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KALISPEL RESIDENT FISH PROJECT
KALISPEL TRIBAL HATCHERY
OPERATIONS AND MAINTENANCE

Annual Report 2000

DOE/BP-35750-3

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Kalispel Resident Fish Project

Kalispel Tribal Hatchery Operations and Maintenance

2000 Annual Report

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Abstract

No Annual Production Goals were achieved for the year. The Kalispel Hatchery experienced two episodes of brood fish mortality. The first due to a standpipe malfunction and the second attributed to “gas bubble disease” caused by elevated Total Dissolved Gases (TDG’s) in the reservoir. To date, the hatchery has 29 brood fish in the raceway and ready to spawn. If all things go well this spring, hatchery operations should be well underway next year.

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Introduction

In 1987, the Northwest Power Planning Council (NPPC) amended its Columbia River Basin Fish and Wildlife Program to include a resident fish substitution policy. This policy called for substitution of resident fish in areas where anadromous fish historically occurred, but were blocked with the construction of the Chief Joseph and Grand Coulee Dams. One of the first projects adopted by the NPPC was the "Assessment of fishery improvement opportunities in the Pend Oreille River within the boundaries of the Kalispel Indian Reservation" (Ashe *et al*. 1991). The purpose of this three-year study was to establish baseline information of existing fish populations and habitat; and identify possible methods of improving fisheries within the reservoir. Recommendations from this study are proposed as resident fish substitution under the Northwest Power Planning Council's 1987 Resident Fish Substitution Policy.

The assessment identified several factors within the reservoir that limited the fisheries opportunities within the Box Canyon reservoir. Some of these factors included water elevation fluctuations, lack of overwinter cover for age 0+ bass, and inadequate recruitment of largemouth bass into the system. The University of Idaho also performed a study during this time (Bennett and Liter 1991) and concurred with the above factors and proposed similar recommendations of the assessment study published by Ashe.

Ashe, *et al* (1991) indicated that growth rates of largemouth bass during the first four years in the Box Canyon Reservoir were lower than bass from other locations of the northern United States, and conversely growth rates after the fourth year were comparable or even higher than other locations. The slower growth combined with a high rate of juvenile mortality associated with overwintering have reduced the potential for the bass population within the reservoir. Largemouth bass density estimates are approximately 6 pounds per surface acre in the Box Canyon Reservoir.

In 1991, Ashe and Bennett suggested the possibility of an off-site rearing facility to supplement the number of juvenile largemouth bass within the Box Canyon Reservoir. Supplemental stocking of yearling largemouth bass has been proven successful in other reservoirs. In Chatfield Reservoir, Colorado, largemouth bass were hatchery-reared to one year of age using intensive and extensive culture from 1978 to 1981. Subsequent samples of age 2 bass in the reservoir composed 12%, 59%, and 59% of the population, during sample years 1980, 1981 and 1982, respectively (Kreiger and Puttman 1986). Increases in the age 2 class fish were directly attributed to hatchery supplementation.

Based on these findings, biological objectives for largemouth bass (*Micropterus salmoides*) were identified and incorporated into the NPPC's program. The largemouth bass biological objectives are as follows.

- Increase the biomass of harvestable largemouth bass in the Box Canyon reservoir from the current 6 pounds/acre to an interim target of 8 pounds/acre by 2003 and a final target of 12 pounds/acre by the year 2008.
- Increase age 0+ largemouth bass overwinter survival from current levels of 0.4-3.9 percent to approximately 15-20 percent.

Specific recommendations or strategies to attain these biological objectives were also formulated and presented to the NPPC for approval and funding. These recommendations are as follows.

- Operate and maintain low-capital warm water hatchery constructed on the Kalispel Indian Reservation to produce 100,000 largemouth bass fry and 50,000 fingerlings for release into Box Canyon reservoir.
- Construct, operate, and maintain water control structures on the Pend Oreille wetlands wildlife project for the purpose of creating bass nursery sloughs.
- Construct, place, and maintain artificial cover structures to increase the amount of bass age 0+ fry winter cover in the Box Canyon reservoir. The purpose of the cover is to increase the overwinter survival of age 0+ largemouth bass.
- Monitor effectiveness of largemouth bass supplementation.

In 1996, construction activities commenced on the largemouth bass hatchery, located on the Kalispel Indian Reservation. The final completion date of the hatchery was November, 1997. Upon completion of the hatchery, largemouth bass will be gathered, spawned, and reared in the facility. The initial outplanting of juvenile largemouth bass into the Box Canyon reach of the Pend Oreille River is scheduled for the spring of 1998. In summer of 1999, the hatchery staff was able to produce 242,000 largemouth bass fry for release.

The goals of this project are to facilitate the production and rearing of juvenile largemouth bass for supplementation and thereby increase the production of harvestable bass. The Annual Production Goals (APG's) for the hatchery is to release 100,000 35mm fry and 50,000 140mm fingerlings into the Box Canyon reservoir.

Description of Project Area

The Pend Oreille River begins at the outlet of Pend Oreille Lake, Idaho and flows in a westerly direction to approximately Dalkena, Washington. From Dalkena, the river turns and flows north into British Columbia, where it eventually ties into the Columbia River. The approximate drainage area at the international border is 65,300 km^2 (Barber *et al*. 1990). The normal high flow month is June with a mean discharge of 61,858 cfs, the normal low flow month is August with a mean discharge of 11,897 cfs (Barber *et al*. 1990). The Box Canyon Reservoir has 47 tributaries and covers 90 river kilometers of the Pend Oreille River. The reservoir entails the portion of the river between the Albeni Falls and Box Canyon Dams.

The Kalispel Tribal Hatchery is located on the 436 acre Pend Oreille Wetlands Wildlife Mitigation Project, located on the Kalispel Indian Reservation. The project is situated along the east side of the Pend Oreille River, approximately nine miles north of Usk, WA.

Methods and Materials

Supplementation

All hatchery-reared largemouth bass will be marked with a coded wire tag to distinguish them from the native largemouth bass population. Location of the coded wire tag will used to identify the size of fish at release. Three different outplanting locations have been identified: Rednours slough, Dike slough, and Campbell slough (Figure 1). At this time, two separate sizes and dates have been identified for release.

All outplanting locations will be sampled with a Smith-Root electro-shocking boat. For a more detailed description of the supplementation monitoring and evaluation efforts, refer to the Kalispel Tribal Hatchery Supplementation Plan located in Appendix A.

Hatchery Operation

Raceway spawning of largemouth bass will be employed at the Kalispel Tribal Hatchery. Raceway spawning of largemouth bass has been proven successful at the Jake Wolf Hatchery, San Marcos, TX and other largemouth bass hatcheries (Tom Hays, pers. comm.). This technique allows the hatchery manager and staff to easily observe the brood fish and determine the extent to which successful spawning is taking place. The use of artificial spawning nests will enable the hatchery staff to transport the fertilized eggs from the raceway to the hatchery troughs for intensive rearing. This reduces the number of brood fish required for achieving the Annual Production Goal's for the hatchery.

The hatchery will have 14-18 pairs of brood fish that will produce all of the hatchery-reared fry. These brood fish will be acclimated in the hatchery for at least 10-12 months prior to the spawn. Once acclimated, these brood fish should be ready to perform all of the spawning activities. In the spring, the brood fish will be closely monitored while the water temperature is slowly increased. Once the water temperature in the raceway approaches 65° F and the brood fish appear ready to spawn, 16 artificial spawning nests will be placed in the raceway. Brood fish requirements are determined based on a need of 150,000 35 mm fry and assuming 67% survival. During this time, the two rearing sloughs will be filled and fertilized to enhance the natural phytoplankton blooms. The phytoplankton blooms provide a vegetative food source for zooplankton which the newly hatched fry will feed upon.

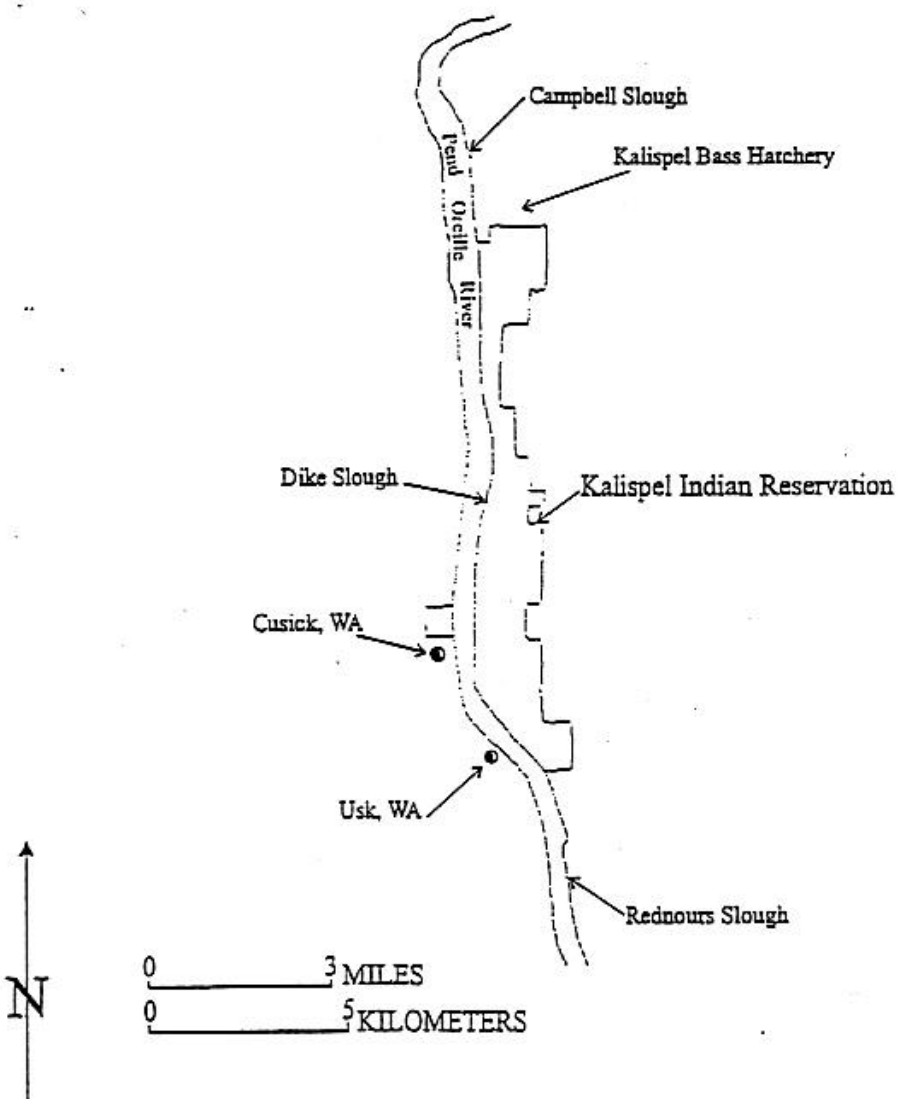

Figure 1. 2000 Largemouth bass release sites.

During each of the spawning periods, the artificial nests with eggs are allowed to remain in the raceway for 1-2 days before being transferred to the incubation troughs. When transferred to the incubation troughs the nests with fertilized eggs will be treated with a 250 mg/l Formalin bath treatment to disinfect the eggs. Treatments will continue until the eggs hatch (generally 2-3 days). Each trough can be partitioned-off to hold fish that are more than 2 days apart. This reduces the size disparity and any losses due to cannibalism. After 3-4 days in the troughs, the eggs hatch and the fry begin to appear along the bottom of the trough. The fry will remain in the troughs for an additional 7-10 days until they "swim up" in search of food. At this time, the fry will be enumerated and transported to the rearing sloughs for grow out.

The largemouth bass fry will remain in the fertilized sloughs until most of the zooplankton is consumed and/or they are large enough to collect (6-8 weeks). At this time, the fry will be collected and transferred to the hatchery for marking. Once marked, the fry will be transported to the predetermined release site. Approximately 50,000 bass fry will be retained in the hatchery and trained on artificial feed. These fish will be raised in the hatchery at an initial density of 0.25 lb./ft^3, and trained to receive artificial feed until they achieve a density of up to 1.0 lb./ft^3. At this maximum density, the four indoor troughs (86 ft^3 each) can accommodate up to 45,000 65mm fingerlings (assuming 90% survival) and the raceway can accommodate up to 100,000 75mm fingerlings. These fingerling-sized fish will be marked in the cheek and released in the late summer.

Two rearing sloughs will be used to hold and raise largemouth bass fry. Each slough has a water control structure (dam) at its mouth and a 4 inch water supply from the pump station. The dams have an overflow spillway with stop-log channels for water level control and a 6 inch gate valve for draining the slough during fish harvest and pond maintenance activities. The south slough has the potential for an air supply line at a future date. This will enable the intensive rearing and over-wintering of fish in the slough.

Monitoring and Evaluation

Supplementation

Monitoring and evaluation of supplementation efforts will be conducted by electro-shocking the outplanting locations following release to estimate the survivability of hatchery-raised largemouth bass. All hatchery-raised largemouth bass will be marked with a coded wire tag. The location of the coded wire tag will identify the size of the fish at the time of release (fry or fingerling). Strategies on the most effective release size will then be formulated to best accomplish our Annual Production Goals (APG). For a more detailed description of the supplementation monitoring and evaluation efforts, refer to Appendix A.

Hatchery Operation

To ensure efficiency, the hatchery staff will closely monitor all aspects of the hatchery operation. Listed below are factors that will be monitored at the hatchery (physical and biological) and are derived from Piper *et al.* (1992).

Physical aspects

- Volume of water (ft^3) used in each trough during hatchery operations (incubation, rearing).
- Amount of water flow (gallons/minute) into each trough during hatchery operations.
- Water temperature

Biological aspects

- Percent survivability from egg to fry.
- Food and Diet
    1. Cost/pound for fish feed.
    2. Relationship (conversion) between the amounts of feed to the amount of actual growth/fish.
- Fish
    1. Amount of brood fish and number of eggs produced/fish.
    2. Amount and weight of fry hatched during spawn (troughs).
    3. Amount and weight of fry planted into rearing sloughs.
    4. Amount of fry transported from rearing sloughs to outplanting location.
    5. Weight gain/loss of brood fish (pre-spawn and post-spawn).
    6. Date eggs fertilized, hatched, transferred to sloughs, and outplanted.
    7. First feeding of fry.
- Disease
    1. Occurrence, kind, and possible contributing factors.

Rearing sloughs

Physical aspects

- Volume (acre feet), average depth of slough.
- Amount of inflow required to maintain water level in slough.
- Average water temperature.
- Fertilization date, type, amount, cost, and results.
- Amount of phytoplankton blooms and zooplankton estimates (dates of bloom, types of plankton and zooplankton).

Biological aspects

- Percent survivability from fry to fingerling.
- Food and Diet
    1. Cost per pound of feed and cost per pound of fish gained.
    2. Amount of food fed as percentage of fish body weight.
    3. Pounds of food fed per pound of fish produced (conversion).

- Fish
    1. Gain in weight.
    2. Average length and weight before release into sloughs.
- Disease
    1. Occurrence, kind, and possible contributing factors

Results and Discussion

In the 1999 project year, the hatchery staff was successful in producing 242,000 newly hatched largemouth bass fry through raceway spawning techniques. These fry were transferred to the rearing sloughs for grow-out, but because of high water were flushed out into the reservoir. Later that summer, the 24 brood fish that produced these fry were lost to mortality caused by a standpipe malfunction. Seventeen brood fish in total were lost due to the standpipe malfunction, ten female and seven males. The remaining brood fish that didn't die the first two days were released into the reservoir.

The hatchery staff corrected the problem and immediately gathered 27 brood fish from the reservoir. The new brood fish had 8-10 months to get acclimated before the next spawn. Things looked good for the following 2000 spring spawn despite this set-back.

Power outages in the springtime are quite common for the Pend Oreille Valley. The hatchery experienced a power surge that damaged the transformer in the drum screen making it inoperable for a two-week period (April 29-May 13). During this time, we were unable to treat the incoming water with the UltraViolet filter, 21-micron drum screen, bead filter, and de-gassing column. We have operated under this situation before and had no problems.

However, on May 8, 2000 we began noticing white patches along the fins of some of the brood fish. The next day, we found a few dead fish and immediately began researching the possible cause. May 10, we called Steve Roberts (Washington Department of Fish and Wildlife Fish Pathologist) and he said that he would be out the next day to assist in the investigation. On May 11, 2000 Steve Roberts examined the brood fish and diagnosed the problem as "Gas Bubble Disease". In the end, we lost all 27 brood fish of which 26 mortalities were directly attributable to gas bubble disease. The other fish was dead prior to the gas bubble disease incident and was due to a fishhook lodged in its throat.

Gas bubble disease is attributed to the gas super-saturation in the water. Gas super-saturation can be produced by water spilling over a dam and the pumping of water. Under natural conditions, bass fight the elevated total dissolved gas (TDG) levels by going to deeper water. In the hatchery, the bass cannot escape to deeper water so they must endure the conditions. These gas bubbles can lodge themselves in the blood vessels and restrict the respiratory circulation, leading to death by asphyxiation (Piper, et al, 1982). Following the determination of the cause of mortality, we began to investigate the source of the problem. On May 15, 2000 Brian Crossley, Spokane Tribe of Indians biologist visited the hatchery to measure the Total Dissolved Gases at various points of the operation. The results are listed below.

Location of Measurement	Water Temperature	Percent Nitrogen Supersaturation	Total Gas Pressure (%)
River intake (surface)	10.77° c	112.9%	110.5%
River intake (1.6 meters deep)	10.73° c	114.2%	111.3%
Hatchery splitter box (before treatment)	12.75° c	116.6%	111.9%
Raceway (before treatment)	13.19° c	112.3%	103.6%
Degassing column (following treatment)	13.26° c	107.8%	102.6%

The supersaturation of gases at the source of the water supply (Pend Oreille River) was the beginning of the problem. Gas bubble disease is generally chronic when water contains between 105% to 140% nitrogen saturation (Post, 1987). The river intake was between 112.9% to 114.2% saturation and 116.6% at the hatchery before any treatment. The nitrogen level at the raceway was 112.3%. This water must first pass through the drum screen and the ultraviolet unit before it reaches the raceway. Under the current design, the de-gassing column cannot treat the water until it passes through the raceway, enters the reuse sump, and is pumped to the hatchery building where it spills through the de-gassing column. The nitrogen supersaturation levels after this point were 107.8%. During this time, the total gas pressure in the reservoir (intake) was at or above the upper limits of the Washington State water quality standard of 110%.

With this new information, the hatchery staff contacted Fishpro, a consultant with Bonneville Power Administration and they visited us to help identify any possible solutions to the problem. We took measurements at key locations in the hatchery to see if we were adding to the problem. Nothing was found. Fishpro consultants recommended monitoring the saturation levels and installing additional packed columns to help reduce the supersaturation levels of the water. Steve Roberts also confirmed these recommendations.

There are various factors that contributed to the gas bubble mortality in the hatchery: damaged drum screen; elevated Total Dissolved Gas in the reservoir, and; possible leaks in the water system. These elevated TDG levels were never a noticeable problem prior to the 2000 operation. The hatchery staff will continue to contact the Albeni Falls Dam to gather information regarding spill over the dam. We have installed a surge protector to prevent the drum screen from damage, and will keep a constant eye on leaks within the water system.

To date, we have 29 brood fish in the hatchery. These fish are healthy and ready to spawn next spring. Significant progress has taken place in regards to the production procedures, emergency protocol, and operating manuals for the hatchery. These documents are located at the Kalispel Tribal Hatchery. All that remains to be tested is fry collection from the sloughs; tagging operations; fingerling growout, and; outplanting operations.

The 2000 Annual Operating Plan listed five objectives for the year. Listed below are the 2000 objectives along with the amount of progress achieved for the year.

Objective 1. Develop egg collection, spawning, and incubation techniques and procedures for producing largemouth bass to meet 2000 Annual Production Goals.

Approximately 29 brood fish have been gathered and are being held in the raceway. The brood fish require at least one year to acclimate themselves to their new environment. The one-year acclimation period was not accounted for in the previous hatchery operation.

The brood fish spawning techniques and egg collection/incubation techniques have been developed. These activities are described in the Method and Materials section of this document. No Annual Production Goals were achieved during the year.

Objective 2. Develop and describe fry and fingerling rearing methods to meet 2000 Annual Production Goal.

Fry rearing strategies include all activities from fry "swim up" to transportation of the fry to the outplanting location. These rearing activities have been formulated and are documented in the Methods and Materials section of this document. These production procedures are described but not tested. We expect to fine-tune these procedures once production commences.

Objective 3. Mark all hatchery-raised largemouth bass for outplanting into the Box Canyon Reservoir.

All hatchery-reared largemouth bass will be marked with a coded wire tag to distinguish them from the native largemouth bass population. Location of the coded wire tag will used to identify the size of fish at release. At this time, two separate sizes and dates have been identified for release. All outplanting locations will be sampled with a Smith-Root electro-shocking boat.

The marking operation has been developed but not tested. Once production activities begin, we expect these procedures to be fine-tuned.

Objective 4. Monitor effectiveness of hatchery supplementation. Complies with the Northwest Power Planning Council's (NPPC) Fish and Wildlife Program under section 10.8B.19.

A Kalispel Tribal Bass Hatchery Supplementation Plan has been prepared and is attached as Appendix A.

Objective 5. Prepare and submit final report for FY 2000.

Summary and Conclusions

No production goals were achieved for the year. The 24 brood fish that produced the 242,000 largemouth bass fry in 1999 were lost due to a malfunction of a standpipe in the hatchery. Twenty-seven brood fish were collected and being acclimated for the next year's spawn when they succumbed to "gas bubble disease" caused by elevated TDG levels in the reservoir. Currently, the hatchery has 29 brood fish in the raceway ready for the upcoming spawn.

Raceway spawning of largemouth bass has been proven successful in other areas of the United States and we believe that they will also be successful at the Kalispel hatchery. Under the current operation, success lies entirely with successful brood fish spawning. The health of the brood fish is the most important element to the project. In the first two years of operation stress was the biggest problem. Now, water quality factors, both on-site and at the source (river) have greatly affected the operation. Every year, new factors arise that make the operation difficult to predict.

Power surges will always be a problem and elevated TDG levels in the reservoir may always be a problem for the hatchery due to the continued operation of up-river dams. The hatchery staff has installed a surge protector on the drum screen to prevent down time and has purchased TDG monitoring equipment for the hatchery and reservoir. Other possible solutions to the problem include installing an additional packed column to de-gas the water before it enters the hatchery and raceway. Other improvements such as the construction of grow-out ponds will help the hatchery staff achieve the Annual Production Goals established for the hatchery operation.

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