ANGLER HARVEST SURVEY

LITTLE ATLIN LAKE 2008

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Key Findings

- Anglers spent 4,175 hours angling on Little Atlin Lake in the summer of 2008. At an average of 1.0 hours of angling per hectare, this angling effort was high for a medium-large sized lake fishery.

- Little Atlin Lake is shallow and the fishery targets northern pike. It is by far Yukon's largest fishery for northern pike.

- Anglers caught 5,366 northern pike and harvested (kept) 1,009 resulting in a total harvest of 2,088 kg. A low annual harvest rate of 4% of the estimated carrying capacity, and an increasing angler success rate both suggest a healthy fishery and population, while the size data could suggest declining quality. Each of these indicators has some uncertainty so strong conclusions are not possible.

- Anglers caught 187 lake trout but released 109 of them (58% harvest rate), resulting in a total harvest of 258 kg of lake trout. This known minimum harvest was less than the estimated Optimal Sustainable Yield of 583 kg. However, because the lake is more suitable for pike than lake trout, our estimates of sustainable yield for lake trout on Little Atlin may be high.

- With a high – and increasing – angling effort, and with uncertain data for both northern pike and lake trout, the Little Atlin Lake fishery and fish resource should be monitored closely.

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Introduction

We conduct angler harvest surveys, also called creel surveys, on a number of Yukon recreational fisheries each year. We use these surveys, together with other fish and fishery-related assessments, to find out if the harvest of fish from the lake is sustainable. The Yukon Department of Environment tries to conduct angler harvest surveys on key fisheries every 5 years or according to angler patterns and management concerns. The results of the surveys directly contribute to management decisions that make sure fisheries are sustainable over the long term.

Little Atlin Lake is in south central Yukon in the Yukon River basin and within the traditional territory of the Carcross Tagish First Nation (CTFN). It is located approximately 4 km south of Jakes Corner, along the Atlin Road. The lake drains into the Lubbock River and then into Atlin Lake. It is a medium to large lake of 4,033 ha (40.3 km^2) and is shallow (mean depth of 10.6 m). Little Atlin Lake supports populations of Arctic grayling, lake trout, northern pike, and lake whitefish. The northern pike fishery is one of the largest in Yukon. More people target northern pike at Little Atlin than any other lake in Yukon.

Little Atlin Lake is primarily accessed through the boat launch at the north east corner of the lake. Although not an official campground, there is enough room for 2 or 3 groups to set up camp. The Atlin Road runs parallel to much of the lake's eastern shore, but access points are typically restricted to private properties because the road is usually high above the lake. Aside from a few homes and cabins along the shore, the nearest communities are Tagish and Marsh Lake.

The angler harvest has been surveyed on 3 previous occasions: 1990, 1998, and 2002. In 2008, Little Atlin Lake was chosen for surveying because of its extremely high level of use and importance to CTFN.

The 2008 survey was done to:

- determine how much time anglers spent fishing (effort);
- understand the fishery's characteristics and patterns of use;
- measure the success rate of anglers;
- compare the level of harvest to the productive capacity of the lake;
- record biological information on harvested fish;
- provide anglers with information about regulations; and
- establish a fisheries management presence.

Harvest Regulations

Little Atlin Lake has been managed as a Special Management Water since 2004/2005. These regulations protect declining or depressed stocks or species of interest. Barbless hooks are required. The catch limit for lake trout is one fish per day and all fish over 65 cm required to be released. The possession limit is also one fish. For Arctic grayling, the catch limit is 2 fish per day and all fish over 40 cm must be released. The possession limit is also 2 fish. For northern pike, the catch limit is 4 fish per day and all fish over 75 cm must be released. The possession limit is also 4 fish. General catch and possession limits apply to all other species. Appendix 1 shows the regulation history for Little Atlin Lake.

Methods

Survey

In 1990 the Yukon Government adopted survey methodology developed by the Ontario Ministry of Natural Resources (Lester and Trippel 1985). A field worker conducts face-to-face interviews with anglers on selected sample days throughout the summer. The worker asks a standard set of questions about the social and biological aspects of the fishery. Data gathered include:

- How much time did anglers spend fishing?
- What fishing methods did anglers use?
- How did anglers fish (boat, shore, etc.)?
- Were anglers guided?
- Where were anglers from?
- What type of visitor were anglers (day users, campers, etc.)?
- What kinds of fish were anglers trying to catch?
- How many fish did anglers catch?
- How many fish did anglers release?

Any other information offered by anglers about their fishing experience is also recorded.

The field worker also collects biological data on the catch of cooperative anglers. Biological data gathered include: length (mm), mass (g), sex, maturity, scales or an otolith (a small bone from the fish's head) for aging, and stomachs

for content analysis in the lab. Any other information about general health and condition of the fish is recorded by the field worker (e.g., abnormalities, disease, lesions).

The field worker subjectively assesses the weather's effect on fishing over the entire sample day (no possible adverse effect, possible adverse effect, definite adverse effect).

The timing of the survey depends on management objectives, key species, and the nature of the fishery. It typically runs from ice out in the spring until either just after Labour Day or the end of September. The goal is to do sampling on at least 20% of the total survey days. The survey is subdivided into several seasonal periods (usually 3 or 4), which are further divided into weekends and weekdays. Each period has a minimum number of sample days, with a higher weighting and increased number of sample days for those periods with higher expected angler use.

Sample days are 14 hours long, 8:00AM to 10:00PM. On sample days, the field worker interviews all willing anglers. The field worker also records anglers who are observed but not interviewed.

Analysis

When the survey is finished, we enter the data into an Access database and analyze it using standard statistical methods. We determine the age of sampled fish by counting growth rings on the otolith. Diet is determined by examining the stomach contents.

Lake Productivity

The productivity of a lake determines the amount of fish produced annually and can guide how much harvest can be sustained. Estimates of lake productivity are calculated using average lake depth, the concentration of total dissolved solids, and the average annual air temperature at the lake. Ryder's morphoedaphic index (1974) is used and incorporated into Schlesinger and Regier's equation (1982) for calculation of maximum sustained yield (MSY) for all species. Calculation of MSY for lake trout assumes a biomass of 30% lake trout; where appropriate this may be replaced by the most recent survey data. Following O'Connor (1982) and others, 15% of MSY provides an "optimum" sustained yield (OSY), which maintains high quality fisheries on light to moderately fished lakes.

2008 Little Atlin Lake Survey

The survey began May 23 (ice out) and concluded September 3, 2008.

We used an access survey methodology. The field worker was stationed at the boat launch at the north end of the lake (Figure 1) for the entire sample day and interviewed angling parties at the end of their fishing trip. Previous surveys and local knowledge suggest that most anglers access Little Atlin Lake from this location.

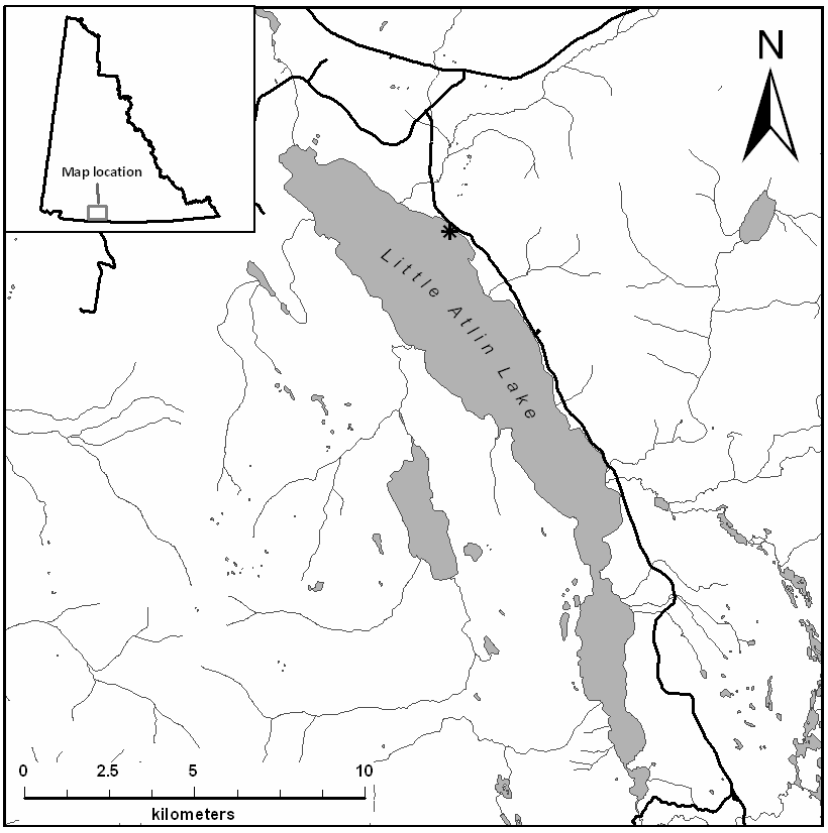

Figure 1. Little Atlin Lake, showing location of 2008 Angler Harvest Survey (*).

The survey period was partitioned into 6 time periods, weekends and weekdays in May/June, July and August/September. Of the 104 day survey period, 36 days were sampled, resulting in a sampling effort of 35%.

We divided the data analysis into 2 parts. In the first part, we combined data across all 6 time periods. In the second part we compared results between time periods (Appendix 2). All data were analyzed at the party level.

Results of the 2008 Survey

Effort

We estimate that 4,175 hours of angler effort (fishing time) were spent on Little Atlin Lake over the survey period. This was 1.0 hours of angling effort per hectare, a high value for a Yukon lake of this size. Altogether, 1174 anglers in 504 parties fished on Little Atlin Lake for an average of 3.6 hours per angler. Fishing occurred for an average of 40.1 angler hours per day over the entire survey.

Fishing Methods

Trolling was the most popular method of fishing, followed by a combination of methods and then spin casting (Table 1).

Table 1. Fishing methods, Little Atlin Lake 2008.

Method of Fishing	Percent of Parties
Still	1%
Jig	
Drift	
Troll	47%
Spin Cast	17%
Fly Cast	1%
Other or Combination	34%

Methods of Access

The majority of anglers accessed the lake by motorboats (Table 2). Some anglers accessed the lake from canoes and a handful fished from shore.

Table 2. Angler access methods, Little Atlin Lake 2008.

Access Method	Percent of Parties
Canoe	5%
Rowboat	
Motorboat	93%
Shore	1%
Other	1%

Guided Anglers

The percentage of guided anglers was very low (Table 3).

Table 3. Guided anglers, Little Atlin Lake 2008.

Guided Anglers?	Percent of Parties
Yes	2%
No	98%

Angler Origin

Most anglers were from Whitehorse (Table 4). A few were local anglers from Tagish or nearby cabins and houses. Anglers from Marsh Lake and Carcross were included under Yukon residents. Ten percent of anglers were from Canada (outside Yukon) or the US.

Table 4. Angler origin, Little Atlin Lake 2008.

Origin	Percent of Parties
Local	8%
Whitehorse	77%
Yukon	2%
Canada	4%
U.S.	6%
Other	2%

Visitor Type

Most anglers were day users (Table 5). Other anglers camped at the boat launch (Crown land) or stayed in a government campground.

Table 5. Angler visitor type, Little Atlin Lake 2008.

User Type	Percent of Parties
Day users	79%
Camper – Territorial campground	2%
Camper – Crown land	19%
Camper – Private campground	

Weather

Weather did not appear to have an adverse effect on angling (Table 6).

Table 6. Sample day weather, Little Atlin Lake 2008.

Did Weather Affect Angling?	Percent of Parties
No possible adverse effect	94%
Possible adverse effect	5%
Definite adverse effect	1%

Catch and Harvest

A very large number of northern pike were caught (Table 7). This is by far the largest pike fishery in Yukon. The retention rate of 19% was typical of a Yukon northern pike fishery. Anglers caught 187 lake trout and retained nearly 60% of these, an above average retention rate for Yukon. The lake whitefish fishery in Little Atlin Lake is the largest in Yukon; Aishihik, Laberge, and Snafu lakes are the only other significant summer recreational fisheries for lake whitefish.

Table 7. Angler catch and harvest, Little Atlin Lake 2008.

Species	# Caught	# Kept	Retention Rate
Lake trout	187	109	58%
Lake whitefish	90	51	56%
Northern pike	5366	1009	19%

Estimated angler success rates, calculated over the entire survey as numbers of fish caught per hour of angling effort (CPUE), is presented for all anglers (regardless of target species) in Table 8.

Table 8. Estimated catch per unit of effort (fish/hour), Little Atlin Lake 2008.

Species	CPUE
Lake trout	0.045
Lake whitefish	0.022
Northern pike	1.29

Biological Data

Northern pike

We sampled 149 northern pike for fork length (mean 605 mm), weight (mean 1,831 g), and condition factor (mean 0.83). The sex ratio was 2 females per male. Northern pike were harvested across a wide range of sizes from 425 to 850 mm (Figure 2). This size distribution was very similar to the one observed in 2002, and was similar to what is found elsewhere in Yukon.

We aged 138 northern pike. These pike ranged in age from 3 to 17 years, the average age was 6.6 years, and the most common age was 5 years (Figure 3). Young fish (less than 2 years) are not vulnerable to angling gear and regulation does not allow harvest of larger fish, hence these components of the population are under represented in the sample. Very few age data for northern pike in other Yukon lakes are available for comparison.

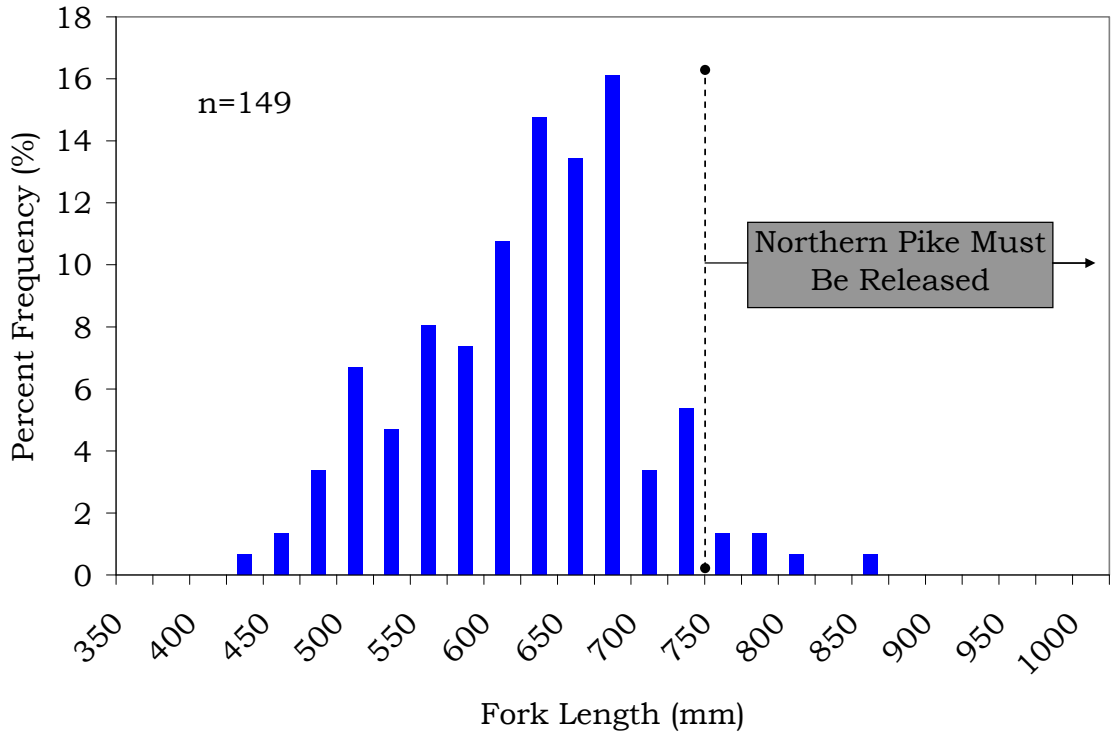

Figure 2. Lengths of northern pike caught by anglers, Little Atlin Lake 2008.

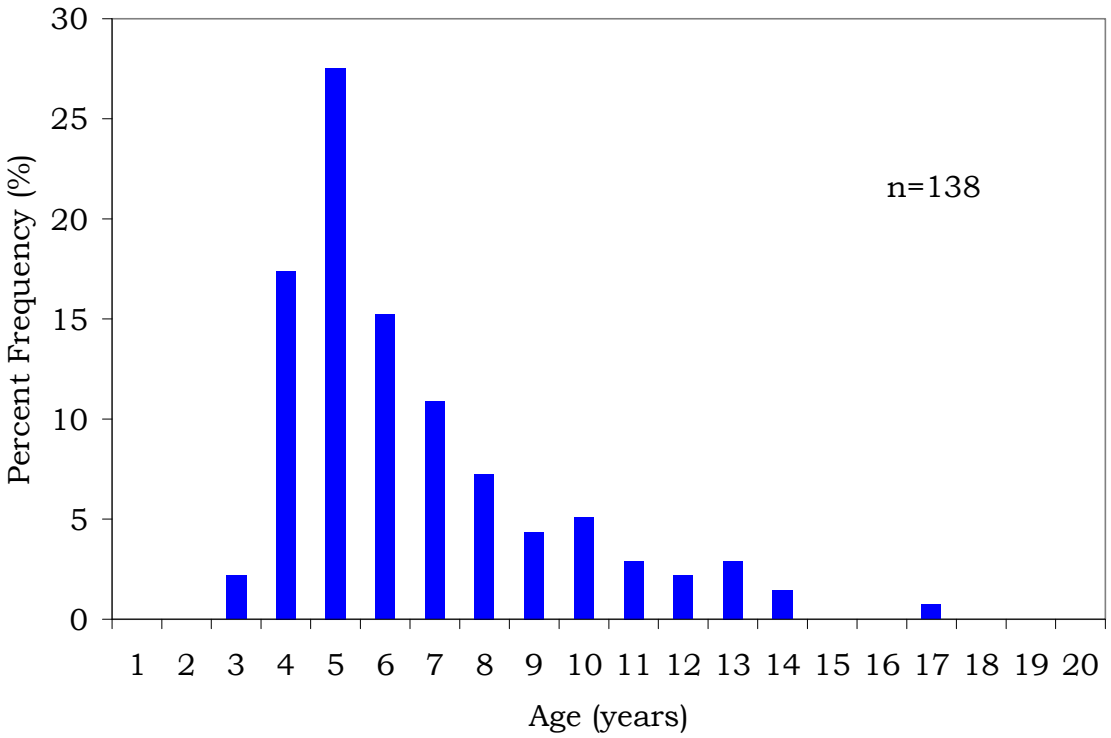

Figure 3. Ages of northern pike caught by anglers, Little Atlin Lake 2008.

We examined the stomachs of 138 northern pike. Of these, 47 were empty or had very small traces of contents and the remaining 91 averaged 43% full. Unidentified fish were the most common diet item (Table 9).

Table 9. Sampled northern pike stomach contents, Little Atlin Lake 2008.

Stomach Content	Percent Volume
Unidentified fish	79%
Slimy sculpin	15%
Least cisco	3%
Dragonflies, damselflies	1%
Unknown	1%
Scuds, sideswimmers	1%
Unidentified invertebrates	<1%
Unidentified vegetation	<1%
Northern pike	<1%
Leeches	<1%
Round whitefish	<1%
Lake whitefish	<1%

Lake trout

We sampled 33 lake trout for fork length (mean 545 mm), weight (mean 2,127 g), and condition factor (mean 1.31). The sex ratio was 0.83 females per male. Most of the lake trout harvested were between 500 and 600 mm in length (Figure 4). We aged 21 lake trout. Average age was 17.3 years and age ranged from 7 to 36 years (Figure 5). Small (young) fish are not vulnerable to angling gear and regulation does not allow harvest of larger fish. These portions of the population are therefore under represented in the sample. The small number of fish in this sample size does not allow us to make comparisons with other lake trout populations.

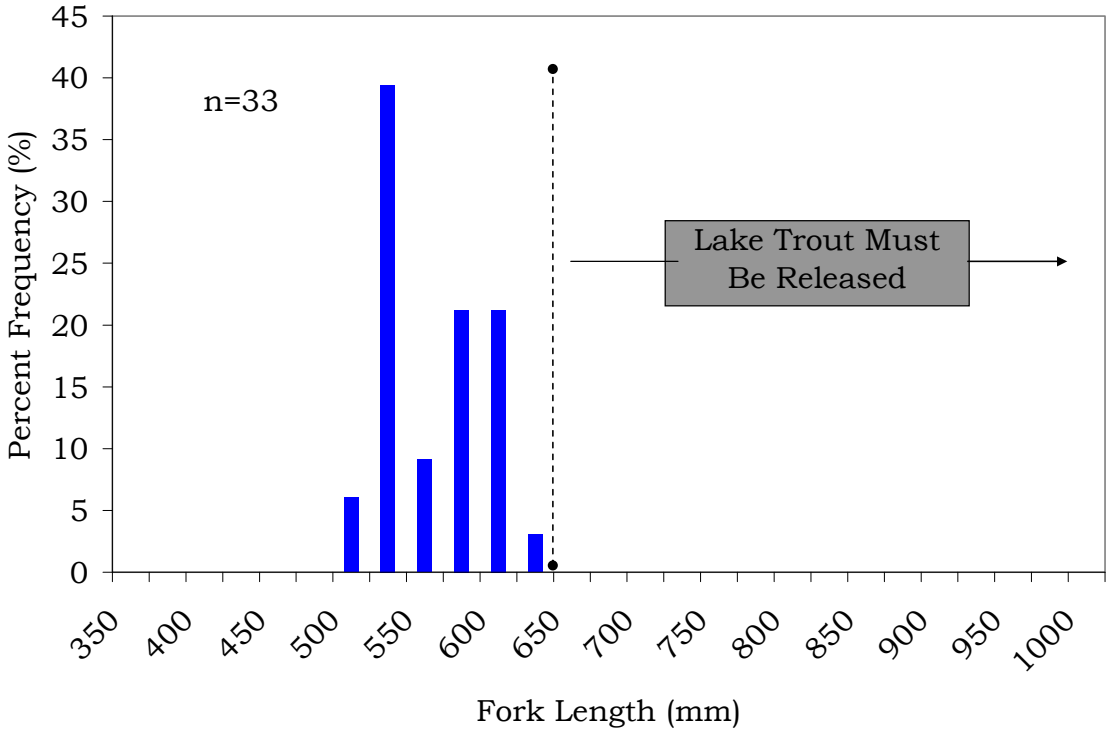

Figure 4. Lengths of lake trout caught by anglers, Little Atlin Lake 2008.

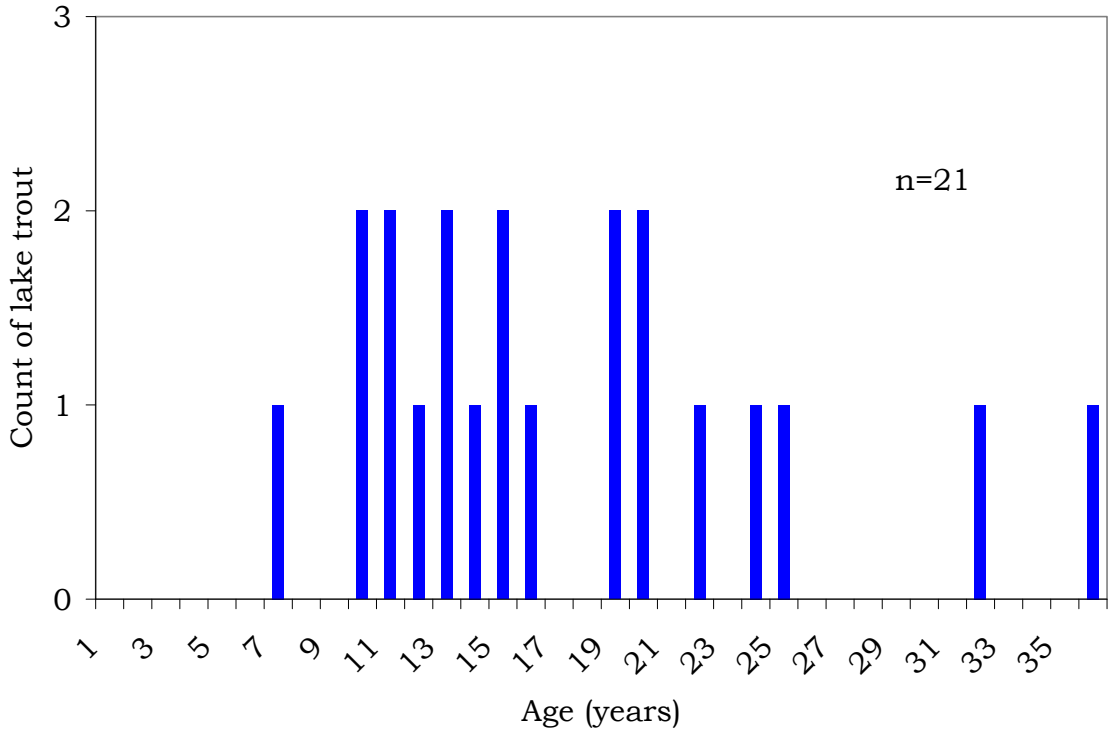

Figure 5. Age of lake trout caught by anglers, Little Atlin Lake 2008.

We examined the stomachs of 29 lake trout. Of these, 4 were empty and the remaining 25 averaged 75% full. Least cisco was the most common diet item (Table 10).

Table 10. Sampled lake trout stomach contents, Little Atlin Lake 2008.

Stomach Content	Percent Volume
Least cisco	65%
Unidentified fish	24%
Non-biting midges	10%
Unidentified fish	<1%
Unknown	<1%
Northern pike	<1%

Lake whitefish

We examined the stomachs of 5 lake whitefish. Of these, one was empty and the remaining 4 averaged 30% full. Copepods and unidentified vegetation were the most common diet items (Table 11).

Table 11. Sampled lake whitefish stomach contents, Little Atlin Lake 2008.

Stomach Content	Percent Volume
Copepods	25%
Unidentified vegetation	25%
Unidentified invertebrates	18%
Caddisflies	18%
Non-biting midges	7%
Stoneflies	4%
May flies	3%

Other biological data for lake whitefish is not included here because of small sample size but is available from Environment Yukon.

Comparison with Previous Surveys

We previously completed angler harvest surveys on Little Atlin Lake in 1990, 1998, and 2002. The 1998 and 2002 surveys were similar in methodology and design and are directly comparable with the 2008 survey. The 1990 survey was slightly longer in duration but at a lower sample intensity; comparisons to the 1990 results should be done with this in mind.

Effort

Estimated summer open water angler effort over the past 18 years has fluctuated greatly (Table 12). We estimated 4,175 angler hours of effort in the 2008 survey which was much higher than the first survey in 1990, and about 900 hours more than the previous survey in 2002. However, in 1998 angler effort was the highest yet observed.

Table 12. Total estimated angler hours, Little Atlin Lake 2008, 2002, 1998, and 1990.

	2008	2002	1998	1990
Hours	4,175	3,281	6,449	1,284

Fishing Methods

Fishing methods have shifted since the 2002 survey (Table 13). Trolling increased in popularity while combinations of methods decreased.

Table 13. Fishing methods (percent of parties), Little Atlin Lake 2008 and 2002.

Fishing Method	2008	2002	1998	1990
Still	1%			
Jig		2%		
Drift				
Troll	47%	24%	N/A	N/A
Spin Cast	17%	13%		
Fly Cast	1%	2%		
Other or Combination	34%	59%		

Methods of Access

Most angler on Little Atlin Lake use motorboats (Table 14). Canoe and shore fishing remain infrequent.

Table 14. Methods of access (percent of parties), Little Atlin Lake 2008 and 2002.

Method of Access	2008	2002	1998	1990
Canoe	5%	4%		
Rowboat				
Motorboat	93%	89%	N/A	N/A
Shore	1%	2%		
Other	1%	6%		

Guided Anglers

Formally guided parties have accounted for 2 to 5% of the angler effort in all surveys (Table 15). These data are not available from 1990.

Table 15. Guided anglers (percent of parties), Little Atlin Lake 2008, 2002, and 1998.

	2008	2002	1998	1990
Yes	2%	4%	5%	N/A
No	98%	96%	95%	

Angler Origin

Over the past 18 years of survey data, the proportion of Whitehorse anglers has remained fairly consistent (Table 16). All other categories have also remained consistent. The biggest change since 1990 is the decrease in the number of Canadian anglers from outside Yukon. Note that 1990 results are categorized differently: in 1990, 'Yukon' included Local, Whitehorse, and Yukon from the other years.

Table 16. Origin of anglers (percent of parties), Little Atlin Lake 2008, 2002, and 1998.

Origin	2008	2002	1998	1990
Local	8%	8%	5%	N/A
Whitehorse	77%	84%	81%	N/A
Yukon	2%		1%	77%
Canada	4%	4%	6%	16%
U.S.	6%	4%	4%	
Other	2%		3%	7%

Visitor Type

Visitor type has been dominated by day users in all years (Table 17). There was an increase in the percentage of Crown land campers and a slight decrease in day users in 2008. These data were not collected in 1998 and 1990.

Table 17. Visitor type (percent of parties) Little Atlin Lake 2008 and 2002.

Type	2008	2002	1998	1990
Day Users	79%	88%	N/A	N/A
Camper – Territorial Campground	2%			
Camper – Crown Land	19%	12%		
Camper – Private Campground				

Weather

The field worker's subjective assessment of weather effects on angling activity indicates that weather was better in 2008 than in 2002, such that weather was unlikely to have decreased fishing activity (Table 18). Weather data were not collected in 1990.

Table 18. Weather effects on angling activity (percent of parties), Little Atlin Lake 2008, 2002 and 1998.

Did Weather Affect Angling?	2008	2002	1998	1990
No possible adverse effect	94 %	67%	82%	N/A
Possible adverse effect	5%	30%	18%	N/A
Definite adverse effect	1%	3%	6%	N/A

Catch and Harvest

Lake trout catch estimates for 2008 were similar to previous surveys, except 1998 when catches were higher (Table 19). The number of lake trout harvested increased only slightly because anglers released an increasing proportion of their catch.

Northern pike catch estimates were once again the highest of any species. Retention rates were very low for northern pike, but since they were caught in such large numbers they were the most harvested fish. The number of northern pike kept in 2008 was the highest yet recorded.

Lake whitefish catch was not reported in 1990, and more recent estimates show that catches are minimal with lake whitefish only being retained in small numbers since 1998.

Table 19. Estimated number of fish caught, fish kept and the retention rate, Little Atlin Lake 2008, 2002, 1998, and 1990.

Species	Retention	2008	2002	1998	1990
Lake trout	Caught	187	146	275	199
	Kept	109	100	254	76
	Released	78	46	21	123
	% Kept	58	68	92	38
Northern pike	Caught	5,366	2,696	5,316	592
	Kept	1,009	474	856	256
	Released	4,357	2,222	4,460	336
	% Kept	19	18	16	43
Lake whitefish	Caught	90	85	59	
	Kept	51	18	17	
	Released	39	67	42	
	% Kept	57	21	29	

Estimated CPUE (number of fish per angler hour) over the entire survey can reflect the changes in the fishery because it incorporates effort and catch. Dramatic decreases in CPUE for a particular species could indicate problems in terms of the health or status of the fish species in question.

Table 20. Estimated catch per unit of effort (fish/hour), Little Atlin Lake 2008, 2002, 1998, and 1990.

Species	2008	2002	1998	1990
Lake trout	0.04	0.04	0.04	0.16
Northern pike	1.29	0.82	0.82	0.46
Lake whitefish	0.02	0.03	0.01	N/A

After a drop between 1990 and 1998 lake trout CPUE has remained stable since 1998 (Table 20). Note that most anglers do not target lake trout on Little Atlin so CPUE for lake trout is correspondingly low. Northern pike CPUE has seen dramatic increases since the first survey in 1990. The CPUE was very high, but stable between 1998 and 2002, but increased even further in 2008. The CPUE data for other species are biased by very small sample sizes so are not reported here. Lake whitefish are occasionally targeted, but are usually an incidental catch.

Fishery Sustainability

Lake Trout

Angler patterns on Little Atlin have shifted over the last 20 years and may confuse the interpretation of some of our results. In 1990, lake trout fishing was quite good and above average for Yukon lakes (0.16 fish per hour for Little Atlin compared to 0.13 for Yukon). During that decade, angler success declined significantly to a low level (0.04 fish per hour by 1998), where it remains today. We believe, and have received confirmation from anglers, that when this decline happened, fishing pressure shifted from lake trout to northern pike. A shift in which species are targeted by anglers can artificially affect angler success rates. For example, if an angler is targeting lake trout, she will use gear and techniques that are species-appropriate and fish in lake trout habitats. Her success in catching lake trout will be higher than an angler who is targeting northern pike. We would therefore expect the success rates for catching lake trout to decline if many anglers began to switch their efforts to targeting other species like northern pike. We believe this to be the case on Little Atlin Lake, and if this is true, the success rates for lake trout on Little Atlin are

underestimates, and do not reflect the true abundance of lake trout. Lake trout fishing on Little Atlin Lake is poor, but not as poor as our results suggest.

We estimate that Little Atlin Lake could sustain a total annual lake trout harvest of about 583 kg (total dissolved solids: 161 mg/L, mean annual air temperature: -1.2 °C, mean depth: 10.6 m; see Methods - *Lake Productivity*). This is calculated assuming a fish community composed of 30% lake trout by biomass, which is considered standard for Yukon lakes. However, Little Atlin Lake is a shallow lake with less lake trout habitat than other lakes. Lake trout likely do not make up as large a proportion of the fish community as they do in other Yukon lakes. Our fisheries assessments support this assumption. In 1995, 2000, and 2005 small-mesh netting surveys, we found few lake trout (average of 0.04 lake trout per net compared to a Yukon average of 0.78, YG unpublished data). Lake trout harvest should therefore be kept well below the calculated 583 kg sustainable yield level. Lake-specific productivity data are needed to revise our estimate of sustainable yield for lake trout in Little Atlin Lake.

Anglers harvested 109 lake trout over the summer (Table 21). Total fish mortality includes the unintentional mortality of any released fish. Catch and release, when done properly, can have a minimal impact. Lake trout survival rates range from 93% for lightly handled fish to 76% for deep-hooked fish (YFWMB 1998). We used an average of 85% survival. For the 78 lake trout released this results in an additional mortality of 12 fish for a total harvest and mortality of 121 fish. Based on the average size of harvested fish, the weight of total lake trout mortality in the recreational fishery was 258 kg. We consider this a minimum, because harvests from the open water fishery outside of the period of this survey, from the ice fishery, and the First Nations subsistence fishery are not included. No information is currently available on these fisheries, but anecdotal information suggests that effort and harvest are minimal in the recreational ice fishery.

Table 21. Estimated summer lake trout harvest by anglers, Little Atlin Lake 2008, 2002, 1998, and 1990.

Lake Trout Harvest	2008	2002	1998	1990
Lake trout harvested	109	100	254	76
Lake trout released	78	46	21	123
Catch and release mortality (15%)	12	7	3	18
Total harvest and mortality	121	107	257	94
Mean lake trout weight (kg)	2.13	2.12	1.71	1.71
Total harvest and mortality (kg)	258	227	440	161

The minimum total fishing mortality in 2008 was an estimated 258 kg, which is less than half of the predicted optimal sustainable yield of 583 kilograms. If the unaccounted-for harvest (ice fishing, subsistence fishing, and open water fishing outside of the survey period) was small, then the current harvest of lake trout should not lead to a decline in fishing quality on Little Atlin Lake. However, because there are greater uncertainties in our estimate of sustainable yield for Little Atlin Lake, we recommend regular monitoring of the fishery and the lake trout population. More refined estimates of the lake's productivity for lake trout would be useful for management purposes.

Northern Pike

Anglers harvested 1,009 northern pike over the summer (Table 22). Total fish mortality (death) includes the unintentional mortality of any released fish. When pike are caught and released, there is some mortality of the released fish. However, the rate is relatively low when compared to other species, and we use an average mortality rate of 3% based on the finding of several studies (YFWMB 1998). For the 4,357 pike released, we therefore estimate that an additional 131 fish later died for a total harvest and mortality of 1,141 fish. Based on the average size of harvested fish, the mass of total northern pike mortality in the recreational fishery was 2,088 kg. This is the highest removal of pike yet recorded and the trend is towards greater catch and harvest through time.

Table 22. Estimated summer northern pike harvest by anglers, Little Atlin Lake 2008, 2002, 1998, and 1990.

Northern Pike Harvest	2008	2002	1998	1990
Northern pike harvested	1,009	474	856	256
Northern pike released	4,357	2,222	4,460	336
Catch and release mortality (3%)	131	67	134	10
Total harvest and mortality	1141	541	990	266
Mean northern pike weight (kg)	1.83	1.91	1.59	1.89
Total harvest and mortality (kg)	2,088	1,033	1,574	503

To estimate the sustainable yield of northern pike, we use a different approach and model. Based on a model developed in Alaska, Little Atlin Lake has a carrying capacity of 51,441 kg of northern pike (see Appendix 3 for methods, data, and caveats; Simpson 1998). Given this, the current rate of exploitation of northern pike in Little Atlin Lake is 4%. We do not have data on what an appropriate harvest rate is in Yukon, but suggest that a 4% rate is not alarming. Because this approach does not result in definitive conclusions, we also examined other indicators of population health.

Angler success indicates that the northern pike population in Little Atlin Lake is healthy. The success of anglers, measured by the number of fish caught per hour, has increased 180% in the last 20 years (1998 – 2008; Table 20). The CPUE of northern pike has risen steadily since 1990. We caution that angler CPUE can at times be misleading so relying on CPUE of anglers alone is not recommended – see the section entitled "Invisible Collapse" in the *Status of Yukon Fisheries 2010* (Environment Yukon 2010) – anglers are very good at finding fish even when the population is in decline. We also believe that this increase in pike CPUE may be a result of more anglers targeting pike (see above discussion on lake trout). Nonetheless, an increasing CPUE is generally a good sign.

The size data, however, do not conclusively point to a healthy population. In general, the large northern pike in the harvest suggests a healthy population and high quality fishing opportunities. In Little Atlin Lake, the size distribution of pike caught has not shifted greatly between 1998 and 2008 with one exception: in 2008, there were fewer fish kept in the 675 – 725 mm range (i.e., just below the slot size; Figure 6). If this was because there are fewer large fish in the population, then this may mark a decline in fishing quality. Another possibility is that anglers were reluctant to keep fish that were just shy of the maximum length permitted. Harvest data cannot be used to conclusively answer this question because they may not represent the underlying population; fisheries assessments are best suited to understand changes in the northern pike population size structure.

Our survey results suggest that the population of northern pike in Little Atlin Lake appears healthy. However, a high level of vigilance is recommended for this fishery because:

- Angler effort is high and increasing;
- There are no population assessments of northern pike so only data from the fishery are used to make management decisions;
- Size data may indicate there are fewer large fish in the population than before; and
- There are uncertainties about sustainable yield and harvest rate for northern pike populations.

Angler activity and the harvest of northern pike from Little Atlin Lake should be closely monitored. Methods to assess the population health and the biology and size structure of northern pike populations in Yukon are needed. This will help accurately assess sustainable yield and harvest rate for pike and document changes in size structure through time. We also recommend that estimates of sustainable yield for lake trout in Little Atlin Lake are revised, and efforts made to quantify the other sources of harvest.

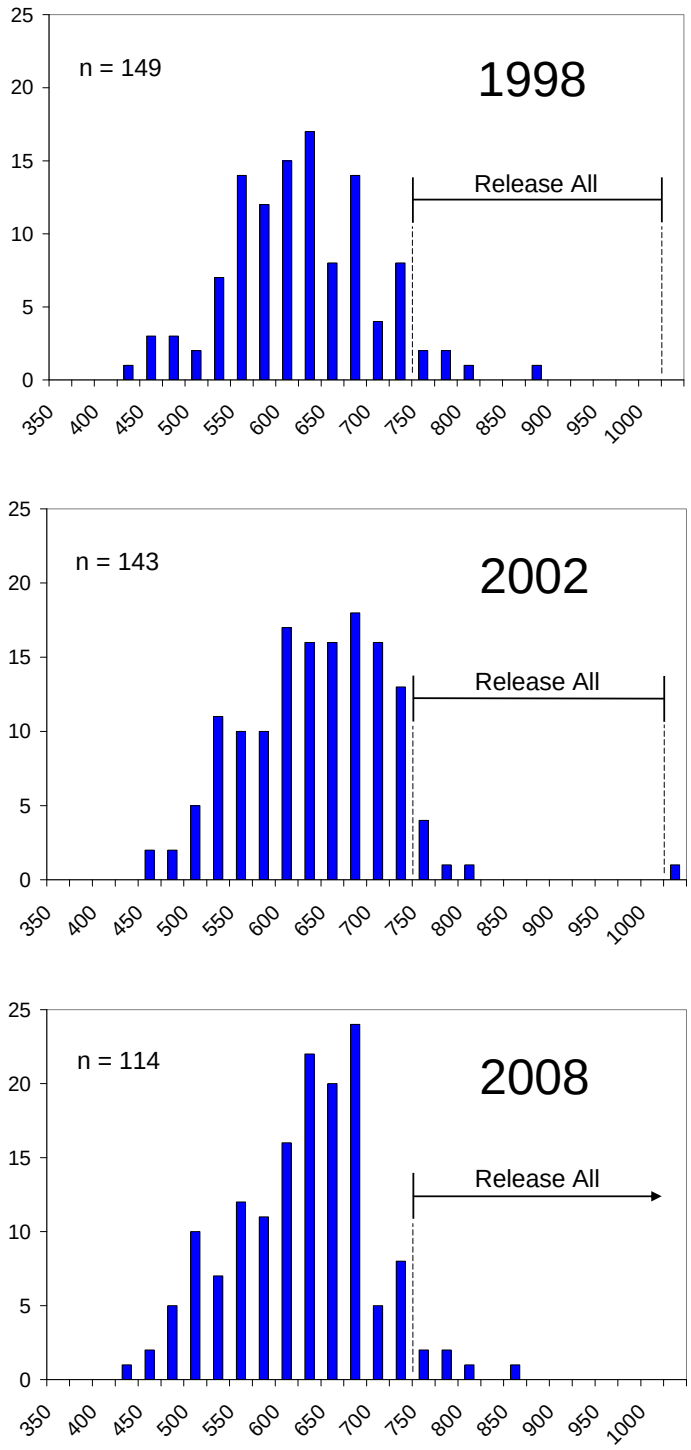

Figure 6. Lengths of northern pike caught by anglers in 1998, 2002, and 2008. Not enough data are available in 1990 to include this year in the comparison.

**Information on size limits is included. Note that fork lengths are displayed, but regulations speak to total lengths. For northern pike, 105 cm total length is 99 cm fork length; 75 cm total length is 71 cm fork length.

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APPENDIX 1. Little Atlin Lake angling regulation changes 1989 to 2008.

Year	Species	Catch limit	Possession limit	Size restrictions
1989/90*			General Regulations	
	Lake trout	3	6	Only one fish over 80 cm
	Arctic grayling	5	10	none
	Northern pike	5	10	none
	Whitefish	5	10	none
1991/92			General Regulations	
	Lake trout	3	6	Only one fish over 65 cm
	Arctic grayling	5	10	Only one fish over 40 cm
	Northern pike	5	10	Only one fish over 75 cm
	Whitefish	5	10	none
1997/98			High Quality Water	
	Lake trout	2	2	No fish between 65 and 100 cm Only one fish over 100 cm
	Arctic grayling	4	4	No fish between 40 and 48 cm Only one fish over 48 cm
	Northern pike	4	4	No fish between 75 and 105 cm Only one fish over 105 cm
	Whitefish	5	10	none
2004/05			Special Management Water	
	Lake trout	1	1	No fish over 65 cm
	Arctic grayling	4	4	No fish over 40 cm
	Northern pike	4	4	No fish over 75 cm
	Whitefish	5	10	none

* Yukon Government obtained responsibility for freshwater fisheries management from the federal government in 1989.

APPENDIX 2. 2008 Little Atlin Lake angler harvest survey results: comparisons between periods

Effort

Mean daily angler effort on weekends was high most of the season, but with a slight drop in July (Figure 4). Weekday effort was consistent over all periods.

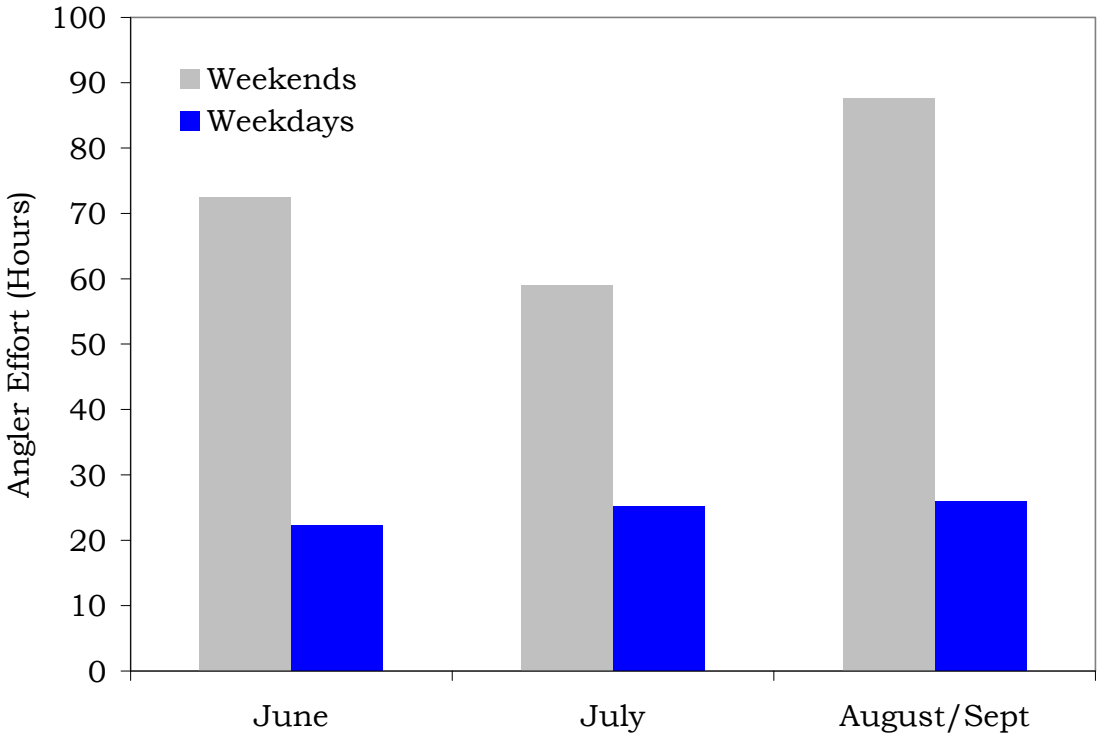

Figure 2.1. Estimated angler effort per day, Little Atlin Lake 2008.

Guided Anglers

All guided parties captured through the survey were distributed through May/June weekdays and August/September weekdays. No guiding took place on the weekends. Guided trips were led by Spirit of the North Guides and only occurred on 3 occasions.

Visitor Type

Day users were abundant on all weekends and weekday periods throughout the season. The Crown land campers were more abundant on the weekend as

Whitehorse residents would arrive at the boat launch on Fridays and leave on Sundays. A few campsites with fire pits have been set up around the boat launch by these Crown land campers.

Catch

Lake trout CPUE was low, but consistent, over the summer (Table 2.1). Lake whitefish were only incidentally or infrequently angled for in a couple of periods with very low CPUE. Northern pike CPUE was very high throughout the entire season. There was a slight drop during the month of July, but overall northern pike fishing was very good throughout the season.

Catch per unit effort patterns for lake trout are consistent with typical Yukon summer patterns. Success is high in the spring following ice out and then drops as water temperature warms. Fall increases are usually related to onset of spawning and cooling water temperatures. These fluctuations are not dramatic on Little Atlin Lake as CPUE remained fairly low, but consistent over the summer.

Table 2.1. Estimated catch per unit of effort (fish/hour), by period.

Period	Lake Trout	Lake Whitefish	Arctic Grayling	Northern Pike
May/June weekends	0.05	0.009		0.58
May/June weekdays	0.05	0.003		0.78
July weekends	0.04	0.008		0.57
July weekdays	0.02			0.60
August/September weekends	0.02	0.002		0.85
August/September weekdays	0.00			0.70

APPENDIX 3. Northern pike productivity model

We used a productivity model to predict the carrying capacity of northern pike in Little Atlin Lake. The model was developed in Alaska, using lakes in the Fairbanks area (Simpson 1998). The model is based on the percent nearshore area (i.e., the proportion of the lake area that is less than 5 m deep).

The Model

Carrying capacity of northern pike (kg/ha) = -2.976 + 0.2968 X

Where X = percent nearshore area (< 5 m depth)

Applying the model to Little Atlin Lake

X = 53, based on a GIS analysis from bathymetric contour lines

Northern pike carrying capacity (kg/ha) = 12.75

area (ha) = 4033 ha

Lake-wide northern pike carrying capacity = 51,441 kg

Based on this model and a 53% nearshore area, Little Atlin Lake has a carrying capacity of 51,441 kg of northern pike.

Caveats

The sample size of lakes used to produce the model was small (only 4 lakes). Although the model explained 87.4% of the variation in carrying capacity among the lakes, it was not statistically significant (P = 0.065) because of the low sample size.