LAKE TROUT POPULATION ASSESSMENT

CARIBOU LAKE 2011

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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 and impact 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, sensitivity, and management concern. The surveys focus on lake trout, an indicator of the health of northern lake ecosystems.

We surveyed Caribou Lake in 2011 using SPIN (Summer Profundal Index Netting; Sandstrom and Lester 2009). Environment Yukon previously surveyed the lake using a different index netting technique in 1996, 2001, and 2006. SPIN provides more statistically robust methods and improves confidence in survey results (Jessup and Millar 2011).

The 2011 SPIN survey captured 87 lake trout, resulting in a lake-wide CPUE (catch per unit effort) of 3.63, and an estimated density of 53.2 lake trout / hectare. Caribou Lake has a high density of lake trout.

Key Findings

- Caribou Lake is a very small lake with a high density of small-bodied lake trout.
- Caribou Lake is an ideal candidate for validation of the relationship between SPIN, CPUE, and density. We recommend a mark-recapture study to establish this relationship.

Table of Contents

List of Tables

List of Figures

Introduction

Each year, Environment Yukon conducts assessment 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.

The SPIN assessment involves 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 Caribou Lake using small-mesh netting in 1996, 2001, and 2006, and using SPIN in 2011. Differences between the two methods mean that results from this survey cannot be compared statistically with past surveys. Here we report the 2011 results and make only subjective comparisons with previous surveys.

Study Area

Caribou Lake is located approximately 50 km southeast of Whitehorse, east of the northern end of Marsh Lake (Figure 1). The lake sits at an elevation of 820 m asl. The lake is approximately 1.6 km long and covers an area of 51 ha. It has a mean depth of 16.5 m and maximum depth of 21 m. The lake is fed by a small unnamed creek at the north end, and drains westward into Marsh Lake via Caribou and Grayling creeks.

Access to Caribou Lake is by an unmaintained road from the Alaska Highway. There is no boat launch. There is one residence on the lake. Caribou

Lake lies within an overlap between Carcross/Tagish First Nation and Kwanlin Dün First Nation Traditional Territories.

The recreational fishery at Caribou Lake has been managed as a Special Management Water since 2001. The catch limit for lake trout is one fish per day, and all lake trout over 65 cm must be released. The possession limit is one lake trout. The catch limit for Arctic grayling is 2 fish per day, and all grayling over 40 cm must be released. The possession limit is 2 Arctic grayling. Northern pike are not present in Caribou Lake. General catch and possession limits apply to all other fish species.

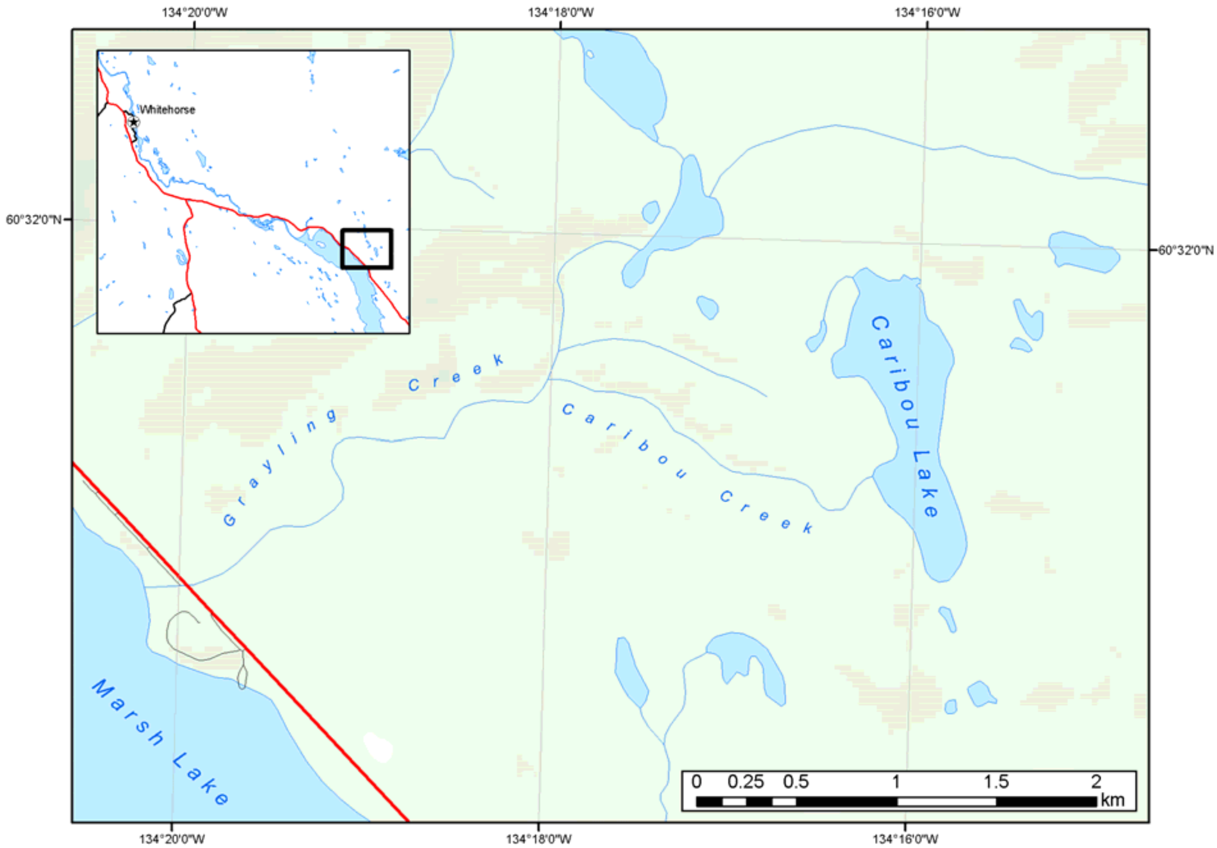

Figure 1. Location of Caribou Lake, Yukon.

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 and determine CPUE. Each 64 m gillnet was made up of 8 panels of monofilament web with mesh sizes from 57 mm to 127 mm. We set each net for 2 hours.

We calculated the lake-wide catch per unit effort (CPUE) as the number of lake trout of “harvestable” size (300 mm and up) caught per net. CPUE is considered an index of abundance and changes in 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 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 surveyed Caribou Lake on July 5, 6, 7, and 12, 2011. We set a total of 32 nets, divided among 4 depth strata (Table 1). We initially weighted the number of sets in each stratum by the surface area of the stratum. However, we adjusted the final distribution of effort midway through the survey by concentrating on those strata with the highest catch rates. We chose the locations for setting the nets within each stratum randomly by using random point generation in ArcGIS 9.3. Any clumped distributions of points were manually dispersed to ensure coverage of the entire lake.

Table 1. Effort breakdown by stratum, Caribou Lake 2011.

Stratum (depth range)	Area (ha)	% Area	No. Samples	% Sample
0-3 m	13	25%	4	13%
3-9 m	17	33%	14	44%
9-15m	12	24%	8	25%
15-21+m	9	18%	6	19%
Total	51	100%	32	100%

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).

We used SPIN Support Systems Ver. 9.03 for calculations of CPUE, density, and population size, as well predictions of sample size and power for future surveys.

Results and Discussion

Temperature and Dissolved Oxygen

Temperature and dissolved oxygen are water quality variables critical to lake trout and they determine suitable and optimal habitats within a lake. Lake trout habitat has been defined as *suitable* where temperatures are below 15°C and dissolved oxygen is above 4 mg/L (Clark et al. 2004). Outside these levels (i.e., temperature above 15°C and dissolved oxygen below 4 mg/L) the habitat is *unsuitable* for lake trout. The *optimal* temperature range for Yukon lake trout is between 2 and 12°C (Mackenzie-Grieve and Post 2006). The *optimal* dissolved oxygen level for lake trout is ≥7 mg/L (Evans 2005).

A temperature and dissolved oxygen profile was taken in the north basin of Caribou Lake on 12 July 2011 (Figure 2). The lake was strongly stratified, with the thermocline (zone of steep temperature gradient, also called the metalimnion) at 6.5 m (Figure 3). Temperatures were unsuitable (>15°C) from the surface to 5 m, suitable (12 - 15°C) between 6-7 m, and optimal (≤12°C) below 7 m. Dissolved oxygen levels were optimal (>7 mg/L) down to 13 m, and suitable between 13 and 15 m (4 – 7 mg/L; Figure 3).

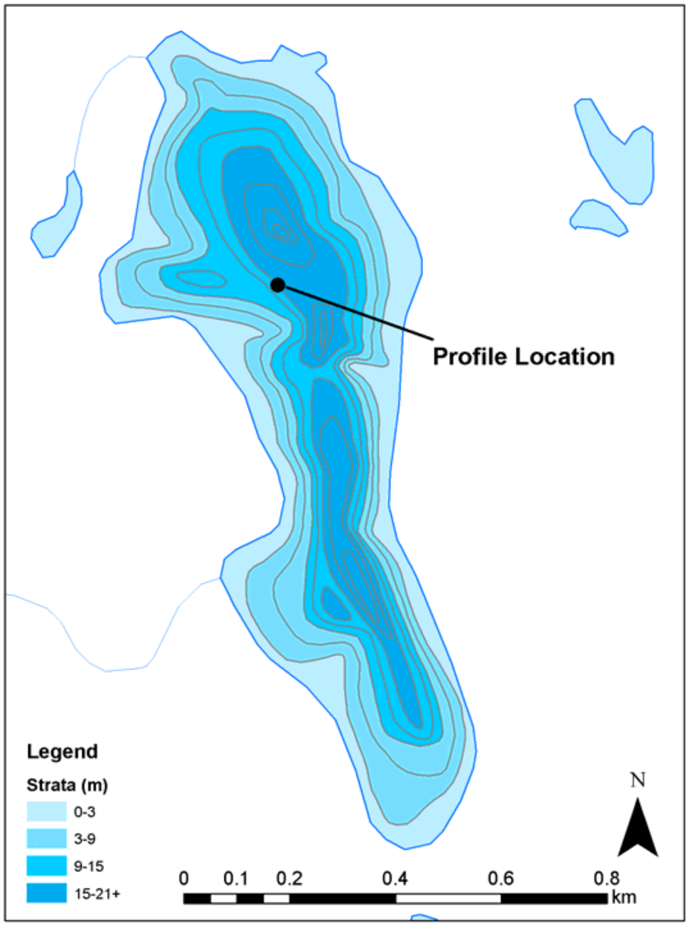

Figure 2. Location of temperature and dissolved oxygen profile taken in Caribou Lake, 12 July 2011.

Overall, water conditions were suitable between 6 m and 15 m, and optimal between 7 m and 12 m. Suitable habitat was constrained by high temperature (>15°C) in shallower water (≤5 m) and low dissolved oxygen (<4 mg/L) in deeper water (> 15 m). The usable and optimal habitat corresponded to a volume within our 2nd and 3rd depth strata.

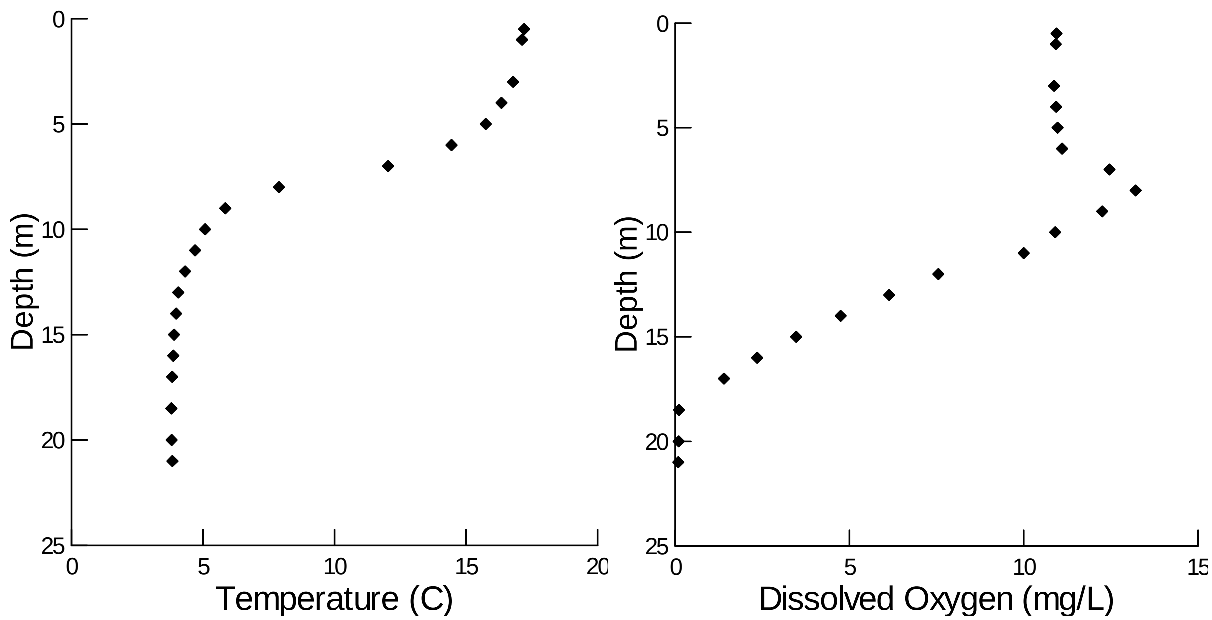

Figure 3. Temperature and dissolved oxygen profiles of Caribou Lake on 12 July 2011.

CPUE, Density, and Population Size

We captured 87 lake trout (not including 2 fish <300 mm) in 2011 (see Appendix 2 for set and capture locations and Appendix 3 for capture details). The mortality rate for lake trout was 23% (20 fish) and we kept stomachs and otoliths from all fish killed.

We adjusted the catch to account for net selectivity bias based on the lengths of lake trout captured. The selectivity-adjusted total catch was 129 lake trout (Table 2). After weighting the data by catch in each strata, we found a lake-wide CPUE of 3.63 (SE = 0.56).

Table 2. Selectivity-adjusted catch by stratum, Caribou Lake 2011.

Stratum (depth range)	% Sample Sites	Catch	% Catch
1 (0-3 m)	13%	8	7%
2 (3-9 m)	44%	79	62%
3 (9-15 m)	25%	34	26%
4 (15-21+ m)	19%	7	5%
Total	100%	129	100%

Lake trout density was 53.2 lake trout / hectare, giving a lakewide abundance of 2,716 lake trout (68% confidence interval: 2,238 – 3,237). Note that before full confidence can be placed on estimates of density and population size, the relationship between CPUE and density should be tested in Yukon.

Future Surveys

At the current sample size (n = 32 sets) and variability of the data, our predicted power to detect changes of 25% is only 0.62 (i.e., if there is a change of 25% or more in the lake trout population, we will detect it 62% of the time). In order to detect change with a power of 80% (a common management goal), sample size would need to be increased to an estimated 56 sets. Increasing sample size to this level would represent a significant increase in effort, and is not recommended. Rather, future surveys should monitor and attempt to minimize within-strata variation as the survey progresses in order to improve power to detect change.

Results from Previous Surveys

Small-mesh index netting surveys showed an increase in CPUE between 1996 and 2001, and then remained stable between 2001 and 2006 (Table 3). Small-mesh CPUE was higher than the Yukon average for small-body, productive lake trout lakes (1.19) in 2001 and 2006, but only equal to the average in 1996. These surveys 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, the results from both the SPIN survey and the two most recent small-mesh surveys agree: Caribou Lake has a high density of lake trout.

Table 3. Results of small-mesh netting surveys of Caribou Lake.

	2006	2001	1996
Gillnet sets	6	6	5
Lake trout caught	18	19	6
Small-mesh CPUE	3.00	3.17	1.20

We carried out angler harvest surveys on Caribou Lake in 1996 and 2011. The 1996 survey measured a total of 115 angler hours, or 3.6 hours / hectare (YG Internal Files). This per-hectare angler effort was amongst the highest of any Yukon recreational fishery (behind only Louise, Snafu and Tarfu lakes). The 2011 survey, however, showed a large decline in angler effort (YG data).

Biological Characteristics

Both stomach contents and size can reveal whether a lake contains small-bodied lake trout that feed mostly on invertebrates or large-bodied 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.

Lake trout in Caribou Lake are of the small-bodied type and feed mostly on invertebrates, rather than fish. Lake trout ranged between 280 and 460 mm in length (Figure 4) and the average length 390 mm. The average weight of lake trout was 654 g. Fish ages were not available at the time of publication but will be available upon request from Environment Yukon. Of the stomachs of 19 lake trout that we examined, 3 were empty and the remaining 16 averaged 37% full. Pond snails were the most common diet item identified and fish made up only 15% of the contents (Table 4).

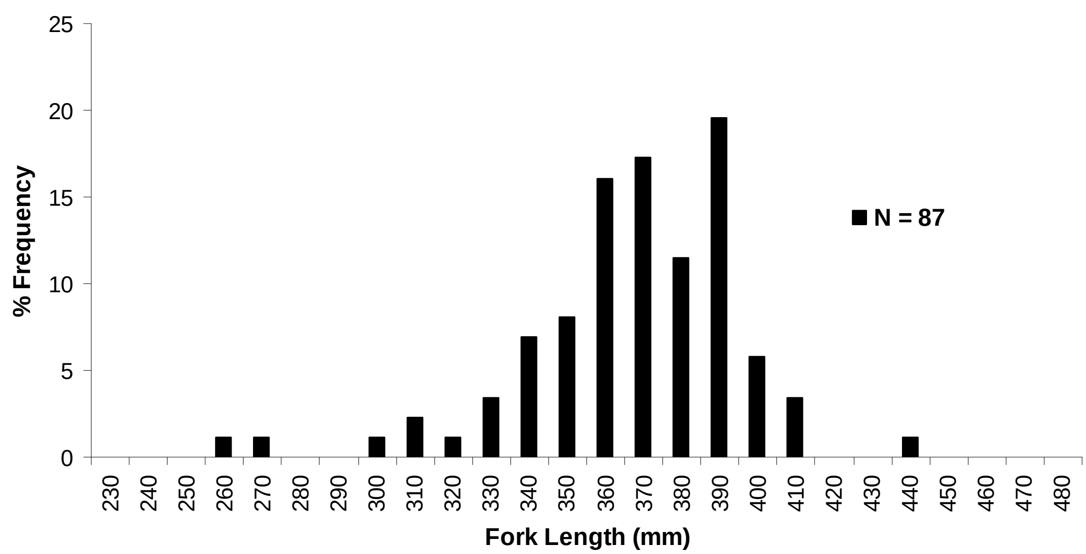

Figure 4. Length distribution of Caribou Lake lake trout in 2011.

Table 4. Sampled lake trout stomach contents, Caribou Lake 2011

Stomach Content	Percent volume
Pond snails	40%
Non-biting midges	21%
Unidentified fish	15%
Dragonflies, Damselflies	13%
Scuds, Sideswimmers	7%
Unidentified vegetation	2%
Slimy sculpin	1%
Orb snails	1%

Population Status and Conclusions

Smaller, more productive lakes (like Caribou) usually have high fish densities when compared to larger, less productive lakes (Burr 1997). Lakes like Caribou, which have few competing fish-eating fish (like northern pike and burbot), are also expected to have higher densities than lakes with these species present (Carl et al. 1990).

We found that Caribou Lake has a high density of small-bodied lake trout. When compared to other Yukon lakes with small-bodied lake trout (also surveyed using SPIN), Caribou Lake has a higher-than-average density (Appendix 1). Previous small-mesh index netting surveys also found that Caribou has a high lake trout density relative to other lakes.

Despite the high observed density of lake trout in Caribou Lake, this population is vulnerable to overharvest by virtue of its small size. While current angler effort and harvest is low (YG data), it has been very high in the past, and even modest increases in angling activity could reduce lake trout density in Caribou Lake. We recommend continued monitoring of angler effort at Caribou Lake.

The density and population size estimates that SPIN provides are based on comparisons between CPUE and independent measures of lake trout density. This relationship has been established for Ontario lakes, but has not yet been verified for Yukon lakes. This must be done before much weight is given to the density and population size estimates. One method for independently measuring lake trout density is mark-recapture population estimation (Seber 1982). Mark-recapture population estimates are most easily accomplished when the study subjects are easily captured, and the study population is relatively small. Because relative abundance of lake trout is high in Caribou Lake, while the absolute abundance of lake trout is low (by virtue of

Caribou Lake's small size), this lake is an ideal candidate for investigation into the accuracy of lake trout density estimates from SPIN. We recommend developing a mark-recapture population estimate for lake trout in Caribou Lake, and using this to build a relationship between SPIN CPUE and lake trout density for Yukon lakes.

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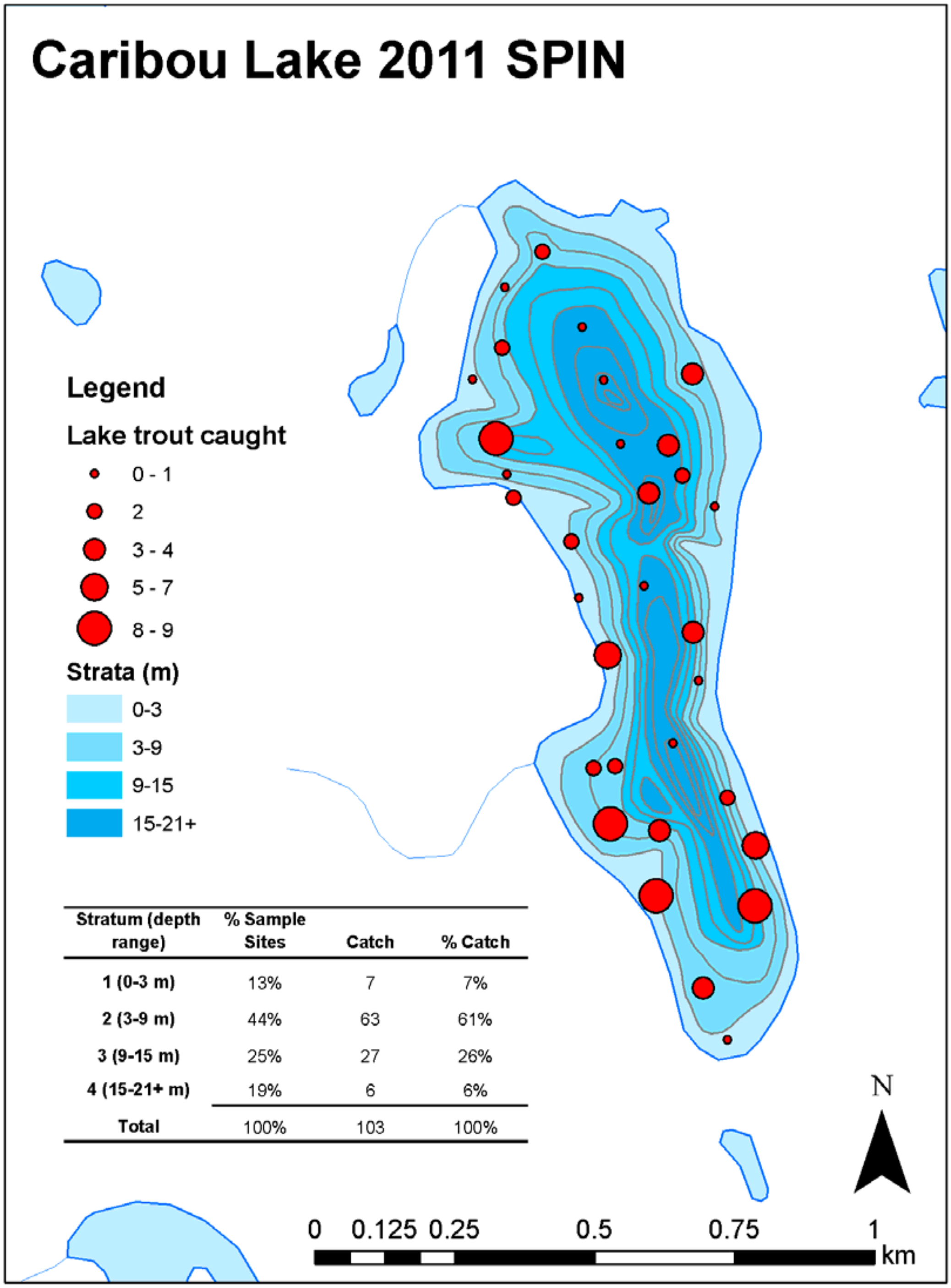
APPENDIX 1. Estimated CPUE (SPIN) and density from Yukon lakes to date.

Lake	Lake Trout Morphology	Year	CPUE (SPIN)	Density (fish/ha)
Caribou	Small body	2011	3.63	53.2
Lewes	Small body	2010	3.31	48.6
Fish	Small body	2009	2.64	38.9
Kathleen	Small body	2011	2.11	31.2
Louise (Jackson)	Small body	2011	2.06	30.3
Fish	Small body	2010	2.01	29.7
Kathleen	Small body	2010	1.94	28.6
Tatlmain (Tatla Mun)	Large body	2011	1.08	4.4
Sekulmun	Large body	2010	0.88	3.7
Ethel	Large body	2011	0.27	1.9
Tarfu	Large body	2010	0.2	1.7
Pine	Small body	2010	0.08	1.5
Snafu	Large body	2010	0	0

APPENDIX 2. Caribou Lake SPIN set and capture locations.



Stratum (depth range)	% Sample Sites	Catch	% Catch
1 (0-3 m)	13%	7	7%
2 (3-9 m)	44%	63	61%
3 (9-15 m)	25%	27	26%
4 (15-21+ m)	19%	6	6%
Total	100%	103	100%

APPENDIX 3. Caribou Lake SPIN capture details 2011.

Legend

AG=Arctic grayling; LT=lake trout; RW=round whitefish
RG=released, good condition; RP=released, poor condition; KD= dead and retained

Date	Effort (Set #)	Mesh size (mm)	Stratum	Species	Fork Length (mm)	Weight (g)	Fate	Sex
July 5, 2011	11	64	2	LT	410	700	RG	
July 5, 2011	11	64	2	LT	460	1325	RG	
July 5, 2011	6		4	No Catch				
July 5, 2011	1	57	2	AG	312	300	KD	F
July 5, 2011	1	70	2	AG	314	250	RG	
July 5, 2011	1	114	2	AG	304	300	RG	
July 5, 2011	3	64	1	AG	290	275	RP	
July 5, 2011	3	64	1	AG	285	225	RP	
July 5, 2011	3	64	1	AG	306	300	RP	
July 5, 2011	3	64	1	AG	264	100	RP	
July 5, 2011	3	64	1	AG	290	300	KD	M
July 5, 2011	3	114	1	AG	312	325	KD	F
July 5, 2011	3	114	1	AG	280	225	KD	M
July 5, 2011	3	114	1	AG	285	200	KD	M
July 5, 2011	3	57	1	AG	297	225	RG	
July 5, 2011	3	57	1	AG	260	200	RG	
July 5, 2011	3	76	1	AG	315	300	RG	
July 5, 2011	3	76	1	AG	325	325	RG	
July 5, 2011	3	76	1	AG	315	325	RG	
July 5, 2011	3	76	1	AG	330	400	RG	
July 5, 2011	3	76	1	AG	335	325	RG	
July 5, 2011	3	102	1	LT	420	875	RG	
July 5, 2011	3	70	1	AG	300	275	RG	
July 5, 2011	3	70	1	AG	310	275	RG	
July 5, 2011	3	70	1	AG	288	225	RP	
July 5, 2011	3	70	1	AG	314	300	RG	
July 5, 2011	3	70	1	AG	325	300	RP	
July 5, 2011	3	70	1	AG	300	250	RP	
July 5, 2011	3	70	1	AG	280	225	RG	
July 5, 2011	3	70	1	AG	365	525	KD	M
July 5, 2011	3	70	1	AG	310	300	RG	
July 5, 2011	3	70	1	AG	335	375	KD	M
July 5, 2011	3	89	1	AG	357	475	RG	

Date	Effort (Set #)	Mesh size (mm)	Stratum	Species	Fork Length (mm)	Weight (g)	Fate	Sex
July 5, 2011	10	64	3	LT	415	850	RP	
July 5, 2011	10	64	3	LT	430	825	RG	
July 5, 2011	8	64	4	LT	410	500	RP	
July 5, 2011	4	64	3	LT	332	325	KD	M
July 5, 2011	4	64	3	LT	290	350	RG	
July 5, 2011	4	70	3	AG	323	400	RG	
July 5, 2011	4	57	3	AG	307	300	KD	F
July 5, 2011	7	70	1	LT	395	750	KD	M
July 5, 2011	7	70	1	AG	310	400	RP	
July 5, 2011	7	70	1	AG	295	300	RG	
July 5, 2011	7	70	1	AG	340	400	RG	
July 5, 2011	7	70	1	AG	300	275	RG	
July 5, 2011	7	70	1	AG	310	325	RG	
July 5, 2011	7	76	1	LT	366	525	RP	
July 5, 2011	7	76	1	AG	320	325	RG	
July 5, 2011	7	57	1	AG	300	250	RG	
July 5, 2011	7	57	1	AG	320	300	RG	
July 5, 2011	7	57	1	AG	310	275	RG	
July 5, 2011	7	57	1	AG	289	225	RG	
July 5, 2011	7	64	1	AG	306	250	RP	
July 5, 2011	7	64	1	LT	435	600	600	
July 5, 2011	7	64	1	AG	290	200	KD	M
July 5, 2011	9	57	4	LT	405	625	RP	
July 5, 2011	9	76	4	LT	280	500	KD	F
July 5, 2011	9	76	4	LT	395	475	RP	
July 5, 2011	5	89	4	LT	391	550	KD	F
July 6, 2011	14	76	2	LT	375	550	RG	
July 6, 2011	14	76	2	LT	385	575	KD	F
July 6, 2011	14	76	2	AG	320	325	RP	
July 6, 2011	14	76	2	AG	360	500	KD	M
July 6, 2011	14	76	2	AG	285	250	RG	
July 6, 2011	14	76	2	AG	340	425	KD	F
July 6, 2011	14	76	2	AG	285	250	RG	
July 6, 2011	14	70	2	AG	350	475	RP	
July 6, 2011	14	70	2	AG	330	425	RP	
July 6, 2011	14	70	2	AG	260	300	RG	
July 6, 2011	14	70	2	AG	330	400	RP	
July 6, 2011	14	89	2	LT	395	825	RG	
July 6, 2011	14	89	2	LT	375	550	RP	
July 6, 2011	14	57	2	AG	295	300	KD	M
July 6, 2011	14	57	2	LT	382	600	RG	

Date	Effort (Set #)	Mesh size (mm)	Stratum	Species	Fork Length (mm)	Weight (g)	Fate	Sex
July 6, 2011	14	57	2	LT	400	700	RG	
July 6, 2011	14	57	2	AG	335	350	KD	F
July 6, 2011	14	57	2	LT	415	850	RG	
July 6, 2011	17	102	3	LT	355	450	RG	
July 6, 2011	17	70	3	LT	370	550	RG	
July 6, 2011	20	76	2	LT	365	575	RG	
July 6, 2011	20	76	2	LT	380	550	RG	
July 6, 2011	20	76	2	AG	310	325	RG	
July 6, 2011	20	57	2	AG	320	325	RG	
July 6, 2011	20	57	2	AG			Escape	
July 6, 2011	20	102	2	LT	350	650	KD	F
July 6, 2011	20	102	2	AG	372	500	RG	
July 6, 2011	20	70	2	AG	325	375	RP	
July 6, 2011	20	70	2	LT	365	500	RG	
July 6, 2011	20	64	2	AG	360	475	KD	M
July 6, 2011	18	64	2	LT	345	650	RG	
July 6, 2011	18	64	2	LT	420	870	KD	M
July 6, 2011	18	57	2	LT	380	625	KD	F
July 6, 2011	18	57	2	AG	325	475	KD	F
July 6, 2011	18	76	2	LT	390	675	RG	
July 6, 2011	18	76	2	LT	387	600	RG	
July 6, 2011	18	76	2	LT	397	700	RG	
July 6, 2011	18	70	2	LT	395	675	RG	
July 6, 2011	18	70	2	LT	395	550	RP	
July 6, 2011	18	89	2	LT	410	750	RG	
July 6, 2011	15	57	3	LT	385	575	RP	
July 6, 2011	15	64	3	LT	397	725	KD	
July 6, 2011	19	57	3	LT	365	500	RG	
July 6, 2011	19	57	3	LT	387	625	RP	
July 6, 2011	19	89	3	LT	410	700	RP	
July 6, 2011	19	89	3	LT	377	600	RG	
July 6, 2011	19	89	3	LT	392	575	KD	M
July 6, 2011	19	64	3	LT	355	450	RP	
July 6, 2011	19	64	3	LT	320	350	RG	
July 6, 2011	19	64	3	LT	375	550	RG	
July 6, 2011	19	102	3	LT	415	700	KD	F
July 6, 2011	16		4	No Catch				
July 6, 2011	12	70	1	AG	275	250	RG	
July 6, 2011	12	57	1	LT	417	700	RG	
July 6, 2011	12	57	1	AG	270	225	RG	
July 6, 2011	12	64	1	AG	292	275	RG	

Date	Effort (Set #)	Mesh size (mm)	Stratum	Species	Fork Length (mm)	Weight (g)	Fate	Sex
July 6, 2011	12	64	1	AG			Escape	
July 6, 2011	13		4	No Catch				
July 6, 2011	22	127	2	LT	~350		Escape	
July 6, 2011	22	57	2	LT	385	625	RG	
July 6, 2011	22	57	2	LT	405	625	RP	
July 6, 2011	22	57	2	AG	340	450	RP	
July 6, 2011	22	89	2	LT	410	975	RG	
July 6, 2011	22	89	2	AG	365	500	RG	
July 6, 2011	22	70	2	AG	310	350	RG	
July 6, 2011	22	70	2	LT	410	950	RG	
July 6, 2011	22	70	2	LT	420	800	KD	F
July 6, 2011	22	70	2	LT	397	600	RG	
July 6, 2011	22	70	2	LT	365	525	RG	
July 6, 2011	22	64	2	AG	320	400	RG	
July 6, 2011	22	64	2	AG	365	475	RP	
July 6, 2011	22	76	2	AG	320	400	RG	
July 6, 2011	23	76	2	AG	365	475	RG	
July 6, 2011	23	76	2	AG	357	500	RG	
July 6, 2011	23	76	2	AG	325	400	RG	
July 6, 2011	23	57	2	AG	315	375	RG	
July 6, 2011	23	57	2	AG	295	325	RG	
July 6, 2011	23	70	2	AG	307	325	RG	
July 6, 2011	23	70	2	AG	305	350	RG	
July 6, 2011	23	70	2	AG	280	275	RG	
July 6, 2011	23	64	2	AG	297	300	RG	
July 6, 2011	23	64	2	LT	402	800	RG	
July 6, 2011	23	64	2	LT	395	800	RG	
July 6, 2011	23	64	2	LT	382	600	RG	
July 6, 2011	21	89	1	AG	380	525	KD	M
July 6, 2011	21	89	1	AG	315	350	RG	
July 6, 2011	21	89	1	LT	410	700	KD	M
July 6, 2011	21	89	1	AG	320	350	RG	
July 6, 2011	21	89	1	AG	350	450	RG	
July 6, 2011	21	76	1	AG	305	325	RG	
July 6, 2011	21	76	1	AG	310	325	RG	
July 6, 2011	21	76	1	AG	265	225	RG	
July 6, 2011	21	76	1	AG	295	350	RG	
July 6, 2011	21	76	1	AG	335	450	RG	
July 6, 2011	21	76	1	AG	290	300	RG	
July 6, 2011	21	76	1	AG	270	225	KD	F
July 6, 2011	21	64	1	AG	317	350	RG	

Date	Effort (Set #)	Mesh size (mm)	Stratum	Species	Fork Length (mm)	Weight (g)	Fate	Sex
July 7, 2011	24	64	2	LT	335	400	RG	
July 7, 2011	24	64	2	LT	405	500	RG	
July 7, 2011	24	64	2	LT	370	600	RG	
July 7, 2011	24	57	2	LT	400	700	RG	
July 7, 2011	24	57	2	LT	400	675	RG	
July 7, 2011	24	57	2	AG	305	300	RG	
July 7, 2011	24	76	2	LT	400	550	RG	
July 7, 2011	24	76	2	AG	330	350	RG	
July 7, 2011	24	76	2	AG	330	375	RG	
July 7, 2011	24	76	2	AG	370	450	RG	
July 7, 2011	24	102	2	LT	385	675	RG	
July 7, 2011	24	102	2	AG	315	325	RG	
July 7, 2011	24	102	2	AG	330	350	RG	
July 7, 2011	24	102	2	AG	310	300	RG	
July 7, 2011	24	102	2	AG	310	300	RG	
July 7, 2011	24	89	2	LT	410	750	RG	
July 7, 2011	25	57	3	LT	437	875	RG	
July 7, 2011	25	57	3	LT	360	500	KD	F
July 7, 2011	25	57	3	LT	405	700	RG	
July 7, 2011	26	64	2	LT	415	700	RG	
July 7, 2011	26	64	2	AG	340	400	RG	
July 7, 2011	26	76	2	AG	265	200	RG	
July 7, 2011	26	70	2	AG	327	350	RG	
July 7, 2011	27	102	2	AG	315	375	RG	
July 7, 2011	27	102	2	AG	375	500	RG	
July 7, 2011	27	102	2	AG	365	500	RG	
July 7, 2011	27	102	2	AG	340	450	RG	
July 7, 2011	27	64	2	AG	315	325	RG	
July 7, 2011	27	64	2	AG	302	350	RG	
July 7, 2011	27	114	2	AG	315	300	RG	
July 7, 2011	27	114	2	AG	342	475	RG	
July 7, 2011	27	114	2	AG	340	400	RG	
July 7, 2011	27	57	2	LT	380	650	KD	
July 12, 2011	28	57	2	AG	285	225	RG	
July 12, 2011	28	57	2	AG	225	250	RG	
July 12, 2011	28	57	2	AG	275	225	KD	M
July 12, 2011	28	57	2	AG	260	175	RG	
July 12, 2011	28	70	2	AG	310	325	RG	
July 12, 2011	28	64	2	AG	285	300	RG	
July 12, 2011	28	64	2	AG	275	250	RG	
July 12, 2011	28	64	2	AG	320	350	RP	

Date	Effort (Set #)	Mesh size (mm)	Stratum	Species	Fork Length (mm)	Weight (g)	Fate	Sex
July 12, 2011	28	64	2	AG	280	250	RG	
July 12, 2011	28	64	2	AG	312	350	KD	M
July 12, 2011	28	64	2	AG	290	300	RP	
July 12, 2011	28	64	2	AG	307	300	RG	
July 12, 2011	28	76	2	AG	320	400	RG	
July 12, 2011	28	76	2	AG	325	350	RG	
July 12, 2011	28	76	2	LT	422	775	KD	M
July 12, 2011	28	102	2	LT	415	775	RG	
July 12, 2011	29	76	2	AG	315	325	RG	
July 12, 2011	29	57	2	AG	340	425	RP	
July 12, 2011	29	57	2	AG	350	425	KD	F
July 12, 2011	29	102	2	LT	390	700	RG	
July 12, 2011	29	102	2	LT	405	775	RG	
July 12, 2011	29	70	2	AG	340	450	RG	
July 12, 2011	29	70	2	AG	310	350	RG	
July 12, 2011	29	64	2	AG	317	400	RP	
July 12, 2011	29	64	2	AG	305	300	RG	
July 12, 2011	30	89	3	LT	385	550	KD	F
July 12, 2011	31	64	2	AG	337	425	RG	
July 12, 2011	31	64	2	AG	320	375	RG	
July 12, 2011	31	64	2	AG	280	250	RG	
July 12, 2011	31	64	2	AG	310	325	RG	
July 12, 2011	31	64	2	LT	~390		Escape	
July 12, 2011	31	64	2	AG	315	250	RG	
July 12, 2011	31	57	2	AG	315	300	KD	M
July 12, 2011	31	57	2	AG	300	300	KD	F
July 12, 2011	31	57	2	AG	305	300	RP	
July 12, 2011	31	57	2	AG	272	225	RG	
July 12, 2011	31	57	2	AG	310	300	KD	F
July 12, 2011	31	57	2	AG	285	250	KD	F
July 12, 2011	31	57	2	AG	307	350	KD	M
July 12, 2011	31	57	2	AG	280	250	RG	
July 12, 2011	31	57	2	AG	275	275	RG	
July 12, 2011	31	57	2	AG	310	350	KD	M
July 12, 2011	31	76	2	AG	335	425	RG	
July 12, 2011	31	76	2	AG	350	425	RG	
July 12, 2011	31	70	2	LT	380	600	KD	F
July 12, 2011	32	102	2	LT	420	750	KD	F
July 12, 2011	32	102	2	LT	375	575	RG	
July 12, 2011	32	64	2	LT	410	725	KD	F
July 12, 2011	32	64	2	AG	325	350	RG	

Date	Effort (Set #)	Mesh size (mm)	Stratum	Species	Fork Length (mm)	Weight (g)	Fate	Sex
July 12, 2011	32	64	2	AG	365	500	RG	
July 12, 2011	32	64	2	AG	345	400	RG	
July 12, 2011	32	70	2	AG	300	325	RG	
July 12, 2011	32	70	2	AG	315	325	RG	
July 12, 2011	32	70	2	AG	330	325	RG	
July 12, 2011	32	89	2	LT	410	800	RG	
July 12, 2011	32	57	2	LT	390	700	RG	
July 12, 2011	32	57	2	AG	315	300	RG	
July 12, 2011	33	64	3	LT	410	800	RG	
July 12, 2011	33	70	3	LT	390	675	RG	
July 12, 2011	33	57	3	AG	310	350	RG	
July 12, 2011	33	89	3	LT	380	600	RG	
July 12, 2011	33	76	3	AG	340	400	RG	