ANGLER HARVEST SURVEY
DEZADEASH LAKE 2013

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Yukon
Environment

May 2014

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Yukon Department of Environment
Fish and Wildlife Branch
TR-14-08

Acknowledgements

Brittany Yuill conducted the field work under contract to Yukon Department of Environment. The Alsek Renewable Resources Council and the Champagne and Aishihik First Nation were supportive of the project. Special thanks to the management of Dalton Trail Lodge for their cooperation with this survey; particularly for allowing Ms. Yuill access to the lodge to conduct interviews with staff and guests. Jean Carey, Karen Clyde, and Dan Lindsey reviewed the report.

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Suggested citation:

FOOS, A., N. P. MILLAR, AND O. E. BARKER. 2014. Angler Harvest Survey: Dezadeash Lake 2013 Yukon Fish and Wildlife Branch Report TR-14-08 Whitehorse, Yukon, Canada.

Key Findings

- Angling effort has declined about 20% since the last survey in 2006, to an estimated 2,429 hours expended by 842 anglers in 386 parties. This equates to 0.3 angler hours per hectare, below the Yukon median.
- Guests of the commercial fishing lodge accounted for 46% of angling effort, and had better success for all species than non-lodge anglers.
- 45% of non-lodge anglers fished from shore, which is atypical for Yukon lake fisheries.
- Overall angler success, as measured by the number of lake trout caught per hour of angling, was more than twice the average of other Yukon fisheries surveyed to date.
- Anglers caught 972 lake trout, the highest catch of surveys to date, but released 89% of them. The total estimated harvest, including a percentage for incidental mortality associated with live release, was 550 kg of lake trout, a large increase over all past surveys.
- Known lake trout harvest remains well below thresholds of sustainability (1,200 kg).
- Catches of Arctic grayling and northern pike were much lower than recent surveys, and no fish of either species was retained.

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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. Environment Yukon's goal is 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 ensure fisheries are sustainable over the long term.

Dezadeash Lake is in southwestern Yukon within the traditional territory of the Champagne and Aishihik First Nations (CAFN). Its northern corner is located approximately 40 km south of the community of Haines Junction along the east side of the Haines Road. The road parallels the lake for approximately 14 km. Dezadeash is a moderately sized lake (82.5 km^2) and is unusual in the Yukon because of its very shallow depth (mean depth 4.1 m, maximum depth 7.4 m). There is a territorial government campground and boat launch located just off the highway towards the southern end of the lake, and a few dwellings/cabins scattered along the west and south shores. A commercial fishing lodge, Dalton Trail Lodge, is located in the northwest corner of Dezadeash Lake. The area is notoriously windy, often causing the lake to be rough and difficult for boating.

Dezadeash Lake has been identified as a priority by management agencies and advisory bodies. As a result, we have conducted angler harvest surveys on 5 previous occasions: 1991, 1995, 2000, 2001, and 2006.

The 2013 survey was done to:

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

Angling Regulations

Dezadeash Lake has been a Special Management Water since 1991. These fishing regulations protect the larger spawning fish and encourage the harvest of smaller fish, while allowing the retention of a trophy fish if caught. Anglers must only use barbless hooks and as of 1998 must use single barbless hooks. For lake trout, both the daily catch and possession limits are 2 fish. All lake trout between 65 cm and 100 cm must be released and only one longer than 100 cm may be kept. For Arctic grayling, both the daily catch and possession limits are 4 fish. All grayling between 40 cm and 48 cm must be released and only one longer than 48 cm may be kept. For northern pike, both the daily catch and possession limits are 4 fish. All pike between 75 cm and 105 cm must be released and only one longer than 105 cm may be kept. For all other species, General Waters limits apply.

The regulation history for Dezadeash Lake is detailed in Appendix 1.

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, an aging structure, as well as the collection of 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 sample 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. Sample days are allocated to each period while considering both 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

At the completion of the survey, the data are entered into an Access database and analyzed using standard statistical methods. The ages of sampled fish are determined by counting growth rings in an ageing structure; otoliths (a small bone in the fish's head) for lake trout and Arctic grayling, and the cleithrum (a bone on the body where the gill cover closes) in northern pike. Diet is determined by examining the stomach contents.

Lake Productivity and Sustainable Harvest Level

The productivity of a lake determines the amount of fish produced annually and can guide how much harvest can be sustained.

We estimate lake productivity based on average lake depth, the concentration of total dissolved solids, and the average annual air temperature at the lake. This overall estimate of productivity is a lake-wide estimate for all fish in the lake and is expressed as the maximum sustainable yield (MSY). MSY is a theoretical maximum level of harvest that can be maintained indefinitely.

MSY has frequently been used as a metric in the management of commercial fisheries where the goal is to maximize harvest; managing to MSY relies on reducing the fish population to a point where population growth is maximized. It does not, however, consider things that are important to management of Yukon freshwater fisheries like fish quality (size of fish) and fishing quality (ability of an angler to catch a fish). A more appropriate management goal in this context is the optimum sustainable yield (OSY) – this is a harvest level below MSY at which fish and fishing quality are also maintained.

Sustainable Harvest of Lake Trout – Optimal Sustainable Yield

From the MSY value, which provides an estimate of yield for all fish in the lake, we can then partition among species to obtain an estimate of a sustainable harvest level for lake trout. Based on netting surveys in lakes across Yukon, lake trout generally comprise about 30% of the fish biomass in lakes (Environment Yukon data), so we use this value to calculate a lake trout specific yield. In the case where a netting survey suggests a value other than 30%, we use the revised value. Based on work of O'Connor (1982), we set the target OSY for lake trout at 15% of the lake trout component of MSY, with the goal to maintain high quality fisheries in lightly- to moderately-fished lakes. We have compared current lake trout harvest levels against this benchmark level in Yukon fisheries for the past 25 years, and have increasing confidence that this level maintains quality fisheries.

Further information and details of the calculations are provided in Appendix 3.

2013 Dezadeash Lake Survey

The survey began 1 June and concluded 30 September 30 2013.

We used a roving survey methodology. The field worker was stationed at the government campground and boat launch near the south end of the lake (Figure 1), but roved north up the Haines Road 4 times per day in assigned periods investigating angler use at other popular lake access locations. Previous surveys and local knowledge were used to identify areas of access that were monitored. Daily interviews were also conducted at Dalton Trail Lodge with both guides and clients. The field worker also monitored for any other angling activity occurring on the lake. Angling parties were interviewed when they were encountered and at the completion of their fishing trip when possible.

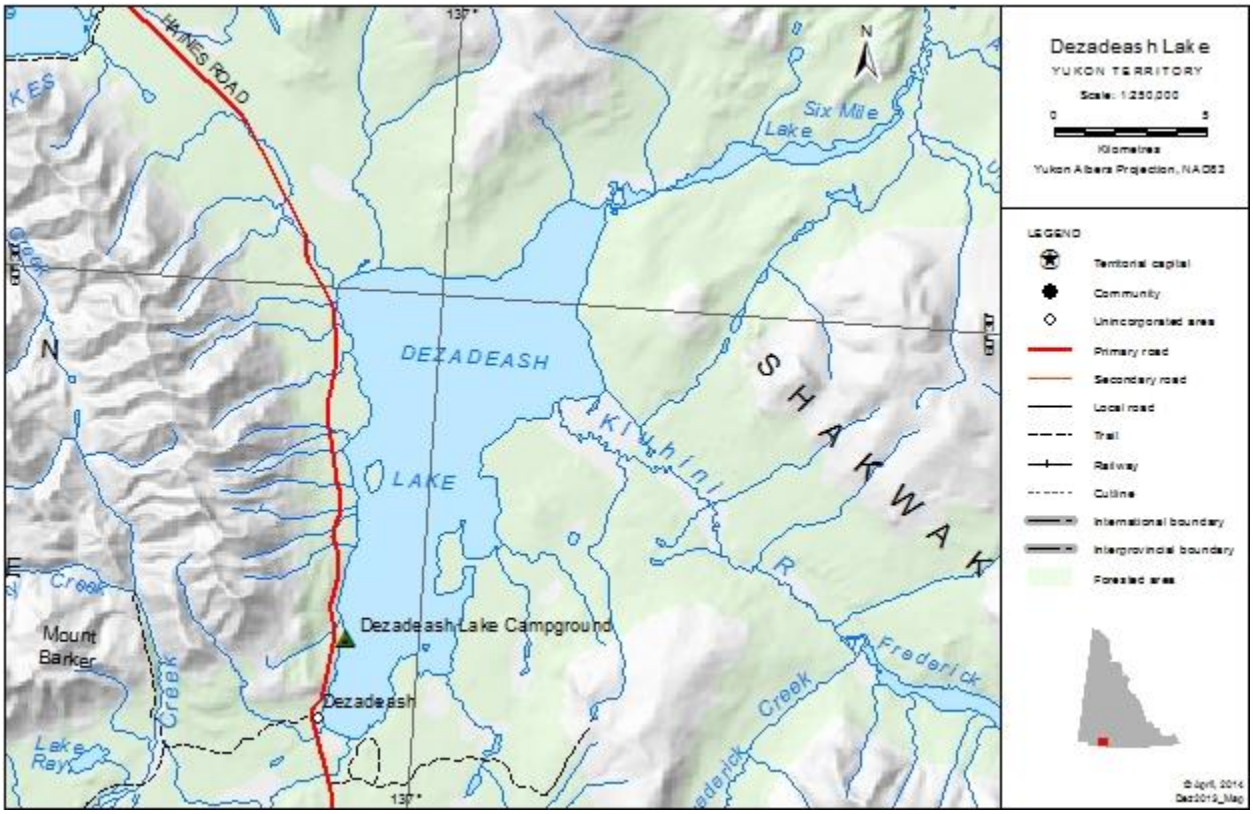

Figure 1. Dezadeash Lake, showing principal location of 2013 Angler Harvest Survey.

The survey period was partitioned into 6 time periods, weekends and weekdays in June, July, and August/September, and 2 location strata, Dalton Trail Lodge and all angling other than the lodge, for a total of 12 strata. Of the 122 day survey period, 40 days were sampled, resulting in a sampling effort of 33%.

Although data were gathered with roving survey methodology, almost all data met access survey methodology rules, so data were analyzed using access methodology. For the few angling parties (n = 11) where the interview occurred before the completion of their fishing trip, we made the interview time the trip completion time and ended the trip, then added a party to the activity count for the day.

We analyzed the data 2 ways. In the first, we combined data across all 12 strata, and in the second part we compared results between strata (see Appendix 2). We analyzed all data at the party level.

Results of 2013 Survey

Effort

We estimate anglers spent 2,429 hours fishing at Dezadeash Lake over the 2013 survey period. Altogether, 842 anglers in 386 parties fished for an average of 2.9 hours per angler. Fishing activity averaged 19.9 hours per day. This equates to a summer effort of 0.3 angler hours per hectare, below the median level of effort on Yukon lakes (0.5 hours/ha; see Appendix 4).

Fishing Methods

By far the most popular method of fishing was spin casting (Table 1). Combinations of methods was the next most popular (usually spin casting and fly casting), with small numbers of anglers using other methods.

Table 1. Fishing methods.

Method of Fishing	Angling Parties (%)
Still	0
Jig	0
Drift	0
Troll	5
Spin Cast	74
Fly Cast	6
Combination	13
Unknown	2

Methods of Access

The majority of angling parties fished from motorboats, but a large percentage angled from shore (Table 2).

Table 2. Method of access.

Method of Access	Angling Parties (%)
Canoe	1
Motorboat	64
Shore	35

Guided Anglers

Seventeen percent of anglers were guided (Table 3), all of them clients of Dalton Trail Lodge. Note that not all clients of the lodge are formally guided, some clients fish without a guide, although this was rare in 2013.

Table 3. Guided anglers.

Guided Anglers	Anglers (%)
No	79
Yes	17
Unknown	4

Angler Origin

Anglers from Whitehorse were the most frequently encountered on Dezadeash Lake (Table 4). The next most commonly-encountered fishers were 'other' anglers, mostly European, followed by 'locals', a category that includes Haines Junction residents. There were also a few anglers from the United States, often Haines, Alaska, as well as other parts of Canada.

Table 4. Angler origin.

Origin	Anglers (%)
Local	15
Whitehorse	49
Yukon	0
Canada	4
U.S.	7
Other (mostly Europe)	18
Unknown	8

Visitor Type

Most visitors were day users, while about a third of anglers stayed in the government campground (Table 5). Slightly less than a quarter of anglers were guests of Dalton Trail Lodge.

Table 5. Visitor type.

Visitor Type	Anglers (%)
Day Users	44
Campground Users	32
Lodge Guests	23
Crown Land Campers	1

Weather

Weather had an adverse effect on fishing activity at Dezadeash Lake (Table 6). A majority of sample days experienced some effects from weather, mostly because of wind.

Table 6. Sample day weather.

Did weather affect angling?	Sample Days (%)
No Possible Adverse Effect	42
Possible Adverse Effect	45
Definite Adverse Effect	13

Catch and Harvest

Lake trout were the most frequently caught fish and the only species that was harvested (Table 7). Arctic grayling and northern pike were also caught, but none were retained. Lake whitefish were caught in small numbers, likely as incidental catch.

Table 7. Estimated angler catch and harvest.

	# Caught	# Kept	Retention Rate (%)
Lake trout	972	103	11
Arctic grayling	466	0	0
Northern pike	238	0	0
Lake whitefish	5	0	0

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

Table 8. Estimated catch per unit of effort (fish/hour).

	CPUE
Lake trout	0.40
Arctic grayling	0.19
Northern pike	0.10
Lake whitefish	< 0.01

Biological Data

Relatively few lake trout were available for biological sampling from the 2013 survey. Such a small sample may not accurately reflect biological data for the catch as a whole, and should be interpreted with caution. Note that young fish (less than 5 years) are not vulnerable to angling gear and regulation requires the release of most large fish. These portions of the population are therefore underrepresented in the sample.

We conducted detailed biological sampling on 15 lake trout from cooperative anglers' harvest. Mean fork length was 569 mm, and mean weight was 2,361 g. These fish had a mean condition factor of 1.28, which is above average for lake trout in Yukon and indicates "fat" fish (condition factor is the relationship between length and weight). The sex ratio was 0.7 males per female. Most lake trout harvested were large, ranging from 494 to 719 mm (Figure 2).

We aged 15 of the sampled lake trout. Ages ranged from 7 to 32 years with an average age of 14 years (Figure 3).

We examined the stomachs contents of 15 lake trout to understand diet. Of these, 8 stomachs were empty, and the remaining 7 stomachs were 24% full. Unidentified fish was by far the most common and voluminous diet item.

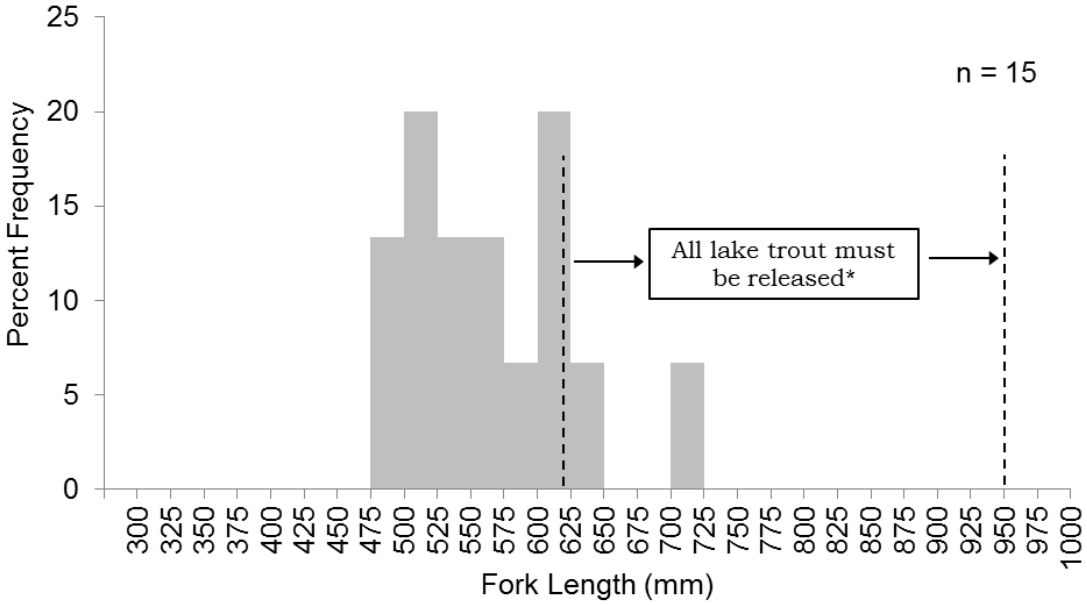

Figure 2. Lengths of sampled lake trout harvested by anglers. *Lake trout between 65 and 100 cm in total length must be released by licenced anglers, this equates to 62 to 95 cm in fork length.

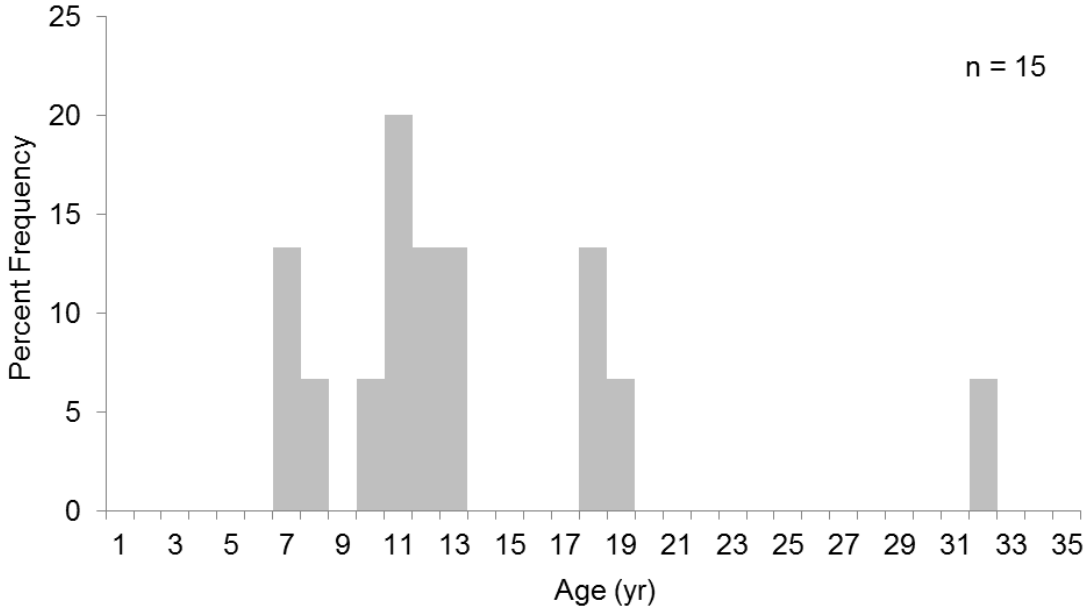

Figure 3. Ages of sampled lake trout harvested by anglers.

Table 9. Stomach contents of sampled lake trout.

Stomach Content	Frequency of Occurrence (%)	Volume (%)
Unidentified fish	78	99
Unidentified vegetation	11	trace
Unknown	11	trace

Comparison with Previous Surveys

We previously carried out angler harvest surveys on Dezadeash Lake in 1991, 1995, 2000, 2001, and 2006. These surveys were of similar methodology and design with the following exceptions: the 1991 survey had low sampling effort, the 1995 survey ended in the middle of September and the 2001 survey was conducted only in September. We consider the 1995, 2000, and 2006 surveys to be directly comparable with the 2013 survey. Results from the 1991 survey are not presented, but were consistently well below those reported here.

Effort

Estimated summer open water angler effort on Dezadeash Lake over the past 22 years increased to a high of 3,037 hours in 2006, and then declined by about 20 percent to 2,429 hours in 2013 (Table 10). 2013 was the second highest result to date.

Table 10. Total estimated angler hours**.**

	2013	2006	2000	1995
Hours	2,429	3,037	1,686	1,769

Fishing Methods

There has been a shift in fishing methods over the surveys (Table 11). Trolling has decreased in popularity (it comprised a large portion of the combination methods in 2006) while spin casting increased in 2013. Fly casting increased through 2006, but declined in 2013 (although it does comprise a portion of combination methods). These data are not available from 1991.

Table 11. Fishing methods (percent of anglers).

	2013	2006	2000	1995
Still	0	0	0	0
Jig	0	0	0	0
Drift	0	0	0	0
Troll	5	16	71	65
Spin Cast	74	28	14	30
Fly Cast	6	22	11	3
Other or Combination	13	34	0	1
Unknown	2	0	5	0

Methods of Access

Methods of access have been increasingly dominated by motorboats while shore fishing remains a popular option (Table 12). Other methods of access remain infrequent. These data are not available for older surveys.

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

	2013	2006	2000	1995
Canoe	1	3	N/A	N/A
Rowboat	0	0		
Motorboat	64	56		
Shore	35	41		
Other	0	0		
Unknown	0	1		

Guided Anglers

Formally guided parties peaked in 2000 and appear to have stabilized at a lower level since then (Table 13). Note that not all clients of the lodge are formally guided; some clients fish without a guide.

Table 13. Guided anglers (percent of anglers).

	2013	2006	2000	1995
Yes	17	18	26	10
No	81	82	74	90
Unknown	2	0	0	0

Angler Origin

Anglers from Whitehorse were the most commonly-encountered group for the first time in 2013, as the percentage of European anglers has declined substantially from previous surveys (Table 14). Local anglers increased in 2013 to levels similar to the 1990s, while non-resident Canadian anglers have been low since 2006. We have seen a steady decline in US anglers since 2000. We see very few anglers from other areas of Yukon.

Table 14. Angler origin (percent of anglers).

	2013	2006	2000	1995
Local	15	5	9	17
Whitehorse	49	16	3	25
Yukon	0	0	0	2
Canada	4	1	17	5
US	7	11	16	11
Other (usually European)	18	68	55	39
Unknown	8	0	0	0

Visitor Type

We have seen a lot of variation in visitor type over the years and interpretation is complicated because these data were not collected in 2000 (Table 15). Between the 2 most recent surveys, lodge users have decreased from a very high level in 2006 to levels more similar to those observed 1995, and day users have increased to the highest level recorded to date.

Table 15. Visitor type (percent of anglers).

	2013	2006	2000	1995
Day users	44	14		34
Territorial campground	32	27		16
Lodge guests	23	60		30
Crown land campers	1			15
Unknown			100	5

Weather

The field worker's subjective assessment of weather effects on angling activity over the sample day shows that weather has a definite adverse effect on fishing activity at Dezadeash Lake (Table 16). This is almost entirely related to wind in all years. The weather in summer 2013 was the best of the years surveyed with far fewer days having a definite adverse effect.

Table 16. Sample day weather.

	2013	2006	2000	1995
No possible adverse effect	42	24	13	29
Possible adverse effect	45	34	49	35
Definite adverse effect	13	41	38	36

Catch and Harvest

The catch and harvest of lake trout in 2013 increased slightly from the past 2 surveys, which were very similar to each other (Table 17). The 2013 lake trout catch and harvest were the highest for surveys to date. The retention rate has been trending slowly upwards since 2000, but remains lower than rates observed in the 1990s and is well below the Yukon average of 40-45%.

Catches of Arctic grayling are much lower than the very high result observed in 2006, and just above the average for all surveys. 2013 was the first year that there was no reported Arctic grayling harvest.

Catches of northern pike dropped dramatically in 2013 from the high in 2006, and are the lowest documented since 1995. Pike harvest has always been low, but there was none reported in 2013.

Lake whitefish were only reported in the 2013, 2006, and 1995 surveys. Few were caught in any year, and none were kept.

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

		2013	2006	2000	1995
Lake trout	Caught	972	873	866	407
	Kept	103	67	38	65
	Released	869	806	828	342
	% Kept	11%	8%	4%	16%
Arctic grayling	Caught	466	1,271	359	411
	Kept	0	20	5	43
	Released	466	1,251	354	368
	% Kept	0%	0.1%	1%	11%
Northern pike	Caught	238	1,165	338	328
	Kept	0	7	9	33
	Released	238	1,158	329	295
	% Kept	0%	0.1%	3%	10%
Lake whitefish	Caught	5	6		8
	Kept	0	0		0
	Released	5	6		8
	% Kept	0%	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. Relying on CPUE of anglers alone, however, is not recommended (see the section entitled “Invisible Collapse” in Status of Yukon Fisheries 2010 [Environment Yukon, 2010]) because anglers are very good at finding fish even when the population is in decline.

Lake trout CPUE has varied widely over the surveys (Table 18), but remains high and well above the Yukon average for lakes surveyed to date (0.15).

The CPUE for Arctic grayling is the lowest result to date by a slight margin, but apart from the high catch rate in 2006, is consistent with all other survey years.

Northern pike CPUE was low in 2013, much lower than the most recent 2006 survey, and below the average for northern pike fisheries in the Yukon (0.18). This is likely a result of fewer anglers targeting pike in 2013.

CPUE for lake whitefish was very low in all years as a result of these fish being incidentally caught in very low numbers.

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

	2013	2006	2000	1995
Lake trout	0.40	0.29	0.51	0.23
Arctic grayling	0.19	0.42	0.21	0.23
Northern pike	0.10	0.38	0.20	0.19
Lake whitefish	< 0.01	0.00		0.00

Fishery Sustainability

Dezadeash Lake is appreciated by the local community and throughout Yukon as a unique and special place. It is also recognized as a lake of special importance to the CAFN. There have been long-standing concerns regarding the fish stocks of Dezadeash Lake, and a Dezadeash Lake management planning initiative has been under way through the Alsek Renewable Resources Council (ARRC) for many years.

Given concerns regarding fish stocks, the existence of an active recreational fishery, subsistence fish harvesting, and the presence of a commercial fishing lodge, there has been regular study and monitoring of both the fishery and the fish population of the lake.

Environment Yukon has conducted numerous angler harvest surveys, and several lake trout population assessments, the most recent being a Summer Profundal Index Netting (SPIN) survey in partnership with CAFN and the ARRC in June 2013. Results from this population assessment indicate that the lake trout population in Dezadeash Lake is very healthy in abundance compared to similar Yukon lakes, with a preponderance of large fish (Millar et al., *in prep.*).

Angling regulations on Dezadeash Lake have seen few changes since 1991 other than the introduction of the requirement for single barbless hooks in 1998/1999 (Appendix 1).

Lake trout

We estimate that Dezadeash Lake could sustain a total annual lake trout harvest of about 1,200 kg (see Methods – *Lake Productivity and Sustainable Harvest Level* and Appendix 3) and maintain a quality fishery.

Total fish mortality (death) includes the unintentional mortality of any released fish. Live release, when done properly, has a minimal impact. Studies that have examined lake trout survival have found it to range from 93% for lightly-handled fish to 76% for deep-hooked fish (YFWMB 1998). Based on the results of these studies we use an average of 85% survival of live released fish for management purposes. We acknowledge that this rate does not represent the experience of many individual anglers who seek to minimize impact to the fish they release. Through the use of the correct gear and the adoption of good fish handling technique by all anglers, the mortality of all live released fish can be reduced.

Anglers harvested 103 lake trout over the summer (Table 19). 869 lake trout were caught and released, resulting in an additional mortality of 130 fish for a total summer mortality of 233 fish. Based on the average size of sampled fish, the total lake trout mortality in the recreational fishery was 550 kg. This is a doubling of harvest estimated in previous surveys, but still well below the optimal sustainable yield estimate of 1,200 kg.

The moderate amount of harvest relative to the high number of fish caught is reflective of the large component of live release angling that takes place on Dezadeash Lake.

Table 19. Estimated summer lake trout harvest by anglers**.**

	2013	2006	2000	1995
Lake trout harvested	103	67	38	65
Lake trout released	869	806	828	342
Est. mortality of released fish (15%)	130	121	124	51
Total harvest + est. mortality (# of fish)	233	188	162	116
Mean weight (kg)	2.4	1.3	1.8*	2.3
Harvest and est. mortality (kg)	550	244	296	262

**No biological samples, average used.*

An ice fishery occurs on Dezadeash Lake but it has never been formally monitored. Anecdotal information suggests that effort and harvest are mostly focused on the burbot setline fishery.

Subsistence harvesting by CAFN occurs on Dezadeash Lake primarily in the ice covered season. Most effort is in the Six Mile Lake area and targets whitefish and suckers (Linaya Workman, CAFN Renewable Resource Manager, *pers. comm.*, 2013). Specific harvest data are unknown.

There is some uncertainty around our estimate of sustainable lake trout harvest for Dezadeash Lake. Because of Dezadeash Lake's unique shape, 1,200 kg may be an overestimate. The shallow depth of the lake contributes to very high productivity estimates, but also means that portions of the lake are too warm in summer to support lake trout (MacKenzie-Grieve 2004). During warm water periods the low thermal tolerance of lake trout forces them to seek thermal relief along the west side of the lake where cold water flows in. This seasonal reduction in available lake trout habitat may limit lake trout production.

Our estimated harvest of 550 kg is below the optimal sustainable yield of about 1,200 kg for Dezadeash Lake and suggests a sustainable harvest. There is uncertainty introduced by unaccounted-for harvest (First Nation fishing, ice fishing, and open-water fishing outside of the period covered by this survey) and potentially reduced productivity due to restricted habitat for lake trout mid-summer. We recommend that future surveys assess and consider all additional harvests. We also recommend that the impact of a mid-summer reduction on habitat volume be more fully explored.

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Appendix 1. Dezadeash Lake angling regulations, 1989 to 2013.

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	Conservation Water Regulations			
	Barbless hooks only			
	Lake trout	2	2	No fish 65 to 100 cm, only one fish over 100 cm
	Arctic grayling	4	4	No fish 40 to 48 cm, only one fish over 48 cm
	Northern pike	4	4	No fish 75 to 105 cm, only one fish over 105 cm
	Whitefish	5	10	none
1998/99	*Single barbless hooks only*			

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

Appendix 2. Comparisons between Periods

Effort

Forty-six percent of the total estimated angler effort on Dezadeash Lake originated from the commercial fishing lodge. Overall mean daily angler effort was higher in June and July but dropped in August/September periods (Figure. 2.1). Weekday effort was lower than weekend effort in all periods for non-lodge anglers, and opposite for lodge anglers. This may be a result of lodge anglers avoiding weekend periods when the lake is busier with non-lodge anglers.

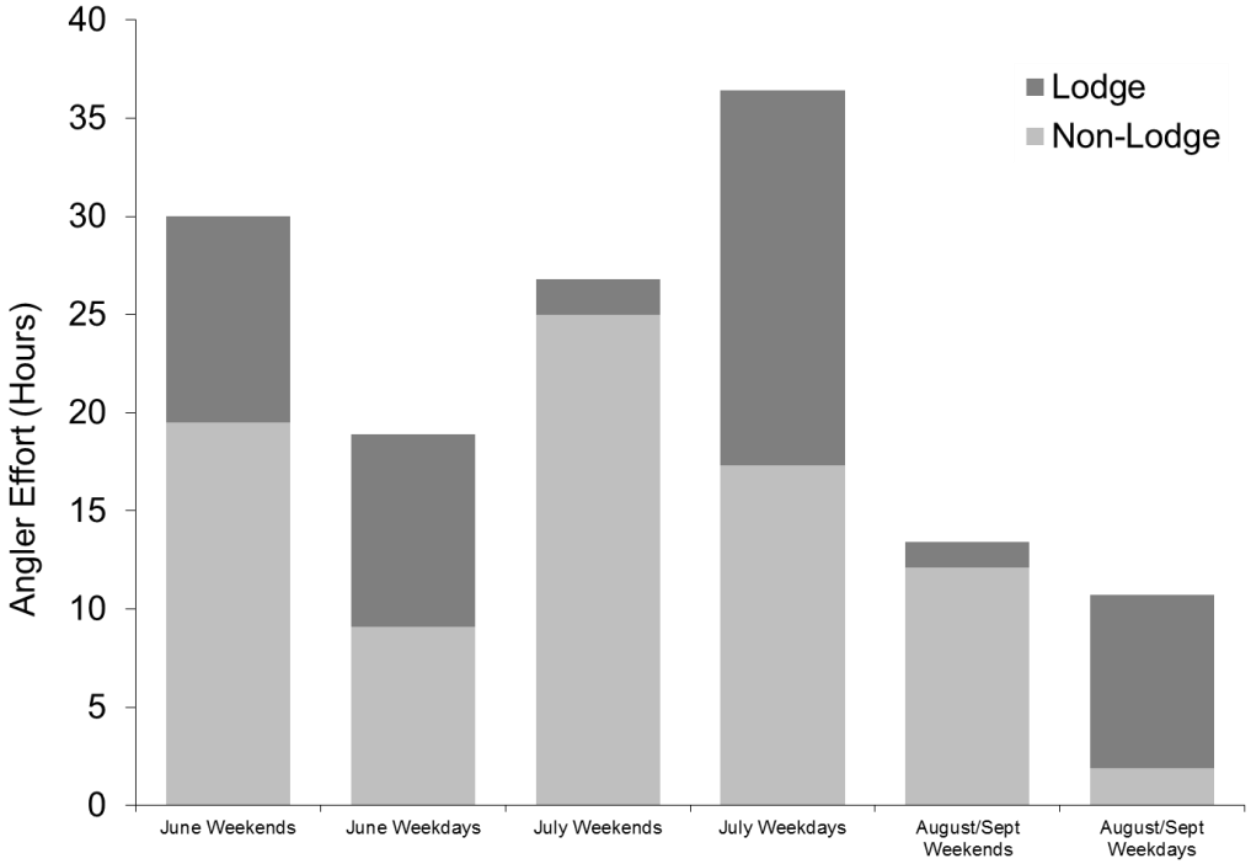

Figure 2.1. Estimated angler effort per day.

Fishing Methods

We found consistency across periods for angling methods other than we documented no trolling by lodge anglers and non-lodge anglers did more fly fishing, mostly on June weekdays.

Methods of Access

There were differences between how lodge and non-lodge anglers accessed the Dezadeash Lake fishery. Almost all lodge access was by motorboat, with only a few shore anglers, while 54% of non-lodge anglers used motorboats and 45% fished from shore. Methods were consistent across periods other than a spike in non-lodge shore anglers on August/September weekends.

Guided Anglers

All guided anglers were observed through Dalton Trail Lodge, and they were present in all periods except August/September weekends. Guided clients accounted for 64% of the lodge anglers, while the remaining 36% were unguided clients. Unguided lodge anglers were present in all periods except July weekends.

Origin of Anglers

Almost all lodge anglers were from outside of Yukon, predominantly Europeans, followed by Americans; 66% of non-lodge anglers were from Whitehorse. Eighteen percent of non-lodge anglers were from Haines Junction and the local area.

Amongst the non-lodge anglers, locals were present in the early summer and almost absent by late summer, while Whitehorse anglers were present in all periods, highest on August/September weekends. Non-lodge anglers from outside Yukon were also highest in June and July, and infrequent in late summer.

Visitor Type

The types of visitors we observed were consistent across periods with few exceptions. Obviously, lodge anglers all stayed at the lodge, while non-lodge anglers were 55% day users and 44% campground users. Day users were more abundant than campers in all periods, and campground users were fewest on July and August/September weekdays.

Catch and Harvest

We observed very different patterns in fishing success between non-lodge and lodge anglers (Tables 2.1 and 2.2). For lake trout, non-lodge anglers had lowest success in June periods and then success increased over the summer, with highest success on weekdays in the July and August/September periods. Lodge anglers had their highest success in June and July, with lower success in August/September.

Non-lodge anglers did not target or catch any northern pike, while lodge anglers caught pike in all periods, with highest success on July weekends. Arctic grayling were sporadically caught by non-lodge anglers with low success, likely a result of not targeting this species, while lodge anglers caught them in most periods, with good success on June weekends and both periods in July.

Lake whitefish were caught only incidentally by non-lodge anglers in June periods.

Catch per unit effort patterns for lake trout were inconsistent with typical Yukon summer patterns. Usually success is high in the spring following ice out and then drops as water temperature rises. Fall CPUE increases may be seen related to onset of spawning and cooling water temperatures.

This pattern is not evident for Dezadeash Lake as a result of the lake's shallow depth. Water in the main basin warms over the spring to temperatures that are occasionally intolerable by lake trout during summer periods. This warm water forces trout to aggregate in cool water stream inflows in order to survive. Anglers who are aware of these aggregations can target lake trout with above-average success in the summer and early fall.

Table 2.2. Estimated catch per unit of effort (fish/hour) by period, non-lodge anglers.

	Lake trout	Arctic grayling	Northern pike	Lake whitefish
June weekends	0.09			0.01
June weekdays	0.07	0.03		0.02
July weekends	0.16	0.02		
July weekdays	0.50			
August/September weekends	0.44	0.10		
August/September weekdays	0.52			

Table 2.3. Estimated catch per unit of effort (fish/hour) by period, lodge anglers**.**

	Lake trout	Arctic grayling	Northern pike	Lake whitefish
June weekends	0.46	0.09	0.05	
June weekdays	0.64	0.75	0.31	
July weekends	0.67	0.89	1.11	
July weekdays	0.51	0.52	0.26	
August/September weekends	0.25		0.50	
August/September weekdays	0.24	0.11	0.09	

Lodge anglers retained only 4% of caught lake trout, while non-lodge anglers retained 18%. We observed no other species retained by either group.

Appendix 3. Calculating productivity for lake trout.

Estimates of lake productivity are calculated using average lake depth, the concentration of total dissolved solids (TDS), and the average annual air temperature at the lake.

Ryder's morphoedaphic index (MEI) (1974)

MEI = TDS/Average depth (m)

is used and incorporated into Schlesinger and Regier's equation (1982) for calculation of a maximum sustained yield (MSY) for all species.

$\log_{10}MSY = 0.050Temp + 0.280 \log_{10}MEI + 0.236$

From here, we calculate an MSY specifically for lake trout. From data gathered in netting surveys of lakes across the Yukon, we find that lake trout generally comprise 30% of the fish biomass in a lake. Where we have data to suggest a different value (e.g., from a recent lake specific survey), then we will use this instead.

Following the work of O'Connor (1982), 15% of MSY provides an "optimum" sustained yield (OSY), with the goal to maintain high quality fisheries on lightly to moderately fished lakes (Table 3.1).

Table 3.1. Data and results for lake trout productive capacity estimation

Lake	Surface area (ha)	Average depth (m)	Average air temperature (°C)	MEI (kg)	MSY (kg)	Lake trout comp. (%)	Lake trout OSY (kg)
Dezadeash	8,250	4.1	-1.6	17.32	26,256	30	1,182

Literature Cited

RYDER, R. A. 1965. A method for estimating the potential fish production of north-temperate lakes. Transactions of the American Fisheries Society 94:214-218.

SCHLESINGER, D. A., AND H. A. REGIER. 1982. Climatic and morphoedaphic indices of fish yields from natural lakes. Transactions of the American Fisheries Society 111:141-150.

Appendix 4. Estimated summer angler hours for surveyed Yukon fisheries.

Lake/Fishery	Lake Size (ha)	Year	Estimated Hours	Hours/ha
Kluane Lake	40,821	2004	2,024	0.05
Bennett Lake	9,680	2009	1020	0.11
Frances Lake	9,941	2009	1,592	0.16
Aishihik Lake	14,500	2006	2,456	0.17
Tagish Lake	35,460	2003	6,888	0.19
Teslin Lake	35,400	2008	6,812	0.19
Quiet Lake	5,441	2011	1,204	0.22
Dezadeash Lake	**8,250**	**2013**	**2,429**	**0.29**
Kusawa Lake	14,200	2006	4,325	0.30
Simpson Lake	2,030	2002	608	0.30
Laberge Lake	20,100	2007	6,706	0.33
Marsh Lake	9,630	2007	3,174	0.33
Ethel Lake	4,610	2012	2,271	0.49
Braeburn Lake	558	2001	299	0.54
Kathleen Lake	3,376	2004	2,265	0.67
Little Atlin Lake	4,033	2008	4,175	1.04
Tatchun Lake	654	2005	750	1.15
Fish Lake	1,320	2010	2,376	1.80
Watson Lake	1,320	2002	2,543	1.93
Pine Lake	548	2009	1,185	2.16
Fox Lake	1,660	2013	5,009	3.02
Frenchman Lake	1,441	2012	4,564	3.17
Caribou Lake	32	1996	115	3.61
Snafu Lake - both	651	2010	3,783	5.81
Tarfu Lake	405	2010	3,141	7.76
Twin (West) Lake	160	2013	1,543	9.64
Louise Lake (Whitehorse)	65	2011	757	11.65
Johnson's Crossing - Spring	n/a	2001	322	n/a

Continued Estimated summer angler hours for surveyed Yukon fisheries.

Lake/Fishery	Lake Size (ha)	Year	Estimated Hours	Hours/ha
Kathleen River	n/a	2004	3,757	n/a
Lubbock River - Spring	n/a	2010	454	n/a
McIntyre Creek	n/a	2004	3,190	n/a
Nares River	n/a	2009	2,041	n/a
Tagish Bridge	n/a	2007	2,420	n/a
			Average	**2.11**
			Median	**0.54**
Stocked Lakes				
Chadden Lake	60		172	2.87
Cantlie Lake	222		853	3.85
Hidden Lakes - 1 & 3	39		1534	39.84
Scout Lake	21		2412	115.96