



## Independent Scientific Review Panel

for the Northwest Power & Conservation Council  
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**Memorandum (ISRP 2016-6)**

**March 28, 2016**

**To:** Henry Lorenzen, Chair, Northwest Power and Conservation Council

**From:** Steve Schroder, ISRP Chair

**Subject:** Final Review of Lake Roosevelt Northern Pike Suppression Proposal (1994-043-00)

### Background

At the Northwest Power and Conservation Council's February 26, 2016 request, the ISRP reviewed a response to our January 25, 2016 review of the Spokane Tribe of Indians' Fiscal Year 2016 proposed "Lake Roosevelt Northern Pike Suppression Plan." This proposed suppression effort is a scope change for the ongoing *Lake Roosevelt Fisheries Evaluation Program (Data Collection)* project ([#1994-043-00](#)).<sup>1</sup> In our January review (hereafter "preliminary review"), we requested a response on eight issues ([ISRP 2016-2](#)) to improve the proposal's scientific credibility. On February 9, 2016, the Council considered the proposal, our recommendation, and public comments, and recommended support for the March 2016 gill netting effort. However, the Council conditioned support for the remaining proposal efforts on a favorable ISRP and Council response review.

The proposed effort is intended to reduce the proliferation of northern pike in Lake Roosevelt through immediate suppression actions guided by studies evaluating the proposed techniques. This proposal is based on baseline data from a pilot study on the northern pike population in Lake Roosevelt (reported within the proposal), which indicated a recent marked increase in abundance of northern pike. Northern pike are voracious predators that are a likely threat to native species and non-native game fishes and they could potentially move downstream in the Columbia River and possibly impact the recovery of ESA listed salmon. The project proponents contend that *"it is critical that a monitoring and suppression plan be developed immediately while abundance is still relatively low... to reduce the risk of Northern Pike numbers expanding within Lake Roosevelt and beyond."*

The proposed northern pike suppression project for Lake Roosevelt is closely related to work by the Kalispel Tribe in Box Canyon Reservoir, Pend Oreille Subbasin, Washington (projects [#1997-004-00](#) and

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<sup>1</sup> We suggest that the northern pike suppression effort be provided with its own project number. This would make it easier to track progress in both the new suppression effort and in the original Lake Roosevelt fisheries evaluation project.

[#2007-149-00](#)). The ISRP concluded that the Kalispel Tribe's effort to suppress the northern pike population in Box Canyon Reservoir was justified. The proponents of the Box Canyon Reservoir suppression effort are applying gillnetting techniques to target spawning populations in shallow water. The proponents of the Box Canyon effort concluded from a pilot study that *"intensively netting northern pike in sloughs and backwaters from ice off through the spring freshet could drastically reduce the abundance of northern pike in Box Canyon Reservoir."* They set an objective to reduce northern pike abundance by 87% or more in the Box Canyon Reservoir and achieved that objective during the pilot study; however, maintaining the reduced level of northern pike abundance will likely require annual effort (i.e., gillnetting during the spawning period and/or more gillnetting at other times of the year) equal to or exceeding what was conducted during the pilot study.

## **ISRP Recommendation**

### ***Meets Scientific Review Criteria (Qualified)***

The ISRP appreciates the gracious and constructive approach of the proponents in addressing the ISRP review comments. The proponents have provided a useful revision of their proposal, supplemental information, and responses to our comments. The effort largely meets scientific review criteria, but the ISRP identifies the following qualifications that can be addressed when finalizing the statement of work for the Council and Bonneville Power Administration (BPA):

- (1) Include explicit hypotheses to be tested by the proposed activities and provide quantitative objectives for what is to be achieved.
- (2) Include quantitative objectives for the northern pike suppression effort as a means to evaluate program success (e.g., reduce northern pike CPUE by \_\_\_% and reduce the relative abundance of large northern pike [ $> \text{___ mm}$  total length] by \_\_\_% by the year 20\_\_\_). Quantitative objectives should be developed for each metric used to evaluate northern pike suppression, and a time frame should also be included in each objective.
- (3) Include quantitative objectives regarding the protection of native fishes captured as bycatch.
- (4) Revisit the elements of proposal that describe criteria for assessing the effects of bycatch and actions to alleviate the effects of bycatch on native species. The focus should be on preventing population-level effects of bycatch on native species. We question bycatch limitations for non-native piscivorous fishes (e.g., walleye) as they do not appear to be consistent with the Council's Fish and Wildlife Program to protect native fishes.
- (5) The planned use of 4-hour gillnet sets during daylight hours using nets with panels of five different mesh sizes needs to be supported. A detailed review of literature or a comparative study of catch rates during the day and at night, for varying durations of gillnet sets, and for different mesh sizes is needed to determine the design of gillnets and sets that will optimize catch efficiency for northern pike.
- (6) Include a study design and description of the otolith microchemistry methods the project will use to determine the natal origins of northern pike sampled in Lake Roosevelt. Discuss how knowledge of natal origins will inform adaptive management decisions regarding northern pike suppression in Lake Roosevelt.

Progress toward meeting quantitative objectives should be evaluated by the proponents and documented in annual progress reports, and the relative success of the results should justify continuation, modification, or termination of the suppression effort. Under the section “Anticipated Future Work,” the proponents’ proposal states that “*work completed for the proposed request for scope change and budget increase will be used by Lake Roosevelt Co-Managers (STOI, WDFW, CCT) to develop a short-term, three year Northern Pike relative abundance survey and suppression plan for FY17, FY18 and FY19.*” If requested, the ISRP could review the co-managers three-year plan before implementation.

Additional comments noted below.

## Response Discussion

### **ISRP Preliminary Review Comment (1)**

*The proposal should include clearly stated hypotheses about northern pike suppression that will be tested. For several activities proposed – including suppression, telemetry, and index netting – there is no indication as to how these activities are expected to yield an understanding of the effectiveness of the proposed northern pike suppression program.*

### **ISRP Preliminary Review Comment (3)**

*The proposal should include clearly defined quantitative objectives with targets (i.e., outcomes, endpoints) over specified time periods.*

### **Proponents’ Response (1)**

Although the overarching objective of keeping northern pike numbers low within Lake Roosevelt remains the same, the proponents have identified four specific and quantifiable objectives. The revised proposal provides additional detail, including refined methods, the total effort proposed, bycatch considerations, and the data collection required for each objective. The revised proposal contains the following four objectives:

- Objective 1. Develop and implement northern pike relative abundance surveys to evaluate CPUE trends, collect biological data, assess bycatch, and inform targeted gillnetting efforts.
- Objective 2. Implement targeted northern pike gillnetting efforts to reduce northern pike numbers in the Kettle Falls area of Lake Roosevelt.
- Objective 3. Determine natal origin of northern pike captured during 2016 survey efforts conducted on Lake Roosevelt.
- Objective 4. Develop an outreach plan and materials for anglers and recreational users addressing the presence and concerns of northern pike in Lake Roosevelt.

Together, the proposed objectives will inform the development, if needed of localized and efficient long-term northern pike population monitoring and suppression methods for Lake Roosevelt. Proponents believe that the proposed northern pike relative abundance survey methodology will provide a useful baseline of abundance and population demographics, and will inform targeted gillnetting efforts. Targeted gillnetting efforts are expected to have higher northern pike CPUEs compared to the randomized gillnetting utilized during relative abundance surveys. Otolith microchemistry will determine if northern pike are spawning in Lake Roosevelt or its tributaries, or if the observed fish are emigrating from other areas. An outreach plan will improve public awareness regarding both the regulatory status of northern pike, as well as the

threat they pose to the Lake Roosevelt fish community and anadromous populations downstream.

### **Proponents' Response (3)**

The revised proposal objectives and methods have been expanded and clarified. The purpose of the proposed work is to collect the data needed to inform the development of scientifically sound and efficient northern pike population monitoring and mechanical removal methods in Lake Roosevelt. The development of the proposed methods has been informed by past and ongoing northern pike suppression projects.

### ***ISRP Final Comments***

Although good progress was made, the proposal still lacks quantifiable objectives and testable hypotheses. Peterson and Dunham (2010<sup>2</sup>) explain the value of hypotheses in this way: *“Whenever possible ... managers should formulate competing hypotheses about how management may influence processes at different scales and measure management outcomes against predictions from these hypotheses. It is recognized that not every management action can be elevated to the level of a research project, but it can be stressed that a clear articulation of processes and testable hypotheses is essential for accurate identification, refinement, and functional understanding of management scales.”* Some potential hypotheses are indicated in the proposal. For example, it is stated that *“The proposed objectives are expected to characterize and reduce northern pike abundance, shift the population towards younger, immature fish, identify natal origin, and provide a useful inventory of biological information.”* This sentence hints at testable hypotheses regarding northern pike abundance and population structure that can be formally stated and tested.

Objective 1 could be stated more explicitly to identify what is to be achieved and the time frame in which it is to be accomplished. It seems the primary purpose of Objective 1 is to identify areas of high northern pike density for the purpose of (1) guiding the suppression effort to those areas and (2) monitoring northern pike population trends and associated biological metrics. Given the exploratory nature of this objective, variable mesh gillnets are probably appropriate. The proponents may wish to examine the suppression effort in Box Canyon Reservoir which used variable mesh gillnets to determine the mesh sizes that could be present in the gillnets used in their northern pike suppression effort in Lake Roosevelt. Also, the Box Canyon Reservoir study and other efforts have found that northern pike concentrate in certain habitat types (e.g., backwaters and sloughs) during early spring, and these findings could help guide development of Objectives 1 and 2.

Objective 2 could be converted into a quantitative statement with a time frame for achievement of the objective. For example, *“In areas of relatively high northern pike density (based on findings in Objective 1), reduce northern pike CPUE by X% and reduce mean total length by X% by 20XX.”*

Objective 3 requires additional detail. The proponents indicate that otolith microchemistry techniques will be used to determine natal origins of northern pike. This will require a study design that includes collection of water samples, analysis of their chemical and isotopic features, collection of otoliths from

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<sup>2</sup> Peterson, J. T., and J. Dunham. 2010. Scale and fisheries management. Pages 81-105 in W. A. Hubert and M. C. Quist, editors. *Inland fisheries management in North America*, 3rd edition. American Fisheries Society, Bethesda, Maryland.

northern pike for analysis, the probable use of a laser ablation multi-collector to provide isotopic ratios of several elements within otoliths, and a statistical classification analysis of some type to determine if isotopic composition of elements in otoliths can be related to spatial variation in water chemistry. Additional information on how this work will be done or who will do it is needed. Further, it is not clear how information on natal origin will be used to inform adaptive management decisions regarding northern pike suppression in Lake Roosevelt.

**ISRP Preliminary Review Comment (2)**

- a) *The proponents should explain why they believe their proposed removal effort and monitoring will be adequate to control or suppress the northern pike population and measure resulting benefits.*
- b) *The concern about northern pike introduction in the Columbia River Basin needs to be addressed, both at the sources and downriver.*
- c) *It is requested that evidence or rationale be provided by the proponents addressing their ability to control or suppress the northern pike population. Additionally, they should provide details on the methods used to measure benefits, the amount of effort required, and the specifics of the monitoring program.*

**Proponents' Response**

- a. To date, there is no plan in place to monitor or remove northern pike in Lake Roosevelt. The proposed objectives begin the work of developing northern pike abundance and distribution monitoring, and future largescale removal methods. The proposed objectives are informed by numerous past and ongoing northern pike suppression and monitoring projects within the Columbia River drainage upstream. In particular, the revised proposal has incorporated information from the successful northern pike suppression program developed by the Kalispel Tribe of Indians (KNRD) and the Washington Department of Fish and Wildlife (WDFW) in Box Canyon Reservoir (BCR), WA. Currently, the ISRP is reviewing the summary finding of the BCR suppression efforts. The proposed objectives have also been informed by northern pike suppression efforts on the Columbia River in British Columbia, downstream of Hugh L. Keenleyside Dam, as well as by the pilot northern pike abundance survey conducted in Lake Roosevelt in July, 2015.
- b. The revisions to the proposal have expanded the narrative describing the history of northern pike introductions and population expansion upstream of Lake Roosevelt. The revised proposal better reinforces that the proposed work is not only supportive towards ongoing projects above and below Lake Roosevelt, but is also synergistic with ongoing suppression efforts upstream.
- c. The revised proposal's justification, literature cited, and methods have been expanded and clarified. More detail and background has been included regarding proposed survey methodology and data collection. The proposed objectives are informed by the successful northern pike suppression program implemented in BCR, WA, by suppression efforts on the Columbia River in British Columbia, and by the northern pike abundance survey conducted in Lake Roosevelt in 2015.

## **ISRP Final Comments**

(a) The proponents have provided a more detailed argument as to why they believe the proposed removal effort will be adequate based on the experiences of other projects focused on northern pike suppression. Nonetheless, they propose an annual total of 6 days of targeted gillnetting over three separate 2-day time periods to suppress northern pike in Lake Roosevelt. This appears to be a very small amount of effort compared to other suppression projects, such as the Box Canyon Reservoir northern pike suppression effort. Quantitative evidence is needed to support the proposed level of gillnetting effort as being potentially effective in suppressing northern pike in Lake Roosevelt. It may benefit the program to conduct a comparative study of catch rates during the day and at night and for varying durations of net sets in order to determine the type of sets that will optimize catch efficiency.

It remains unclear that the threat of northern pike to native salmonids and other native species is more acute than that occurring from other non-native, piscivorous species (i.e., walleye and smallmouth bass) that have established populations in Lake Roosevelt. The problem of predation by non-native piscivores on native fishes is not simply a northern pike problem; it is a fish community and food web problem.

(b) This response is adequate.

(c) As mentioned above in (a), quantitative evidence that the planned amount of removal effort will be adequate to control or suppress northern pike in Lake Roosevelt is lacking. Mechanical removal (i.e., gillnetting) of northern pike can be effective in reducing a growing population. The proponents may wish to follow the Box Canyon Reservoir suppression project for setting quantitative objectives.

It would have been informative if the proponents had provided a more explicit description of the coordination and information sharing that occurred with other northern pike suppression projects that were used in the development of the proposal. If there is a formal mechanism for coordination and data sharing that is emerging among entities conducting northern pike suppression, a description of it would be a valuable inclusion in the proposal.

### **ISRP Preliminary Review Comment (4)**

*The proposal calls for “Spring Pike Index Netting” to occur annually, but there is no mention as to how the resulting monitoring data will be used to evaluate the suppression program. Data analyses should be linked to assessment of hypotheses (#1 above) and quantifiable objectives (#3 above).*

#### **Proponents’ Response**

“Spring Pike Index Netting” (SPIN) survey language has been removed from the proposal. While the SPIN methodology designed to monitor trends in Northern Pike population abundance in BCR has been successfully implemented there, there is a need to develop a Lake Roosevelt specific method to track abundance trends due to morphological differences between the two reservoirs. The objective of the surveys proposed is to collect the biological data needed to inform the development of a larger-scale northern pike population monitoring methodology and targeted gillnetting removal methods for Lake Roosevelt. As described in the revised proposal, the data will be used to inform future targeted gillnetting efforts, characterize the northern pike population in the Kettle Falls area of Lake Roosevelt, evaluate bycatch concerns, and to develop quantitative targets for likely suppression efforts.

### **ISRP Final Comments**

In response to Preliminary Comment (4), the proponents have removed the use of the Spring Pike Index Netting methodology from the proposal and replaced it with their own monitoring program. A description of their methods is presented in the proposal, but it cannot be determined if the methods will be adequate to assess trends in the northern pike population. Four-hour-long gillnet sets during the day with 4 gillnets (16 sets/day) over 2, 4-day sampling periods may not catch sufficient numbers of northern pike to enable trends to be assessed. Why have the proponents decided on 4-hour-long gillnet sets during daylight hours? The Box Canyon Reservoir northern pike suppression project uses overnight sets in their monitoring. Catch efficiency with gillnets is generally presumed to be substantially higher at night because net avoidance is lower. Have the proponents given any consideration to gillnetting during the night and for more extended time periods? Assessment of catch-per-unit-effort (CPUE) and length frequency data from one year of sampling using power analyses or simulation methods is needed to determine the adequacy of the proposed monitoring program. If the monitoring program is determined to be promising, summary statistics computed from CPUE and length frequency data may be used to develop quantitative objectives for the Lake Roosevelt northern pike suppression program.

The sex of northern pike captured should be documented in addition to other metrics. This may provide an alternative method of population estimation (see ISRP Final Comments [5]).

#### **ISRP Preliminary Review Comment (5)**

- a) *There is no mention of a component to evaluate the extent of removal that may occur from the proposed effort. The proposal should address what could be done to estimate the annual exploitation rate (i.e., annual fishing mortality) of northern pike and the relationships to abundance, length structure, age structure, total mortality, and other indices of northern pike population structure and dynamics.*
- b) *Have mark-recapture studies in conjunction with suppression efforts been considered?*

#### **Proponents' Response**

- a. The purpose of this proposal is to collect the data needed to better understand the current northern pike population in Lake Roosevelt, and to inform what large-scale suppression would entail. The current northern pike population in Lake Roosevelt appears to be relatively small and geographically restricted to the Kettle Falls area (a 21 rkm stretch between the confluence of the Colville River and the Evan's National Park Service boat launch). However, the precedent set in BCR, WA, demonstrated how quickly a northern pike population can grow and expand if left unaddressed. Numerous studies have documented the ability of non-native invasive northern pike to decrease the diversity of fish communities through predation and competition. Metrics for successful suppression have been described in the reports from BCR. These metrics included decreases in northern pike abundance and shifts toward smaller, reproductively immature individuals following three years of suppression activities.
- b. Due to the relatively small numbers of northern pike caught during the pilot abundance survey conducted on Lake Roosevelt in July, 2015, the proponents do not find it feasible to attempt a mark-recapture study. Such a study would likely require substantial effort, entail

great expense, and would require managers to release many northern pike alive. The proposed objectives will provide important baseline information, including northern pike relative abundance, population characteristics, and determination of natal origin by use of otolith microchemistry techniques. These findings will guide further development of northern pike monitoring and suppression in Lake Roosevelt.

**ISRP Final Comments**

(a) The proponents have not addressed the comment as to what could be done to estimate the annual exploitation rate (i.e., annual fish mortality) of northern pike and its relationships to estimates of abundance, length structure, age structure, total mortality, or other indices of northern pike population structure and dynamics. A number of important elements are not addressed in this proposal. They include linkages between the statistics to be derived from the proposed monitoring methods (see Preliminary Comment [4] regarding the adequacy of the proposed monitoring program), the numbers of northern pike to be removed annually by the suppression effort, and the abundance and dynamics of the northern pike population in Lake Roosevelt.

(b) It is likely that much more effort than is described in the proposal is going to be required to not only suppress the northern pike population but also to assess the response of the northern pike population to suppression efforts. It is recognized that the northern pike population in Lake Roosevelt may be relatively small at this time and that mark-recapture population estimates may not be feasible, but catch-per-unit-effort data from the proposed suppression and monitoring efforts may not be sufficient to assess the abundance of northern pike in the future or the effectiveness of the suppression program over time.

It may be possible to assess changes in northern pike abundance in Lake Roosevelt using a change-in-ratio method of abundance estimate. For example, the sex ratio of male to female northern pike prior to suppression efforts can be compared to the sex ratio after removal. This may work if the removals target primarily one sex. In the case of northern pike gillnetting efforts during spring, it is likely that male fish will be the primary target. This approach may be an alternative to mark-recapture estimation of abundance.

**ISRP Preliminary Review Comment (6)**

*The description of the telemetry component is insufficient for the reviewers to make judgments. More detail is needed. Additional information should address what the proponents want to learn from the telemetry study and how this information will be used to improve the northern pike suppression efforts.*

**Proponents' Response**

The telemetry component has been removed from the proposal. The proponents believe that telemetry would provide useful insights regarding northern pike habitat usage and could help identify where spawning congregations form, which would aid in the development of efficient targeted removal efforts. However, due to the required effort and associated expense, this component has been removed from the revised proposal. The cost-benefit of telemetry data will be considered further if deemed necessary for the success of future suppression efforts.

## **ISRP Final Comments**

Adequate response.

### **ISRP Preliminary Review Comment (7)**

*There is a need to assess the extent of by-catch and its potential impacts on native and desired non-native fish populations in the reservoir. [...] There is a need for a clearly stated quantitative objective regarding maximum acceptable by-catch and how the objective has been determined and will be assessed.*

#### **Proponents' Response**

The proponents have incorporated the evaluation of bycatch mortality into the refined data collection proposed. Bycatch data will be used to inform future, large-scale monitoring and suppression efforts in Lake Roosevelt. Quantitative bycatch thresholds have been incorporated into the proposed methods. Bycatch limits were informed from previous gill net surveys in Lake Roosevelt.

## **ISRP Final Comments**

The criteria set for assessing the effects of bycatch and initiating action to alleviate the effects of bycatch are not clear or based on potential population-level effects of bycatch on native species. This element of the proposal should be revisited. It is stated in the description of the monitoring program that *"Targeted gillnetting effort will be discontinued within the core study area if bycatch mortality is deemed unacceptable. Unacceptable bycatch includes mortality of more than two wild kokanee, two redband trout, or one white sturgeon during one four-hour gill net effort. Nor more than an average of ten mortalities per four-hour gill net effort will be acceptable for each managed (e.g. walleye Sander vitreus), native (e.g. largescale sucker Catostomus macrocheilus), or hatchery released fish species."* Does this mean that if the stated criteria are exceeded during a single 4-hour net set, the monitoring program is discontinued? If so, how is the northern pike suppression program to be assessed if sampling is terminated? The concern regarding bycatch is that the northern pike suppression effort does not have population-level effects on desired native species and managed sport fish. The criteria set for evaluation and termination of monitoring are not linked to potential effects of bycatch on populations of desired and managed fishes. Similarly, in regard to the northern pike removal component, it is stated that *"Targeted gillnetting effort will be discontinued within the core study area if no northern pike are collected, or if bycatch mortality is deemed unacceptable. Unacceptable bycatch includes mortality of more than two wild kokanee, two redband trout, or of one white sturgeon during one four-hour gillnetting effort. No more than an average of ten mortalities per four-hour gillnetting effort will be acceptable for each managed..., native..., or hatchery released species."* Much more gillnetting effort will be expended during the suppression efforts, but the criteria for evaluation and termination remain the same. Again, does this mean that if the stated criteria are exceeded during a single 4-hour net set, the suppression program is discontinued?

Methods to revive and assess survival of native fishes captured in gillnets are needed and should be included in monitoring and suppression protocols. For example, will live boxes be used to facilitate revival of bycatch species and assess short-term survival prior to release?

Bycatch of native fishes is a concern, but bycatch of non-native piscivores (i.e., walleye, smallmouth bass) is not of concern if the ultimate goal is to preserve or restore native fishes. We recognize the social issues associated with management for both native fishes and non-native piscivores, and the conflicting management actions that are occurring. However, we question bycatch limitations for non-native piscivorous fishes (e.g., walleye) and ask if such limitations are consistent with the Council's Fish and Wildlife Program to protect native fishes.

**ISRP Preliminary Review Comment (8)**

*An important task in the near future is to assess the impacts of northern pike on focal species. For example, a bioenergetics model could be coupled with population estimates to approximate the effects of pike suppression compared with no suppression where the predator population is allowed to grow. These issues should be discussed in the proposal and the contributions that the Lake Roosevelt northern pike suppression project may make should be stated.*

**Proponents' Response**

The revised proposal incorporates additional literature describing the ability of northern pike to alter fish community structures through competition and predation, and their dietary preference for soft rayed fishes such as salmonids. Northern pike are known to detrimentally impact salmonid populations when introduced into naive fish communities. There is no reason to believe similar negative effects to the Lake Roosevelt fish community and native fish recovery efforts would not occur as northern pike numbers increase. As there is a large body of literature available describing the impacts of northern pike introductions, the proponents have not included a bioenergetics or dietary analysis component as part of the revised proposal. Due to the relatively small number of northern pike present in the Kettle Falls area, implementation of a sound bioenergetics study would likely require great effort and expense, and would not provide managers new information.

**ISRP Final Comments**

The response is adequate, but the proponents should recognize that more detailed study is going to be needed to assess fully the effects of northern pike on desired species and the potential responses of desired species to northern pike suppression efforts. Bioenergetics modeling in areas where northern pike and other non-native piscivores are known to be abundant can be a useful tool to assess their impacts on focal species. Information needed for bioenergetics modeling of northern pike includes diet data. Stomach samples from northern pike captured during suppression and monitoring efforts could be preserved and their contents analyzed.