Independent Scientific Review Panel
for the Northwest Power & Conservation Council
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Memorandum (ISRP 2016-2) **January 25, 2016**

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

From: Steve Schroder, ISRP Chair

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

Background

In response to the Northwest Power and Conservation Council's December 8, 2015 request, the ISRP reviewed 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). 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 threaten native species and non-native game fishes, and they have the potential to move downstream in the Columbia River to possibly impact the recovery of ESA listed salmon.

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 #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 85% in Box Canyon Reservoir, which is likely to require more annual effort (i.e., more gillnetting during the spawning period and/or more gillnetting at other times of the year) than was conducted during the pilot study.

Recommendation

Response Requested

This proposal is consistent with the Box Canyon Reservoir northern pike suppression effort. However, further development of several elements of this proposal would improve its scientific credibility:

(1) The proposal should include clearly state 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. (See Comments, *1. Sound science principles [i.e., methods]*, #4 below for examples of testable hypotheses.)

(2) 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. The concern about northern pike introduction in the Columbia River Basin needs to be addressed, both at the sources and downriver. From a source in Lonepine Reservoir in the Little Bitterroot system where northern pike were introduced in the 1950s, northern pike have subsequently spread downstream in the Flathead River, into the Clark Fork and Lake Pend Oreille, and into the Pend Oreille River, Box Canyon Reservoir, and into Lake Roosevelt. Northern pike are probably well-established in all of these waters. The expansion of northern pike is a systemwide problem with a continual source of fish upriver from Lake Roosevelt. This reality is not discussed or dealt with in the proposal. Therefore, there is reason to be skeptical that the proposed suppression effort will be sufficient to reduce the long-term abundance of northern pike in Lake Roosevelt to a level where meaningful benefits can be observed. 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.

(3) The proposal should include clearly defined quantitative objectives with targets (i.e., outcomes, endpoints) over specified time periods. Only a vague statement describing the desired outcome is presented in the proposal (see Comments, *3. Clearly defined objectives and outcomes* below). Effective adaptive management requires development and use of quantitative objectives in proposals and management plans.

(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).

(5) 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. Have mark-recapture studies in conjunction with suppression efforts been considered?

(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?

(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. Although by-catch will be greatly reduced by netting northern pike at spawning time, it is not clear that this limited netting approach over a short time and relatively small area will be adequate to reduce northern pike abundance in Lake Roosevelt. Gillnetting at other times and locations, which may be necessary, would likely yield more by-catch mortality. 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.

(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.

Comments

1. Sound science principles (i.e., methods)

Several concerns regarding the proposed methods were identified:

(1) Hypotheses are not presented in the proposal. The proposal would benefit from an array of hypotheses to be tested regarding northern pike suppression efforts.

(2) There is insufficient information regarding the amount of netting effort, netting locations, or timing of netting. The number of northern pike that may be removed should be estimated, based on experiences with gillnetting suppression efforts in other lakes and reservoirs. We fear that the proposed effort is insufficient to reduce the northern pike population to desired levels. What evidence can the proponents provide to support the proposed levels of spring-spawning removal efforts by gillnetting and by tournament fishing?

(3) It is questionable if the small mesh sizes of the experimental gillnets to be used will be effective in harvesting northern pike. Monitoring Methods ID 140 (gillnetting) was listed but not available on the monitoring website. How effective are smaller gillnet mesh sizes (e.g., 1") in capturing northern pike? These details were not described in Baxter and Neufeld (2015) or the 2015 pilot study. If the smallest mesh sizes are ineffective at capturing northern pike, would it be more efficient to use nets with larger, more-effective mesh sizes?

(4) Regarding the telemetry component, there is no description of search procedures, the intensity of searches, how locations of tagged fish will be determined, or how the data will be stored and analyzed. The proponents should have some hypotheses regarding the movements of northern pike. For example, is it hypothesized that there are very few spawning areas such that most of the tagged fish would return to these spawning areas? Or, is it hypothesized that spawning areas are wide spread throughout the reservoir? More importantly, how many fish must be tagged to provide sufficient data to test the hypotheses? A sample of 12 tagged fish is likely to be insufficient to provide enough information to test hypotheses.

(5) The Spring Pike Index Netting (SPIN) is not fully explained. The amount of sampling effort to be expended is not described. There is no description as to how the data from the SPIN will be used to evaluate the success or failure of the suppression efforts.

(6) The purpose of mechanical suppression for 5 days in March before the SPIN survey is not clear. Is the purpose of the 5-day gillnetting session to mark and release pike to make them available for recapture during the index survey and allow mark-recapture population estimation? If not, perhaps that option should be considered, along with the potential concern that northern pike removal in March could distort the survey index relative to other years and complicate subsequent analysis of trends.

(7) A 2-day fishing tournament is planned as an additional component of suppression efforts. Limited information is provided, however, on how the tournament will be conducted or how many fish may be removed by such an effort. What evidence is available to indicate that such a fishing tournament can contribute significantly to northern pike population suppression? Is the 2-day harvest event likely to yield enough fish to have an impact on the northern pike population?

(8) Public outreach is a stated purpose of the 2-day fishing tournament. It will provide an opportunity to encourage anglers to kill and remove northern pike and inform stakeholders of the risk that northern pike pose in the reservoir. Descriptions of the methods that will be used for public outreach and to assess the success of public outreach in association with the fishing tournament are needed.

(9) There is no assessment of the annual exploitation (fishing mortality) rate that may be achieved by the proposed suppression effort. Mark-recapture experiments are needed in conjunction with the suppression efforts and SPIN to make this evaluation. The scientific information presented does not indicate that a high percentage of the northern pike can be removed. What proportion of the northern pike population needs to be removed annually in order to prevent further growth of the population?

(10) By-catch is inevitable, and mortality of fish captured in gill nets is high. There is a need to assess the extent of by-catch and its potential impacts on native fish populations (e.g., redband trout and native minnows and suckers) and desired non-native fish populations in the reservoir. Numerous native and nonnative species may be caught, likely in higher proportions than the targeted northern pike. This is especially so if gillnetting is conducted outside of the spawning period when northern pike tend to be concentrated. The proportion of northern pike in the catch may be higher with larger meshes, but experimental gillnets with five different mesh sizes are proposed for use in Lake Roosevelt. These nets will capture many sizes and species of fish. The by-catch issue needs to be addressed.

(11) Some tasks were described by use of Monitoring Methods ID numbers. These may be suitable for generic descriptions of the methods, but the proposal should describe additional details on how these methods may be modified and implemented to fit the objectives of the study. In one case, the text states “determination of natal origin using otolith microchemistry techniques (Monitoring Methods ID 2168; https://monitoringmethods.org/Protocol/Details/2168). This method describes an experimental approach to identify hatchery versus wild kokanee, but the reader is left to assume this method is appropriate for northern pike.

2. Benefit to fish and wildlife

There is a strong desire to control both the spread of northern pike in the Columbia River Basin and their abundance where established populations occur. The reality is that there is currently no known method for elimination of northern pike from large water bodies, and control measures are limited in their effectiveness. The desire to “do something” may be overwhelming the practical realities of achieving effective control. Effective control will likely require much more effort than is suggested by this proposal or the results of pilot projects included in reports attached to the proposal.

The proposal cites the 2014 Fish and Wildlife Program as having acknowledged "*that invasive species, such as Northern Pike, imperil native species and hinder restoration activities* (NWPCC 2014)." This statement is misleading as the 2014 Program does not mention northern pike, although it does include this acknowledgement about the threat posed by non-native species in general. The main reference offered for northern pike (and walleye) posing a serious threat to salmonids seems to be McMahon and Bennett (1996), but that paper merely speculates about the potential impact of northern pike on Pacific salmon. There is wide-spread belief that northern pike pose a threat to native fishes, particularly Pacific salmon, in the Columbia River Basin. The argument for northern pike suppression that is presented in the proposal could be much stronger using literature on northern pike introduced outside of their native ranges. Making an effort to reduce the proliferation of northern pike in Lake Roosevelt is consistent with the 2014 Program. However, both the biological and cost effectiveness of the effort needs to be considered. Initial cost estimates and records of actual expenditures should be maintained so that a cost assessment can be made in the future.

Northern pike are a voracious invasive predator in the upper Columbia Basin, and there are significant concerns that northern pike may further deplete native fish populations. Northern pike suppression efforts are underway in southcentral Alaska where northern pike have been introduced, and those efforts may inform similar efforts in the Columbia River Basin (Sepulveda et al. 2012). The assumption justifying the suppression effort is that northern pike are having or will soon have a detrimental effect on the native fish populations if the northern pike population is allowed to expand. This assumption is reasonable, especially since the risk to native fishes appears high.

Although northern pike suppression is likely to benefit native fish populations, it would be worthwhile for researchers in the Columbia River Basin to better document the potential effect of an expanding northern pike population on focal species and the effect of northern pike suppression. The ISAB/ISRP's soon-to-be-released 2016 Critical Uncertainties Report identifies non-native species and their effects on native fishes as a top priority uncertainty. For example, a bioenergetics modeling approach using seasonal diet and population data for northern pike could be used to estimate consumption of salmon. A bioenergetics model could be used to estimate predation-related mortality based on current, suppressed, and expanding northern pike population estimates. It is highly unlikely that northern pike can be eradicated from the Columbia River Basin, so a key question is how many northern pike can watersheds tolerate before reaching moderate to major impacts on focal species? Further, given the habitat preferences of northern pike, are focal species in some watersheds more susceptible to the impacts of northern pike predation?

The ISRP (2012-6) reviewed northern pike suppression proposals and projects in the upper Columbia Basin and requested a progress report on northern pike suppression in Box Canyon

reservoir within 3 years (i.e., 2015). A quantitative objective of that project was to remove 85% of the northern pike in Box Canyon Reservoir. This progress report has just been submitted for review by the ISRP. We have not yet reviewed it, but it is likely to inform northern pike suppression efforts proposed for Lake Roosevelt.

In view of the abundance of smallmouth bass and walleyes already in the system, how is removal of northern pike expected to benefit the native fish community? If a high proportion of northern pike are removed, what is the effect relative to the numbers of walleye, smallmouth bass, and other non-native piscivores? Are northern pike a larger threat to native species than smallmouth bass and walleye? The Lake Roosevelt northern pike suppression project should provide information contributing to answers for these questions.

3. Clearly defined objectives and outcomes

Quantitative objectives with targets (i.e., outcomes, endpoints) over specified time periods are not included in the proposal. Quantitative measures to assess success or failure, targets, and an end point are needed. Only a vague statement of the desired outcome is presented in the stated purpose: "*This proposal outlines the next steps to implement actions that will stop the spread of Northern Pike in Lake Roosevelt. In order to prevent the establishment Northern Pike, it is proposed that suppression efforts and pertinent studies be planned and implemented immediately.*" The lack of quantitative objectives is a weakness in the proposal that needs to be remedied.

In regard to the level of northern pike suppression that is needed, a quantitative objective could be developed using methods applied in Box Canyon Reservoir (i.e., Fishery Analysis and Simulation Tools [FAST] developed by Slipke and Maceina 2000) or the desired outcome from that effort (i.e., remove 85% of the northern pike population). The investigators should have some understanding about the percentage of the northern pike population that needs to be removed annually to effectively suppress the population.

An objective that was implied but not clearly stated is to minimize mortality of native fish captured in addition to northern pike. Minimization of by-catch mortality is very important for efforts that attempt to kill invasive species. A clearly stated, quantitative objective regarding maximum allowable by-catch is needed.

A large number of northern pike will be captured and killed. An opportunity exists to describe some aspects of the diet of northern pike in Lake Roosevelt. It would be worthwhile to identify, measure, and estimate the wet weight of fishes consumed by various sizes of northern pike. Diet data are needed to document the extent to which northern pike are consuming focal species, and these data could be used to estimate numbers of focal species consumed by the

northern pike population (see bioenergetics approach noted above in *Recommendation #8* and *2. Benefit to fish and wildlife*).

4. Monitoring and evaluation

Reliable trend information is necessary for assessing the Lake Roosevelt northern pike suppression program. The Spring Pike Index Netting (SPIN) is proposed as a means for monitoring and evaluation. However, the SPIN is not fully explained. The amount of sampling effort to be expended is not fully described. Also, description is needed as to how the data from the SPIN will be used to evaluate the success or failure of the suppression efforts. Based on experiences elsewhere, how useful is SPIN for detecting northern pike population trends? Has its reliability been assessed?

Effort is needed to estimate the annual exploitation (i.e., annual fishing mortality) rate that the northern pike population may experience as a result of the proposed annual gill netting and fishing tournament. This is an important element of both monitoring and evaluation. Given the relatively rapid growth of northern pike in the reservoir and high fecundity of the species, it is likely that a very high level of exploitation will be needed to suppress the population. Experiences from other efforts to suppress invasive fish species with similar life histories suggest that an annual exploitation rate of 20-25% of the juvenile and adult population is likely to lead to a "sustainable fishery" with little or no response in either the abundance (i.e., catch-per-unit-effort) or length structure of fish. It is likely to require an annual exploitation rate of 60-80% to identify a measurable change in CPUE and length or age structure of northern pike. The extent of bycatch associated with a high level of annual exploitation of northern pike is likely to be substantial with unknown effects on native fishes and desired game fish. Such a level of exploitation will have to go on indefinitely to achieve suppression of the northern pike population. It is advised that mark-recapture studies be conducted to assess exploitation. Mark and release of northern pike in March can permit mark-recapture analysis, as was done in the Canadian study (Baxter and Neufeld 2015). Similar mark-recapture analyses could also be conducted for important native fishes and desired game fishes to assess the effects of bycatch during northern pike suppression efforts on other fishes.

References

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Sepulveda, A. J., D. S. Rutz, S. S. Ivey, K. J. Dunker and J. A. Gross. 2013. Introduced northern pike predation on salmonids in southcentral Alaska. Ecology of Freshwater Fish 22:268–279.

Slipke, J. W., and M. J. Maceina. 2000. Fishery analysis and simulation tools (FAST). Auburn University, Auburn, Alabama.