Lake Pend Oreille Kokanee Net Pen Alternative: Response to Question from the Northwest Power Planning Council

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Northwest Power Planning Council
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ISAB 99-5
Letter/Memorandum
August 30, 1999

The Question:

The Council, at its July 1999 work session in Spokane, agreed to refer to the Independent Scientific Advisory Board the following question: Will the alternative concept submitted by the Kalispell Tribe and Pend Oreille PUD to raise kokanee in Lake Pend Oreille be as likely to attain the same ultimate result- to produce 750 thousand kokanee for harvest - as the IDFG proposal?

Background:

The plan of the Kalispell Tribe and Pend Oreille PUD would be to rear enough kokanee in net pens in Lake Pend Oreille to achieve a goal of 750,000 catchable fish, as an alternative to the Idaho Fish and Game/ University of Idaho (IDFG/U of I) plan, which has the same goal, but is proposed to achieve it by enhancement of natural spawning through regulation of lake elevations to maintain an abundance of clean, wave-washed shoreline spawning areas. Both plans are intended to reverse the decline in abundance of kokanee in Lake Pend Oreille that was observed beginning in the 1960s. Prior to that time, the catch was around 1,000,000 fish per year, and after that has fluctuated around 200,000 fish per year. The Council in its 1994 Fish and Wildlife program called for IDFG to submit a five-year study plan to investigate the effect of changing water level management of Lake Pend Oreille to benefit kokanee (1994 FWP Sec. 10.6E.1). The IDFG/ U of I plan consequently was submitted to the Council. The study plan consisted of a five-year experiment to test the hypothesis that the decline in kokanee abundance was brought about by hydropower and flood control operations that at times eliminate natural spawning areas of kokanee in the nearshore area of the lake. The hypothesis being tested is that regulation of lake elevations would improve effectiveness of natural spawning of kokanee in Lake Pend Oreille, and that this would lead to a measurable increase in abundance of catchable kokanee to a level of 750,000 fish annually.

At the request of the Council, in 1997 the ISAB reviewed the IDFG/U of I study plan for experimental lake level regulation and the resulting effects on kokanee abundance (ISAB 97-4). In addition, the Independent Scientific Review Panel (ISRP) has reviewed the annual study proposals for FY1999 and FY2000 (ISRP 98-1 and 1A; and 99-2 and 2A). In their 1994 FWP, the Council identified other factors in the lake that might affect kokanee abundance, and should be studied. These might be considered to be alternative hypotheses to explain the decline in kokanee abundance. In our report, ISAB 97-4, we discussed a number of alternative hypotheses that might explain the observed decline in abundance of kokanee. An alternative hypothesis, which we think to be a strong possibility, is that the observed decline in kokanee abundance is related to the introduction of the opossum shrimp, *Mysis relicta.* The decline in kokanee began at about the same time as introduction of the *Mysis*, which also roughly corresponded with the beginning of lake level fluctuations due to hydroelectric and flood control operations (although the sharpest annual declines in catch of kokanee occurred during the first 9 years after *Mysis* introduction, when the shrimp was in the process of becoming well established and increasing in abundance). There is a large body of literature that documents declines in kokanee populations resulting from the introduction of *Mysis*, an animal that has been found to compete with kokanee for food. We reviewed this literature

in our report ISAB 97-4. From a management standpoint, we recognize that the hypothesis that kokanee populations were influenced more by *Mysis* than by loss of shoreline spawning habitat is the more difficult alternative. It is most difficult to face because no management measure of which we can find a record has been successful in reducing or controlling *Mysis*. Through our reports to the council, we have encouraged the IDFG and U of I investigators to develop a rigorous experiment to test alternative explanations for the decline in kokanee abundance.

The results of this ongoing IDFG/U of I experiment are not yet conclusive. One of the reasons is that in two of the study years, lake levels were not maintained at the necessary levels required by the experiment, apparently because of requirements for flood control or hydropower production brought about by unforeseen weather conditions.[1] According to the letter of October 26, 1998 from Stephen P. Mealey, Director, IDFG has requested that the Corps of Engineers maintain the level of Lake Pend Oreille above 2055 feet for an additional seven years. The letter refers to an ISRP recommendation that the project should extend for a longer time to allow better analysis of the relationship of fish population changes to lake factors. While it is true that the ISRP did recommend a longer period of study in order to encompass additional generations of kokanee, further reflection on our part has raised the point that if we hope to be able to isolate water level as the factor that might most strongly affect abundance of kokanee, among the many other factors that have been postulated to do so, it will be necessary to change the water level deliberately and observe the result – as described in the original five-year proposal of IDFG/U of I. Their most recent proposal describes a program to monitor the kokanee population during a longer time period of high lake elevations. We doubt that an additional seven years of simply monitoring of kokanee populations at one lake level and comparing them to the past can lead to any convincing conclusions about the effects of lake levels on kokanee abundance. It will be necessary to return to the original IDFG/U of I concept of a well designed experiment, with lake levels deliberately manipulated on perhaps an alternate year basis (as one example), in order to be able to arrive at convincing conclusions. In such an experiment, evaluations could be based, for example, on relative abundance estimates of year classes of kokanee associated with particular lake levels.

It would be a mistake to abandon the IDFG/U of I experiment in favor of the net pen plan, a plan that would also have to be regarded as experimental. We believe it to be highly unlikely that the goal of 750,000 catchable kokanee can be achieved by use of net pens. If our hypothesis that kokanee abundance is limited by competition for food with *Mysis* is correct, as experience elsewhere has shown, then the fish might need to be fed in the pens until they reach a large size. On the other hand, if the IDFG/U of I hypothesis is correct, that kokanee abundance is limited by availability of spawning area, then the net pens might be considered as an alternative to be tested. At the present time, we think our

[1] Experience has alerted us to the strong possibility that the need for rigorous adherence to experimental designs may be neither universally understood nor appreciated among the regional participants in the Council's program, whose cooperation is essential for its successful implementation. It needs to be recognized that a properly designed and executed experiment can provide answers to management questions in much less time, less cost and less inconvenience than to proceed in a passive monitoring mode over an indefinite period.

hypothesis is more likely true, based on experience with *Mysis* elsewhere, as previously noted. Information from Lake Pend Oreille that fits our hypothesis is provided in the letter of July 19, 1999 from Virgil Moore of IDFG, to wit "....stocking of up to 14 million kokanee annually has failed to boost the population back to a recovered level." Because this stocking of kokanee from a hatchery has not led to a measurable increase in abundance, our conclusion would be that the population of kokanee is limited by factors that come into play after the spawning and initial rearing stages of these fish (hatchery rearing circumvents exposure of the fish to conditions in the lake at these stages). To us, the most likely explanation is that competition of the released hatchery fish with *Mysis* is limiting kokanee abundance, so that no additions of kokanee from whatever source is likely to lead to a measurable increase in abundance of kokanee in the lake.[2] Data from a well-designed experiment will be required to convince us to the contrary.

In addition, the net pen concept would need to be further refined before it could be considered to be a testable alternative to lake level regulation. The information provided is not sufficient to answer the following questions, answers to which are needed to judge the merits of the concept and the ability to proceed with it:

1. What is the proposed source of eggs for the substantial number involved in this experiment?
2. Has a suitable location been identified where requirements for net pen rearing are found? The logistical problems associated with the suggested net pen enterprise are of a large magnitude. Net pens must be located where flow through them is sufficient to carry oxygen to the fish and wastes away from them without carrying the hatchery feed away from them.[3] The fish must be provided adequate space in the pens. Net pens for rearing sockeye (the anadromous form of kokanee) in Lake Wenatchee, Washington have dimensions 12 feet wide, by 16 feet long, by 16 feet deep. The Kalispell/Pend Oreille PUD concept calls for fifty net pens. If these were to be of the same size as those in Lake Wenatchee, they would cover 9600 square feet, about ¼ acre, not allowing for necessary space between the pens for walkways and water circulation. The nets require maintenance when algae accumulates on the webbing. Feeding the fish requires hand labor.[4]
3. At what size would the kokanee be released from the net pens? Director Mealey's letter indicates the authors thought they could achieve 6 inches the first year. We think this is highly unlikely, based on growth rates of kokanee and sockeye observed elsewhere. For example, sockeye reared in net pens in Lake Wenatchee reach about 4

[2] The principles in gardening and fisheries management are similar. Carrying capacity of flower pots or gardens is limited by space and the presence of nutrients. Weeds have a way of taking over and crowding out the plants we would rather have. Fisheries managers once thought that *Mysis* would make a good food source for trout and kokanee, that *Mysis*, being of relatively large size, would feed on smaller animals and concentrate them for the benefit of the fish. But it was soon found that trout and kokanee did not feed significantly on *Mysis*, so that the fish ended up in competition with *Mysis* for the same smaller food organisms.

[3] The Washington Department of Fish and Wildlife was obliged to discontinue net pen rearing of chinook salmon in Lake Chelan because of concerns about effects of fish waste and excess fish food on water quality criteria expressed by the Washington Department of Ecology.

[4] An additional factor that occurs with use of net pens, is that some lake shore residents object to the interference with their open views of the water.

inches by fall of the first year, at which time they are released in order to avoid problems with icing of the pens.[5] Holding the fish for an additional year in Lake Pend Oreille to achieve the 6-inch size would require description of a method for accomplishing this.
4. What is the expected survival rate of released kokanee? Experience in Lake Wenatchee indicates 19 to 60% survival of released sockeye, with higher survivals associated with releases late in the fall of the year. Releasing 750,000 fish from net pens probably does not represent 750,000 catchable kokanee in the lake.

Conclusion: It is premature to conclude that kokanee populations can be increased in Lake Pend Oreille by either of the proposed methods. Further information from an experimental approach is needed. The net pen suggestion would have to be considered to be an experiment as well, but the information we have does not include either a description of the necessary components of an experiment or an adequate analysis of the substantial requirements of such an enterprise. If, in fact, the presence of an abundant population of *Mysis* is a key factor limiting kokanee abundance in Lake Pend Oreille, then neither the lake level regulation nor the net pen rearing are likely to achieve the desired goal of producing 750,000 kokanee for harvest.

Recommendations:
1. We recommend against discontinuing the experiment with lake level regulation that is underway.
2. If the lake level experiment is to be expanded beyond the initial five years approved by the Council, a full description of the experiment should be required to be provided to the Council (for review by the ISRP prior to its implementation) of a rigorously designed experiment that includes changing lake elevations and observing the effects on kokanee abundance. Simply continuing passive monitoring observations for a period of years at the same lake level would not be a productive use of resources (water, fish or personnel).

[5] We are indebted to Andrew Murdock of the Washington Department of Fish and Wildlife for information on the Lake Wenatchee sockeye program, which is a joint program of Chelan County P.U.D. and the fishery agencies and tribes with responsibility in the mid-Columbia River.