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Lake Pend Oreille Predation Research Quarterly Report

Tom Bassista, Fishery Research Biologist
Melo Maiolie, Principal Fishery Research Biologist
Mark Duclos, Fishery Technician
Bill Ament, Senior Fisheries Technician
Bill Harryman, Senior Fisheries Technician

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Lake Wide Population Estimate for Pelagic Predators

During the past quarter we calculated a pelagic predator population estimate in Lake Pend Oreille to determine the effectiveness of our new hydroacoustic survey design and to obtain a benchmark estimate for predator and prey balancing. Population estimates were based on hydroacoustic transects we performed during August of 2002. The total lake wide population estimate was 39,044 fish > 16" found in the pelagic or open water area of the lake. This estimate only includes fish found over at least 230 ft of water and no closer than 30 feet from the lake bottom. Our population estimate had a 90% confidence interval (CI) or error rate of –27% (28,651 fish) to +32% (51,604 fish). With our increase of hydroacoustic transects in 2002 we were able to meet our research objective of; designing a survey that produces a population estimate with a CI of +/- 50%.

The greatest number of pelagic predators were found in the northern end of the lake (21,044), the second highest was found in the middle portion of the lake (15,327), and the fewest number of pelagic predators were found at the southern end of the lake (2,110) (**Fig. 1**). Based on hydroacoustic measurements fish length ranged from 16" to 46" with an average of 21" (**Fig. 2**).

It is important to note that this population estimate is only a portion of the entire predator population. For example, this does not include estimates of lake or bull trout that are occupying benthic or bottom areas of the lake. Benthic estimates will be made as the project evolves and once we are able to get an accurate account of the fish species and proportions that make up the pelagic predator population. Sonic tracking of the three main predators (bull, lake and rainbow trout) as well as large pikeminnow and lake whitefish during summer months will aid us in determining the species composition of our pelagic predator population estimate. With an accurate population estimate and species composition data we can determine biomass estimates for the pelagic predator community and begin our basis for predator and prey balancing with hopes of bringing back a kokanee and trophy rainbow trout sport fishery.

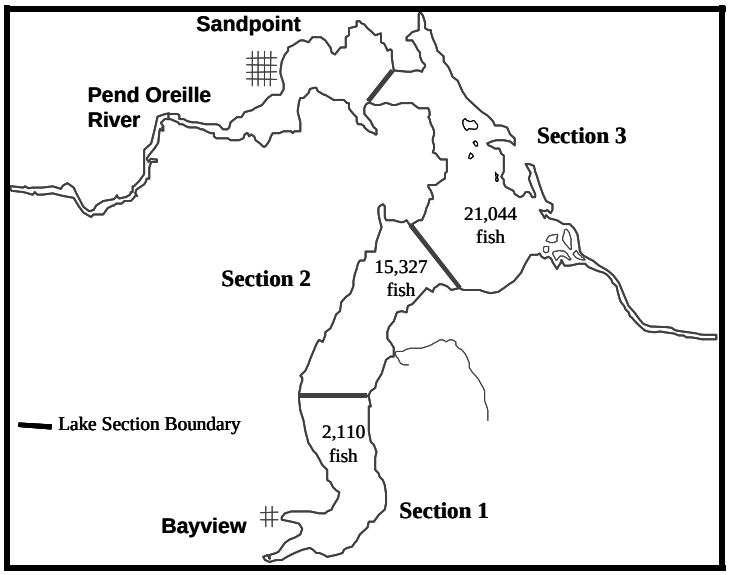

Figure 1. Map of Lake Pend Oreille showing the three sample sections with August, 2002 pelagic predator (fish > 16") population estimates for each section.

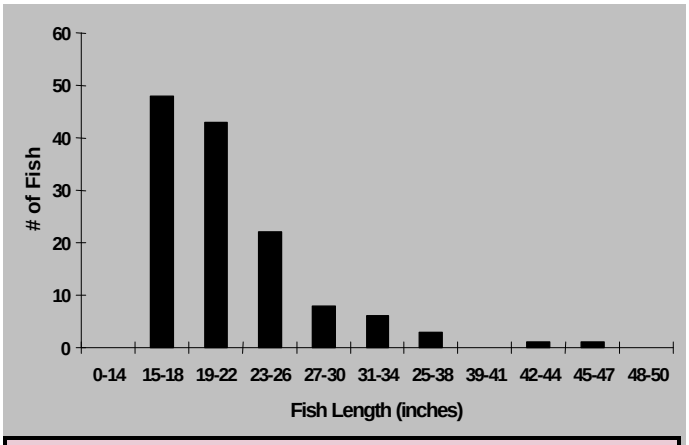

Figure 2. Length distribution of pelagic predators tracked in Lake Pend Oreille based on August, 2002 hydroacoustic measurements.

This quarterly report contains preliminary data and conclusions that are not citable.

Habitat Utilization of Rainbow and Lake Trout During Winter

From 22 December, 2002 to 20 March, 2003 we monitored the winter habitat utilization of 3 rainbow trout and 4 lake trout in Lake Pend Oreille to determine the susceptibility of these species to be detected by hydroacoustic equipment and consequently allow for a winter population estimate. Fish were surgically implanted with depth sensitive sonic tags and were tracked using a hydrophone and receiver throughout the entire lake. Our tagged fish swam freely in the lake and after a short duration post-surgery (approx. 2 weeks) we assumed the fish were acting naturally and provided us with an estimate of winter habitat use. Fish were located at least once on a weekly basis during both day and night. However, fish were monitored more intensely (i.e. multiple times/week) from 03 February to 13 February to coincide with our winter hydroacoustic surveys. Each time a fish was located we made every possible attempt to get as close as possible to the fish. Once we were near the fish we recorded the fish's depth, latitude and longitude, lake depth under fish, distance from shore, and the time of observation. With each observation we were able to determine the habitat the fish was utilizing and most importantly determine if the fish was occupying our predefined pelagic zone and hence a possible pelagic predator on our acoustic echogram.

For all tracking observations during both day and night, rainbow trout were exclusively found in the pelagic zone while only a portion of lake trout observations (day-20%, night-37%) showed pelagic use. Rainbow trout utilized an average depth of 9 ft during the day and 2 ft during the night. Rainbow trout, both day and night, mostly stayed at least 1/2 mile from shore in water temperatures ranging from 40º to 45º F. Pelagic lake trout utilized an average depth of 105 ft during the day and 99 ft during the night. Pelagic lake trout were most often found within 1 mile of the shoreline in temperatures ranging from 40º to 45º F. Habitat segregation between lake trout and rainbow trout was observed during the day (**Fig. 3**) and the night and results from our sampling suggests that winter may provide an opportunity for pelagic lake trout population estimates using hydroacoustic gear.

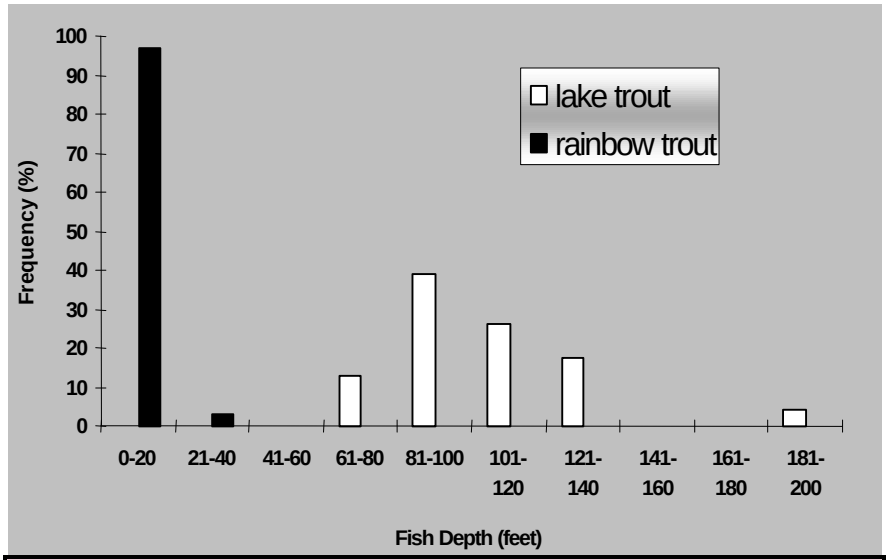

Figure 3. Daytime percent habitat use (depth) of pelagic lake trout and rainbow during winter 2002-2003 in Lake Pend Oreille.

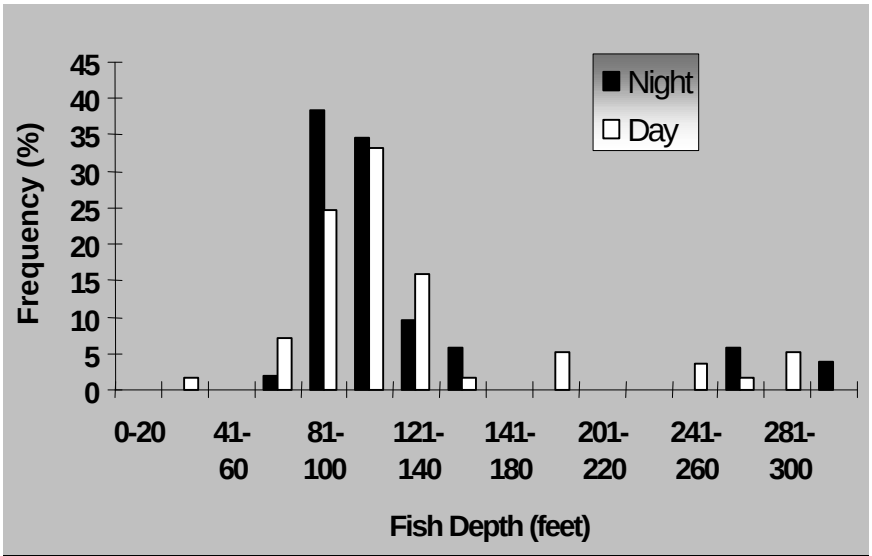

Figure 4. Day and night percent habitat use (depth) of non-pelagic (benthic) lake trout in Lake Pend Oreille during winter 2002-2003.

A more significant component of the entire lake trout population is the benthic (bottom) community. As mentioned earlier most of our lake trout habitat observations were of fish with close contact to the bottom and consequently, very close to shore (average of 800 ft from shore during day and 500 ft during night). These non-pelagic lake trout utilized an average depth of 129 ft during the day and 123 ft during the night (**Fig. 4**) in water temperatures that averaged 41ºF. All of our lake trout utilized this non-pelagic or benthic habitat at some point during our winter tracking. Fish were found in the pelagic area when they appeared to be crossing the lake to seek out new feeding areas or they may have been taking advantage of pelagic kokanee as a food source.

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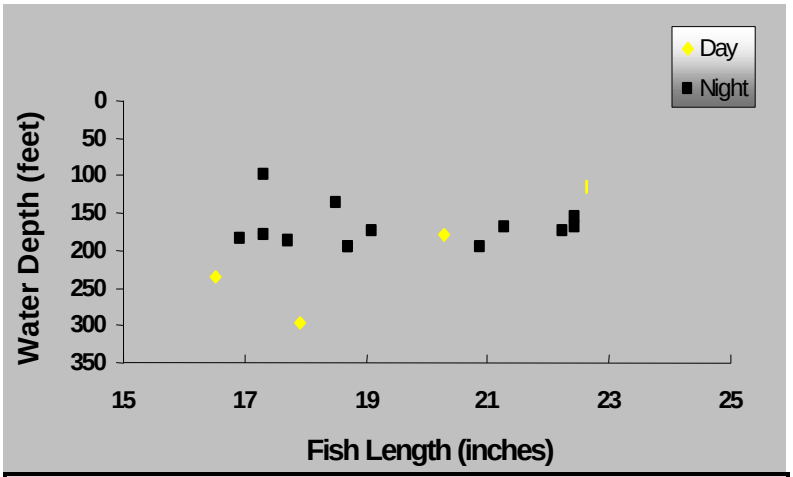

Figure 5. Depth and size distribution of pelagic predators counted during a winter hydroacoustic survey on 11 and 12 of February in Lake Pend Oreille.

Winter Hydroacoustic Assessment for Pelagic Predators

On 11 and 12 February we performed a small-scale (6 transects compared to 31 during summer) hydroacoustic survey to determine habitat use and to investigate the feasibility of performing a winter population estimate for pelagic predators. Two transects, which ran from one side of the lake to the other, were selected from each lake section (for lake sections see fig. 1 on pg. 1). Transect echograms were analyzed for pelagic predator depth and size distribution. Also, since these transects were performed simultaneously with winter fish tracking efforts a comparison was made between the two techniques.

During night and day, pelagic predators (> 16") were found at an average depth of 172 ft in a depth range of 75 to 305 ft (**Fig. 5**). Average length of pelagic predators was 19.4" with a range of 16.5 to 22.6". It is interesting to note that our tracking data (see pg. 2) shows that pelagic lake trout mostly (> 85%) occupy a depth range of 80 to 140 ft while only 18% of the pelagic fish found from acoustic sampling occupy that depth range. Either our tracking sample size for lake trout was to low and was not representative of all pelagic lake trout or the deeper pelagic fish from acoustic sampling may be another species (e.g. bull trout) or a combination of both factors.

During our mid-February hydroacoustic sampling, our gear did not record any large pelagic fish in water depths less than 50 feet. We observed the same situation when we performed our acoustic sampling in late fall of 2002. Our tracking data shows that rainbow trout mostly (> 95%) occupy the top 20 feet of the water column. Our results suggest that winter is an ineffective time to monitor rainbow trout populations using hydroacoustics in Lake Pend Oreille.

Winter may be a good time to document pelagic use of lake trout but our data does not support the use of hydroacoustics during winter to calculate a lake wide population estimates of lake trout. Most of our tracking observations of lake trout were in the non-pelagic area of Lake Pend Oreille so a hydroacoustic survey designed to count fish in the benthic areas of the lake would be necessary in order to get a complete picture of the entire lake trout population.

Lake-Wide Pelagic Predator and Kokanee (Age 0 and Age 1-5) Density Comparisons

With an accurate pelagic predator population estimate we begin to gather baseline information concerning the abundance of pelagic predator and kokanee prey. As we continue our studies on identifying the species composition of the pelagic predator community we will be able to accurately estimate pelagic predator biomass. The main objective of our predation research is to bring the predator and prey population to balance and hence bring back a kokanee sport fishery. But first we must know what the current predator/prey biomass ratio is and then we must be able to determine a balance point. **Table 1** shows the density (fish/hectare) of kokanee compared to pelagic predators. Pelagic predator densities increase as kokanee prey increase and the lowest ratio of total kokanee to 1 pelagic predator is found in section 3 (234 kokanee-all ages to 1 pelagic pred.). We know from past research done by Dmitri Vidergar in 2000 from the University of Idaho that rainbow and lake trout > 16" consume mostly age 1 to 4 kokanee. He estimated that these predators have the potential to consume ± 230 kokanee age 1-4/year (approximately 40 pounds/year). For every one pelagic predator in ***(Continued on page 4)***

Table 1. Density estimates for Age 0 kokanee, Age 1-5 kokanee, and pelagic predators > 16" during August, 2002 in Lake Pend Oreille (see Fig. 1 of pg. 1 for sample section areas).

	Fish Density f/ha (1 ha = 2.5 acres)		
	Age 0 kokanee	Age 1-5 kokanee	Pelagic Predator > 16"
Section 1	215.0	165.0	0.4
Section 2	322.0	232.0	1.9
Section 3	363.0	291.0	2.8

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Preparations for the Upcoming Field Season

During the past quarter we ordered an additional 20 depth sensing sonic tags (transmitters) and an additional sonic receiver. We anticipate using the 20 tags (**Fig. 5**) to monitor lake, bull, and rainbow trout habitat use throughout the spring, summer, and fall of 2003. We are particularly interested in the habitat use by these three species during August, which is when we will perform our next round of lake wide pelagic predator population estimates. We will utilize sport fishermen, again, as well as gill nets to obtain fish for tagging. The additional sonic receiver (**Fig. 6**) was purchased to allow us to have 2 crews out tracking simultaneously, once a new hydrophone is purchased. The hydrophone pictured in Fig. 6 is one that is currently used for our tracking efforts. It is a directional hydrophone, meaning that it only detects transmitter signals when it is "in-line" with the transmitter. We have the option of purchasing an omnidirectional (senses signals from 360º) hydrophone with 100 ft of cable. The advantage of the omnidirectional hydrophone with extra cable would be to listen to transmitter signals (fish) below the summer thermocline and avoid the downward bending affects the thermocline has on noise in the water, which ultimately leads to a dramatic decrease in signal range. We have been working with researchers from the Navy's Acoustic Research Detachment facility in Bayview to prepare ourselves for summer sampling.

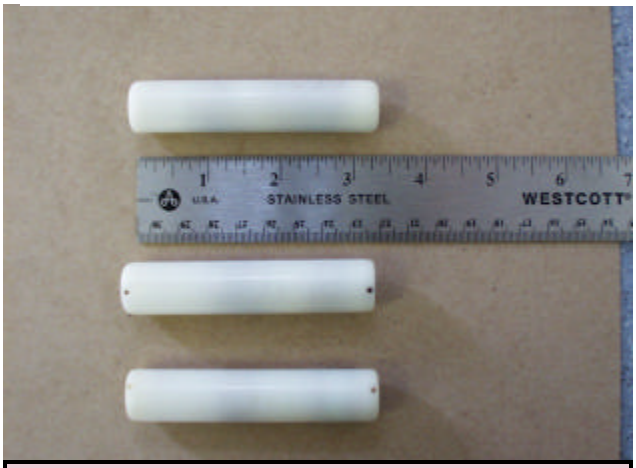

Figure 5. Depth sensing sonic tags (transmitters) used by researchers to determine habitat use of Lake Pend Oreille predators. Transmitters are surgically implanted into the fish's abdomen.

Figure 6. Sonic receiver (left) and directional hydrophone used by researchers on Lake Pend Oreille to find tagged fish and determine habitat use.

(Continued from page 3)

section 1 there are 412 age 1-5 kokanee (approximate predator:prey biomass (lbs) ratio of 1:14) which would allow for plenty of kokanee to survive throughout the year. However, in section 2 we find ratios of 122 kokanee age 1-5 to 1 pelagic predator and in section 3 we find ratios of 103 kokanee age 1-5 to 1 pelagic predator (approximate predator:prey biomass (lbs) ratio of 1:4-both sections combined) indicating the potential for the pelagic predator population to have an impact on the kokanee population and perhaps limit high growth potential for predators. It is important to note here, again, that we are only looking at the pelagic portion of the population and we have to keep in mind that the benthic predators also take there share of the kokanee population. Lake-wide we have an approximate pelagic predator:prey biomass (lbs) ratio of 1:7. Our kokanee survival data suggests that this ratio is imbalanced (to few prey) and our research efforts will focus on finding the proper balance point to help manage the LPO fishery.

Activities for Next Quarter

During this next quarter we will perform spring time habitat utilization of rainbow, lake and bull trout. We will conduct a spring time hydroacoustic survey to determine depth and size distribution of pelagic predators. We will hire a bio-aide to assist us with summer and fall sampling. We will complete a rough draft of the Lake Pend Oreille Predation Research annual report. We will also contact a statisticians from the University of Idaho to help devise a plan to analyze our echogram fish community data.

Questions or comments on this quarterly report should be addressed to: Tom Bassista or Melo Maiolie, PO Box 806, Bayview, Idaho 83803, ph# (208)683-9218, tbassista@idfg.state.id.us

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