LAKE TROUT POPULATION ASSESSMENT SEKULMUN LAKE 2010

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Yukon
Environment
Environnement

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SEKULMUN LAKE
2010

Yukon Department of Environment
Fish and Wildlife Branch
TR-12-12

Acknowledgements

Susan Thompson, Treharne Drury, Lorne LaRocque, and Sandy van Dijk conducted the survey. Oliver Barker, Jean Carey, Rob Florkiewicz, and Dan Lindsey reviewed and edited the report.

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Suggested citation:

JESSUP, L. AND N. MILLAR. 2012. Lake trout population assessment: Sekulmun Lake 2010. Yukon Fish and Wildlife Branch Report TR-12-12, Whitehorse, Yukon, Canada.

Summary

Environment Yukon has been surveying important fish stocks since 1991. We use these surveys to detect population changes and monitor population health. Along with angler harvest surveys, these data are also used to assess the sustainability of fisheries.

Environment Yukon works with First Nations, RRCs, and user groups to determine priority lakes for surveys. Criteria for identification of priority lakes include accessibility for anglers, sensitivity of the fish population, and management concern. The surveys focus on lake trout, an indicator of the health of northern lake ecosystems.

We surveyed Sekulmun Lake in 2010 using SPIN (Summer Profundal Index Netting). Environment Yukon previously surveyed the lake using a different index netting techniques in 2001. SPIN provides more statistically robust data and improves confidence in survey results (Jessup and Millar 2011).

Lake-wide CPUE (catch per unit effort) was 0.88; lake trout density is estimated at 3.7 lake trout / hectare.

Key Findings

- Sekulmun Lake has a healthy population of lake trout.
- Density was found to be relatively low which is expected for a population of large lake trout in a large, low-productivity lake.
- Our power to detect change fell short of our stated management goal. It may be difficult to reach this goal for large lakes like Sekulmun with low densities of lake trout.

Table of Contents

List of Figures

List of Tables

Introduction

Each year, Environment Yukon conducts assessments of fish populations, with a focus on lake trout. Between 1991 and 2009, over 100 Yukon lakes were surveyed using small-mesh netting, a method based on the index netting techniques described by Lester et al. (1991). Beginning in 2010, we began to assess fish populations using a new method, Summer Profundal Index Netting (SPIN; Sandstrom and Lester, 2009). SPIN provides more statistically robust data and improves confidence in survey results (Jessup and Millar, 2011).

We choose lakes for assessment based on the size of the active recreational fishery, the aboriginal subsistence fishery, and the commercial and domestic fisheries, as well as other available information. Lakes with heavy harvest pressure are surveyed on a regular basis.

SPIN assessments involve setting gillnets at various sites in the lake and recording the catch and biological information about each fish caught. The survey usually tells us:

- relative abundance of lake trout as measured by an index (CPUE, or catch per unit effort);
- changes in relative abundance from previous surveys;
- the estimated density (number of lake trout per hectare) and abundance (number of lake trout) in the lake;
- length and weight of individual lake trout as well as other species captured; and
- age and diet of any fish killed.

Environment Yukon surveyed Sekulmun Lake using SPIN in 2010, and using small-mesh netting in 2001. Differences between the 2 methods mean that results from this survey cannot be compared statistically with the previous survey. Here we report the 2010 results and make only subjective comparisons to 2001.

Study Area

Sekulmun Lake lies to the west of Aishihik Lake, southwest of Aishihik Village (Figure 1). The lake is in the traditional territory of the Champagne and Aishihik First Nations. There is no road access, but there is a trail from Aishihik Village and the lake can also be accessed by boat by travelling up the Taghah (Sekulmun) River. The lake is approximately 30 km long and covers an area of approximately 4,932 ha. The lake has a mean depth of 28 m and a maximum depth of 53 m. The lake is fed by Isaac and Albert creeks as well as numerous other small, unnamed creeks. It is drained by the Taghah (Sekulmun) River into Aishihik Lake, part of the Alsek River Watershed.

The recreational fishery has been managed with Conservation Waters regulations since 1991. The catch and possession limit for lake trout is 2. All lake trout between 65 and 100 cm must be released and only one may be over 100 cm. Anglers must use barbless hooks. Fish species present in the lake include lake trout, Arctic grayling, northern pike, burbot, lake whitefish, round whitefish, pygmy whitefish, and longnose sucker.

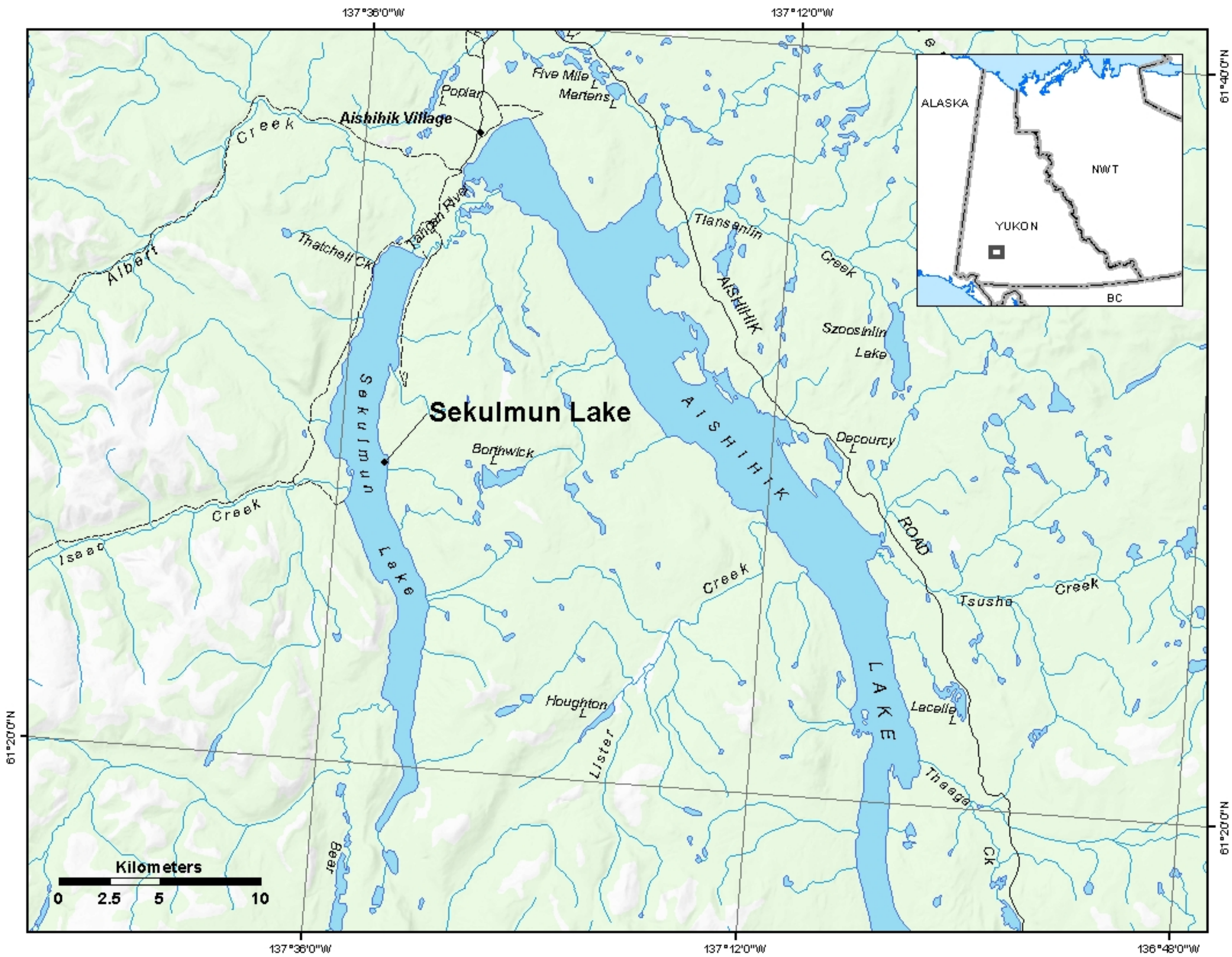

Figure 1. Location of Sekulmun Lake, Yukon.

Methods

We followed the Summer Profundal Index Netting (SPIN) method for lake trout assessment (Sandstrom and Lester 2009, Jessup and Millar 2011). Gillnets were set at different depths throughout the lake to capture lake trout. Each 64-m gillnet was made up of 8 panels of monofilament web with mesh sizes from 57 mm to 127 mm. Each net was set for 2 hours.

We surveyed Sekulmun Lake 18 – 21 August 2010. We set a total of 86 nets, divided among 5 depth strata (Table 1). We initially weighted the number of sets (effort) in each stratum by the surface area of the stratum. However, we adjusted the distribution of effort during the survey by concentrating on those strata with the highest catch rates. Initial set locations within each stratum were chosen using random point generation in ArcGIS 9.3. Any clumped distributions of points were dispersed manually to ensure coverage of the entire lake.

Table 1. Effort breakdown by stratum.

Stratum (depth range)	Area		Number of Sets	
	ha	%	No.	%
0-10 m	669	13%	13	15%
10-20 m	652	13%	11	13%
20-30 m	876	18%	21	24%
30-40 m	2167	43%	33	38%
40-50+ m	621	12%	8	9%
Total	4985	100%	86	100%

Catch per unit effort (CPUE), or the number of lake trout of “harvestable” size (300 mm and up) caught per net was calculated for each stratum. We accounted for net selectivity (the fact that certain sizes of fish are more prone to capture than others) by applying a correction factor to each fish caught, based on its likelihood of capture (see Sandstrom and Lester (2009) for a full rationale of net selectivity). The total stratified lakewide CPUE was calculated as:

$$\text{Lakewide CPUE} = \sum(\text{CPUE}_i \bullet W_i)$$

where:

CPUE_i = selectivity adjusted CPUE of stratum $_i$

W_i = surface area of stratum $_i$ / lake surface area

CPUE is considered an index of abundance and changes in the CPUE are thought to reflect actual changes in the lake trout population. Therefore, CPUE can be compared between surveys and used to detect population growth or decline. The method excludes fish below 300 mm because they are not usually captured by anglers.

We then converted CPUE to density (fish/ha) based on an empirical relationship between CPUE and fish density that has been established for Ontario lakes. From this, we estimated absolute abundance (i.e., the total population size) by multiplying density by lake size (number of fish/ha • lake area (ha) = number of fish in lake). Before we can be fully confident in our estimates of density and absolute abundance, the relationship between CPUE and density must be verified for Yukon lakes.

We used SPIN Support Systems Ver. 9.04 (Sandstrom 2012) for calculations of CPUE, density, and population size, as well predictions of sample size and power for future surveys. We measured, weighed, and released all fish captured. Any fish that died was sampled for age (using otoliths or ear “bones”) and diet (stomach contents).

Results and Discussion

CPUE, Density, and Population Size

We captured 60 lake trout and based our population estimates on the 57 lake trout that were > 300 mm in length; 3 fish were < 300 mm in length. One fish we captured fell out of the net before we had a change to measure it. in 86 net sets (see Appendix 2 for set locations). Round whitefish and lake whitefish were also captured in this survey. Incidental mortalities included 11 lake trout and 8 round whitefish. An additional 11 lake trout, 20 round whitefish, and 1 lake whitefish were kept for biological sampling.

We adjusted the total lake trout catch for net selectivity bias based on the lengths of lake trout captured, resulting in a selectivity-adjusted total catch of 67 lake trout. After weighting the data by catch in each strata, we found a lake-wide CPUE of 0.88 (SE = 0.16).

Lake trout density was estimated at 3.7 trout / hectare and lake-wide abundance was estimated at 18,651 lake trout (68% CI: 10,303 – 27,303).

Table 2. Selectivity-adjusted catch and CPUE by stratum**.**

Stratum (depth range)	# Sample Sites	Catch	CPUE
1 (0-10 m)	13	4	0.34
2 (10-20 m)	11	7	0.61
3 (20-30 m)	21	6	0.30
4 (30+ m)	33	30	0.92
5 (40-60 m)	8	19	2.40
Total	86	67	0.88

Results from Previous Surveys

The 2001 survey captured 10 lake trout in 39 sets, resulting in a CPUE of 0.26, which is slightly lower than the Yukon average of 0.36 for large-body, unproductive lake trout lakes. This survey used a method that is quite different from the current method. Nets were set from shore out into the lake only sampling the littoral (nearshore) zone, mesh material and mesh sizes were different, set duration was only one hour compared with 2 hours, and effort was lower. Though only subjective comparisons can be made between the 2 surveys, the results from both surveys agree: Sekulmun Lake has a low density of lake trout.

Biological Characteristics

Average length and weight of lake trout was 536 mm and 2,345 g respectively. Stomach contents can reveal whether a lake contains small-body lake trout that feed mostly on invertebrates or large-body lake trout that feed mostly on fish. Maximum size and size-at-maturity is smaller and growth is slower in the small-body, invertebrate-eating life history form than the large-body, fish-eating form. Stomach contents are not available, but the large average size indicates that this is a large-body, fish-eating population.

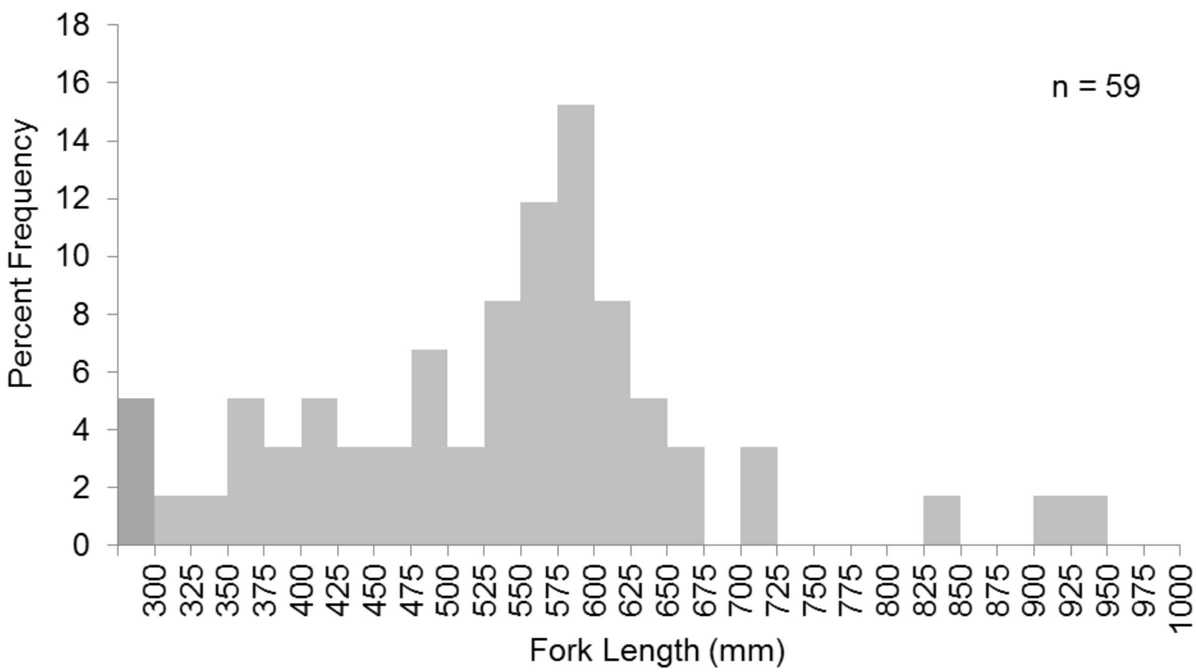

Figure 2. Distribution of the lengths of lake trout caught. The darker bar on the far left represents 3 fish that were all less than 300 mm: 272 mm, 284 mm, and 240 mm.

Population Status and Conclusions

Larger, less productive lakes with large-body lake trout usually have lower densities than smaller, more productive lakes with small-body lake trout (Burr 1997). Lakes that have predator species other than lake trout, like northern pike and burbot, are also expected to have lower densities than lakes with fewer predators (Carl et al. 1990).

We found that Sekulmun Lake has a relatively low density of large-body lake trout (Appendix 1). Sekulmun Lake is a large, low-productivity lake with large-body lake trout, which also contains other top predator species (pike and burbot). Based on these characteristics, Sekulmun Lake would have a low density of lake trout under natural conditions. While angler harvest is unknown, the lake is relatively remote and harvest is likely to be low. Commercial harvest quotas were retired in 1968. Based on the observed and expected lake trout density and considering the suspected harvest, the lake trout population appears naturally low and healthy.

Future Surveys

Because we found the population to be healthy, we are most interested in being able to detect future population declines which might require management action. To facilitate responsive management, we target the ability to detect 25% changes in CPUE with a power of 80%. Power refers to the probability of detecting a change when that change is real. In other words, we want to have an 80% chance to detect a drop in CPUE of 25%.

At the current sample size (n = 86 net sets), our predicted power to detect a decline of 25% in CPUE is 55%, below of our goal. This may be a problem that we encounter again with other lakes with low density of lake trout. To increase power in future surveys, we recommend raising the sample size (setting more nets) or reducing the variation in catch data by focusing netting effort on those strata where catches are highest; in 2010, the deepest stratum was sampled less than it should have been, given the high CPUE.

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Appendix 1. Characteristics of lake trout populations for Yukon lakes.

Lakes are arranged in descending order of lake trout density (last column). Information on lake trout morphology and life history (small body vs. large body), and the presence of other top predators is included. Lake productivity refers to the annual maximum sustainable yield of all fish in kilograms per hectare. It is estimated following the method proposed by Schlesinger and Regier (1982) of relating mean annual air temperature to the morphoedaphic index (Ryder, 1965). This information is presented so that comparisons can be made between lakes with similar characteristics.

Lake	Lake Characteristics				SPIN Results		
	Surface Area (ha)	Productivity (kg fish / ha)	Lake Trout Morphology	Other Top Predators	Year	CPUE	Density (fish/ha)
Caribou	51	3.89	Small body	None	2011	3.63	53.2
Lewes	131	3.17	Small body	None	2010	3.31	48.6
Fish	1386	2.44	Small body	None	2009	2.64	38.9
Kathleen	3398	1.87	Small body	None	2011	2.11	‡
Louise (Jackson)	68	3.27	Small body	Rainbow trout	2011	2.02	29.8
Fish	1386	2.44	Small body	None	2010	2.01	29.7
Kathleen	3398	1.87	Small body	None	2010	1.94	‡
Ta’tla Mun	3265	2.05	Large body	Pike/burbot	2011	1.00	4.1
Sekulmun	4985	1.16	Large body	Pike/burbot	2010	0.88	3.7
Ethel	4610	1.42	Large body	Pike/burbot	2011	0.30	2.0
Tarfu	405	2.74	Large body	Pike	2010	0.2	1.7
Pine	603	2.87	Large body	Pike/burbot	2010	0.08	1.3
Snafu	284	3.54	Large Body	Pike	2010	0	0

‡ Data not available. Contact Parks Canada for more information on Kathleen Lake

Appendix 2. Sekulmun Lake 2010 SPIN set locations