FISHERY RESEARCH

EVALUATION OF LARGE TRAP NETS FOR LAKE TROUT REMOVAL IN LAKE PEND OREILLE, IDAHO

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Prepared by:

Mike P. Peterson
Fishery Research Biologist

and

Melo A. Maiolie
Principal Fishery Research Biologist

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EVALUATION OF LARGE TRAP NETS FOR LAKE TROUT REMOVAL IN LAKE PEND OREILLE, IDAHO

Project Progress Report, Part 2

2004 Annual Report

By

Mike P. Peterson
Melo A. Maiolie

Idaho Department of Fish and Game
600 South Walnut Street
P.O. Box 25
Boise, ID 83707

To

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Division of Fish and Wildlife
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ABSTRACT

We assessed the use of large trap nets to suppress the introduced population of lake trout *Salvelinus namaycush* in Lake Pend Oreille, Idaho. Lake trout were chosen for removal because their population expansion poses a threat to bull trout and kokanee within the lake. While trap netting, we also monitored the mortality rates of nontarget species and estimated the abundance of lake trout. Starting September 30, 2003, we began setting nets throughout the lake to estimate the number of lake trout present in Lake Pend Oreille. The nets varied in lead heights and mesh size as part of the assessment to identify the most effective gear. Using the Schnabel multiple-census population estimator, we estimated that Lake Pend Oreille contained 6,376 lake trout >52 cm after handling 1,186 lake trout (marked and unmarked) during the six month study. Based on the population estimate, we caught 16% of the population >52 cm in length. We identified lake trout movements of up to 31 km, indicating that individual lake trout utilized most of the lake. Our catch rates ranged from a high of 3.0 lake trout/net/day (during spawning season) to a low of 0.13 lake trout/net/day (during the winter season). We captured nine species with the trap nets and found the catch and mortality of most nontarget species were relatively low. The most commonly captured species was the lake whitefish *Coregonus clupeaformis* (41,204 fish caught). Due to lake bathymetry (steep shorelines and few shallow areas), these nets could not be set in many of the lake trout habitats found within the lake. Data indicated that the large trap nets alone may not be a suitable way to suppress the lake trout population in a short period of time, since they caught only $^{1}/_{6}$ ($^{1}/_{5}$ to $^{1}/_{8}$ based on the 95% confidence limits) of the population. Trap nets also proved to be a valuable research tool for collecting lake trout for population estimates and sonic tagging projects without causing high mortality to nontarget species.

Authors:

Mike P. Peterson
Fishery Research Biologist

Melo A. Maiolie
Principal Fishery Research Biologist

INTRODUCTION

Predator and prey relationships were studied as part of the Lake Pend Oreille Fishery Recovery Project for the past few years. In 1999, it was determined that predators and prey were unbalanced due to the rapid decline in the kokanee *Oncorhynchus nerka* population (determined by low survival rates of the older age classes of kokanee) (Maiolie et al. 2002). The three main predators on the kokanee population are Gerrard strain rainbow trout *Oncorhynchus mykiss,* bull trout *Salvelinus confluentus*, and lake trout *Salvelinus namaycush.* Vidergar (2000) identified the rainbows as the primary predator for kokanee. However, because of the trophy fishery that exists on Lake Pend Oreille for the rainbows, it appeared reducing their population would not be supported by the public. Furthermore, reduction in the bull trout population was not an option because of their protection under Endangered Species Act (ESA).

Vidergar (2000) estimated the lake trout population in April of 1999 at approximately 1,800 individuals. In 2000, a creel survey was performed on Lake Pend Oreille; harvest was estimated at 4,700 lake trout, possibly indicating an increase in the lake trout population. Based on the continued decline in the kokanee population, possible competition between bull trout and lake trout (Donald and Alger 1993; Fredenberg 2002; USFWS 2000), and the possible expansion in the lake trout population, the Idaho Department of Fish and Game (IDFG) decided to place large trap nets in Lake Pend Oreille, Idaho to assess lake trout population size and reduce the threat posed by lake trout to other species within the lake. Prior to making a decision to remove any lake trout, we evaluated the effectiveness of these trap nets to capture lake trout with low mortality rates associated with by-catch of other species.

OBJECTIVES

The following objectives were in our 2003-2004 Statement of Work to the Bonneville Power Administration (BPA):

Objective 1. Balance the pelagic predator and prey populations at a ratio of less than 1 kg predator to 6 kg prey. This ratio is a starting point for predator-prey balancing; other objectives will help to define this ratio more specifically for Lake Pend Oreille.

Objective 2. Research and implement methods for the removal of rainbow and lake trout that will not impact bull trout. Adjust the predator : prey ratio until the balance point is reached (currently thought to balance at 1:6).

Objective 3. Minimize the competition between bull trout and other predatory fish. Kokanee survival rates over 50% would indicate forage is not in limited supply.

METHODS

Sampling Gear

To address the objectives for the project, IDFG worked with Harbor Fisheries, Inc. of Baileys Harbor, Wisconsin to set and operate the trap nets with their two boats (one 47’ to lift the nets and a 35’ to set the anchors). Funding and contracting was through Avista Power Company and funding for the monitoring was through BPA. Commercial fishermen and

biologists on the Laurentian Great Lakes have used commercial trap netting gear for many years to sample lake trout and other fish species (Schmalz et al. 2004; D. Hickey, personal communication). Harbor Fisheries, Inc. set eight large trap nets at the beginning of this assessment (Figure 1).

The nets had leads (274 m in length) that varied in height: four nets had 9.14 m high leads, two had 12.19 m high leads, and two had 15.24 m high leads. The "pots" of the nets were 6.10 m wide x 6.10 m high x 12.19 m long, and the "tunnels" were 1.22 m wide x 1.22 m high. Six nets had 35.6 cm stretch mesh size in the leads and 10.2 cm stretch mesh in the pot. These nets were standard lead heights and mesh size that Harbor Fisheries, Inc. used in the Great Lakes. Two additional nets were built with a smaller mesh size in the pot (5.1 cm instead of 10.2 cm stretch mesh) in an attempt to catch smaller fish.

A ninth net (experimental net) was built two months into the project to determine if lake trout were avoiding the "heart area" of the traps because they swam over the trap where the lead net tapers down to the pot. This net was built with the standard 35.6 cm stretch mesh size in the lead and 10.2 cm pot mesh size, but with a 12.19 m tall pot so there was no taper from the top of the lead to the pot. The ninth net also had a wider tunnel to allow fish more room to enter the "heart" of the trap. The dimensions of the tunnel in the experimental ninth net were 0.91 m wide x 3.66 m high.

Trap Net Locations

The first eight nets were placed in the water between September 30 and December 8, 2003, followed by the ninth net on December 17, 2003 (Table 1 and Figure 2). Nets were spread around the lake to sample lake trout from the entire population found within Lake Pend Oreille. We placed the trap nets at depths ranging from 21.3 m to 51.8 m to focus on habitats utilized by lake trout, based on tracking data collected by IDFG personnel (Bassista and Maiolie 2004). Nets were also set in areas used by lake trout fishermen and in areas of possible lake trout habitat seen on contour maps. However, some nets were placed in deeper water to determine whether we were missing part of the population and only trapping fish in shallower habitats. One full day and two boats were needed to set a net in the lake.

Once nets were placed into the lake, we tried to lift and empty the "pots" every other day during the peak of our catch rates (October-November) and decreased lifting nets to twice a week for the remainder of the season (December-March). As catch rates decreased at a specific net site, nets were moved to find new areas to capture lake trout in an attempt to increase catch. The movements of nets around the lake are also shown in Figure 2.

Data Collection

Initially we marked lake trout with fin clips according to their location of capture (Table 1 and Figure 2). After consulting a statistician, we decided that individual fish should be marked to calculate recapture probabilities as well as to quantify tag loss (to account for assumptions). On November 25, 2003, we began to tag lake trout using individually numbered spaghetti tags.

With each lift of the nets, we measured all lake trout for total and fork lengths, looked for tags and fin clips, subsampled lake whitefish for total length, and scanned bull trout for PIT tags. We also counted and measured all other species captured in the nets. Unmarked lake trout

were tagged (with both fin clips and spaghetti tags), and both unmarked and marked lake trout were transported (about 5 km to 15 km) to redistribute them within the population or released at the net to track movements. All nontargeted species were released alive.

We also collected biological data from 56 lake trout to identify length at age and size at first maturity. We only collected otoliths from recaptured fish (during the first half of the project) so we could leave as many marked fish in the population for the Schnabel estimate. A lake trout was classified as mature if gonads were fully developed or we could see evidence from previous spawning (e.g., old eggs inside the body cavity).

Statistical Analysis

We used the Schnabel multiple-census estimator (Van Den Avyle 1993) to determine the abundance of lake trout in Lake Pend Oreille. The Schnabel method was chosen over other mark-recapture techniques so we could calculate a population estimate as we were marking and releasing fish. The formula for this estimator is:

$$\hat{N} = \frac{\sum_{t=1}^{n} C_t M_t}{\sum_{t=1}^{n} R_t}$$

where $\hat{N}$ is the population estimate of lake trout, *t* = the individual sample period, *n* = number of sample periods, C = total number of fish sampled during sample period *t*, M = total number of marked fish released prior to sample period *t*, and R = number of marked fish that were recaptured. Sample periods (t) for this study were one-week intervals.

The confidence limits were computed by first finding the variance of (1/N), which equals:

$$\hat{V}(1/N) = \frac{\sum_{t=1}^{n} R_t}{\left(\sum_{t=1}^{n} C_t M_t\right)^2}$$

and then determining the 95% confidence interval as $(1/\hat{N}) \pm 1.96\ \hat{V}(1/N)$ and computing the inverse of the limits to find the confidence interval of N itself. The statistical reasoning behind these calculations can be found in Van Den Avyle (1993).

Assumptions of the Schnabel method were also taken from Van Den Avyle (1993) and listed below:

1. Marked fish did not lose their marks.

2. Fish were not overlooked when recaptured.

3. Marked and unmarked fish were equally vulnerable during recapture (no learning behavior).

4. Marked fish must redistribute in the population when released.

5. The population was closed (we assumed the numbers of fish entering the population during the sampling period were negligible and no emigration occurred).

6. No mortality occurred during the estimate.

Microsoft® Excel 2000 was used to develop spreadsheets for the Schnabel population estimator and other calculations. Collected data was also stored in spreadsheets for future data analyses.

Using charts prepared by Robson and Regier (1964) for the Peterson estimator and a guess of about 20,000 lake trout (based on angler harvest and a guess at exploitation), we determined that we needed to mark 800 lake trout to produce a population estimate that differed from the true population number by no more than 25% at a 95% level of confidence.

We calculated relative catch efficiencies to determine if there was any size bias (larger fish being recaptured more often) associated with using the trap nets. Relative efficiency was defined as the number of recaptures divided by the number of captures within each 2 cm length group. We then split the catch into three size groups: 52-66 cm, 67-81 cm, and 82-87 cm (only four fish were recaptured over 87 cm). The efficiencies between these size groups were compared using a Student's *t*-test with separate variances (SYSTAT version 10). Differences were considered significant if they exceeded the 90% confidence level. We also calculated separate population estimates for each of the three size groups (the larger size group included all fish up to 103 cm) using the standard Schnabel method. The sum of these estimates was compared to the original estimate to determine the amount of change in the population estimate if a size bias occurred.

RESULTS

Population Estimate

By the end of the study, (March 31, 2004), we marked 987 lake trout over 52 cm (20.5") total length (lake trout under 52 cm did not appear to be fully recruited to the gear and were dropped from the population estimate, Figure 6) and recaptured 83 lake trout for a population estimate of 6,376 lake trout >52 cm. Our population estimate had a 95% confidence interval of -18% (5,247 lake trout) to +27% (8,124 lake trout). We estimated the population weekly since the beginning of the project. Since the sixth week of the estimate (November 13-19), the population ranged from 5,056-6,376 lake trout >52 cm (Appendix A).

Trap net efficiencies were compared for three different size groups of lake trout. Mean relative efficiency for the small (52–66 cm), medium (67–81 cm), and large (82-87 cm) groups were 0.07, 0.06, and 0.16, respectively (Figure 3). We failed to show a statistically significant difference between the means of the small and medium group ($p = 0.563$), or between the mean of the large group and the combined mean of the small and medium groups ($p = 0.111$). The population estimate corrected for size-bias was 6,604 (which fell within the confidence intervals of the original estimate). The difference between the two estimates was small (228 lake trout or 4%); therefore, if size bias occurred it had a minor effect on the population estimate (Table 2).

Distribution and Movements

Lake trout were distributed throughout Lake Pend Oreille. We captured and tagged lake trout from every location where trap nets were set. We noted extensive movements in the marked lake trout in Lake Pend Oreille, similar to sonic tagging studies (Bassista and Maiolie 2004). Seven lake trout tagged in the northern half of the lake were recaptured in the southern end, and five lake trout tagged in the southern half were recaptured in northern trap nets. Also 66% of the lake trout were recaptured at a different location than their initial marking, indicating a fair degree of mixing.

We recaptured two lake trout more than once. The first individual was marked at the Thompson or Sheepherder Point nets before November 25 (fin clip only) and recaptured the first time in the Cape Horn net on December 2, where it was spaghetti tagged (a linear distance of 31.15 km). It was released the same day at Whiskey Point and recaptured again in the Garfield Bay net on December 10 (a linear distance of 12.53 km, Figure 4). The second lake trout was originally tagged at the Thompson or Sheepherder point nets (before November 25) and released, and then recaptured the first time at the Thompson Point net on January 7, where it was spaghetti tagged. It was released between the Lee Point net and Deadman Point then recaptured the second time at the Thompson Point net on March 4. The average number of days between original capture and the recapture date (spaghetti-tagged lake trout) was 35.2 days (ranging from 5 days to 112 days).

Trap Net Effectiveness

During this study, we captured 1,100 lake trout (fish under and over 52 cm). A total of 1,002 lake trout were captured in the eight nets set around the north end of the lake (all nets north of and including the Garfield Bay net), and 98 additional lake trout were handled from the three net locations in the southern end of the lake (Appendix B).

Our catch rates have ranged from a high weekly mean of 3.0 lake trout/net/day (six trap nets, 7 days, 127 fish) to a low of 0.13 lake trout/net/day (nine trap nets, 7 days, 8 fish). Our peak catch rate occurred the week of October 23-29 during the spawning season (as evidenced by ripe fish). After the peak catch rate, we noted a steady decline in lake trout catch until early spring (Figure 5). Before the trap nets were removed from the lake, catch rates appeared to be increasing. We had a total of 31,025 hours of effort with the trap nets during the six-month period.

The lake trout captured during the trap net evaluation ranged in size from 34-103 cm total length. The average total length for lake trout in Lake Pend Oreille was 67.9 cm (Figure 6). Weights were not collected from all of the lake trout that were tagged as part of the population estimate (to reduce handling stress); however, weights were collected from 157 lake trout. The average weight of the sampled lake trout from Lake Pend Oreille was 3.55 kg.

Of the 56 lake trout collected for biological data, only 14 were mature; the remaining 42 were immature. We only recaptured 23 lake trout during the spawning season, so we could not identify any definitive length at first maturity. We sampled six mature lake trout (two male and four female) during the spawning season and eight more mature lake trout (one male and seven female) in early spring. The smallest mature male was 62 cm and the smallest mature female

was 65 cm. We sampled 16 males ranging from 44-70 cm that were not mature and 26 immature females ranging from 34-73 cm.

We captured nine species with the deep-water trap nets in Lake Pend Oreille: lake trout, bull trout, rainbow trout, brown trout *Salmo trutta*, kokanee, lake whitefish *Coregonus clupeaformis*, northern pikeminnow *Ptychocheilus oregonensis*, largescale sucker *Catostomus macrocheilus*, and peamouth *Mylocheilus caurinus*. Mortality rates of nontarget species were mostly low, ranging from 0.0%-27.0%. The exception was rainbow trout with a 100% mortality rate, although only four were caught (Table 3). Length frequencies for bull trout, northern pikeminnow, and suckers are shown in Appendix C.

We sampled 41,204 lake whitefish during the six-month trapping season. Catch rates for lake whitefish were as high as 1,440 lake whitefish captured in a net during one week of fishing effort. The average total length of the lake whitefish was 39.5 cm. We used only the data from the Warren Island net because it was one of the small mesh nets and captured a larger size range of lake whitefish (Figure 7). Mortality of lake whitefish was initially high (17.5%) when lake water temperatures were warm (17°C on September 23, 2003) before fall turnover; however, once lake water temperatures started to decline, the mortality dropped to a final mortality rate of 7.4%. Many of the lake whitefish bloated as the nets were raised, causing them to float when released. Roughly 25% needed to be “fizzed” (punctured) to allow them to resubmerge. Delayed mortality of fizzed whitefish was unknown.

As part of the evaluation of the large trap nets, we used different combinations of net types to identify what worked best in Lake Pend Oreille to capture lake trout. Due to our limited ability to place nets in the lake and no replication at an individual location, we were unable to determine whether the lead heights or mesh size had a significant effect on lake trout catch. However, it appeared that the two 9.14 m large mesh nets captured more lake trout than the two 9.14 m small mesh nets (with a mean of 14.6 lake trout/week versus 2.4 lake trout/week), but location was probably the most influential factor in determining lake trout capture.

DISCUSSION

Data collected in this study will be used to model the lake trout population in Lake Pend Oreille. Modeling results will be included in a future report to show how the population changes under different mortality scenarios.

Trap Net Limitations

There were some limitations to the use of large trap nets in Lake Pend Oreille. These nets are very large and need areas with a gradual slope and flat bottom for proper fishing. Due to lake bathymetry (steep shorelines and few shallow areas), these nets were not suitable for fishing in many of the lake trout habitats found within Lake Pend Oreille. Weather also played a role in when the nets could be lifted. During windy (1 m swells on the lake) or cold days (below -4°C), we were unable to lift the nets because of the risks of tripping the anchors or having the nets freeze to the deck of the boat.

Population Estimate Assumptions

There were some limitations to the population estimate as well. First, we had no way of knowing whether new lake trout entered the population from upstream sources or left the population by migrating downstream. During winter, flows into and out of Lake Pend Oreille were low, as was typical, (U.S. Army Corps of Engineers data from Albeni Falls Dam), so immigration and emigration were likely low, but this was not quantified. In addition, mortality of lake trout undoubtedly occurred during the six months of this study; however, it was assumed to be zero for the purpose of our population estimate. Higher mortality of tagged lake trout than unmarked fish would have caused the population estimate to be too high.

We were also concerned about the assumption of having marked lake trout mix into the population at large, and the non-randomness of our marking and recapturing locations. Lake trout marking and recapturing locations could not be located randomly since only specific sites were suitable for setting trap nets. Tagged lake trout were generally moved (approximately 10 km) away from the trap net sites before release and lake trout appeared to travel extensively about the lake. This should have helped to distribute marked fish into the unmarked population. We also assumed because of the length of time between captures (mean of 35 days) that lake trout were probably mixing after being released. If lake trout homed back to the area of their capture, then the population would have been underestimated. However, 66% of the recaptured lake trout were caught at a different location than their initial marking, indicating a fair degree of mixing.

Trap nets appeared to recapture the 81-103 cm size class more often than the two smaller size classes (52-66 cm and 67-81 cm) (Figure 3). Fisheries professionals have observed similar size bias when estimating population sizes using electrofishing methodology (D. Schill, personal communication). However, after performing two sample *t*-tests on the data, we were unable to show statistically a size bias associated with the trap nets. Small sample sizes in the larger size groups of lake trout may have given the appearance of increasing efficiencies and/or hindered our ability to detect significant changes. However, correcting the population estimate for any potential size bias only added 4% to the estimate.

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We wish to thank the following people for their contribution to this study. Technician Mark Duclos and biological aides Matt Gearhiser, Jake Miller, and Ted Siegford assisted with many of the field activities and collecting the biological data. Avista Corporation provided the funding to hire the commercial fishermen and gear, and Region 1 of the Idaho Department of Fish and Game made contributions that made the project possible. Special thanks to Ned Horner for securing the funding and working closely with the public and commercial fishermen. We would also like to thank Dan Schill, Ned Horner, and Tim Copeland who edited drafts of this report. We appreciated the help from these people and agencies.

Table 1. Description of the setting of nine large trap nets in Lake Pend Oreille, Idaho. The numbers beside each net site corresponds with the numbers in Figure 2.

Net Site	Date Set	Date Removed	Lead Height	Pot Depth	Fin Clip Used
1. Sunrise Bay	9/30/03	11/27/03	12.19 m	32.6 m	Adipose Only
2. Thompson Point	10/01/03	3/31/04	9.14 m	41.1 m	Adipose + Left Ventral
3. Garfield Bay	10/03/03	3/31/04	12.19 m	37.8 m	Right Ventral Only
4. Warren Island[a]	10/09/03	3/31/04	9.14 m	44.5 m	Adipose Only
5. Sheepherder Point	10/19/03	2/17/04	15.24 m	26.5 m	Adipose + Left Ventral
6. Idlewilde Bay	10/21/03	3/30/04	9.14 m	38.4 m	Left Ventral Only
7. Lee Point[a]	11/04/03	2/25/04	9.14 m	42.4 m	Adipose + Right Ventral
8. Cape Horn	11/23/03	3/30/04	15.24 m	43.0 m	Left Ventral Only
9. Whiskey Bay	12/08/03	3/30/04	12.19 m	21.9 m	Left Ventral Only
10. Memaloose Island[b]	12/17/03	1/13/04	12.19 m	39.6 m	Adipose Only
11. Camp Bay[b]	1/14/04	3/31/04	12.19 m	38.1 m	Right Ventral Only
12. Anderson Point	2/21/04	3/31/04	15.24 m	51.8 m	Adipose Only
13. Sunnyside Bay[a]	3/09/04	3/31/04	9.14 m	38.1 m	Adipose Only

[a] Small mesh pot with the 10.2 cm stretch mesh in the leads.
[b] Experimental net with wider tunnel and taller pot.

Table 2. Comparison between the two calculated Schnabel population estimates and the 95% confidence intervals for the estimates.

Type of Estimate	Population Estimate	95% Confidence Interval
Schnabel split into size classes		
52-66 cm	3,018	-25% (2,259)
		+51% (4,546)
67-81 cm	2,876	-27% (2,099)
		+59% (4,569)
82-99 cm	710	-30% (497)
		+75% (1,241)
Total for the three size classes	6,604	
Schnabel all sizes combined	6,376	-18% (5,247)
		+27% (8,124)
Difference between the estimates	228	

Table 3. Total catch for all nine trap nets during the six month study. Marked lake trout include both fish > and <52 cm. The total caught includes all individual fish, both > and <52 cm that were captured with the trap nets. The number of mortalities and mortality rate is for all net caused mortality.

Species	Time Fished (hrs)	Marked Lake Trout	Recaptured	Total Caught	Number of Mortalities	Mortality Rate
Lake Trout	31,025	1,043	86	1,100	11	1.0%
Lake Whitefish	31,025			41,204	3,049	7.4%
Bull Trout	31,025			136	7	5.1%
Rainbow Trout	31,025			4	4	100.0%
Brown Trout	31,025			1	0	0.0%
Pikeminnow	31,025			107	1	0.9%
Suckers	31,025			93	0	0.0%
Peamouth	31,025			11	3	27.3%
Kokanee	31,025			1	0	0.0%
Total				**42,657**		

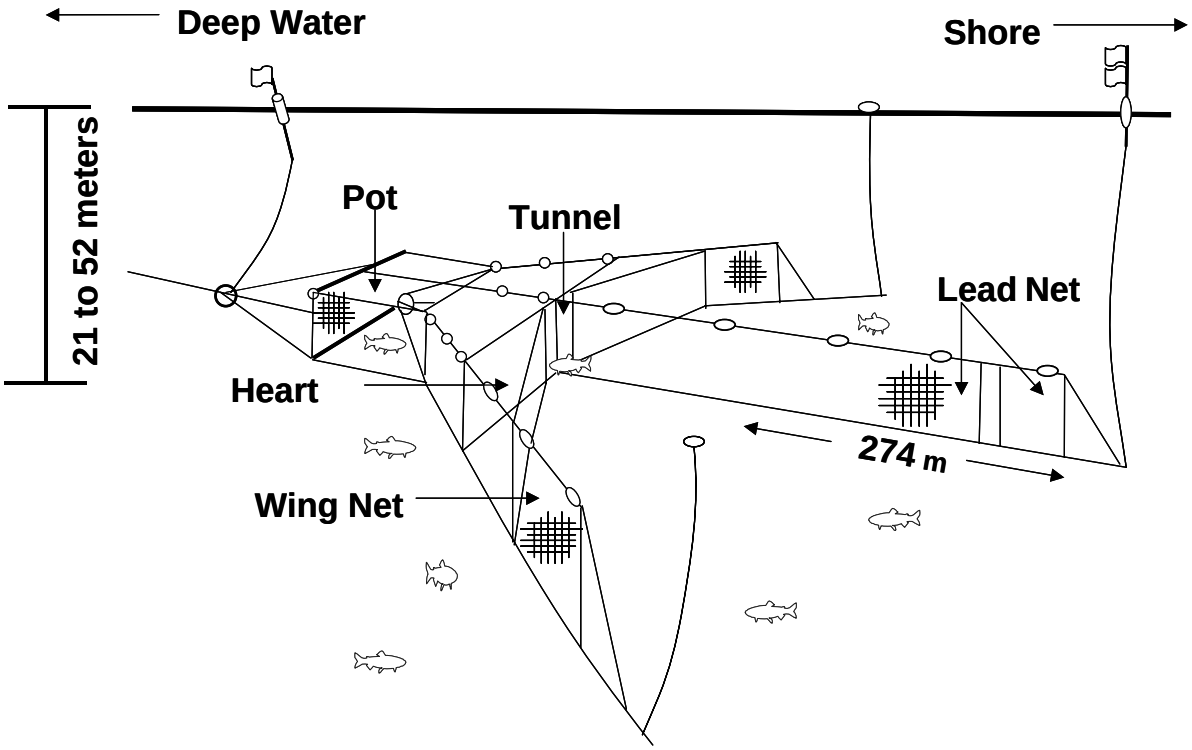

Figure 1. Design of the trap nets used in Lake Pend Oreille, Idaho, 2003-04. Nine nets were fished to estimate the abundance of lake trout in Lake Pend Oreille, Idaho. Image redrawn from one provided by the University of Wisconsin Sea Grant Advisory Services.

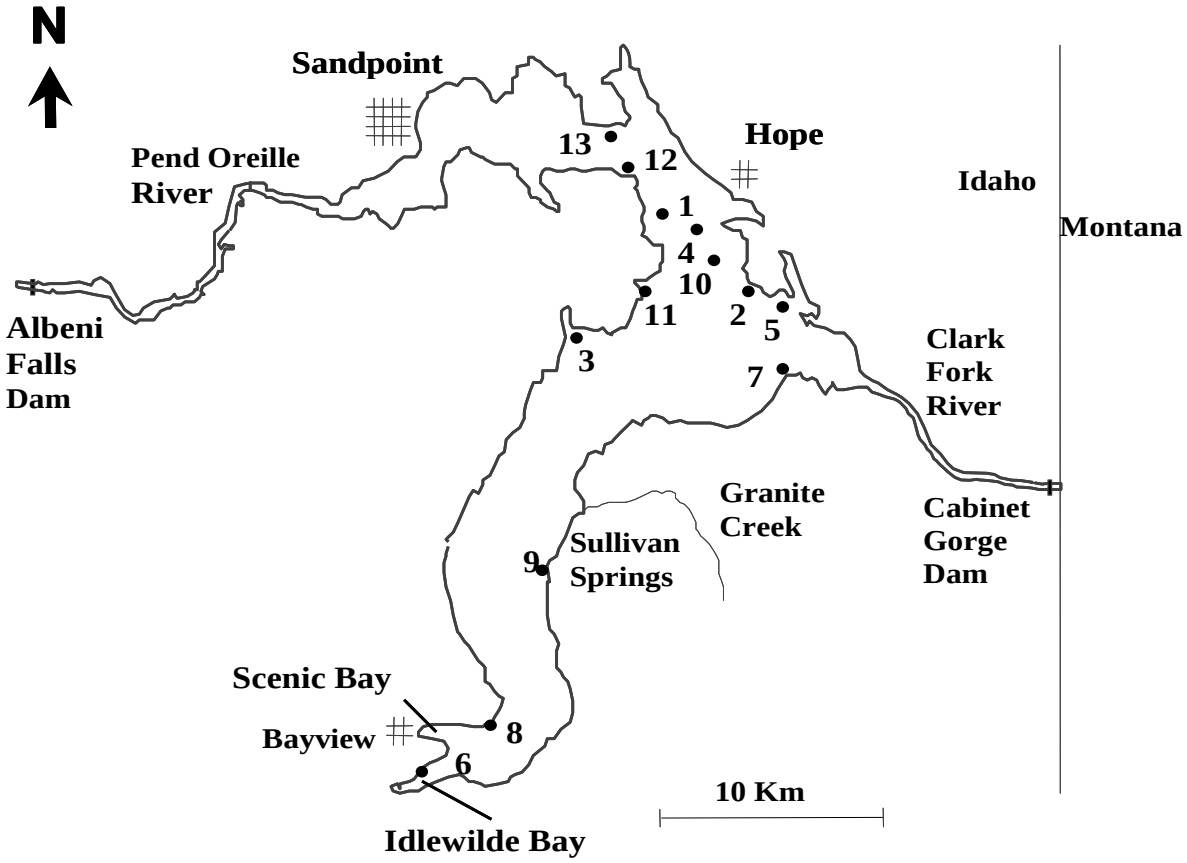

Figure 2. Map of Lake Pend Oreille, Idaho and trap net placements. The numbers correspond with the order the nets were placed into the lake and the description in Table 1.

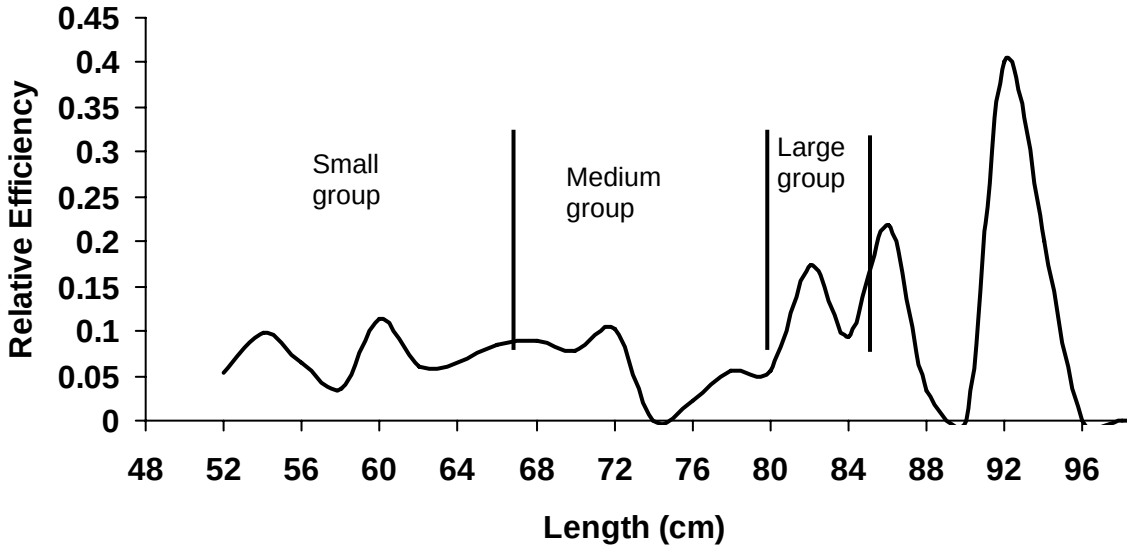

Figure 3. Graph of the relative efficiencies used to determine if size bias occurred among different size groups of lake trout caught in trap nets. Lake trout over 87 cm were not used due to small sample sizes.

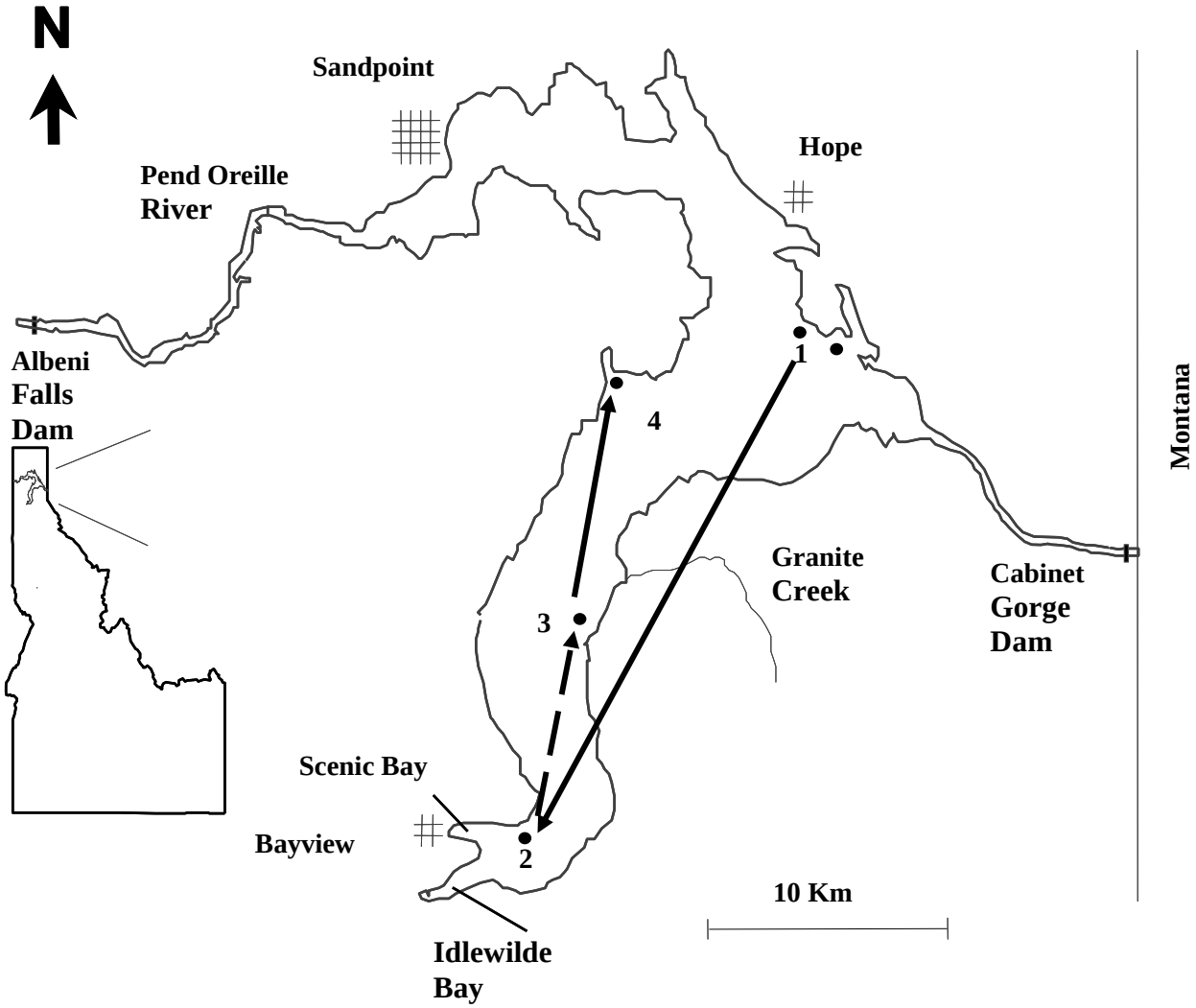

Figure 4. Movements made by one marked lake trout (#03028) within Lake Pend Oreille, Idaho. Solid line indicates general fish movements and the dotted line shows the fish was transported by boat and then released. 1. Originally captured at Thompson or Sheepherder point before November 25, 2003. 2. Recaptured at Cape Horn on December 2, 2003. 3. Released near Granite Creek on December 2, 2003. 4. Recaptured at Garfield Bay on December 10, 2003.

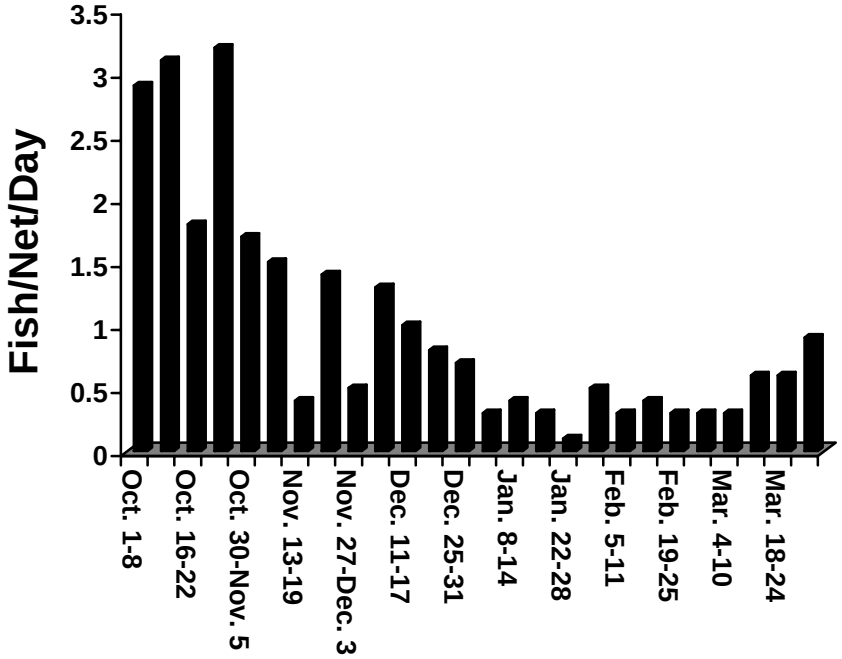

Figure 5. Catch rates for lake trout during the trap net evaluation project on Lake Pend Oreille, Idaho, from October 1, 2003–March 31, 2004. The highest catch rates occurred during the spawning season and decreased into the winter months.

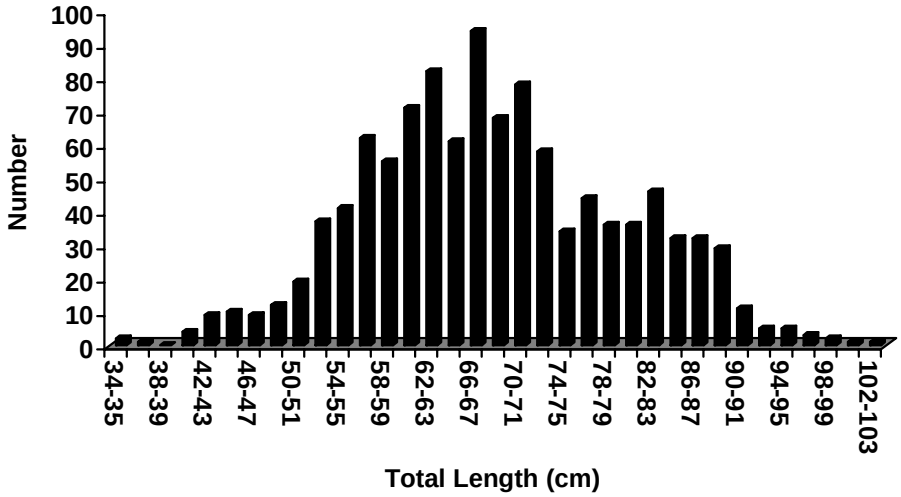

Figure 6. Length frequency distribution of lake trout (n = 1090) captured in the deepwater trap nets in Lake Pend Oreille, Idaho, 2003.

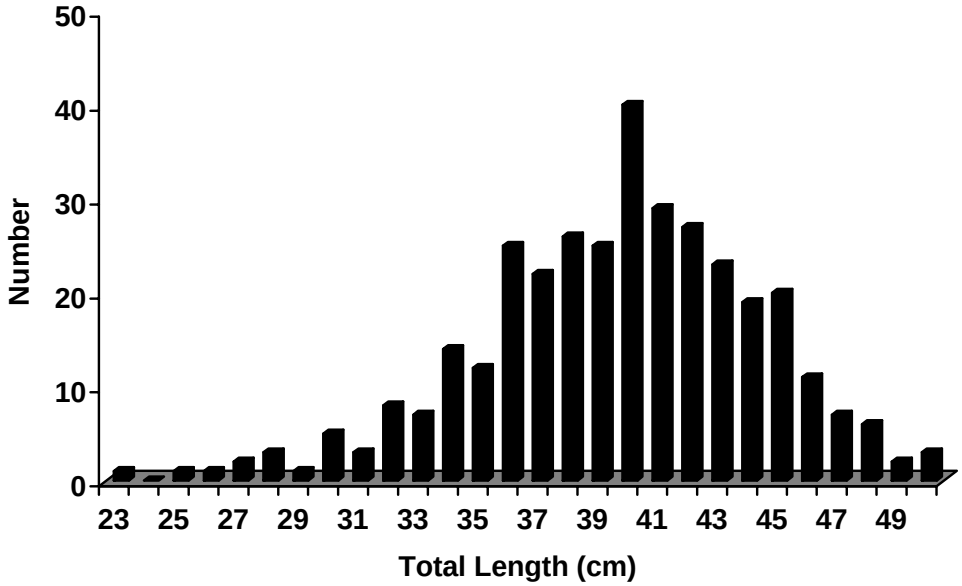

Figure 7. Length frequency distribution of lake whitefish (n = 343) from the Warren Island area of Lake Pend Oreille, Idaho.

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APPENDICES

Appendix A. Variables used to calculate the Schnabel population estimate for lake trout over 52 cm (20.5”) in Lake Pend Oreille, Idaho.

Sample Date	Sample	Recaptured	Unmarked	Total	Running population estimate
10/01/2003—10/08/03	1	0	56	56	
10/09/2003—10/15/03	2	4	77	81	1114
10/16/2003—10/22/03	3	2	59	61	2044
10/23/2003—10/29/03	4	3	124	127	3973
10/30/2003—11/05/03	5	1	74	75	5871
11/06/2003—11/12/03	6	7	63	70	5014
11/13/2003—11/19/03	7	1	18	19	5194
11/20/2003—11/26/03	8	5	67	72	5473
11/27/2003—12/03/03	9	4	23	27	5177
12/04/2003—12/10/03	10	5	62	67	5493
12/11/2003—12/17/03	11	5	48	53	5609
12/18/2003—12/24/03	12	2	49	51	6166
12/25/2003—12/31/03	13	6	29	35	5884
01/01/2004—01/07/04	14	3	15	18	5788
01/08/2004—01/14/04	15	6	20	26	5501
01/15/2004—01/21/04	16	4	13	17	5343
01/22/2004—01/28/04	17	3	5	8	5181
01/29/2004—02/04/04	18	5	26	31	5152
02/05/2004—02/11/04	19	2	14	16	5189
02/12/2004—02/18/04	20	1	23	24	5396
02/19/2004—02/25/04	21	2	14	16	5431
02/26/2004—03/03/04	22	0	21	21	5680
03/04/2004—03/10/04	23	3	18	21	5693
03/11/2004—03/17/04	24	1	33	34	6013
03/18/2004—03/24/04	25	5	30	35	6028
03/25/2004—03/31/04	26	3	48	51	6376
	Total Recaps	83			

Appendix B. Total fish caught at each net site, as well as total effort and mortality rates per species captured during the trap net evaluation project in 2003-2004 on Lake Pend Oreille, Idaho. Marked fish column includes both fish <52 cm and >52 cm that were tagged. The total caught column includes marked fish, recaptures, fish sacrificed and net caused mortalities.

Sunrise Bay	**Pot size: 40 ft**			**Removed from lake on 11/27/03**		
Species	**Time Fished (hrs)**	**Marked**	**Recaptured**	**Total Caught**	**Mortality Rate**	**# of Morts**
Lake Trout	798.25	70	0	71	1.4%	1
Lake Whitefish	798.25			2292	10.7%	245
Bull Trout	798.25			18	27.8%	5
Pikeminnow	798.25			17	5.9%	1
Peamouth	798.25			7	0.0%	0
Suckers	798.25			2	0.0%	0
		Total Fish Caught		**2407**		

Thompson Pt	**Pot size: 30 ft standard mesh**					
Species	**Time Fished (hrs)**	**Marked**	**Recaptured**	**Total Caught**	**Mortality Rate**	**# of Morts**
Lake Trout	4340.75	404	28	450	1.1%	5
Lake Whitefish	4340.75			3439	9.9%	341
Bull Trout	4340.75			28	0.0%	0
Brown Trout	4340.75			1	0.0%	0
Pikeminnow	4340.75			5	0.0%	0
Suckers	4340.75			3	0.0%	0
		Total Fish Caught		**3926**		

Garfield Bay	**Pot size: 40 ft**					
Species	**Time Fished (hrs)**	**Marked**	**Recaptured**	**Total Caught**	**Mortality Rate**	**# of Morts**
Lake Trout	3758.5	138	27	172	0.0%	0
Lake Whitefish	3758.5			6250	9.4%	589
Bull Trout	3758.5			23	4.3%	1
Pikeminnow	3758.5			14	0.0%	0
Suckers	3758.5			13	0.0%	0
		Total Fish Caught		**6472**		

Warren Island	**Pot size: 30 ft small mesh**					
Species	**Time Fished (hrs)**	**Marked**	**Recaptured**	**Total Caught**	**Mortality Rate**	**# of Morts**
Lake Trout	3202	59	6	76	0.0%	0
Lake Whitefish	3202			13983	4.6%	643
Bull Trout	3202			5	0.0%	0
Pikeminnow	3202			14	0.0%	0
Sucker	3202			2	0.0%	0
Peamouth	3202			4	75.0%	3
		Total Fish Caught		**14084**		

Appendix B. Continued.

Sheepherder's Pt	Pot size: 50 ft				Removed from Lake on 2/17/04	
Species	Time Fished (hrs)	Marked	Recaptured	Total Caught	Mortality Rate	# of Morts
Lake Trout	2888.25	191	13	209	2.4%	5
Lake Whitefish	2888.25			2168	6.8%	147
Bull Trout	2888.25			15	0.0%	0
Rainbow Trout	2888.25			4	100.0%	4
Pikeminnow	2888.25			15	0.0%	0
Suckers	2888.25			6	0.0%	0
		Total Fish Caught		**2417**		

Idlewilde Bay	Pot size: 30 ft standard mesh					
Species	Time Fished (hrs)	Marked	Recaptured	Total Caught	Mortality Rate	# of Morts
Lake Trout	3679	21	1	22	0.0%	0
Lake Whitefish	3679			676	9.6%	65
Bull Trout	3679			5	0.0%	0
Kokanee	3679			1	0.0%	0
		Total Fish Caught		**704**		

Lee Point	Pot size: 30 ft small mesh				Removed from lake on 2/25/04	
Species	Time Fished (hrs)	Marked	Recaptured	Total Caught	Mortality Rate	# of Morts
Lake Trout	2654.5	23	0	23	0.0%	0
Lake Whitefish	2654.5			1773	1.4%	24
Bull Trout	2654.5			1	0.0%	0
Pikeminnow	2654.5			18	0.0%	0
Sucker	2654.5			5	0.0%	0
		Total Fish Caught		**1820**		

Cape Horn	Pot size: 50 ft					
Species	Time Fished (hrs)	Marked	Recaptured	Total Caught	Mortality Rate	# of Morts
Lake Trout	3058.75	28	4	33	3.0%	1
Lake Whitefish	3058.75			1293	9.8%	127
Bull Trout	3058.75			12	8.3%	1
Pikeminnow	3058.75			6	0.0%	0
		Total Fish Caught		**1344**		

Appendix B. Continued.

Whiskey Bay	Pot size: 40 ft					
Species	Time Fished (hrs)	Marked	Recaptured	Total Caught	Mortality Rate	# of Morts
Lake Trout	2696.5	47	3	51	0.0%	0
Lake Whitefish	2696.5			5023	3.4%	169
Bull Trout	2696.5			18	0.0%	0
Pikeminnow	2696.5			18	0.0%	0
Suckers	2696.5			62	0.0%	0
		Total Fish Caught		**5172**		

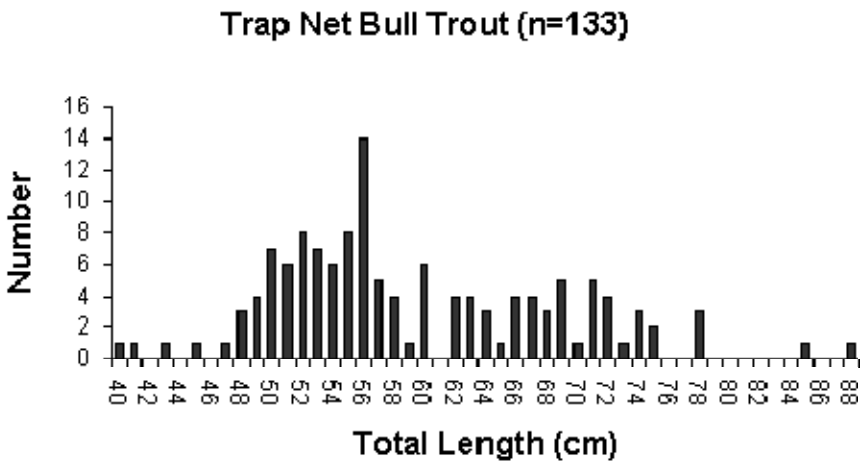
Memaloose Shelf		Net removed from lake on 1/13/04				
Species	Time Fished (hrs)	Marked	Recaptured	Total Caught	Mortality Rate	# of Morts
Lake Trout	616	2	0	2	0.0%	0
Lake Whitefish	616			377	1.3%	5
		Total Fish Caught		**379**		

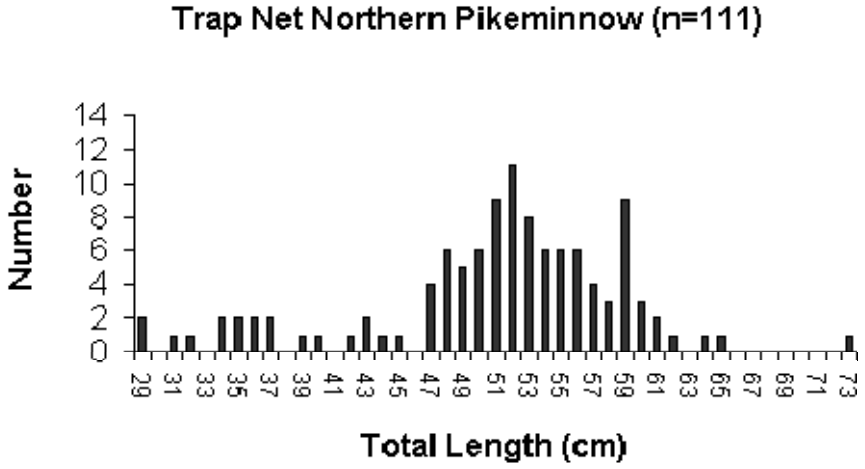
Camp Bay						
Species	Time Fished (hrs)	Marked	Recaptured	Total Caught	Mortality Rate	# of Morts
Lake Trout	1837	10	1	11	0.0%	0
Lake Whitefish	1837			1655	2.3%	38
Bull Trout	1837			7	0.0%	0
		Total Fish Caught		**1673**		

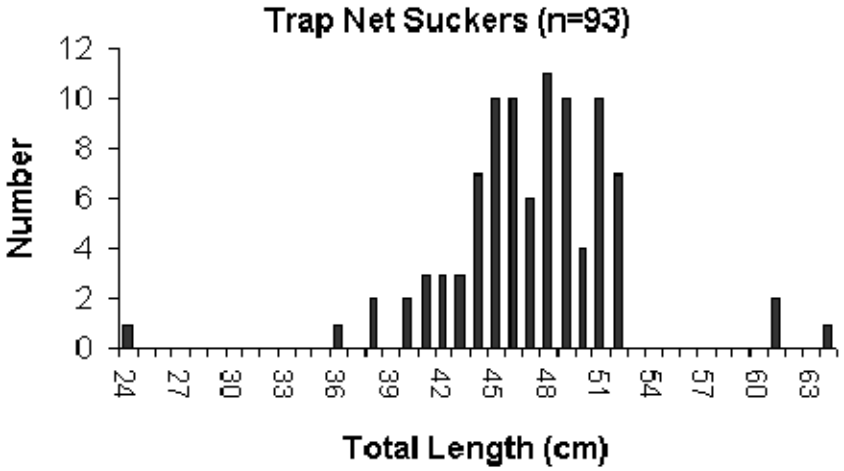
Anderson Point						
Species	Time Fished (hrs)	Marked	Recaptured	Total Caught	Mortality Rate	# of Morts
Lake Trout	972.75	48	3	63	0.0%	0
Lake Whitefish	972.75			2275	15.7%	358
Bull Trout	972.75			4	0.0%	0
		Total Fish Caught		**2342**		

Sunnyside						
Species	Time Fished (hrs)	Marked	Recaptured	Total Caught	Mortality Rate	# of Morts
Lake Trout	522.75	2	0	3	0.0%	0
Lake Whitefish	522.75			2436	12.2%	298
		Total Fish Caught		**2439**		

Appendix C. Length frequencies of three species captured during the trap net evaluation project in 2003-2004 on Lake Pend Oreille, Idaho.







Prepared by:

Mike P. Peterson
Fishery Research Biologist

Melo A. Maiolie
Principal Fishery Research Biologist

Approved by:

IDAHO DEPARTMENT OF FISH AND GAME

Virgil K. Moore, Chief
Bureau of Fisheries

Daniel J. Schill
Fisheries Research Manager