ANGLER HARVEST SURVEY

TESLIN LAKE 2008

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Key Findings

- 2,103 anglers spent 6,812 hours of angling effort on Teslin Lake in the summer of 2008. This is one of the highest angling efforts for any lake in Yukon. However, taking the size of Teslin Lake into account, this was only 0.19 hours of angling per hectare, a low level of effort which is typical of very large Yukon lakes.

- We estimate anglers caught 1,619 lake trout and 50% of these were released. The estimated harvest was 820 lake trout, or 1,640 kg.

- Including both harvest and incidental mortality (death) from catch and release, the total estimated harvest was 1880 kg of lake trout. This amount is less than the estimated Optimal Sustainable Yield of 2,300 kg.

- Based on the current harvest level in the recreational fishery, fishing quality should maintain or improve in Teslin Lake. However, the number of fish taken in the subsistence fishery continues to be an information gap.

Table of Contents

List of Figures

List of Tables

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 either 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.

Teslin Lake is in the south central Yukon within the traditional territory of the Teslin Tlingit Council. It is a very large (35,400 ha or 354 km^2) and deep (mean depth 59 m) lake. Teslin Lake is located along the Alaska Highway with its northern tip around 125 km southeast of Whitehorse. The village of Teslin is located on the eastern shore near the centre of the lake by Nisutlin Bay. The highway parallels much of the northern portion of this long (125 km) and narrow (2-3 km) lake. Teslin Lake is a transboundary water, with its southern third in British Columbia.

The village of Teslin is home to around 480 people. The majority of the population is part of the Tlingit First Nation. The Teslin Tlingit rely on Teslin Lake and the surrounding area for fishing, hunting, gathering, and other traditional uses.

The lake supports large populations of lake trout, northern pike, inconnu, Arctic grayling, burbot, and whitefish. It is also home to Chinook salmon, which migrate to and from the ocean via the Yukon River. The sheltered Nisutlin Bay provides excellent habitat for waterfowl, migratory birds, moose, bears, and many other species.

The recreational fishery on Teslin Lake developed rapidly after the completion of the Alaska Highway in 1942. Commercial fishing started shortly after with an annual catch quota of 5,900 kg. By the end of the 1960s this quota was reduced to 2,270 kg because of concerns raised by the sports fishery. Commercial fishing continued to slow down and yearly lake trout harvests averaged 150 kilograms between 1980 and 1995 (Thompson, 1996). There have been no active commercial fishing licences on Teslin Lake since 2008.

The recreational fishery has been assessed on four previous occasions: 1992, 1997, 2000, and 2003. The 2007-2012 Community-Based Fish and Wildlife Management Plan for the Teslin Tlingit Traditional Territory identifies Teslin Lake as a concern. More specifically, people were concerned that Teslin Lake may be over fished. The plan suggested that an angler harvest survey be conducted in 2008. In 2001 the Teslin Renewable Resource Council conducted a partial creel/game guardian program on Teslin Lake. This survey is not

discussed here as the results are not directly comparable. Sampling inconsistencies in the 1992 survey also make comparisons to that survey questionable.

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

Teslin Lake has been managed as a Special Management Water since 2000. These regulations protect the larger spawning fish and encourage the harvest of smaller fish, while allowing the retention of a trophy fish if caught. Only barbless hooks are permitted. The catch limit for lake trout is one fish per day and all fish between 65 cm and 100 cm must be released. One lake trout larger than 100 cm may be kept. The possession limit is also one fish per day. For Arctic grayling the catch limit is 4 fish per day and all fish between 40 cm and 48 cm must be released. One grayling larger than 48 cm may be kept. The possession limit for grayling is 4 fish per day. For northern pike the catch limit is 4 fish per day and all fish between 75 cm and 105 cm must be released. One northern pike larger than 105 cm may be kept. The possession limit is 4 fish per day. General catch and possession limits apply to all other species. Appendix 1 shows the regulation history for Teslin 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) to better understand changes in angler activity. These periods are further divided into weekends and weekdays. Each period has its sample days, with a higher weighting for those periods with the higher projected angler use and a minimum number of samples for each period.

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, the data are entered into an Access database and analyzed using standard statistical methods. The age of sampled fish is determined by counting growth rings in 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 Teslin Lake Survey

The survey began May 22 (ice out) and ended on September 3, 2008.

We used an access survey methodology. The field worker alternated between the Village of Teslin marina and boat launch and the Ten Mile Point territorial campground and boat launch along the central eastern shore of the lake (Figure 1). The field worker spent the entire sample day at one location and interviewed angling parties at the end of their fishing trips. Previous surveys and local knowledge suggest that most anglers access Teslin Lake from these locations.

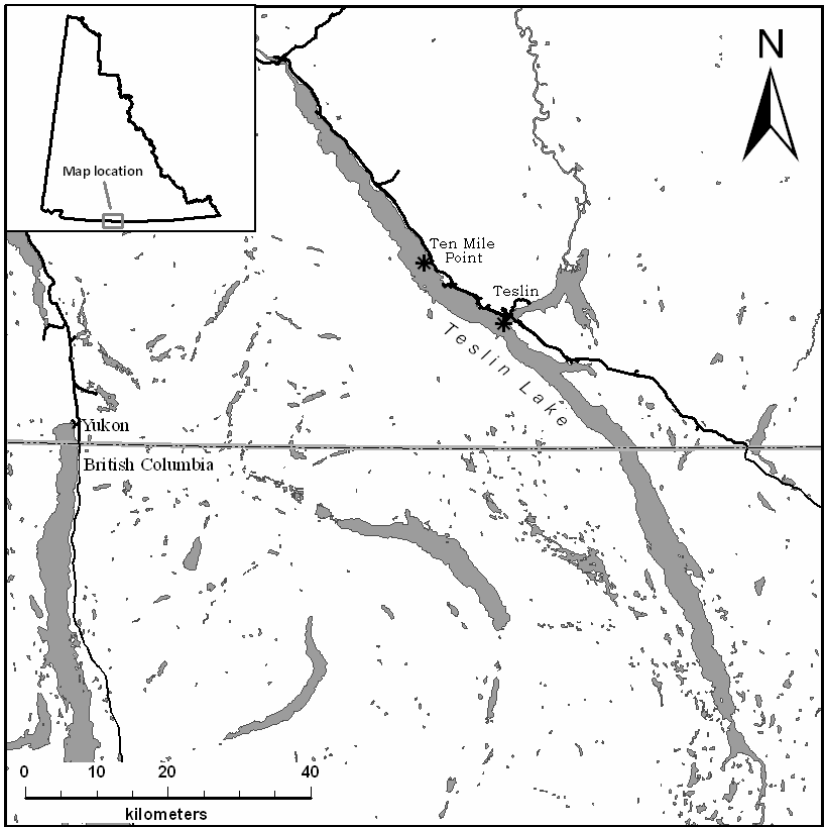

Figure 1. Teslin Lake, showing locations of 2008 angler harvest survey (*).

The survey period was divided into 6 time periods, weekends and weekdays in May/June, July and August/September. During the 105-day survey period, the field worker sampled on 40 days, giving a sampling effort of 38%.

Data analysis was divided into two parts. In the first part, data were combined across all 6 time periods, and in the second part results

were compared between time periods (Appendix 2). All data were grouped and analyzed by fishing party.

Results of the 2008 Survey

Effort

We estimate that 6,812 hours of angler effort (fishing time) were spent on Teslin Lake over the 2008 survey period. Altogether, 2,103 anglers in 963 parties fished on Teslin Lake for an average of 3.2 hours per angler. Fishing activity totalled an average of 64.9 hours per day.

A lake-wide effort of 6,812 hours is one of the highest angling efforts in any Yukon fishery. However, given the large size of the lake, only 0.19 hours of angling effort were spent per hectare, a low level of effort which is typical of very large Yukon lakes.

Fishing Methods

Trolling was by far the most popular method of fishing, followed by spin casting (Table 1). No other methods of fishing were observed.

Table 1. Fishing methods.

Method of Fishing	Percent of Parties
Still	0%
Jig	0%
Drift	0%
Troll	92%
Spin Cast	8%
Fly Cast	0%
Other or Combination	0%

Methods of Access

The majority of anglers used motorboats, while some anglers fished from shore (Table 2). A few anglers used canoes.

Table 2. Angler access methods.

Method of Fishing	Percent of Parties
Canoe	2%
Rowboat	0%
Motorboat	91%
Shore	7%
Other	0%

Guided Anglers

A slightly higher than average percentage of anglers were formally guided (Table 3). All guided clients accessed the lake from the boat launch in Teslin.

Table 3. Guided anglers.

Guided Anglers	Percent of Parties
Yes	8%
No	92%

Angler Origin

Most anglers were from Teslin, followed by Whitehorse anglers (Table 4). There were few out–of-territory Canadian or American anglers.

Table 4. Angler origin.

Origin	Percent of Parties
Local	58%
Whitehorse	36%
Yukon	0%
Canada	3%
U.S.	3%
Other	0%

Visitor Type

The majority of anglers were day users (Table 5). Territorial campground users were the second highest group with most of these parties accessing the lake at Ten Mile Point.

Table 5. Angler visitor type.

User Type	Percent of Parties
Day users	84%
Camper – Territorial campground	11%
Camper – Crown land	3%
Camper – Private campground	2%

Weather

Weather showed a slight adverse effect on fishing activity (Table 6). Almost all of the effect was from wind.

Table 6. Sample day weather.

Did Weather Affect Angling?	Percent of Angler Parties
No possible adverse effect	57%
Possible adverse effect	38%
Definite adverse effect	5%

Catch and Harvest

Lake trout were by far the most heavily caught and harvested species with about a 50% retention rate (Table 7). 490 northern pike were caught, but nearly all were released. No other species were recorded.

Table 7. Angler catch and harvest.

	# Caught	# Kept	Retention Rate
Lake trout	1,619	820	51%
Northern pike	490	49	10%

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).

	CPUE
Lake trout	0.24
Northern pike	0.07

Biological Data

We sampled 94 lake trout for biological data. Mean fork length was 592 mm and mean weight was 1,998 g, suggesting a mean condition factor of 1.13. This is a good condition factor (relationship between length and weight) for lake trout in Yukon and indicates "fat" fish. The sex ratio was 1.2 males per female. A similar number of lake trout were harvested across a wide range of size classes from 425 to 775 mm (Figure 2). A number of slot limit fish were harvested, mainly by First Nation anglers.

We aged 76 lake trout. Average age was 14.5 years (ranging from 6 to 33 years) and the most common age was 9 years (Figure 3). Because young fish (less than 5 years) are not vulnerable to angling gear and regulation does not allow harvest of larger fish (with the exception of one very large trophy) these portions of the population are under represented in the sample.

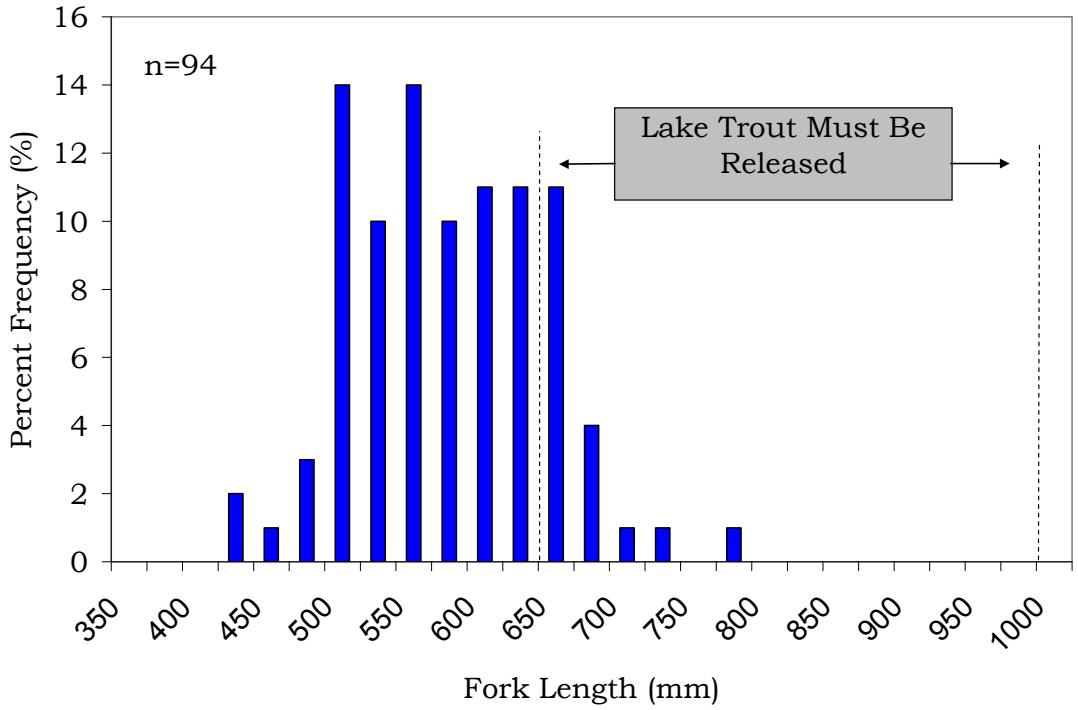

Figure 2. Lengths of lake trout caught by anglers.

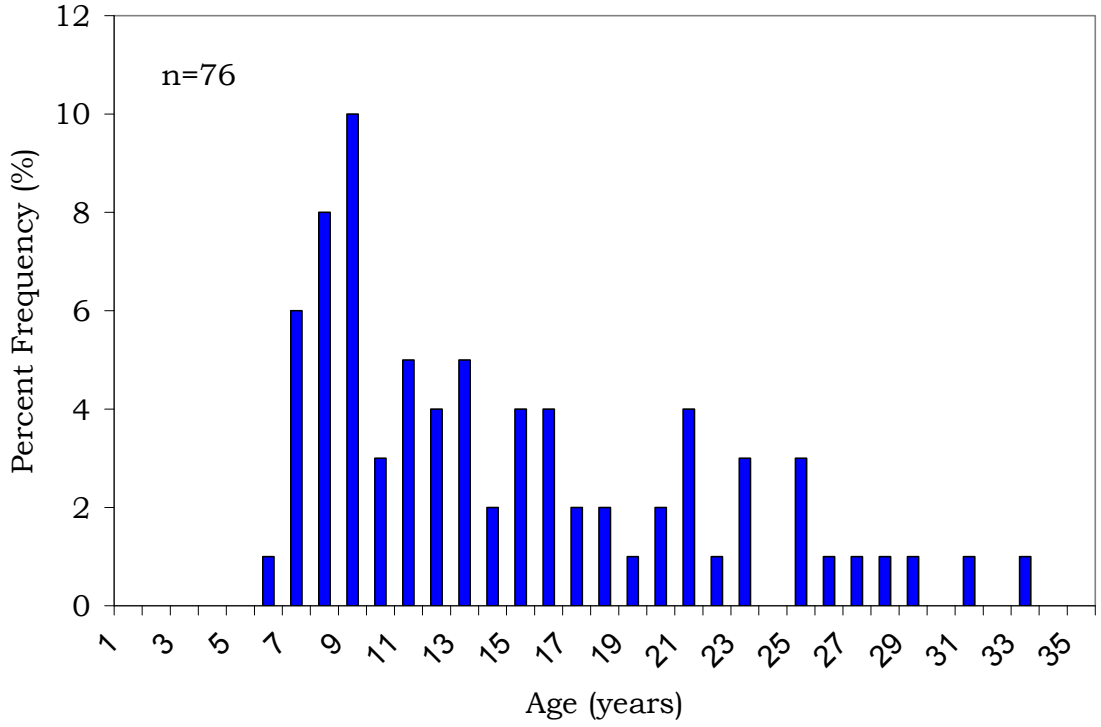

Figure 3. Ages of lake trout caught by anglers.

We examined 89 lake trout stomachs to analyze diet. Of these, 4 were empty and the remaining 85 averaged 79.8% full. Fish were by far the most common diet item identified (unidentified fish, least cisco, and lake whitefish) (Table 9).

Table 9. Sampled lake trout stomach contents.

	Percent Volume
Unidentified Fish	81%
Least Cisco	16%
Lake Whitefish	1%
Unidentified Invertebrates	1%
Round Whitefish	<1%
Stoneflies	<1%
Non-Biting Midges	<1%
Ants	<1%
Beetles	<1%
Caddisflies	<1%
Dragonflies, Damselflies	<1%
Unidentified Vegetation	<1%
Unknown	<1%
Arachnids	<1%
Burbot	<1%
Flies (two-winged)	Traces
May Flies	Traces
Waterboatmen	Traces

Only one northern pike stomach was analyzed and it contained 100% unidentified fish.

Comparison with Previous Surveys

We completed previous angler harvest surveys in 1992, 1997, 2000, and 2003. These surveys are directly comparable with the 2008 survey with the exception of the 1992 survey which is likely an underestimate because of sampling inconsistencies.

Effort

Estimated summer open water angler effort has fluctuated over the past 16 years (Table 10). We estimate 6,812 angler hours of effort over

the 2008 survey. From 1992 to 2008, angler effort nearly doubled, and between 2003 and 2008, it rose by 23%.

Table 10. Total estimated angler hours.

	2008	2003	2000	1997	1992
Hours	6,812	5,559	3,589	8,217	3,475

Fishing Methods

Fishing methods have remained constant over all surveys (Table 11). Trolling has been the dominant method while spin casting has remained the popular method from those angling from shore.

Table 11. Fishing methods (percent of parties).

	2008	2003	2000	1997	1992
Still	0%	<1%	0%	1%	
Jig	0%	<1%	0%	0%	
Drift	0%	0%	0%	0%	
Troll	92%	82%	80%	89%	N/A
Spin Cast	8%	16%	14%	10%	
Fly Cast	0%	<1%	0%	0%	
Other or Combination	0%	0%	6%	0%	

Methods of Access

This is the first survey to record methods of access (Table 12). Both the contractor's notes and the dominant fishing methods observed in previous surveys suggest that motorboats have always been the dominant method of access.

Table 12. Methods of access (percent of parties).

	2008	2003	2000	1997	1992
Canoe	2%	Data Not Available 1992 - 2003			
Rowboat	0%				
Motorboat	91%				
Shore	7%				
Other	0%				

Guided Anglers

Formally guided parties have accounted for a small percentage (7-8%) of the angler effort in all surveys (Table 13). These data are not available from 1992.

Table 13. Guided anglers (percent of parties).

	2008	2003	2000	1997	1992
Yes	8%	7%	7%	7%	N/A
No	92%	93%	93%	93%	

Angler Origin

Over the 16 years of survey data, the proportion of Whitehorse anglers has steadily increased, while the proportion of American anglers has declined (Table 14). Local anglers have remained the majority throughout all surveys. The proportion of Canadian (out of territory) anglers dropped sharply between 2003 and 2008.

Table 14. Origin of anglers (percent of parties).

	2008	2003	2000	1997	1992
Local	58%	52%	65%	59%	54%
Whitehorse	36%	13%	16%	6%	8%
Yukon	0%	2%	0%	2%	7%
Canada	3%	17%	7%	14%	18%
U.S.	3%	9%	12%	17%	10%
Other	0%	7%	2%	2%	3%

Visitor Type

Visitor type has only been recorded during the last two surveys (Table 15). Day users have increased since the previous survey.

Table 15. Visitor type (percent of parties).

	2008	2003	2000	1997	1992
Day Users	84%	66%	Data Not Available 1992-2000		
Camper – Territorial campground	11%	8%			
Camper – Crown land	3%	7%			
Camper – Private campground	2%	18%			

Weather

The field worker subjectively evaluates the effects of the weather on fishing. The data indicates that most days were good for fishing in 2008. Weather was better than in 2000 but far worse than the summer of 1997 (Table 16).

Table 16. Weather effects on angling activity (percent of parties).

	2008	2003	2000	1997	1992
No possible adverse effect	57%	62%	44%	94%	
Possible adverse effect	38%	31%	36%	6%	N/A
Definite adverse effect	5%	7%	20%	0%	

Catch and Harvest

Fewer lake trout were caught in 2008 than in 2003, however the catch in 2008 was slightly higher than the average of the previous four surveys (1442, Table 17). In 2008, a greater proportion of the lake trout caught were kept than in the previous survey, but this proportion was not as high as in the 1992 and 1997 surveys. It is uncertain whether there is a long term declining trend or whether there is a new upward trend in the retention rate.

Northern pike catches were much lower than the 2003 survey, but similar to the 2000 survey. Retention rate of northern pike dropped to an all time low in 2008.

No inconnu or Arctic grayling were reported caught in 2008.

Table 17. Estimated number of fish caught, fish kept and the retention rate.

		2008	2003	2000	1997	1992
Lake trout	Caught	1,619	2,480	996	1,869	421
	Kept	820	903	302	1,244	343
	Released	799	1,577	694	625	78
	% Kept	51	36	30	67	81
Northern pike	Caught	490	906	563	946	101
	Kept	49	176	145	315	13
	Released	441	730	418	631	88
	% Kept	10	19	26	33	13
Arctic grayling	Caught		88	12	74	
	Kept		17	12	59	
	Released		71	0	15	
	% Kept		19	100	80	
Inconnu	Caught		49	3	14	
	Kept		41	0	0	
	Released		8	3	14	
	% Kept		84	0	0	

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 18. Estimated catch per unit of effort (fish/hour).

	2008	2003	2000	1997	1992
Lake trout	0.24	0.45	0.28	0.23	0.12
Northern pike	0.07	0.16	0.16	0.12	0.29
Arctic grayling		0.02		0.01	
Inconnu		0.01			

Lake trout CPUE has remained relatively stable between 1992 and 2008 aside from a rather large spike in 2003. (Table 18). Results are good and slightly above the Yukon average for lakes surveyed to date.

The CPUE data for species other that lake trout should be treated with caution; usually these species receive only a small amount of fishing effort, and so there is a great deal of uncertainty associated with these estimates.

Fishery Sustainability

We estimate that Teslin Lake could sustain a total annual lake trout harvest of about 2,300 kg (total dissolved solids: 64 mg/L, mean annual air temperature: -1.6 °C, mean depth: 59 m; see Methods - *Lake Productivity*). Predictions of sustainable yield are imprecise, so we attempt to minimize risk and maintain fishing quality by using conservative estimates.

The estimated lake trout harvest (harvest estimate x mean weight) from the 2008 summer's angling is 1,640 kilograms (Table 19). Total fish mortality (death) includes the unintentional mortality of any released fish. Catch and release, when done properly, has minimal impact on released fish. 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. This average means that of the 799 lake trout released in 2008 120 died, for a total mortality of 940 fish (Table 19). This is lower than in 2003 and 1997 but is higher than the 1992 and 2000 estimates (Table 19).

Table 19. Estimated summer lake trout harvest by anglers.

	2008	2003	2000	1997	1992
Lake trout harvested	820	903	302	1,244	343
Lake trout released	799	1,577	694	625	78
Mortality of released fish (15%)	120	237	104	94	12
Total harvest and mortality	940	1,140	406	1338	355
Mean weight (kg)	2.0	2.15	2.33	2.08	2.45
Total harvest and mortality (kg)	1,880	2,451	946	2,783	870

Teslin Lake is very large, and even with multiple survey access points, some areas were missed such as the north end (accessed from the boat launch at Johnson's Crossing) or Morley Bay. The estimated harvest is therefore a minimum estimate. Further, no harvest data are available for the winter ice fishing season but anecdotal information suggests that effort and harvest are low. Finally, no harvest data are available for the First Nations subsistence fishery.

There are uncertainties associated with estimating sustainable yield and our estimate of harvest is incomplete. The 2008 survey results suggest that the current level of recreational harvest should maintain or improve fishing quality in Teslin Lake. However, the level of subsistence harvest is unknown. If the combined subsistence and recreational harvest exceeds the sustainable yield of 2,300 kg, then the quality of the lake trout fishery may decline.

Regular monitoring of the harvest from this important fishery should continue. The recent increase in retention rate should be examined in the next survey to see if this trend continues. In combination with harvest from the recreational fishery, harvest from the subsistence fishery should be quantified to ensure that in combination with the recreational fishery, OSY is not exceeded.

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Appendix 1.
Teslin Lake Angling Regulation Changes 1989 to 2008

Year	Species	Catch limit	Possession limit	Size restrictions
1989/90*	Lake trout	5	10	none
	Arctic grayling	5	10	none
	Northern pike	5	10	none
	Whitefish	5	10	none
1990/91	Lake trout	3 1 only over 80cm	6	Only one fish over 80cm
1993/94	Lake trout	2 none between 65 and 100cm	2	Only one fish over 100cm
	Arctic grayling	4 none between 40 and 48cm	4	Only one fish over 48cm
	Northern pike	4 none between 75 and 105cm	4	Only one fish over 105cm
2000/01	Lake trout limit is now one fish			
2005/06	Lake trout	1 none between 65 and 100cm	1	Only one fish over 100cm
	Arctic grayling	4 none between 40 and 48cm	4	Only one fish over 48cm
	Northern pike	4 none between 75 and 105cm	4	Only one fish over 105cm

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

Appendix 2. 2008
Results: Comparisons Between Periods

Effort

Mean daily effort varied quite drastically between the two locations on Teslin Lake. Effort charts have been broken up to show the differences.

Mean daily angler effort at the marina in town on weekends was very high in May/June with a substantial drop in August/September (Figure 2.1). Weekday effort was consistent over the periods, with the highest levels of effort in June. This is a typical pattern in Yukon lake trout fisheries.

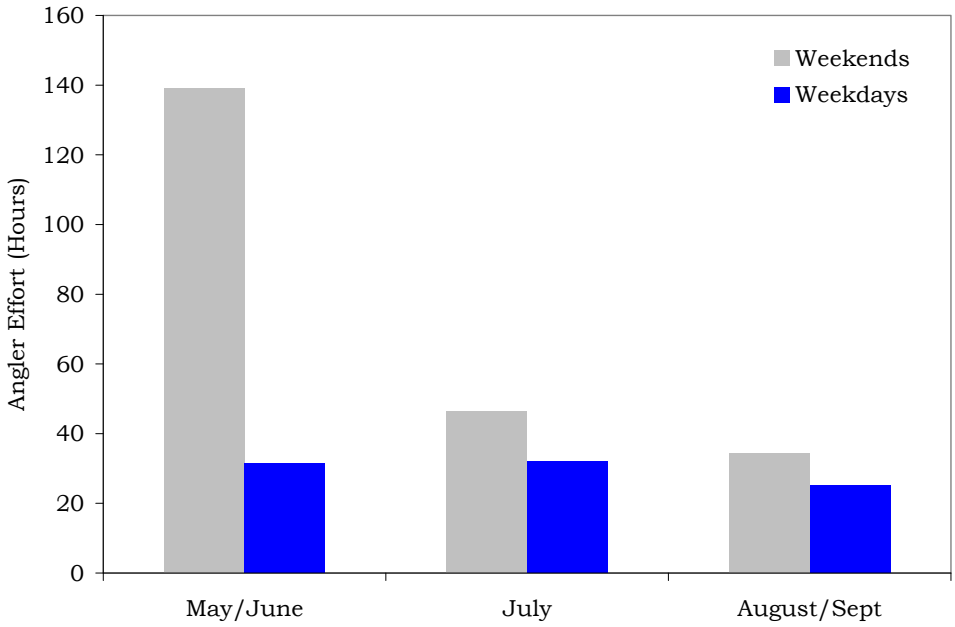

Figure 2.1. Estimated angler effort per day, Village of Teslin Marina.

Mean daily angler effort at Ten Mile Point was only high on weekends in May/June and August/September (Figure 2.2). There was no weekend effort in July and weekday effort was almost nonexistent throughout the entire survey. These patterns were atypical of a lake trout fishery in the Yukon.

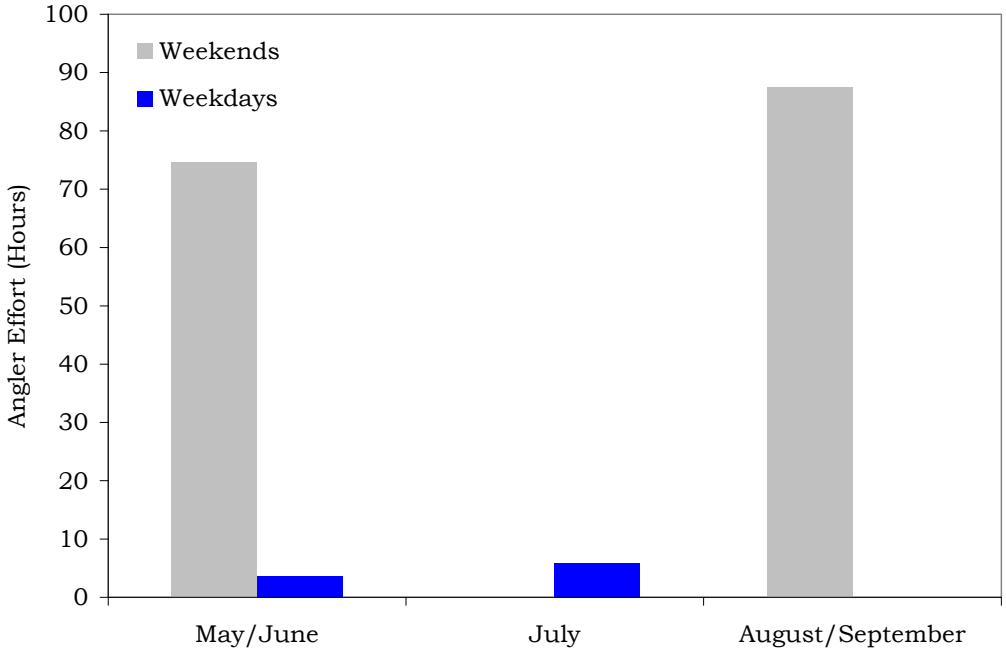

Figure 2.2. Estimated angler effort per day, Ten Mile Point.

Fishing Methods

Fishing methods were relatively consistent across weekends in the survey with most anglers trolling, a few spin casters and a scattering of other methods.

Guided Anglers

All guided parties captured through the survey were distributed evenly between weekdays and weekends. The majority of guiding occurred on weekends in August/September.

Angler Origin

Origin of anglers was relatively consistent over the survey.

Visitor Type

Day users were by far the dominant users in all periods. Government campground users usually departed from Ten Mile Point and were present in all periods.

Catch

Lake trout CPUE was good over the summer, especially by anglers that launched from the village marina. The CPUE was higher in May/June than July and highest on August/September weekdays (Table 2.1). Lake trout CPUE was usually quite high by anglers launching from Ten Mile Point, but anglers weren't observed during all survey periods. Northern pike CPUE didn't pickup until August/September when it was highest on the weekdays (Table 2.1).

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 quite noticeable on Teslin Lake as CPUE dropped in July and picked up again in August/September. CPUE was abnormally high on July weekdays by anglers that departed from Ten Mile Point. Effort was very low in this period and a few very skilled anglers heavily influenced the result.

Table 20. Estimated catch per unit of effort (fish/hour) by period.

Village of Teslin Marina	**Lake Trout**	**Northern Pike**
May/June weekends	0.30	
May/June weekdays	0.17	
July weekends	0.23	0.14
July weekdays	0.13	0.15
August/September weekends	0.25	0.25
August/September weekdays	0.31	0.42

Ten Mile Point	**Lake Trout**	**Northern Pike**
May/June weekends	0.07	
May/June weekdays	0.55	
July weekends		
July weekdays	0.51	
August/September weekends	0.26	
August/September weekdays		