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Idaho Department of Fish and Game

Lake Pend Oreille Quarterly Report October - December 2004

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Kokanee Population Update

Since it is the start of a new year, its probably appropriate to begin with an article on the current "health" of the Lake Pend Oreille kokanee population. Like any physical check up, there are a number of indicators of health. Unlike people that get the results of cholestrol, blood pressure, and heart rate, indicators of kokanee population health would be things like biomass, numbers of adults, survival rates, and stock-recruitment curves. A number of these indicators are described below and, like human medicine, may not all point the same direction. But, if they are all looked at together, they describe the "health" of the population.

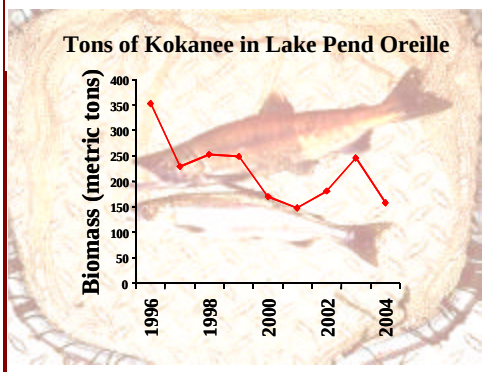

Figure 1. Estimated total tons of kokanee in Lake Pend Oreille between 1996 and 2004.

Kokanee spawners from Trestle Creek, September 2004. Trestle Creek is the main spawning stream for the early spawning variety of kokanee in Lake Pend Oreille.

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The Origin of a Species (Our apologies to Darwin)

Lake trout in Lake Pend Oreille appear to be expanding in spite of the fact that the management goal is to limit their numbers. Any effort to control lake trout, however, depends to a large extent on where they originate. If lake trout originate from the many rocky shorelines of Lake Pend Oreille, then we have a home-grown problem. On the other hand, if a large percentage of the lake trout are emigrating into Lake Pend Oreille from Flathead Lake, Montana, then different control methods are needed.

Fortunately there may be a way to tell. As lake trout grow, the minerals in their bones match the make up of the surrounding water body. So, if there are enough differences in the minerals in the lakes, we should be able to tell where the lake trout originated. Researchers have removed the ear bones (otoliths) from 70 lake trout from Flathead, Upper Priest Lake and Lake Pend Oreille. These were carefully ground down to expose the middle of each otolith and polished until smooth. The otoliths were then sent to Oregon State University where a laser will be used to burn into the surface of the otolith and analyze the strontium, barium, calcium and zinc content at microscopic points along the radius of the otolith (Figure 5, page 3).

If lake trout from Lake Pend Oreille show a pronounced difference between the center of the otolith (formed when the fish was young) and the outside edge (formed just

Continued on page 3.

INSIDE THIS ISSUE:

SPECIAL POINTS OF INTEREST:

- *Kokanee population not showing improvement.*
- *Laser microchemistry being used to determine the origin of lake trout*
- *Newly created spawning areas being used by shoreline spawning kokanee.*
- *Rainbow trout remain shallow on summer nights, possibly missed in hydroacoustic survey.*
- *Estimates of only 4.1 lbs of kokanee for every 1 lbs of predator.*

Lake Pend Oreille Quarterly Reports contain preliminary data and conclusions that are not citable.

Kokanee Population Update, continued from page 1.

Biomass is the total weight of all kokanee in the lake (Figure 1). This year biomass dropped to 158 metric tons (one metric ton equals 1.1 English tons). Most of the weight of a kokanee population comes from age 2 and age 3 fish. We currently have a weak year class at age 2, which caused biomass to drop. Overall kokanee are well below the biomass recorded in the late 1990's, and the upward trend of the previous two years has reversed. The overall trend for the last 9 years has been downward.

Another good indicator is the number of age 3 kokanee in the lake (Figure 2). This is the age group that is just reaching a catchable size of about 8" and some in this age class are beginning to mature. We estimated 680,000 age 3 kokanee in the lake during August. This is about an average year class in recent history and much better than 2000, 2001, or 2002. Predictions are that the number of age 3 kokanee will decline for the next two years.

> *"These important indicators combined together show a rather unhealthy population."*

Survival rate is also a key indicator, especially from age 1 to age 2 (Figure 3). These age groups are 4" to 8" long and are the preferred forage of rainbow trout. Other predators, such as bull trout and lake trout, also eat kokanee in this size range. This survival rate is therefore a good index of predation. Survival rate had been showing improvement over the last 4 years, but declined to 27% this year. Values below 50% are a cause for concern.

One of the classic indicators of fish population health is a graph known as a stock-recruitment curve. In this one curve, its possible to see how well a population is replacing itself, how much harvestable surplus it has, and how resilient the population is at both low and high densities. It is simply a graph of the number of kokanee adults in one generation plotted against the number of kokanee adults that they produced in the next generation. In Lake Pend Oreille, only one of the last 5 year classes of kokanee produced enough offspring to replace itself (Figure 4). This was the 303,000 adult kokanee in 1995 that produced 335,000 adults in 2000. Figure 4 shows that four of the last 5 years classes were well below replacing themselves. According to the solid line plotted in the form of a Ricker equation, the population has no harvestable surplus and is not resilient at either high or low densities.

These important indicators, combined together, show a rather an unhealthy population. Unfortunately the improvement noted the previous several years has taken a downturn. The big challenge is finding the underlying cause of the problems and then prescribing an effective treatment.

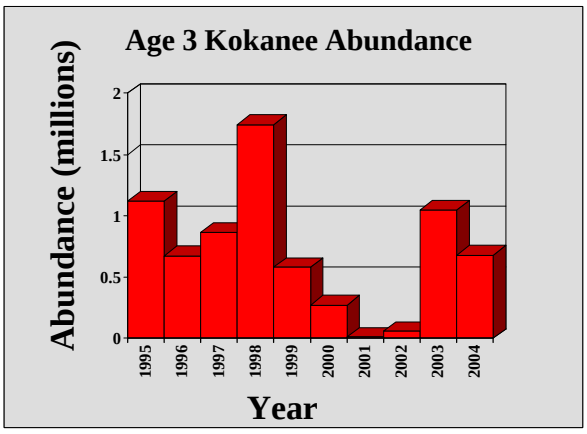

Figure 2. Number of age 3 kokanee in Lake Pend Oreille over the last 10 years.

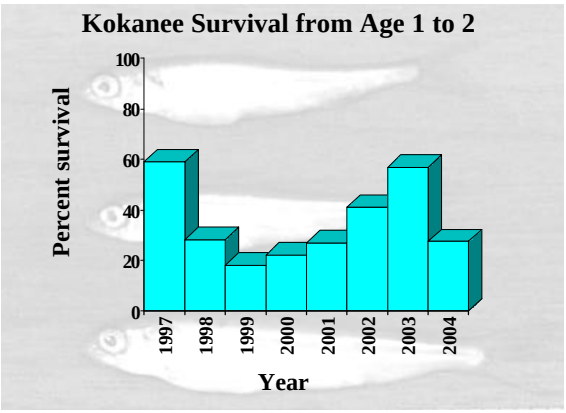

Figure 3. Survival rate of kokanee in Lake Pend Oreille between the ages of 1 and 2.

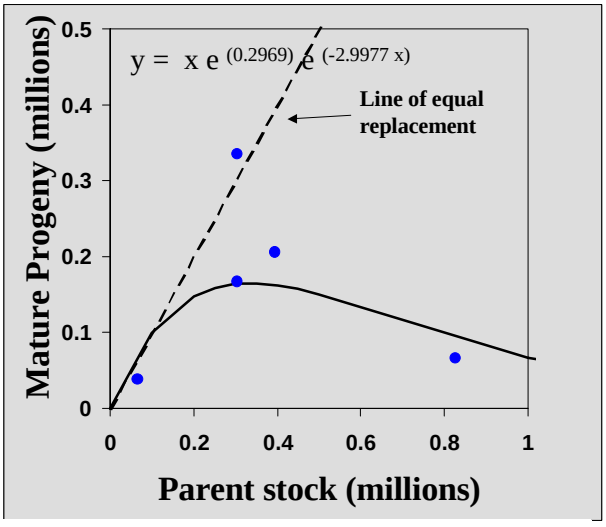

Figure 4. A stock-recruitment curve for kokanee in Lake Pend Oreille.

Lake Trout Otolith Microchemistry,

continued from page 1.

before the fish was caught), then this would indicate the fish moved between lakes. The point at which the minerals changed could also be examined to determine the age of the fish when it migrated. Thus, we should be able to determine not only where the lake trout came from but when they migrated.

Hopefully this information will give us a better understanding of lake trout and how to effectively manage them.

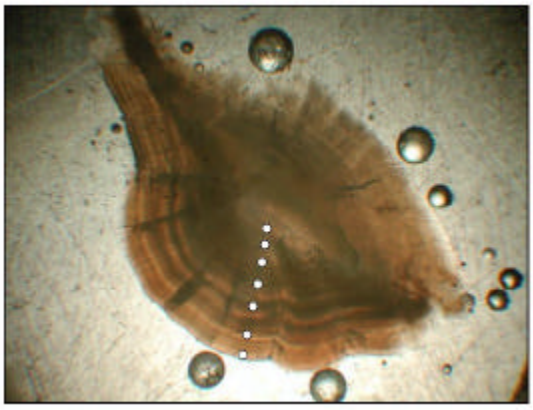

Figure 5. Microscopic view of a lake trout otolith. Otolith was ground down to a thin slice. Small white dots show the areas where trace elements will be measured. (Larger circles are bubbles in the glue holding the otolith.)

Kokanee Spawning Gravel

Last winter (2003-04), Lake Pend Oreille was drawn down to its full extent. This allowed wave action to build gravel bars along the shoreline (Figure 6). We measured these gravel bars and estimated there would be 271,000 ft^2 of new gravel between the elevations of 2050' and 2053' that would be available for kokanee spawning when the lake elevation was held higher this winter.

With increased gravel along the shoreline, we wanted to know if the gravel quality remained good as the lake was raised last spring. We therefore collected core samples from six potential spawning areas this summer. They were dried, weighed and the amount of cobble, gravel, and fine material in each was analyzed (Figure 7). It appeared that the gravel remained in excellent quality.

Kokanee spawning in 2004 will have an abundance of excellent quality habitat.

The next part of the investigation was to see if kokanee were using this new gravel when they spawn. So after the spawning season we went around the lake's shoreline and measured the depth of redds (Figure 8). The most frequently used depth was just above the low pool elevation where the gravel bars were formed; confirming that many kokanee did use the new gravel. Trawling and hydroacoustic surveys next summer will determine how many wild fry were produced and therefore indicate how well the eggs survived.

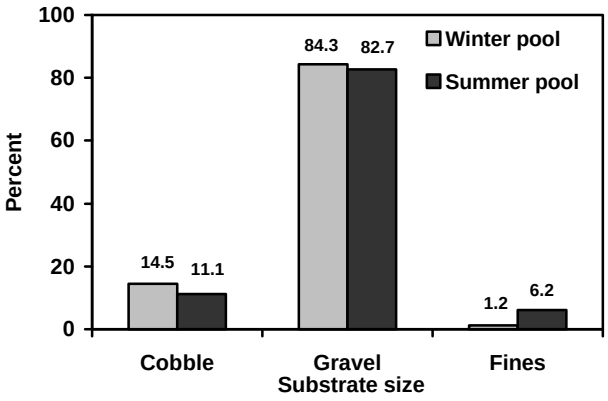

Figure 7. Core samples of substrate on a potential kokanee spawning area near Evans Landing between the elevations of 2051' and 2053'. Grey bar indicates the percent composition sampled during winter of 2003-04, and black bar the composition during the summer of 2004.

Figure 6. Shoreline at the south end of Lake Pend Oreille during the winter of 2003-04. Note bar of gravel just above the water line.

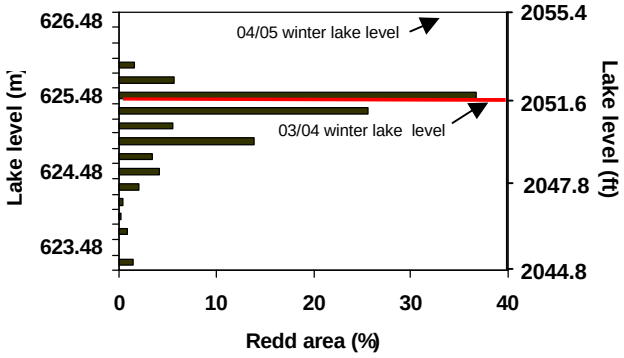

Figure 8. Depths of kokanee redds on the shore of Lake Pend Oreille, 2004-2005.

Search for Predators

Efforts to balance predators in Lake Pend Oreille would greatly benefit from an accurate method to estimate their abundance. Hydroacoustic surveys (echosounding) has shown some promise as a method to estimate larger fish (>16"), which are likely to be predators, in the open water areas of the lake. However, fish species cannot be directly determined from the echograms.

To help identify fish > 16" recorded during a summer hydroacoustic survey (August 2004), we tracked eight rainbow trout, five lake trout and five bull trout from July 12th -September 10th. This time period was chosen because Lake Pend Oreille was thermally stratified and previous research suggested that night-time, during summer, was the best time to perform a hydroacoustic survey. Summer provides the highest water temperatures near the surface, which we hoped would cause rainbow trout to occupy deeper water and therefore be more detectable to down-looking hydroacoustic gear. Large fish (species unknown, but too large to be kokanee) were located on the hydroacoustic survey between 40 and 115 ft (average depth was 75 ft) (Figure 9). In our sonic tracking studies, five of the rainbow trout we tracked used an average water depth of about 35 ft while the remaining three were mostly located at depths < 15 ft and often found near the surface. Conversely, bull trout and lake trout utilized depths mainly below 50 ft and were predominantly found close to shore or near the lake bottom, outside of our hydroacoustic detection area (Figure 9). The data we collected suggests that we may have missed a portion of the rainbow trout population. Some rainbow trout, even in mid-summer spend their nights near the lake surface. Apparently they avoid detection by the echosounding gear when a survey boat passes overhead.

More work is needed to develop an effective survey technique. This summer we plan to test ways to approach fish more quietly in the hopes of detecting shallower fish. If successful, estimating rainbow trout abundance could be a great help in managing this valued resource.

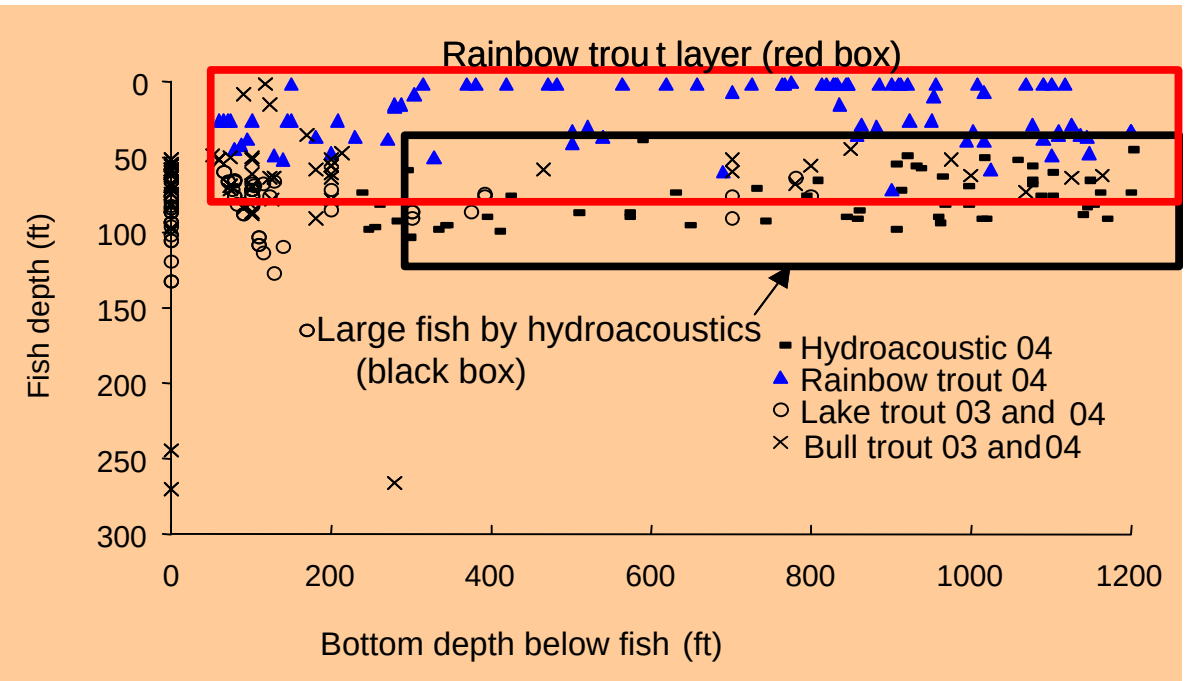

Figure 9. Nighttime spatial representation of unidentified hydroacoustic targets and tracked rainbow trout, bull trout and lake trout in Lake Pend Oreille during August. Fish located on the Y-axis represent fish found on t he lake bottom at that depth.

Links

To Past Reports

Are you looking for past reports concerning Lake Pend Oreille?

They can be found on the Idaho Fish and Game' s Home Page (http://www2.state.id.us/fishgame/common/technical/fisheries.cfm) under the headings of: Information/Library/ Fisheries.

What about Lake Pend Oreille Annual Reports?

These reports can be located on the Bonneville Power Administration Fish & Wildlife Home Page under the Publications Section (http://www.efw.bpa.gov/cgi-bin/FW/publications.cgi) . Look under Resident Fish.

Questions and comments on this quarterly report should be addressed to:

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Balancing Predator and Prey

Methods of estimating the numbers of predatory fish in Lake Pend Oreille are continuing to develop. However, we used the information currently available to see how predator and prey appear to be balancing.

For the past two summers we utilized hydroacoustics to estimate the number of large pelagic fish (fish> 16") in Lake Pend Oreille. For this discussion we assumed all large fish in the open water of the lake were predators irregardless of whether they were rainbow trout, bull trout, lake trout or another species. Lake-wide hydroacoustic surveys measured fish densities along over 100 miles of transects. Densities were expanded into a population estimate and then the weight of this population was calculated using a Kamloops rainbow trout length-weight relationship. Even if we underestimate the entire number of predators in the lake, they may serve as a relative index for predator and prey biomass ratios when done consistently each year. The population estimate of large pelagic fish in 2003 and 2004 were 12,000 and 14,000 fish, respectively, indicating a slight increase between years. On the other hand, the kokanee population (ages 1-4), as determined by hydroacoustics, dropped from an estimated 5.3 million fish in 2003 to 2.5 million fish in 2004. We calculated the biomass of these populations and found that in 2003 there was 1 lb of large pelagic fish to 8.6 lb of kokanee prey while in 2004 this ratio was sharply reduced to 1 lb of large pelagic fish to 4.1 lb of prey (Figure 10). This shifting of the predator:prey ratio could help explain the decline in survival rates of kokanee in 2004. As prey declined relative to the biomass of predators, survival of prey dropped. If the correlation of kokanee survival to predator:prey ratio remains consistent between years, it would be additional strong evidence that predators are controlling the kokanee population.

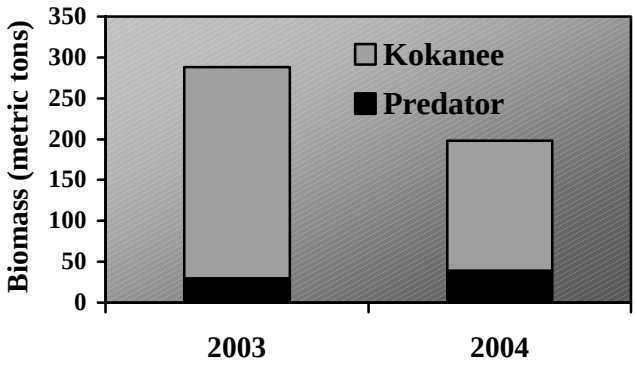

Figure 10. Kokanee (all age classes) and large pelagic fish (>16") biomass estimates from August 2003 and 2004 based on hydroacoustic surveys. Both kokanee and large pelagic fish estimates were sampled simultaneously.

The Lake Pend Oreille Fishery Recovery Project

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