanded to abundance by sampling from the hyper-distribution of capture probabilities estimated by the Bayesian two-stage mark-recapture.

The proposal should provide a clear sense for what proportion of the shoreline of the project area, by habitat type, will be sampled. If only a small proportion will be sampled, and there is high variation in fish densities or capture probabilities across sites (even after stratification), the abundance estimates for each stratum will be imprecise. The proposal cites Figure 1, but it was not included.

The proposal states that 8 sites 1-1.5 km long will be sampled using mark-recapture in each stratum (river, transition, confluence, reservoir). This may yield too few fish to reliably estimate density and capture probability hyper-distributions within a stratum (depending on number of recaptures and variation in catch across sites). This potential problem could be exacerbated by further stratification using habitat type. 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. Perhaps the first year of the study should focus on only one stratum with expected high densities (e.g., Transition), and even consider conducting a multi-session mark-recapture effort (e.g., 4-5 sessions per season). The latter would provide more robust estimates of capture probability as potential behavioral/mixing effects could be better evaluated.

The proposal states that "Final habitat classes will be determined based on observed fish densities." If the proponents are referring to catch rates, then this approach assumes that the capture probabilities across habitat types, and possibly across fish species, are constant, which is unlikely to be the case. A more robust approach for evaluating habitat effects is to incorporate them as fixed effects on capture probability and/or fish density in the Bayesian model. The importance of habitat effects can then be evaluated based on model selection metrics (e.g., DIC). Alternately, the model could estimate capture probability and/or fish density by habitat strata, but this will reduce sample size for the hyper-distributions.

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.

The proposal does not specify how data from offshore gillnetting will be incorporated into abundance estimates. The mark-recapture model that is described estimates capture probability for boat electrofishing only. A similar mark-recapture effort for gillnetting would need to be done to estimate its capture probability. However, this may not be possible given high mortality associated with gillnetting, unless the sets are short. Fish size might differ between near-shore (electrofishing) and offshore (gillnetting). More detail on this element of the proposal is needed.

Although not a significant element of the proposal, the proponents should consider whether estimation of proportional stock density (PSD) is useful. This method relies on the ratio of density or catch rates of larger fish relative to total density or catch. A similar value for this ratio can arise from two different circumstances with very different implications for population dynamics. For example, the ratio may be low because of high mortality of larger fish (e.g., effect of removal efforts) reducing the value of the numerator, or because of a large recent recruitment event, which would increase the value of the denominator. This limits the utility of PSD. A better approach would be to develop size-stratified estimates of abundance from the sampling program and model described in the proposal. Size-stratification will likely improve precision owing to differences in density and capture probability. Fish size could be used as a fixed effect in estimation of these parameters.

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?

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. The proposal would be improved if a stepwise decision diagram was provided that illustrates the process and criteria for identifying origin of prey items. Genetic analyses may not provide adequate level of distinction required to assess predator impacts at population or MPG levels. The proponent is encouraged to coordinate with others who are using stable isotopes to differentiate hatchery versus natural fish prey items in Lower Granite Reservoir (BPA Project 2002-032-00). Though it is unlikely that such data would be adequate to develop specific estimates of predation rates for hatchery versus natural origin fish, data on frequency of detection of evidence of predation on hatchery and natural origin fish could strengthen the interpretation of the potential impacts on natural populations. The ISRP recognizes that this may be beyond the scope of this project because of budgetary limitations; information could be useful as the research develops in future years. In addition, the ISRP encourages the project to coordinate with other Columbia River Basin efforts for assessing predation impacts, such as the long-term pikeminnow monitoring project in the mainstem Columbia, and describe their intended coordination plans in the proposal.

In general, this proposal is very ambitious, and it is not clear how the full suite of Objectives can be accomplished in the first year. 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.

Project Evaluation and Adjustment

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.

Confounding Factors

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).

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?

Relationship to Other Projects and Miscellaneous (Sections 8-13)

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 nonnative fish may not be important predators of juvenile salmonids, they can have important influence on food webs and may signal emerging predation concerns.

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.

Literature Cited

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