Status of Yukon Fisheries
2010

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Fish and Wildlife Branch

Yukon
Environment

Status of Yukon Fisheries 2010:
An overview of the state of Yukon fisheries and the health of fish stocks, with special reference to fisheries management programs

MR-10-01

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Executive Summary

In 1989, the Canada-Yukon Freshwater Fisheries Agreement was signed, transferring responsibility for managing the Yukon's freshwater fisheries to the territorial government. Since then, Environment Yukon has developed a comprehensive fisheries management system that has grown and evolved over time. Fisheries have changed, land claims have been signed, the Yukon Fish and Wildlife Management Board and Renewable Resources Councils have been implemented, and new impacts and stressors on the fisheries have arisen. To meet these evolving processes and emerging needs, new policies, regulations and programs have been developed and introduced.

This report provides an overview for the current status of Yukon fisheries, identifies current issues, provides suggestions for the direction of fisheries management, and could be used as a basis for a strategic plan for fisheries management in Yukon. The remainder of this summary touches on the highlights and main findings:

- The majority of Yukon fish stocks are healthy and intact.
- Recreational, First Nations subsistence, commercial, and domestic fisheries are primarily sustainable.
- One of the biggest impacts on fish populations is harvest and this pressure is not distributed evenly across the territory.

Yukon Fisheries

The recreational fishery is responsible for approximately 85 per cent of the Yukon fish harvest, followed by the First Nation subsistence, commercial, and domestic fisheries. Three species – Arctic grayling, lake trout, and northern pike – make up the vast majority of fish caught and kept through the recreational fishery. Participation of Yukoners in recreational fishing is among the highest in the country with almost 20 per cent of residents participating each year. There is a slow but steady decline in non-resident anglers and, due to a lack of participation among youth, we expect a continuation of the decline in Yukon angler numbers. The stocked lake program is very successful, providing important and diverse angling opportunities close to communities, promoting stewardship and education, and diverting pressure from sensitive wild fish stocks.

Yukon's commercial freshwater fishery is restricted to six waterbodies, is tightly managed and our assessment is that it has a low impact on fish stocks. This fishery provides employment, contributes to the local economy, and helps to satisfy the demand for local fresh fish. The small and localized domestic freshwater fishery is important to Yukoners who live subsistence lifestyles in remote locations. The First Nations freshwater fishery is not closely monitored, but is estimated to have an approximate harvest of 4,000 fish each year. Aquaculture in Yukon is comprised of a small number of pothole lake fish farm

operations that sell fish to the local market and two tank farm operations that export significant amounts of fresh and frozen Arctic char and Arctic char eggs.

Value of Yukon Fish and Fisheries

Fish and fisheries are of great value and importance to Yukoners and must be well managed to maintain these values into the future. Fish and fisheries provide healthy traditional foods and social and cultural value to all people. In the 2005 Survey of Recreational Fishing in Yukon, surveyed anglers said they primarily went fishing *to enjoy nature*, *for relaxation*, *to get away*, or *for family togetherness*, and that catching a fish was less important than these other reasons.

Recreational fishing in Yukon is a $23-million-a-year industry and a large contributor to tourism. Visitors purchase about half of the 15,000 angling licences sold each year and remain longer in the Yukon to take advantage of our fisheries resources. Yukoners earn income providing fishing gear, boats and other equipment, or find employment as fishing guides, lodge operators, commercial fishermen, aquaculturists, and licence vendors.

Impacts and Stressors

Fishing pressure from the recreational fishery has the largest impact of any activity on fish populations in Yukon. Lightly fished lakes that are relatively inaccessible have greater fish densities than the more accessible heavily angled lakes. Lakes that receive the most fishing pressure are those nearer to population centres and major highway corridors. Larger fish, a higher percentage of which are female, are targeted in the recreational fishery. In the short term this reduces the number of large fish in the population, which take many years to replace. In the long term, removal of large breeding fish can have evolutionary consequences such as reduced fish size and decreased egg size and quality. Live release is on the rise in Yukon and when done properly, most released fish will survive. However, excessive live release is discouraged though education programs encouraging ethical fishing practices.

The First Nations fishery has a low overall impact but may have higher localized impacts where fishing pressure is significant and concentrated. The commercial and domestic fisheries are both tightly regulated and have low or very low impacts.

Fish diseases have the potential to cause widespread damage and mortality. Introduced and invasive aquatic species have the potential to cause devastating damage to Yukon's fisheries, infrastructure, and aquatic ecosystems. Thankfully, few problems have been encountered to date. Nonetheless, vigilance is warranted as the consequences of introduced and invasive species have been expensive and challenging to manage in other jurisdictions. Stresses on fish habitat can occur through various impacts such as residential development, forestry, hydro projects, roads, and mining.

Continued collaboration with federal agencies responsible for fisheries habitat management is essential.

Fisheries Management in Yukon

Fisheries management involves many partners including management boards, resource councils, First Nation governments, federal agencies, stakeholder groups, and the public. Fisheries issues and concerns are gathered from many sources, often through collaborative planning processes and public reviews. The Yukon management processes enable all partners to contribute to decision making through widespread consultations on planning processes and regulatory amendments.

Annual monitoring activities such as angler harvest surveys and fish population assessments are two of the key methods used to identify management issues and to provide current information to support decision making.

There are a variety of tools available to manage fisheries including education and regulation. The process of applying regulatory measures involves ongoing education and consultation on issues and potential solutions. Regulatory tools include limits on catch, possession, size, and gear, and seasonal and areal closures. This report includes a detailed explanation of specific regulations for Yukon waters and describes the biological rationale where appropriate.

Status of Yukon Fisheries

Overall, Yukon fish populations are healthy and most fisheries are within sustainable limits. Lake trout, Arctic grayling, and northern pike are the most sought after fish and most of the information is about the status of these species. Where specific population status is not known, it is estimated using best available information.

The status of lake trout in 90 Yukon waterbodies has been determined and a set of harvest recommendations for anglers is laid out for each lake. For a subset of these lakes (30 lakes), harvest management objectives and management considerations are identified. A small number of these lakes are considered to be either overharvested or depleted and will need more immediate management action. Approaches may vary but will include education and outreach, additional monitoring work, and possible regulatory changes where warranted.

Far less is known about the status of specific Arctic grayling populations. Overall, grayling are very widespread in the Yukon and can be found in most waters, however, certain well known spring grayling spawning runs (e.g., Johnson's Crossing and Lubbock River) have declined and monitoring is ongoing to determine the success of regulatory changes limiting harvest. Other runs are thought to have declined, strongly suggesting the importance of pro-

active management in identifying and address issues before they become problems.

While there are no formal monitoring programs in place for northern pike populations, information is available from angler surveys and local knowledge. Again, some highly accessible pike populations (e.g., Little Atlin, Snafu, and Tarfu lakes) may be overharvested and management approaches for these populations are identified.

Outcomes and future directions

This report identifies and explores several challenges, and issues that face Yukon fish, fisheries, and their management. From this, a series of priorities that will guide the direction of fisheries management in Yukon have been set out:

- Focus management on over-harvested, depleted, and heavily accessed fisheries and address management issues in a timely manner
- Improve monitoring of lake trout to improve ability to detect changes in populations
- Increase focus and monitoring of selected Arctic grayling, northern pike, and burbot populations
- Improve anglers' understanding of and compliance with regulations through increased communication and education, more targeted enforcement activities, and improvements to the fishing regulations summary
- Develop a comprehensive strategy for Aquatic Invasive Species
- With First Nations governments, develop harvest monitoring for key First Nations fisheries
- Expand programs to encourage youth and others to engage in angling and to make wise choices on when and where to fish
- Move towards ecosystem and watershed based management and increased emphasis on management of river systems

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1 Introduction

This Status of the Yukon Fisheries review provides an overview on the current state of Yukon fisheries and the health of fish stocks. It details the Yukon's guiding principles and approaches to fisheries management and how both fisheries and their management have evolved over time. Major stressors on fish and their environment are discussed, including the impact of human harvest. The report looks at what has been learned about Yukon fish and fisheries and outlines considerations for maintaining and enhancing these resources into the future. This document is intended to address public interest in the health of the territory's freshwater fish resources and is meant for a wide audience and distribution. This document focuses on those activities within the mandated purview of the Yukon government.

1.1 Guiding principles of YG fisheries management

Fisheries management in the Yukon is guided by a common interest between the goals of Environment Yukon, its Fish and Wildlife Branch, the provisions of Chapter 16 of the Umbrella Final Agreement, and principles of sound fisheries management.

Generally, the management of Yukon's fish, fisheries, and aquatic resources aims to:

- maintain and enhance the quality and integrity, including the biological diversity, of the aquatic environment for present and future generations;
- ensure the sustainable use of fisheries resources through a balanced and integrated management of fish and their habitats;
- manage resources in a manner that is collaborative and promotes environmental and socially responsible awareness, participation, and stewardship; and
- provide sustainable fish harvesting and viewing opportunities for social, cultural, recreational and, where appropriate, commercial purposes.

1.2 Roles and Responsibilities for Fisheries Management

As laid out in Section 91 of the British North America Act of 1867, the federal Canadian government has constitutional jurisdiction over "sea coast and inland fisheries." In Yukon, water, the land underneath and the fish are the property of the federal government, but the Yukon government has been delegated the responsibility to manage freshwater fisheries. Two agreements outline how this will be done.

In 1989, the Canada-Yukon Freshwater Fisheries Agreement was signed. This agreement transferred all administrative responsibilities for the management of non-anadromous fish, or fish that do not migrate to the ocean. Anadromous fish, such as salmon, are still managed by the federal government. The agreement also allows for further agreements to be signed

including those related to fish habitat management, recreational fishing, and fish inspection.

The Canada/Yukon Memorandum of Understanding on Aquaculture Development was signed in 1991. This document sets out responsibilities for aquaculture and establishes the Yukon government as the main regulator and administrator of the industry.

In 1993, the signing of the Umbrella Final Agreement (UFA) changed the structure and process of fisheries management in Yukon. The agreement created the Yukon Fish and Wildlife Management Board (YFWMB) which makes recommendations to the Minister and First Nation governments on matters of fisheries management, legislation, research, policies, and programs. The UFA also created a Renewable Resources Council (RRC) in each Yukon First Nation Traditional Territory. RRCs are involved in making recommendations about fisheries management and issues within each traditional territory. The UFA sets out the harvesting rights of Yukon First Nations people who can use traditional and modern methods and equipment to harvest all species of fish and wildlife within their traditional territory at any time of the year. The Final Agreements signed between Canada, Yukon and individual Yukon First Nations further describe allocation and management priorities and responsibilities.

The Yukon government's Department of Environment licences, manages, and regulates all aspects of the recreational, domestic, and commercial fisheries for freshwater fish. In addition, the department works with First Nations in the management of the subsistence fishery and to ensure the health of fish stocks in their traditional territories. While the Yukon government licences and manages all aquaculture in the territory, federal regulations regarding food safety and animal health also govern this industry.

Where necessary, First Nations governments administer and allocate the subsistence harvest among their members through the legislation and regulations established under the First Nations Self Government Agreements.

The federal Department of Fisheries and Oceans (DFO) licenses, manages, and regulates all aspects of the recreational, domestic, and commercial fisheries for salmon and other anadromous fish. In addition, conservation and protection of habitat for all fish species across the country is the responsibility of DFO although they work with the Yukon government to manage fish habitat in the territory in accordance to the Yukon's fisheries management goals.

1.3 The Regulatory Context for Managing Fisheries and Fish Habitat in Yukon

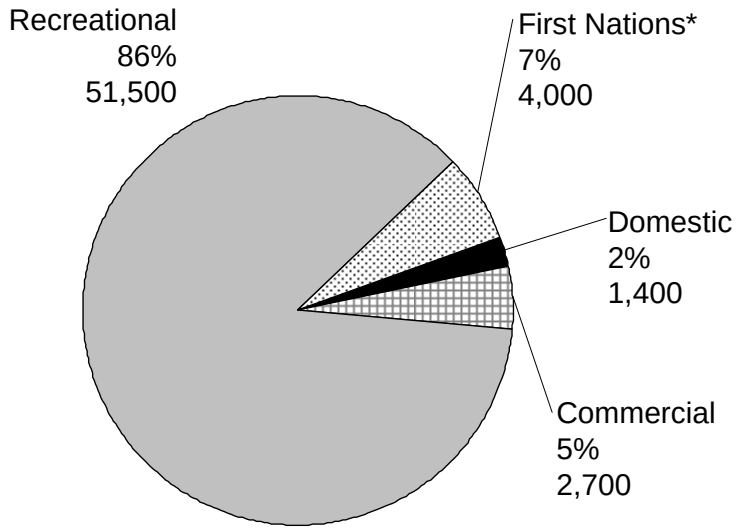
In Yukon, fisheries are managed through a combination of federal legislation and regulations, delegation of management authority through two memoranda of understanding, and territorial management, administration, and policy. The federal Fisheries Act, along with two sets of regulations, is the

paramount piece of legislation for the control of fisheries and the management of fish habitat in Yukon. The federal Fisheries (General) Regulations set out how certain activities are to be carried out and gives the Yukon's Director of Fish and Wildlife the ability to change certain regulations such as fisheries close times, quotas, or catch limits without going through a lengthy federal regulation change process. The federal Yukon Territory Fishery Regulations are the main regulations under the Fisheries Act applicable to fisheries in Yukon. These regulations identify the Yukon government's Minister of Environment as the responsible authority for the administration of freshwater fisheries in the territory. Under this authority, and the authority delegated through the 1989 and 1991 memoranda, the Yukon government administers, establishes policy, and sets out licence conditions for the freshwater fisheries in the territory.

2 Overview of Yukon Fisheries

Yukon fisheries include the recreational (angling), commercial, domestic, and First Nation fisheries. Figure 1 provides a more detailed breakdown of the overall numbers of fish harvested by each of these fisheries.

Figure 1. Number of freshwater fish harvested in Yukon (YG data and DFO 2007).



*First Nations harvest is an estimate.

Aquaculture and guiding/lodge industries are also important elements. The following sections describe these fisheries in more detail.

2.1 The Recreational Fishery – Angling

Most fish in Yukon are harvested through recreational or sport fishing. Anglers primarily target three species: lake trout, northern pike, and Arctic grayling. In 2005, these three species accounted for almost all of the fish caught and kept by anglers (Figure 2). They are targeted for many reasons including food value, size, fighting ability, wide distribution, and ease of catch.

According to licence sales, the size of the recreational fishery grew steadily through the 1950s, 1960s, and 1970s and peaked in the late 1980s (Figure 3). Over the last two decades, there has been a steady but gradual decline in licences sold to the current average of 15,000 annually. About half of the licences are sold to Yukoners, a quarter to non-resident Canadians, and the remaining quarter to international anglers. There are just as many Yukoners angling now as there were 20 years ago but there has been a decline in the number of licences purchased by non-resident anglers.

Figure 2. Number of fish caught and kept by anglers (DFO 2007).

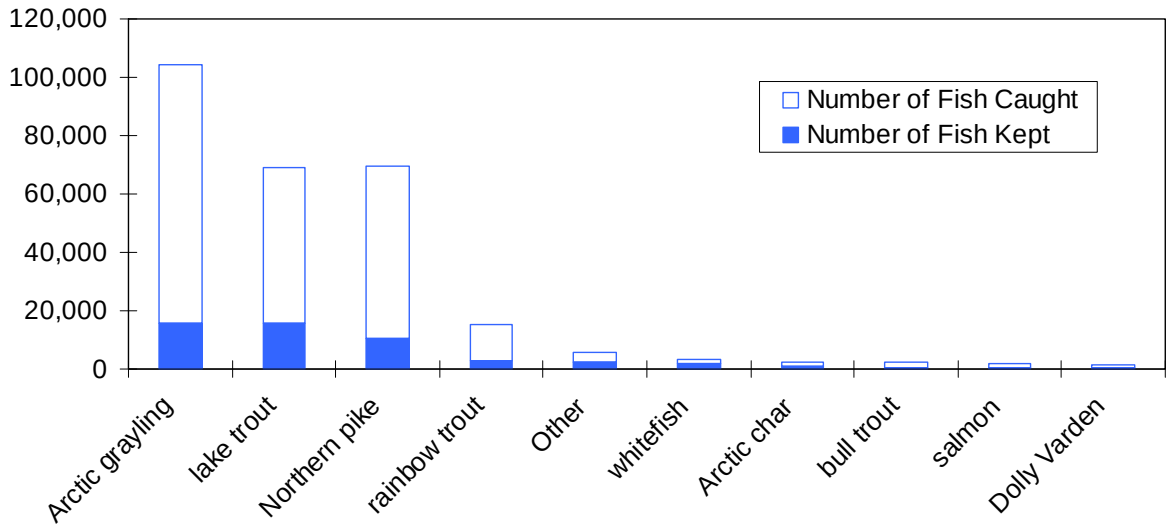
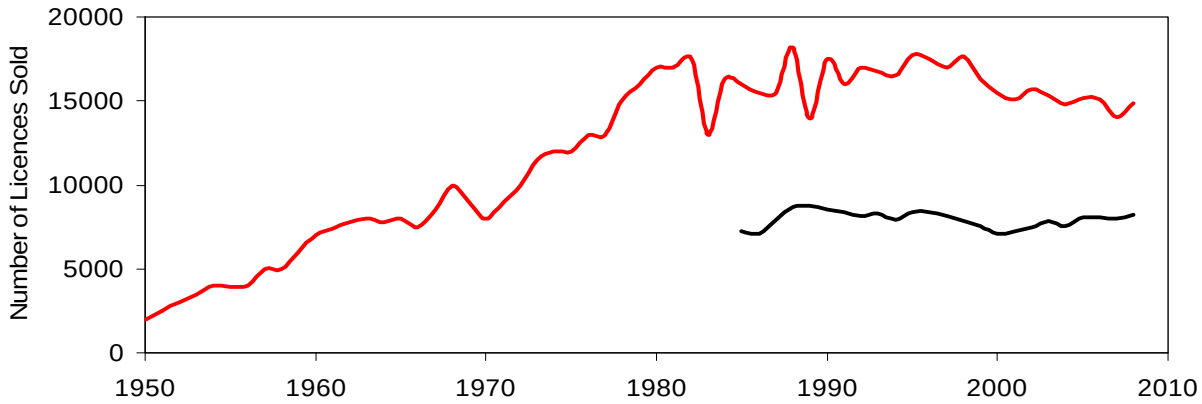


Figure 3. Sales of angling licences to Yukoners (black line) and overall (red line) (YG data). About 25% of those who buy a licence in a given year do not fish.



In comparison to other Canadian jurisdictions, Yukon has the second highest angler participation rates with an average of 17.5 per cent of residents angling each year, a number that has remained steady over the last decade (Figure 4). According to a 2009 report by the YFWMB, an estimated 85 per cent of Yukoners have angled at one point in their lives and most of these have been fishing for over ten years, suggesting that many anglers do not buy a licence each year and are only occasional participants in the fishery.

Though participation rates in the recreational fishery have been steady for some time, there is reason to believe that the rate will soon decline. Yukon anglers are getting older: over the last 15 years, the average age has increased by eight years (Figure 5). At this rate, the average age of an angler in 2040 will

be 65. The most likely explanation for this trend is the decrease, or lack of interest in angling among young Yukoners. If this trend is not slowed or reversed, there will likely be a drop in the Yukon participation rate in the future. Programs to encourage fishing amongst young Yukoners will help to address this trend.

Figure 4. Average angler participation rates in Canada, 1995 – 2005 (DFO 2007). Data are based on proportion of active anglers, not on licence sales.

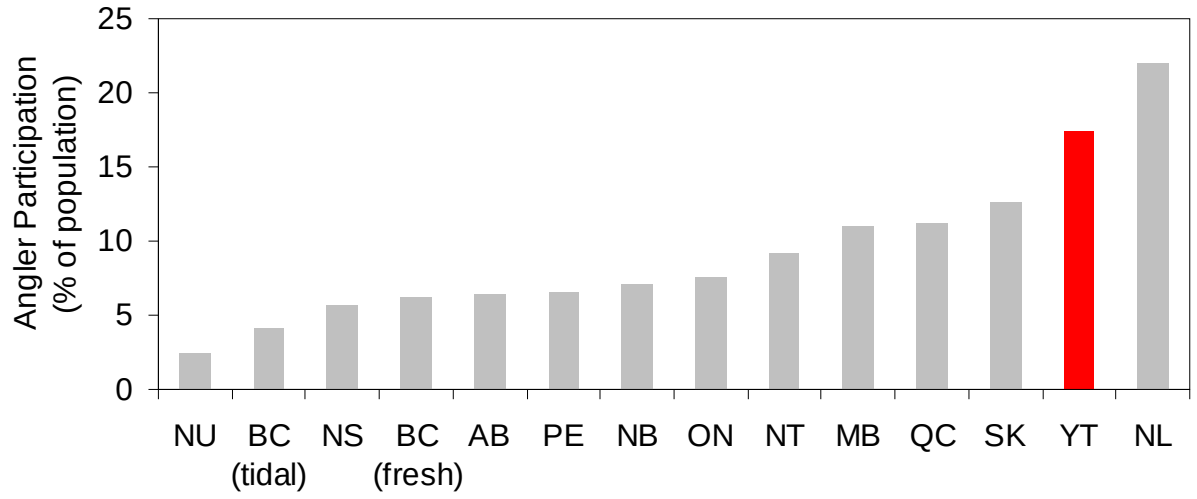
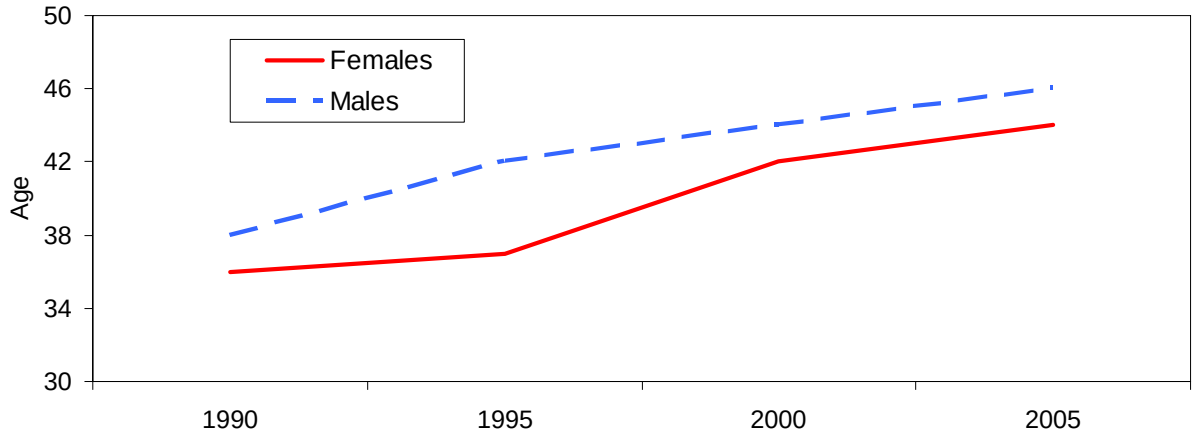


Figure 5. Average age of active male and female anglers in Yukon (DFO 2007).

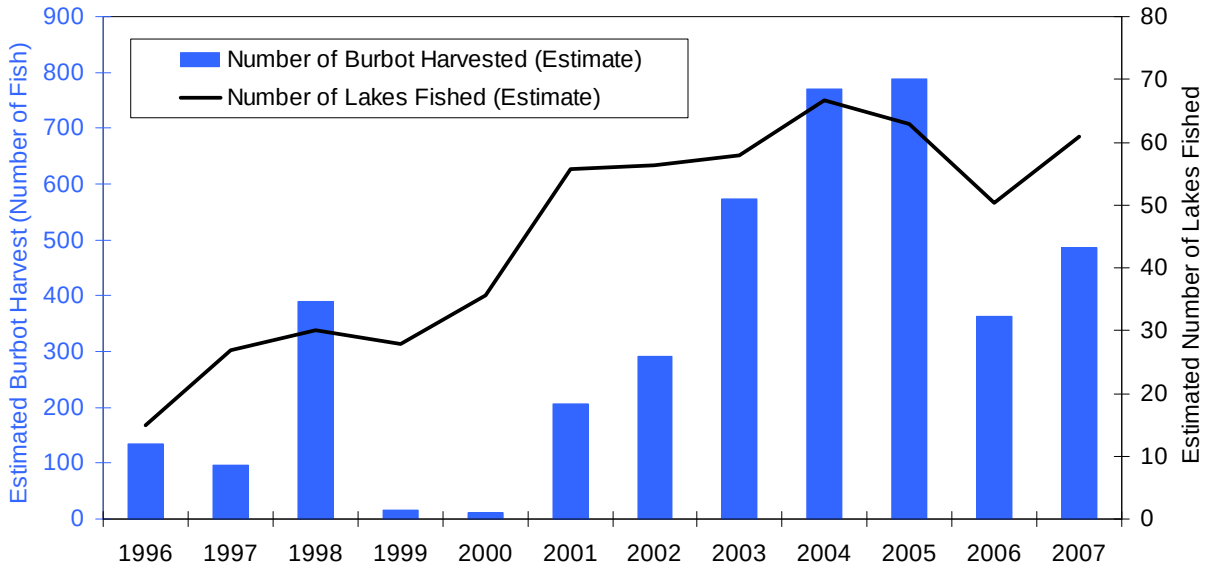


2.2 The Recreational Fishery – Set Lining for Burbot

Through a special Sport Fishing Licence, anglers can use set lines to catch burbot on designated lakes during ice covered period only. Early years of this fishery occurred without harvest limits. Concerns over the sustainability of the catch and waste of fish resulted in a regulation change in 2004 when daily

catch and possession limits for burbot were introduced. Prior to this change reporting of catch and harvest data was not strictly enforced and this resulted in a poor understanding of effort and harvest. Mandatory reporting requirements have been more strictly followed since. Before anglers receive a new licence they must produce their catch records from the previous year. Current records show no change in the number of lakes fished in the last ten years, but point to a possible decrease in harvest over the last few years (Figure 6).

Figure 6. Trends in burbot harvest in the setline fishery* (YG data).



*Note that estimates are rough and based on incomplete data, especially prior to 2004.

2.3 Fishing Lodges and Guides

There are approximately ten lodges and a small number of private guides that offer recreational fishing packages, mostly in the summer months. Each of these operators provides a unique angling opportunity as most lodges have minimal activity and are situated on remote, fly-in lakes with healthy fish stocks. Regulations on these lakes are aimed at conserving vulnerable, large spawning lake trout and in some cases lodge owners have developed additional conservation programs for their clients to follow. Lodges offer a range of services and packages from self guided camps to all-inclusive packages. All fishing guides are regulated through the Wilderness Tourism Licensing Act with respect to public liability but do not require any fisheries-specific licences to operate.

2.4 Stocked Lakes Program and Whitehorse Rapids Fish Hatchery

The stocked lake program has been an important component of fisheries management in Yukon since the early 1980s. The program provides anglers with opportunities to fish in accessible locations and reduces the pressure on wild stocks. About 1,500 Yukoners fish in stocked lakes each year, and almost all of those who do rate the stocking program as either very important or important (YG data). Stocking occurs in 23 pothole lakes and each year between 60,000 and 100,000 fry are released into the lakes on a rotational basis.

Stocked lakes also provide Yukon anglers with the opportunity to fish for species that they would not otherwise be able to access easily. Currently, stocked lakes contain rainbow trout, Arctic char, bull trout, and kokanee salmon. The stocking program is carried out in partnership with the Yukon Fish and Game Association and allows Yukoners to engage in stewardship and educational activities. In 2008, over 80 people assisted with the stocking program around Whitehorse.

The stocking program is not and was never intended to enhance wild stocks, as is done in other jurisdictions. Fish are only stocked into previously fishless closed systems, like pothole lakes, to ensure that stocked fish cannot escape and establish elsewhere where they could compete with wild fish stocks.


Bull trout fry in rearing tanks.


Kokanee salmon ready for stocking.

The Whitehorse Rapids Fish Hatchery is owned and managed by Yukon Energy Corporation with funding provided by the corporation and Environment Yukon. The hatchery's primary function has been to raise chinook salmon fry for enhancement purposes. However, modifications to the hatchery in 1997 now allow for the rearing of freshwater fish. The hatchery now raises fry of several species from local brood stock strains that will be better suited to Yukon's aquatic ecology and climate. To date, Arctic char, bull trout, kokanee, and rainbow trout have been successfully raised.

Currently, about half of the fish used in the Yukon stocking program are rainbow trout imported from British Columbia. Environment Yukon is

developing a five-year plan for the stocking program. A principal goal is to reduce or eliminate the need to import fish. Progress is under way to develop monitoring programs to better understand optimal stocking densities.

2.5 The Commercial Fishery

Yukon's commercial freshwater fishery has existed for over a century. Since the beginning, lake trout and lake whitefish have been the primary target species. These fish were an important food source during the Klondike gold rush for both humans and dogs. Significant commercial fishing occurred during the 1940s with the building of the Alaska Highway and the establishment of a small fur-farming industry. The need for large quantities of fish declined when fur farms closed in the 1950s.

Prior to 1990, any Yukoner could obtain a commercial fishing licence. Over 20 lakes, including some very small and vulnerable lakes, had active commercial fisheries. Although lake-wide quotas were set, enforcement of quotas was poor or non-existent and few records are available.

In 1990, Environment Yukon established new policies for the management of the commercial fishery. The commercial fisheries on small lakes and on lakes with vulnerable or depleted lake trout populations were closed. On larger lakes with an existing commercial fishery, conservative lake-wide quotas on the harvest of lake trout were established (Table 1). Each licensed fisher was also assigned an individual quota. Once this quota is reached, the fisher must cease all fishing. All lakes are closed to fishing in September and October and catch records must be submitted before a new licence is issued. Since 1990, several commercial fisheries have been closed or portions of quotas retired because of observed declines in lake trout stocks.

Table 1. Current commercial quotas.

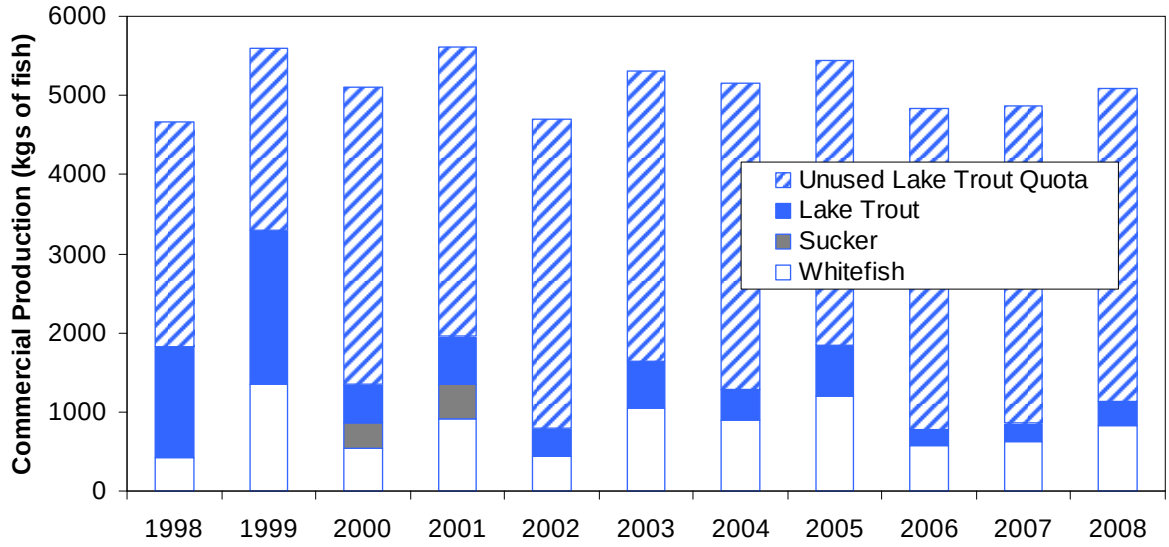
Waterbody	Species	Quota (kg)	# of Licenses
Atlin Lake*	Lake Trout	525	3
Bennett Lake*	Lake Trout	550	1
Kluane Lake	Lake Trout	3,050	7
Teslin Lake*	Lake Trout	125	1
Teslin River	Whitefish	260	1
Yukon River	Whitefish	500	1

* Yukon portion only.

Today, the commercial fishery represents around five per cent of the Yukon-wide harvest. The fishery has declined considerably since 1998 but continues to provide some economic opportunities for Yukoners. The management of the commercial harvest is currently focused on lake trout and no quotas have been established for the harvest of lake whitefish. Commercial

fishing is currently restricted to lake trout in four lakes and fall whitefish runs in two major rivers. Since the late 1990s, only a small portion of the annual allotted quota is taken in the commercial harvest and it is unlikely that the current level of harvest meets the demand for fresh local fish (Figure 7).

Figure 7. Commercial harvest from 1998 to 2008 (YG data).



2.6 The Domestic Fishery

There is a small domestic fishery that allows netting for subsistence needs. Prior to 1990, all Yukoners were entitled to fish with a gillnet for food on any of the 20 commercially-fished lakes. There were no quotas, no enforcement, and reporting was voluntary. In 1990, the Yukon government limited licences to individuals who live primarily off the land in remote or isolated areas and individual quotas were established.

Today, the domestic fishery targets lake whitefish and occurs on a small number of lakes. These lakes have large populations of whitefish and suckers, and licence holders have a very limited quota of lake trout. Less than 10 domestic licenses were issued in 2008/2009 and the total harvest in 2008 was less than 500 kilograms, consisting mainly of whitefish and suckers. Incidental catch of lake trout was less than 50 kilograms. Similar to the commercial fishery, all lakes are closed to fishing in September and October and catch records must be submitted before a new licence is issued. Currently, the catch of freshwater fish in the domestic fishery accounts for two per cent of the total freshwater harvest.

2.7 The First Nations Fishery

The First Nations fishery is Yukon's oldest fishery and it continues to provide subsistence and cultural value to First Nation communities. Under

Yukon's land claim agreements, beneficiaries have the right to harvest fish for subsistence within their traditional territory using traditional and current methods. Native food fishing is recognized as a harvest priority, subject only to conservation limitations. First Nation beneficiaries do not need a licence to fish within their traditional territory and the Yukon government does not licence the harvest. First Nations may record harvest from their members, but this information is not publicly available. Across Yukon, First Nation subsistence harvest of freshwater fish is estimated to be less than 4,000 fish per year all species combined and, in 2005, accounted for an estimated seven per cent of the total harvest of freshwater fish.

2.8 Aquaculture – Fish Farming

Yukon's aquaculture industry has two very different components. The first involves the stocking of fish under licence into pothole lakes, growing them to commercial size, and harvesting them for sale. There are currently 16 fish farm licenses issued on 23 pothole lakes, but not all are active. These lakes are closed systems with no native game fish. Licensed fish farms include small hobby-operations as well as commercial enterprises with substantial private investment. In 2007, 900 kilograms of fish were harvested from three lakes. The second component of Yukon's aquaculture sector involves the raising of fish in tank farms and hatcheries. There are two such facilities in Yukon and both of these raise Arctic char. The output from these facilities is about one million eggs annually and approximately 30,000 kilograms of dressed Arctic char for local markets and export. Both hatcheries are screened on a yearly basis for diseases. Though aquaculture is managed and regulated by the Yukon government, several federal agencies and departments are involved in regulating food safety and industry development.

3 Value of Yukon Fish and Fisheries

Freshwater fish, fisheries, and ecosystems are integral components of Yukon society and economy. They provide food, social, cultural, and recreational benefits to Yukoners. The direct economic benefits of fishing include licence sales and revenue from tourism, commercial fisheries, and aquaculture. Indirect benefits include expenditures on travel and accommodation, supplies such as boats, motors, and fishing equipment and employment related to the fishing industry. There is also great value in the ecological services provided by healthy functioning ecosystems. Recreational fishing, aquaculture, and the commercial and domestic freshwater fisheries also provide an important food source. The freshwater recreational fishery alone produces an estimated 50,000 fish each year. What is clear is that Yukon fish and fisheries are of great value and importance and must be maintained for the future.

3.1 Non-economic Values

Non-economic benefits of fisheries include the reinforcement of social and cultural values. Fishing is a way of life for many Yukon families and has been for generations. Many people choose to live in Yukon because of the relatively pristine environment and the ability to participate in outdoor activities. Fish resources and fishing opportunities are an important part of this attraction and angling is a resource-harvesting activity with broad public participation. Important life lessons are learned when a fish is caught, harvested, cooked, and eaten, or when fish are caught and released for conservation purposes. Public participation in angling is also important for continued awareness and support for the protection of fish habitat and healthy aquatic environments: people who fish are advocates for fish.

First Nations

First Nations people enjoy many benefits from and attach a high value to fish resources. Several studies, including Wein and Freeman's 1995 and Nutall's 2005 study of northern First Nation's hunting and gathering practices, have shown the importance of traditional foods in the diet of indigenous communities in the Canadian Arctic and Yukon. In communities such as Teslin, Ross River, and Old Crow, up to 60 per cent of the community's food supply can come from traditional foods. Traditional foods can be less expensive, provide a healthy food choice, and are a critical component of maintaining cultural identity.

Dependence on fish has decreased in recent years, but harvesting of salmon and freshwater fish remains an important part of annual harvest cycle for many. A 1995 study found that community-harvested fish were consumed on average 78 times a year in each household in four Yukon communities (Wein and Freeman 1995). Many First Nation individuals note the importance of social gatherings at fishing camps and the importance of those activities in

maintaining their cultural heritage (Muckenheim 1998; Nuttall 2005). Fish camps are places where people gather, tell stories, work together, and teach children how to fish. Fish that are harvested are shared with family, friends, and members of the community, especially elders.

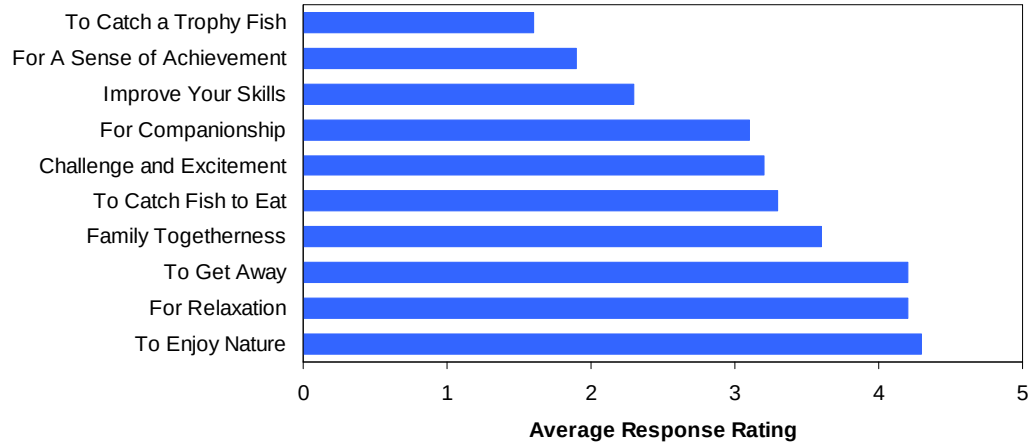
Recreational Fishery

The recreational fishery provides a number of non-economic benefits to Yukon. Residents and non-resident anglers enjoy the diversity of recreational fishing opportunities available throughout the territory. Eighty-five per cent of Yukoners have fished and 97 per cent support recreational fishing (YFWMB 2009). Some of the benefits can be measured but the true value of fish and fishing to society goes far beyond. This view is reflected in the following quote from a participant at a Yukon Fish and Wildlife Management Board workshop:

> *I'd like to suggest that for me a fish is priceless… I can't put a value on the peace of mind I get when I go fishing. I can't put a price on how important it is to me to be with my family: my son, my daughter, my wife in the kinds of places where you find fish. Whether it's on the water, whether it is getting to the water, whether it's just sitting there watching the fish, or whether I'm actually casting a fly to try and catch one…*

Fishing is part of an active lifestyle and provides the opportunity and motivation for people to enjoy and develop a respect for nature. A survey of licensed Yukon anglers found that people fish for various reasons with *enjoying nature, relaxation*, and *to get away* ranking as the most important (Figure 8). Fishing provides a purpose for people to recreate outside and contributes to a healthy, active lifestyle. *Family togetherness* is another important benefit of recreational fishing. Fishing and associated activities provide a focal-point for developing relationships. Such opportunities form life experiences and memories and establish or reinforce values in children that can last a lifetime.

Figure 8. Reasons why Yukoners go fishing. Response is measured as the average rating with five being the highest (DFO 1995).



Yukoners and visitors alike value the opportunities to catch and eat a fish. Approximately 60 per cent of Yukon anglers fish for food alone or for a combination of recreation and food (Otto 2001). Fish is an excellent source of protein, minerals, and long-chain omega-3 fatty acids (Health Canada 2009) and many Yukoners value wild fish as a 'clean' and healthy food compared to commercially produced food. There is also an immense satisfaction in catching your own food. It is for these and other reasons that many Yukon anglers appreciate the ability to eat a fresh fish harvested from a pristine natural environment. Fishing is an activity that gets Yukoners out in nature. They are observing, interacting, and appreciating wild places. These experiences reinforce the value that is attributed to healthy ecosystems and animal and plant communities and creates a steward out of every angler.

Existence value

While most of the reasons people value fish and healthy aquatic ecosystems relate directly to the benefits they derive, species and ecosystems can be valued for the simple fact that they exist and will continue to enhance the quality of life for future generations (Rudd 2007a). The value that is assigned is independent of whether or not they have ever seen the fish or visited the lake. A nationwide study found that Canadians value fish species "in the range of tens to hundreds of millions of dollars annually" (Rudd 2007b). This is one way to understand, in monetary terms, the value that is placed on the existence of aquatic species.

3.2 Economic Values

Yukon's fish and freshwater ecosystems provide a variety of economic benefits to Yukon. Revenue from the sale of Yukon angling licences and associated purchases, fishing-related tourism activities, and sales and employment from the commercial and aquaculture industries all contribute to Yukon's economy.

Recreational Fishing

Recreational angling in Yukon is a $23 million-a-year industry and an important leisure activity for over 15,000 resident and non-resident anglers (DFO 2007). There are both direct and indirect revenues associated with the recreational fishery in Yukon. Licence fees from recreational fishing bring in an average of $250,000 annually to the Yukon government's general revenue. Other direct economic benefits of angling include revenue from fishing lodges and guiding businesses, aircraft charters, and stores selling fishing equipment or other related supplies. Resident and non-resident anglers spend an estimated $12 million each year on fishing (Figure 9). An additional $11 million is spent on major purchases or investments, such as boats and motors, that are attributable to recreational angling in Yukon (Figure 10). These combined numbers result in an average annual expenditure of $1,690 per licensed angler on purchases directly or indirectly related to fishing.

Figure 9. Direct recreational fishing expenditures in Yukon (DFO 2007).

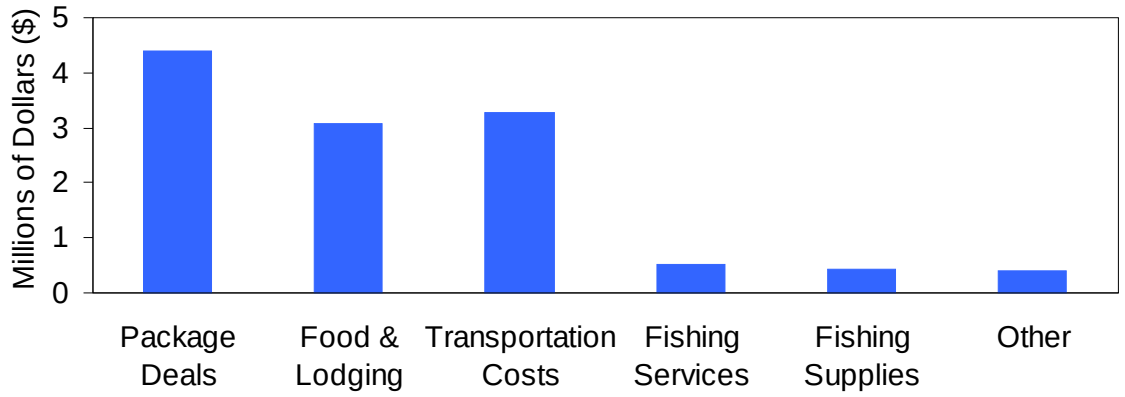
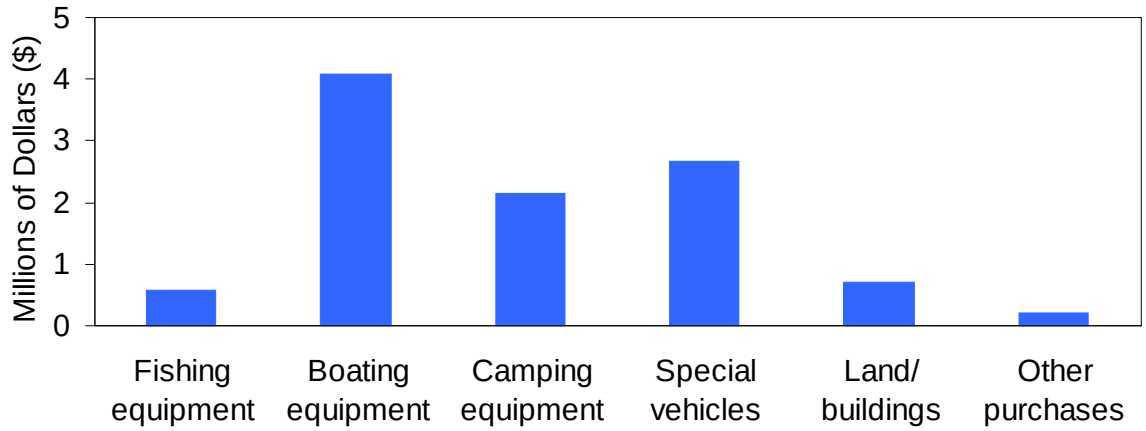


Figure 10. Major purchases related to recreational fishing (DFO 2007)



Contribution to Tourism

Tourism is a large part of Yukon's economy. In 2004 visitors to Yukon spent over $78 million (Tourism Yukon 2006) and recreational angling opportunities influenced the decision of many tourists who visited the territory. Some visitors came specifically to fish, while others ended up fishing once they were already here. When asked what they would have done if there were no fishing opportunities, 37 per cent of non-resident anglers, or 2,800 visitors, stated they would have either "stayed a shorter time" or "not come at all" (DFO 2007). Many of these anglers are accompanied by people who do not fish. If all these visitors are included, the number of tourists brought to Yukon by angling opportunities is substantially greater.

Many Yukon businesses offer fishing expeditions ranging from short excursions to longer stays at remote fly-in fishing camps and lodges. Over 1,000 non-residents were guided by Yukon operators in 2004 (Yukon Department of Tourism and Culture 2008). Fishing attracts people to Yukon,

which in turns exposes other desirable features and opportunities to the visitors and indirectly markets the territory to more people.

Commercial Fishing and Aquaculture

In Yukon, the commercial fishing and aquaculture industries provide economic benefits through sales and employment. In 1986, the commercial fishery had an estimated economic output of $65,000 (DPA 1988), however the fishery has diminished substantially since then, and no recent economic data are available. Many commercial fishers stopped fishing as much because they are getting older and there are fewer places to sell locally caught fish. Yukon's commercial fishery is nonetheless important in that it provides fresh and local wild fish and is a source of employment and revenue. Employment in this industry complements other part-time resource-based jobs such as guiding, trapping, fish farming, prospecting, and wood cutting that are part of the lifestyle of many Yukoners. In an age of increased concern about sustainable fish stocks and a desire for local food, Yukon's commercial fishery may well see an upturn.

While pothole lake fish farming remains a small industry, tank farms and hatcheries produce substantial quantities of eggs and fish for local and export markets. The estimated value of all Yukon aquaculture is about $500,000. The economic benefits of aquaculture are varied and include revenue from sales, local employment, and related purchases by industry.

Ecosystem Services

When intact, healthy aquatic ecosystems provide vital services including water regulation, water supply, food production, and recreation. The replacement costs for these ecosystem services are huge – an estimated $8,500 per hectare per year (Costanza et al. 1997).

4 Impacts and Stressors

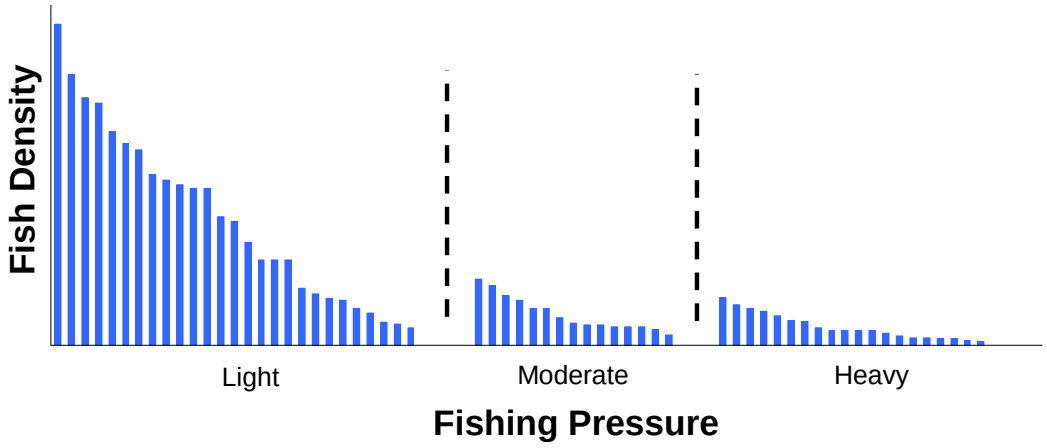
Stressors are factors that result in negative impacts on fish, fish habitat, and ecosystems. Natural or human-induced changes can have long-term effects, either directly or indirectly, on these ecosystems. This section presents the impacts on Yukon's freshwater ecosystems

4.1 Harvest / Fishing Pressure

Each year, an estimated 60,000 fish are taken from Yukon waters, making harvest the biggest stressor for fish populations. Recreational angling is by far the largest Yukon fishery, so the following section discusses impacts in the context of recreational fishing, describing many specific impacts.

One of the clearest indicators of the impact of fishing pressure is that there is an inverse relationship between the quality of fishing and how heavily a lake is fished. When lakes are grouped into categories of heavy-, moderate-, and light-fishing by anglers, lightly-fished lakes generally have a far higher density of lake trout, indicating that heavy fishing pressure results in reduced fishing quality (Figure 11).

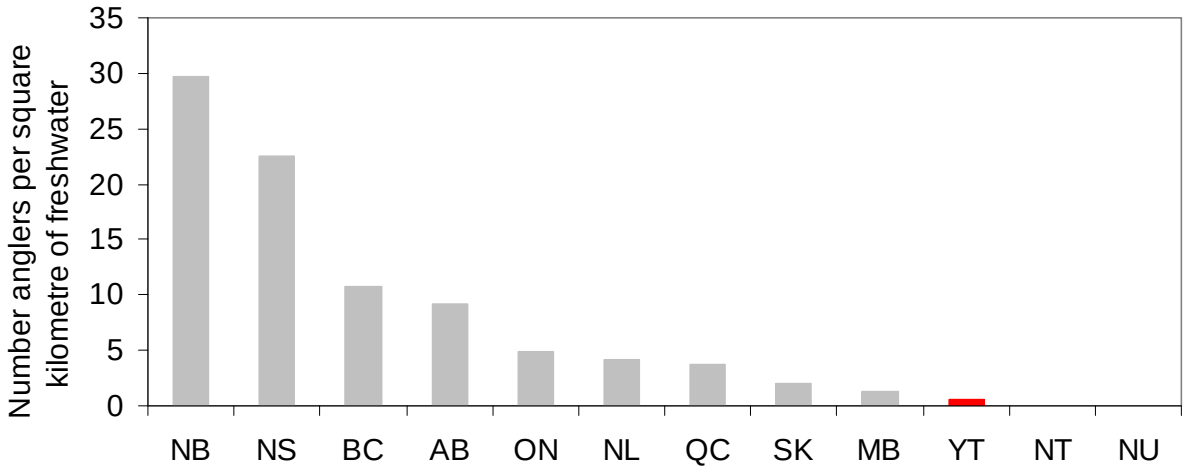
Figure 11. Fishing quality, as measured by the density of lake trout in a lake, in 62 Yukon lakes arranged by intensity of fishing pressure (YG data).



Scale and Distribution of Fishing Pressure

Yukon has far fewer anglers than all the provinces relative to the area of freshwater (Figure 12). Although this comparison may suggest that the management challenges should be fewer in Yukon, a host of differences between jurisdictions such as lake productivity, angler activity, and species preclude drawing strong conclusions. For example, Yukon waters are not as productive as more southerly waters and consequently fish stocks cannot sustain as much harvest.

Figure 12. The size of the recreational fishery relative to the amount of freshwater in Canadian jurisdictions (Natural Resources Canada 2005, DFO 2007).

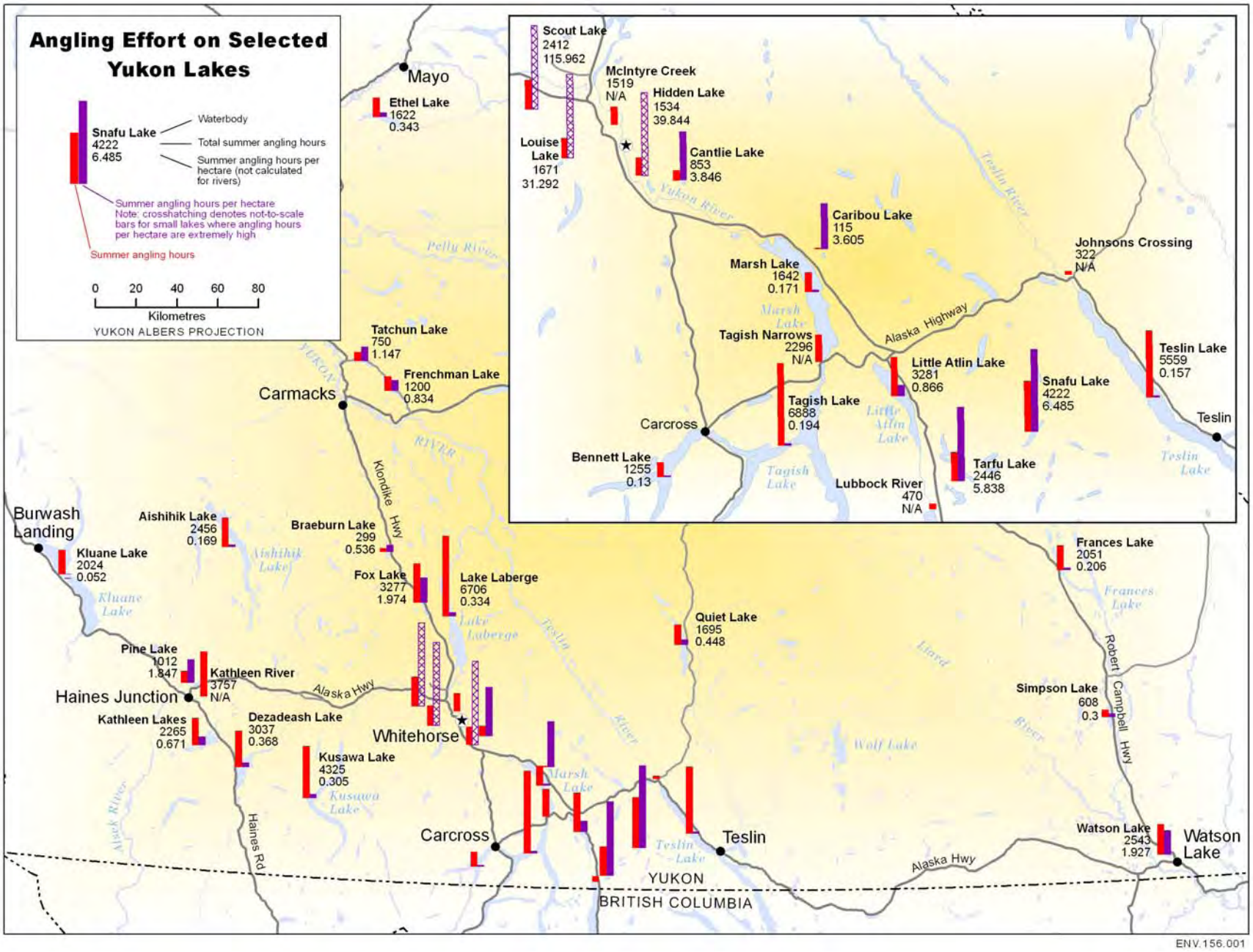


How the fishing pressure is distributed across the landscape is another factor: concentrated fishing activity, such as seen in Yukon, has a greater impact than fishing pressure that is evenly distributed across the landscape (Figure 13). Angling effort and impact are determined by access and proximity to communities. In Yukon, most people live in the Southern Lakes region and Whitehorse alone accounts for 75 per cent of the total population of Yukon (Yukon Bureau of Statistics 2008). The implication for fisheries management is that waters in this area will bear a disproportionately large portion of the pressure and impact. For example, fishing on Marsh and Tagish lakes alone accounts for 12 per cent of the total angler effort and 16 per cent of the Yukon-wide lake trout harvest (DFO 2007).

Disproportionate Harvest of Female Fish

Fifteen years of data from Yukon angler harvests show that more female fish than male fish are taken in the recreational fishery. Of 2,500 harvested lake trout that were smaller than 65 centimetres, 55 per cent were females. Of 362 lake trout that were over 65 centimetres long, 63 per cent were females. This result is related to both size selection (females are generally larger than males) and to females being more active predators in the summer as they feed voraciously to store energy needed to produce eggs.

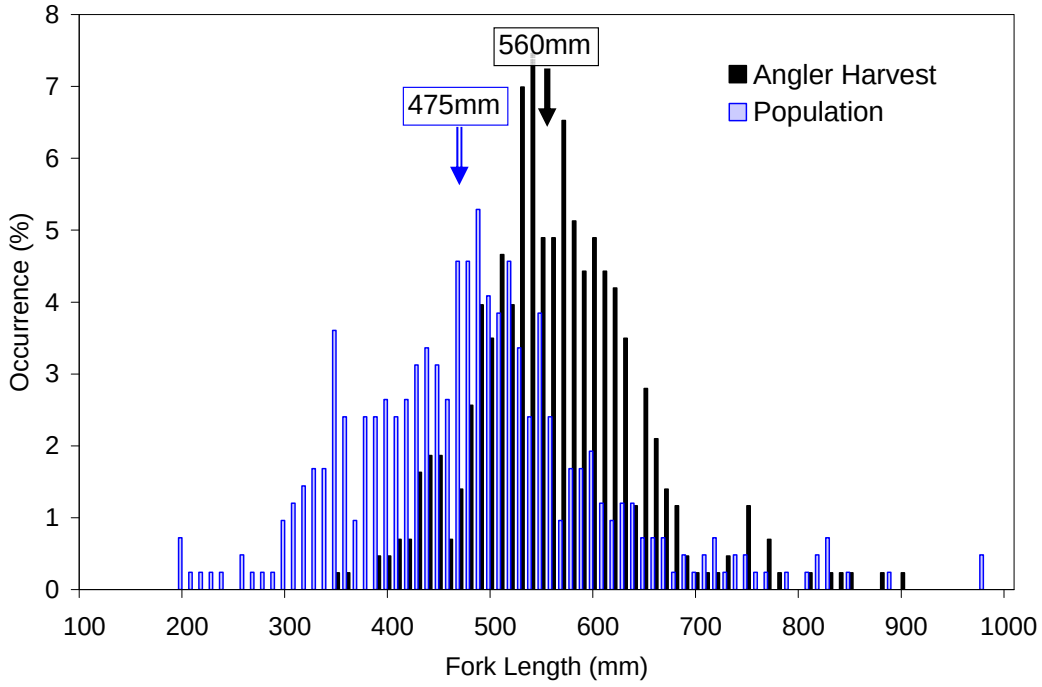
Figure 13. Angling effort on select Yukon lakes (YG data)**.**



Disproportionate Harvest of Large Fish

Angling tends to be selective for larger individuals (Birkeland and Dayton 2005; Cooke and Cowx, 2004; Lewin et al. 2006; Post et al. 2002). The average size of fish caught by Yukon anglers is considerably larger than the average size of fish in the population (Figure 14). There are two main reasons for this. First, large, sexually mature fish must feed aggressively in the summer growing months so that they can store up energy needed for reproduction. Consequently, they move around to a greater degree than smaller fish and are more likely to take a hook. Second, in many cases, anglers specifically target large fish through gear choice and habitat selection.

Figure 14. Length of lake trout harvested by anglers (black bars) from Tagish, Teslin and Kusawa lakes compared to those sampled during population surveys (blue bars) (YG data).



What are the consequences of removing large female fish from the population? Large fish are important to the well being of the population: they are more experienced spawners, produce more eggs of high quality, and can produce larger eggs which can increase larval size and improve early growth (Berkeley et al. 2004; Levin et al. 2006; Walsh et al. 2006). Offspring from older females have been shown to have higher survival rates and a better capacity to withstand starvation than offspring from younger females (Berkeley et al. 2004). Large fish also play an important role in population regulation of some species (Levin et al. 2006) and are important in maintaining predator / prey relationships. In the short term, a sustained harvest of large fish means that

fewer will be available to anglers. In unproductive northern systems, replacement of large fish can take many years.

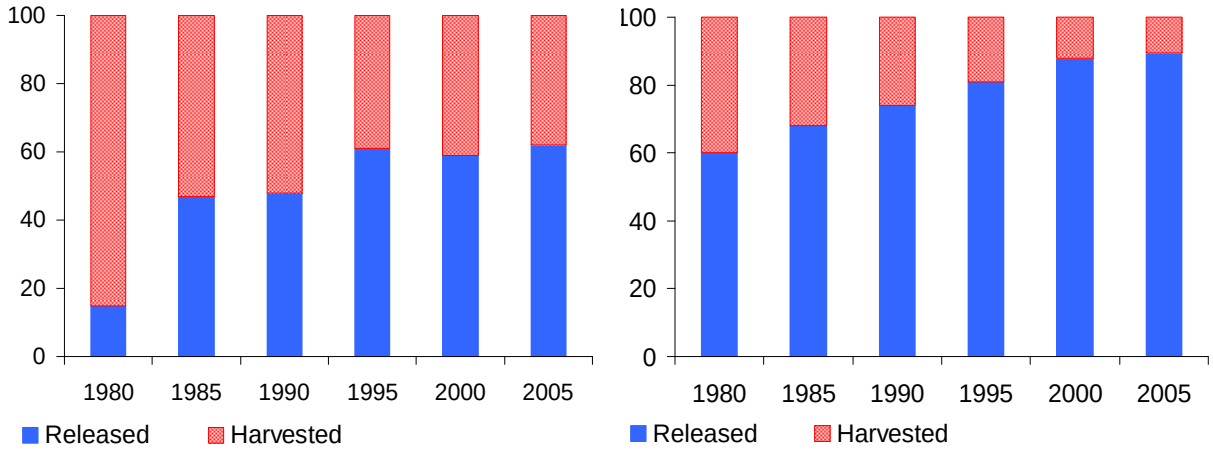
The sustained removal of large, old fish including females of spawning age can also have consequences over time. Intensive fishing pressure focusing on large individuals within a population can select against large fish, making it is less advantageous in an evolutionary sense to grow to large sizes. Experimental studies have shown that size selection can lead to a heritable reduction in body size over time scales as short as four generations (Conover and Munch 2002). Data on Yukon River salmon indicate that chinook have decreased in size over the last four decades with the most likely cause being the use of large-mesh gill nets that result in the capture of the largest fish (Hamazaki 2009).

When fishing pressure causes evolutionary changes within populations, it can result in reduced growth, lower yield, and a limited ability for the population to recover from overharvest (Berkeley et al. 2004; Birkeland and Dayton 2005; Conover and Munch 2002; Swain et al. 2007; Walsh et al. 2006). Although most current research has focused on commercial fisheries, this type of change can also occur in recreational fisheries (Lewin et al. 2006).

Live release (Selective Harvest / Catch and Release)

Live release is an important component of recreational fisheries management, although not everyone approaches live release in the same way. Some Yukoners, including many First Nations people, find live release disrespectful because they feel it amounts to playing with fish. At the same time, many recognize the conservation value of the practice, particularly when used as a selective harvest tool to avoid killing the large spawners. Live release provides a mechanism for anglers to diminish impacts to fish populations. If every fish that is caught is also kept, the impact of the recreational fishery in Yukon would be over five times greater. Angler attitudes and behaviour continue to shift. Non-resident anglers have always practiced a high level of live release, but the practice is becoming more popular among Yukoners (Figure 15). According to the most recent surveys, approximately three-quarters of anglers are now in support of fishing with barbless hooks and half are in support of live release of fish (cited in YFWMB 1999). The educational emphasis is now on live release in moderation while promoting a general attitude of respect for fish.

Figure 15. Proportion of lake trout released and harvested by resident (left) and non-resident (right) anglers in Yukon (DFO 1994, 1997, 2003, 2007).



When done properly, the survival rate for live-released fish can be as high as 94 per cent on average to 76 per cent for deep hooked fish (cited in YFWMB 1999). Many significant contributors to mortality can be controlled and reduced by good practice and these lessons are shared with anglers through the fishing synopsis, other publications, videos, and continued education programs. For example, the YFWMB has produced an excellent pictorial brochure on live release angling. Nonetheless, the impact of excessive live release fishing can be significant and live release should always be practiced in moderation.

Technological Advances

In Yukon, large deep lakes have traditionally meant that species such as lake trout had some protection from angling pressure during the summer when they move to deeper, colder water. However, the increase and improvement of downrigger technology has eliminated these deepwater refuges. Currently there are very few places in any lake that anglers cannot access. Larger and faster boats have also made large lakes more accessible. Even for the novice angler, fish are easy to find with the aid of fish-finder technology.

4.1.1 Mitigating Impacts of Harvest / Fishing Pressure

The impacts of harvest and fishing pressure can be mitigated through regulation and education, through the provision of alternative fishing opportunities in stocked lakes, and by shifting harvest to other species. Education and regulation can both result in a change in anglers' behaviour and can limit the quantity and quality (size, age, sex) of fish taken to ensure that harvest is sustainable. The stocked lakes program (Section 2.4) provides

anglers with high-quality angling opportunities for a variety of species. Proximity to communities, ease of access, and high success rates encourage anglers to use stocked lakes, reducing the pressures on wild fish stocks. Providing information on how to catch other, less-frequently targeted but abundant species, like whitefish, is a good way to shift some of the harvest pressure away from sensitive species. Environment Yukon's *Fishing on Yukon Time* brochure (available in print and online) provides descriptions of fish species and how to harvest them.

4.2 Impacts of Yukon Fisheries

Recreational Fishery

Anglers spend a cumulative 100,000 days fishing in Yukon each year catching 275,000 fish and keeping approximately 50,000 (DFO 2007). Regulations restrict the way in which fish may be caught, the number of fish that can be kept, and the size of each fish that can be taken. But even with these regulations, recreational angling still has a major impact on fish stocks. While an individual angler may take relatively few fish, the cumulative impact of 15,000 anglers can be large. Harvest controls on the fishery are imprecise and the impact from the recreational fishery has the potential to be high and widespread (Table 2). On waters where fishing pressure is particularly high the impact can be extreme and result in the decimation of fish populations.

Table 2. Level of impacts of Yukon fisheries.

Fishery	% Harvest	Harvest Controls	Extent of Impact	Potential Impact
Recreational	86	General	Extensive	High with potential for extreme localized impacts
First Nations	7	Can be specific	Localized	Low with potential for higher localized impacts
Commercial	5	Very specific	Localized	Low
Domestic	2	Very specific	Very Localized	Very Low

Commercial Fishery

Commercial harvest between 2000 and 2009 was small, with most lake trout harvest falling well below the allowable harvest on all four lakes (Table 3). Comparing lake trout harvest by recreational anglers to that of commercial fishers on these lakes, we find that the commercial fishery is harvesting below their allowable harvest and in some cases, as seen on Teslin Lake, well below that harvested by anglers. The harvest of fish in the commercial fishery is tightly regulated and managed. In addition, the impact is restricted to specified

lakes and rivers. The impact of the commercial fishery on Yukon fish stocks is low.

Table 3. Harvest of lake trout by commercial fishers (average of 2000 - 2009) and anglers (values from most recent creel survey) (YG data).

Waterbody	Commercial Quota (kg)	Commercial Harvest (kg)	Angler Harvest (kg)
Atlin Lake	525	115	No data
Bennett Lake	550	275	135
Kluane Lake	3,050	80	630
Teslin Lake	125	0	2000

Domestic Fishery

Currently, the catch of freshwater fish in the domestic fishery accounts for two per cent of the total freshwater harvest. The harvest by the domestic fishery is tightly controlled and is restricted to certain lakes that are usually not fished by recreational anglers due to their remoteness from communities and difficult access. The impact of the domestic fishery on Yukon fish stocks is very low.

First Nations Fishery

While First Nations are not obligated to record or divulge harvest information, they sometimes share harvest records with the Yukon government. Harvest is estimated to be less than 4,000 fish of all species per year. Across Yukon, the impact on fish stocks from this fishery is considered to be very low. However, in some circumstances, such as harvest of spawning aggregations, the First Nations fishery may have significant localized impacts.

4.3 Fish Parasites and Diseases

Parasites can negatively affect the health of individual fish and fish populations by increasing stress, limiting feeding, impairing respiration, and reducing spawning frequency. The impact of a parasite depends largely on what it does to the fish and where it attaches to its host. Many parasites affect the gastrointestinal system, while some, including flatworms, bind to the gills and affect respiration. Some parasites can cause serious damage and even kill their hosts.

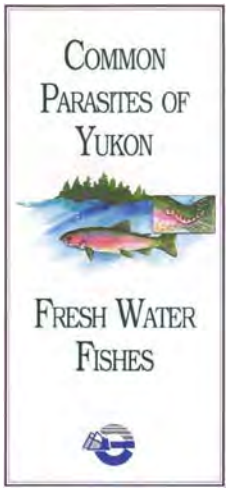
Fish diseases, caused by either bacteria or viruses, can target different organ systems, impair bodily functions, and manifest themselves through different physical signs. Diseases can devastate fish populations in short periods of time and, once introduced, eradication or control can be difficult.

Environment Yukon currently conducts investigations and testing for parasites and diseases on an as-needed basis. Prevention is the primary component of the strategy to reduce the impact of fish diseases and parasites. The most common way diseases are spread is through the introduction of

aquatic organisms, including fish, to lakes and rivers. Movement of aquatic organisms is strictly controlled through the Yukon Introductions and Transfers Committee, a joint federal-territorial process. New federal Health of Aquatic Animals legislation will address the control and eradication of fish diseases.

Common diseases and parasites of Yukon Fishes

A survey in 1993 identified the major parasites found in Yukon fishes as tapeworms, roundworms, flatworms or flukes, and leeches. In small numbers, these parasites pose little to no risk to their fish hosts. However, in large numbers they can cause adverse behaviour and physiological changes that can make fish more susceptible to predation and result in increased morbidity and, in severe cases, mortality. Several lakes including Snafu, Tarfu, and Little Atlin lakes have populations of lake trout, lake whitefish, and northern pike that are heavily infested with the tapeworm Triaenophorus that manifests itself in the form of cysts in the flesh of lake trout and whitefish and adult tapeworms in the intestines of pike. While unsightly, this parasite poses no health risk to humans.



One of the most dramatic examples of the devastation that a disease can cause came during the summer of 2003 in Watson Lake. There, anglers witnessed a decimation of northern pike. Red sores and tumours visible on the pike indicated that a virus (Lymphosarcoma) could have been the cause of the near total wipeout. Luckily no other fish species in the lake were affected. Pike have since recovered in the lake but no explanation for the outbreak of the disease has been found. Other diseases including Ichthyonphonus (a fungus), Furunculosis (a bacterium), and infectious pancreatic necrosis (a virus) have all been found in Yukon. For anglers interested in the common parasites in Yukon fish, a publication with this information is available on the Environment Yukon website.

4.4 Introduced and Invasive Aquatic Species

Aquatic invasive species are organisms whose introduction can lead to over-predation on native species, disruption of food sources, changes in water quality, or alteration of habitats (CCFAM 2004, OAG 2008). There are several ways that species can be introduced, including:

- **Recreational Fishing:** Invasive species may cling to waders, boots, and other fishing gear if not properly cleaned, and be transferred between waterbodies. Bait itself may be an invasive species if transported live, or carry parasites or diseases. In Yukon, fishing with live bait is not permitted, however dead bait may also carry diseases.

- **Recreational Boating:** Invasive species can attach to boats, motors, trailers, or other equipment and be released when the boat is launched in a different waterbody. Yukon lakes are accessed by boats that are frequently moved between waterbodies, watersheds, and other regions.
- **Aquarium Trade:** This includes the transfer of fish, invertebrates, plants, amphibians, and reptiles that are popular for aquariums and ponds, but are generally not native to the area. Invasion may occur when an organisms escapes or is released to the environment. This is most likely how goldfish came to be established in the Takhini Hot Springs. Thankfully, the cold climate makes Yukon waters a hard place for these species to establish themselves.
- **Unauthorized Introductions and Transfers:** The introduction or transfer of fish or plants must be authorized by federal and territorial fisheries management agencies and will not be permitted if the species is considered to be invasive. All transfers are carefully screened and monitored by an Introductions and Transfers Committee. In the past, before such controls were in place, an introduction of invasive species into a small number of Yukon waters occurred as a result of a stocking program. Also, an escapement of fish from an aquaculture facility led to the establishment of Arctic char in McIntyre Creek.

Despite being far away from the epicentre of many of the largest fights against invasive species in North America, Yukon is not immune to the threat of invaders. Zebra mussels first arrived in North America in 1988 and since then have spread throughout the Great Lakes region and across to the Pacific. This organism causes huge ecological damage and costs taxpayers millions of dollars by damaging infrastructure including water supplies, navigation, boating, recreation, and hydro power. Yukon is so far mussel free, but it is not immune to the spread of this organism. Twice in the past few years zebra mussels were found attached to recreational watercraft entering Alaska from Yukon by US Customs and Border Protection agents who are trained to identify invasive species. On one occasion, three boats were turned back, purportedly taken to Whitehorse by the owners and professionally cleaned, at which point they returned to the border. The second inspection found that the boats were free of mussels and were allowed into Alaska. On the second occasion, two boats were turned back and did not return to the border crossing for a second attempt at entry. No reports of zebra mussels have been recorded before or since this incident, but it highlights the need for education, legislation, and monitoring of aquatic invasive species.

Several species of fish have been introduced to Yukon. Though not all species are invasive, meaning that they do not compete with native species or do not spread rapidly, they are nonetheless unplanned and unwanted introductions. These include:

- **Goldfish:** These aquarium pets were released into a pond at the Takhini Hot Springs. Due to the concern that these fish would escape into the Takhini River, the Yukon government undertook an extensive program to remove the species from the ponds. Following removal of the fish through netting, predation, and ultimately treatment with a fish toxin, more were released into the same pond. Public education concerning potential impacts may help to prevent this from happening again.
- **Rainbow Trout:** Rainbow trout occur naturally in the Kathleen River system and elsewhere in the Alsek drainage, but in the 1950s they were stocked into an open system in the Upper Yukon River watershed near Whitehorse. They escaped and colonized McIntyre Creek. Since then, they have been captured downstream in the Yukon River, observed in the Whitehorse Rapids Fishway, and have established a self-sustaining population in Croucher Creek, a tributary to the Yukon River within the City of Whitehorse. Their presence may lead to competition with native species including juvenile chinook salmon and Arctic grayling. Their current range is not well understood, and the species appears to be spreading slowly.
- **Threespine stickleback:** In the 1970s, threespine stickleback were accidentally brought to Yukon with a shipment of rainbow trout destined for Gloria and Long lakes, two of the regularly stocked pothole lakes. Somehow the stickleback had been introduced to the BC hatchery that supplied the rainbow trout. Since then, the stickleback remains confined to these lakes.
- **Arctic char:** On several occasions, Arctic char have escaped from a local aquaculture facility. Char are now found in both the McIntyre and Porter creek systems where they do not naturally occur. The facility has since taken measures to prevent further escapes.

Little information about potential or existing invasive species in Yukon is available. To some extent, Yukon is sheltered from major pathways of introduction. Travel distances to Yukon decreases the number of boats brought by road and the cold water combined with harsh winters make it difficult for many non-native species to become established. However, the zebra mussel example and the existence of introduced species clearly demonstrate that Yukon is not immune to these issues. Although monitoring and reporting systems are being implemented in other jurisdictions in Canada, at this time there is no such system in Yukon. The potential clearly exists for significant impacts to Yukon freshwater fisheries and ecosystems from invasive species.

When dealing with invasive species, the most effective approach is prevention. Once an invasive species is established, eradication and control become difficult and very expensive. A comprehensive invasive species strategy will examine the ways by which species can enter or spread and develop an approach to minimize introductions as a first priority. If prevention fails,

emphasis is then placed on detection, then on rapid response to prevent establishment, and finally, on management to contain any introduced species. Yukon currently lacks such a strategy to deal with aquatic invasive species.

4.5 Impacts to Fish Habitat

Healthy fish stocks are dependent upon healthy habitats. Across Canada, the federal Department of Fisheries and Oceans has the legislative responsibility and mandate to manage and protect all fish habitat. The Yukon government collaborates with the federal agency on the management of fish habitat where impacts affect territorial fisheries or conflict with local fish management goals.

Fish habitat is managed according to DFO's 1986 Policy on the Management of Fish Habitat (DFO 1986). One of the principal components of this is the No Net Loss policy. When habitat alteration, destruction, or degradation occurs, an equal area of equally suitable habitat must be created as compensation.

Aquatic ecosystems are influenced by a number of natural factors including water temperature, sediment, turbidity, and nutrient content. Water temperature affects incubation time of eggs, spawning times, and may make fish more susceptible to disease. Sediment can cover or change spawning gravels and fine sediments on spawning sites reduce water flow and oxygen levels. Turbid or murky water makes it more difficult for fish to see their food. Elevated levels of nitrogen and phosphorus can cause an increase in productivity with detrimental effects such as raised water temperature, decreased water quality, and oxygen depletion which can weaken and eventually kill fish.

Compared to other, more densely populated and industrialized jurisdictions, Yukon has experienced lower levels of development pressure on aquatic ecosystems. In Yukon, residential development, forestry, hydro development, roads, and mining have the potential to cause stress on fish and fish habitat.

Residential Development

Residential development requires clearing of natural vegetation and building infrastructure including roads, power lines, and sewer systems. Once residential development is established in an area, the amount of human activity increases and so does the impact on aquatic ecosystems, fish, and fish habitat.

Forestry

Forestry activities can affect fish habitat, especially where deforestation occurs in the riparian areas near streams, rivers, and lakes. Clearing and removal of vegetation increases erosion and runoff into nearby waterbodies. Forestry and clearing in riparian areas can affect water temperatures, water

volume, water quality, debris loading and ultimately stream morphology and productivity. Across Yukon, forestry is of low to moderate concern as a stressor to fish and fish habitat, but can have significant localized impacts.

Hydro

Hydro developments can impact fish and freshwater ecosystems by blocking rivers or streams and altering the timing and level of annual flows. In Yukon, current development is mainly limited to three Yukon watersheds including three hydroelectric power plants run by Yukon Energy Corporation. These include the Whitehorse Rapids Plant on the Yukon River, the Aishihik Hydro facility downstream of Canyon and Aishihik lakes and the Mayo Hydro Plant on the Mayo River downstream of Wareham and Mayo lakes. Additionally, the Yukon Electrical Company Limited operates a micro hydro facility at Fish Lake, west of Whitehorse. These developments have had some impact on local fish populations and this will likely increase as the territory looks to hydro to meet its energy needs. The Yukon Energy Corporation's 20-year resource plan anticipates that demand for energy in the territory will continue to grow and identifies possible projects for increasing electrical generation (YEC 2006). These projects include construction of a new powerhouse and modification of lake level management at Mayo, alteration of water storage on the Marsh Lake system, and diversion of Gladstone Lakes into Isaac Creek at the headwaters of the Aishihik system.

Roads

Roads impact fish and fish habitat primarily by increasing human access, impacting water quality, and fragmenting or breaking up aquatic habitats. New roads to lakes and rivers can quickly lead to increased harvest pressure, a reduction in the fish population, and a drop in angling quality. Most road crossings of fish-bearing streams require either a bridge or culvert. When culverts are improperly installed, fish passage can be disrupted by creating barriers due to high water velocity or perching of culverts that creates a waterfall. Currently, some road and highway culverts across Yukon are barriers to fish passage. However, passage can be restored through better design, repairs, and regular maintenance.

Hard Rock Mining

Hard rock mining involves removing materials from the ground through excavation. Waste material called tailings are a by-product and are often high in contaminants. Such mining developments can affect fish and freshwater ecosystems through increased sedimentation, nutrient loading in fish habitats, and through the leaching of contaminants to fish-bearing waters. In some cases, significant sections of creeks are destroyed or degraded and the lost fish habitat must be compensated for elsewhere. These impacts are for the most part localized. However, in some cases, they may have far reaching effects when toxic runoff is carried far downstream. The impacts of hard rock mining

to fish and fish habitat can be extremely long term, carrying on long after the operational life of the mine.

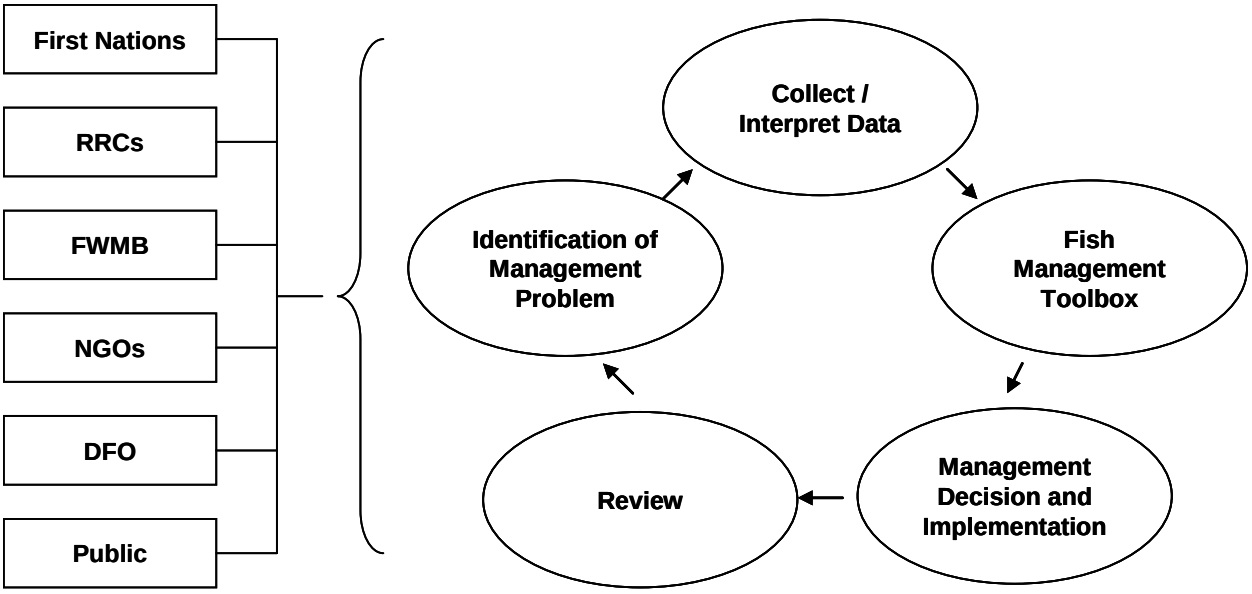
Placer Mining

Placer mining uses water to mechanically separate gold deposits from the sediment, dirt, and gravel in which it is found. Large volumes of sediment-laden water are produced as a result. Placer mining can affect freshwater ecosystems by physically altering habitat at the mine location, changing downstream water quality through increased sedimentation and turbidity, and by changing the flow regime. Government of Yukon, Fisheries and Oceans Canada, and Council of Yukon First Nations have developed a management system for Yukon's placer mining industry that allows for the protection of fish and their habitats while allowing a sustainable placer mining industry. Most placer mining is concentrated in relatively few drainages that have a long history of disturbance. New reclamation standards ensure that fish habitat is now restored at the end of mining.

5 Yukon Fisheries Management

The development of freshwater fisheries management in the territory is based on the fundamentals outlined in the Yukon Umbrella Final Agreement. Land claims opened the door to broader, more inclusive management and created public advisory bodies such as the YFWMB and RRCs. Many current programs, policies, and approaches were developed with involvement from these partners. Territorial fisheries management is now a comprehensive process that involves identification of a problem, data collection, decision making, and follow up evaluation with input from various management partners occurring at all stages (Figure 16). The process allows for feedback and flexibility in order to adapt to future needs.

Figure 16. Yukon fisheries management process.



5.1 Identifying the Management Problems

Early identification of issues ensures that Yukon fish stocks remain healthy. Identification of fisheries management concerns comes from many sources, including monitoring of angler harvest and fish populations, the angling public and traditional and local knowledge and is reflected in the first step of the process (Figure 16). Management problems vary from those related to the status of fish stocks to the health of habitats and ecosystems. One of the key challenges is to have adequate and appropriate information to be able to conclusively demonstrate a management issue and then also to demonstrate that the chosen solution successfully addressed the issue.

Assessment of the status of fisheries often involves comparing the current condition with available baseline, or historic, information. In the absence of an historical record, managers may use relatively recent data to represent baseline conditions even though these conditions could have changed through time due to human impact. Thus, the baseline that is established may not truly reflect the historic, or natural, condition. This phenomenon also affects the perceptions of anglers which are formed by experiences in their own lifetimes and may differ greatly from those of anglers of the previous generation (Box 1).

Box 1. Shifting baseline syndrome.

Each generation of anglers and fisheries managers establishes a baseline of what is 'good fishing' or 'natural' based on their life experience. This baseline may be radically different from the baseline belonging to previous generations. What one generation considers poor fishing or depleted will be considered by the next generation to be normal and all future changes will be judged in reference to the new baseline. This phenomenon, known as the shifting baseline syndrome, has the potential to obscure historic changes. Management decisions should be based on environmental conditions that are as close to a "natural baseline" as possible. As a result, it is important to document and learn from elders and those that have maintained a long connection with the land so that we can maintain a true sense of what natural conditions can and should be (Pauly 1995; Sáenz-Arroyo et al. 2005).

Annual Monitoring

Many fisheries issues can be identified or predicted through annual monitoring programs. These programs usually focus on the most socially important management issues and the most ecologically vulnerable species. The recreational fishery is a major focus of annual monitoring because anglers are the heaviest users of the resource. In terms of species, lake trout are a primary focus of monitoring programs because they are a valued component of the ecosystem and are targeted by anglers.

Over the years, trends in fish stocks can be tracked through time. This allows potential fisheries concerns to be identified as they arise, and the effects of past management decisions to be evaluated. There are two main monitoring programs conducted annually: angler harvest surveys and surveys of fish populations.

Monitoring Angler Harvest

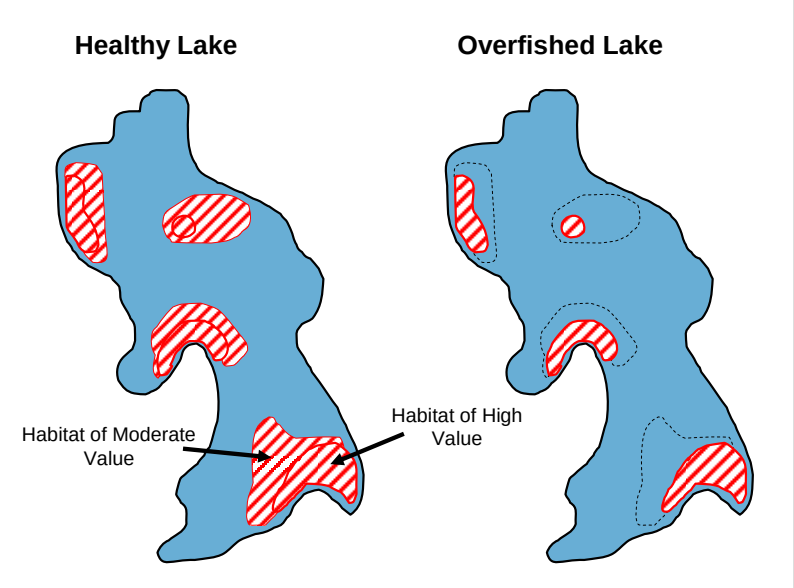
Angler harvest surveys, or "creel surveys", as they are more commonly known have been conducted on 34 of the most popular and heavily-fished lakes each year since 1990. Some of these key fisheries have been surveyed as many as eight times. "Creel" refers to the wicker baskets historically used by anglers to carry home their catch.

Creel surveys provide estimates of the amount of fishing effort, the numbers of fish that were caught and harvested, and angler success rates. Data also reflect seasonal patterns of use, origin of anglers, success rates by species, and biological information on the harvest including length, weight, sex, and age of the fish. One of the main outcomes of these surveys is an identification of over-harvested fisheries through a comparison of total harvest to an estimate of the sustainable yield.

Creel surveys also provide an opportunity for anglers to voice their opinions on fish stocks and regulations. Unfortunately, angler catch compared to effort is not always a reliable measure of fish stock health because anglers always seek out the best fishing locations so their effort is not distributed evenly across a lake. Indeed, anglers may happily go on fishing a lake until there are very few fish left and may not take notice, a phenomenon called the ”invisible collapse” (Box 2).

Box 2. Invisible collapse.

Anglers are predators and seek out their prey in the most efficient and effective manner. In the figure below, the red hashed areas represent areas of highly and moderately suitable fish habitat and fish density. In a healthy lake, fish are distributed in both the good habitats and habitats of lesser value. Good anglers know where these habitats are and will fish primarily in these locations. When a lake is over harvested and the population declines, fish will shift to using only high quality habitat. Anglers who fish these high quality habitats will continue to have high success rates, sometimes even increased success rates, despite an overall decline in the number of fish in the lake. Consequently, anglers will often not detect declines in fish populations, hence an ‘invisible’ collapse (Post et al. 2002). Relying on angler catch statistics to estimate population health is therefore not always the best approach and should not be the only way in which fisheries are monitored.



Monitoring Fish Populations

Assessments of lake trout populations are conducted on several lakes each summer. These surveys involve setting nets in a lake for short time periods. Fish are captured, carefully handled to gather information on length and weight, and then released. These surveys produce an index of fish density called "catch per unit effort" (CPUE) that can be used to measure changes in fish abundance over time. An increase in the density index indicates an increase in the abundance of lake trout within the lake. These surveys do not estimate the actual lake trout abundance (the number of fish in the lake) nor are they designed to monitor species other than lake trout. They require substantial resources as they are performed from boats with at least two crew members and as many as 150 one-hour net sets might be done on a large lake although smaller lakes may require as few as 10 one-hour sets.

While the Yukon government focuses its annual monitoring efforts on lake trout and lake fisheries in order to efficiently utilize resources, this creates significant data gaps for other species such as Arctic grayling, northern pike, and whitefish and for river and stream ecosystems. Targeted monitoring programs on fisheries of interest and heavily used waters can provide better information for management purposes. For example, there are several popular lake fisheries for northern pike. While creel data indicates that some populations are likely stressed, current assessment methods do not provide a clear picture of pike population dynamics. Management of pike stocks and their use is challenging when only limited information is available.

Local Knowledge

Fisheries issues are often raised by First Nation governments, RRCs, Conservation or Fishery Officers, community planning processes, anglers, or the general public. These sources provide useful information on local conditions and opinions and provide a useful addition to information gathered through monitoring to identify fisheries management concerns. Where problems are identified, resources are focused in the areas of highest concern. Through the incorporation of local knowledge and collaboration at the community and regional levels, the identification of issues, the setting of priorities, and the gathering of information are carried out in support of management decision making. While there are already many avenues in place to engage local knowledge in management such as through RRCs and region or lake-specific plans, further opportunities to engage local residents and anglers should be explored.

5.2 Collecting and Interpreting Data

In order to have a well informed decision-making process, all relevant fisheries data need to be identified and interpreted. They also need to be stored in a way to allow easy and efficient access. Environment Yukon is continuing to work on its website and is working on the improvement and centralization of fisheries information into databases. In order to address specific fisheries

issues, annual monitoring programs may need to be redirected or new programs developed. Some of the currently available annual monitoring data is described in the following sections.

Comparing angler harvest to productive capacity

The productive capacity of a lake ecosystem is a measure of how much organic matter or living material is produced on a yearly basis and can be measured at different levels of the food chain. Lakes vary in productivity in relation to their size, shape, latitude, altitude, climate, amount of nutrient inputs, and many other factors. Shallow lakes at low elevation with large nutrient inputs, large littoral areas, and with more warm growing days tend towards greater productivity.

Productivity of a lake can be expressed per hectare or for a lake as a whole, in which case it represents the productivity of the entire fish community. Productivity can also be expressed on a species-by-species basis. For fisheries it is generally expressed in terms of the number of fish of harvestable size that are produced each year.

Biologists use rough models to estimate the productivity of lakes and express this as a Maximum Sustainable Yield (MSY), or the maximum number of fish that can be taken each year over an indefinite period. In Yukon, a modified indicator, Optimum Sustainable Yield (OSY), is used to represent the number of fish that can be harvested from a lake over an indefinite period while maintaining a high quality fishery. This number is compared to the estimated harvest obtained from angler harvest surveys and production records of other fisheries. A harvest greater than the OSY, is an indication that a lake may be overharvested. One difficulty is the imprecision of MSY and OSY estimates for Yukon lakes. Further refinement of these estimates of lake productivity will provide greater certainty to management decisions.

Tracking abundance through time

In order to implement and measure the success of management actions there must be appropriate supporting data. The ability to accurately assess the state of fish populations or track their status through time with an appropriate degree of precision is required.

Creel surveys are one reliable indicator of angler success and can be tracked through time. However, these surveys do not provide a basis for population size estimates. Angler success will often remain high even as populations decline because anglers are very effective at targeting species. So while declining angler success likely indicates population concerns, angler success may appear to be stable even while a fish population is declining (See Box 2).

Stock assessments using nets and other methods of fish capture are used to track changes in fish populations through time. These surveys are generally meant to be used as rapid assessment and were not originally

intended to be statistically robust. While the methods do give a picture of population abundance, they are imprecise and are only able to detect large changes in populations. While these monitoring methods do provide valuable information, they are not entirely meeting current management needs. More refined methods to monitor and assess fish populations are required to provide accurate and robust estimates that are needed to make informed management decisions.

5.3 Management Decisions & Actions: Process

Generally speaking, most non-habitat fisheries management issues are related to over-harvest so the solutions usually involve altering the behaviour of anglers or the intensity of angling effort and harvest. The section below outlines the various tools available to fisheries managers.

When fish populations are identified as needing increased protection or conservation, the Yukon government consults with its partners to discuss appropriate measures and approaches. In the case of a regulatory change, the Yukon government, other agencies, or the public can forward proposed changes through the existing regulation process that involves public consultation. Eventually, proposals are forwarded to the Yukon Minister of Environment for consideration. If approved, a new regulation or amendments to current regulations may be required. Decisions are made according to the best available information while also considering the precautionary principle (see Box 3).

One challenge of the regulatory process is the time that it takes to implement new regulations. It is critical for managers to be able to effect change in a timely fashion for new regulations to be most effective. As many changes require amendments to regulations under the federal Fisheries Act, they often take a long time to enact because they must go through a territorial process initially and then a federal process, which may take several years.

Box 3. Precautionary principle.

The precautionary principle finds its basis in old adages like “better safe than sorry” and “first do no harm”. Its essential message is that a lack of scientific knowledge should not be taken as reason for inaction should there be significant risk to the environment. Principle 15 of the Rio Declaration from the Rio Earth Summit in 1992 states: “In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation" (United Nations 1992).

This basic principle has widespread acceptance and should be used in conjunction with risk management to guide decisions. It should be used when there is a lack of scientific data but the risk of adverse, lasting, or permanent effects is high.

Fisheries regulations are either reactive, meaning those that respond to arising issues, or proactive, those that anticipate potential problems. The Yukon government has tried to be proactive in developing regulations that are designed to manage fish stocks before they show signs of decline due to overharvest. The objective is to apply conservative regulations before fish stocks begin to go down, particularly for populations known to be at a higher risk of decline due to improved or increased access, their sensitivity to over exploitation or other factors. This precautionary approach is necessary as it may take years or decades to fully understand how regulation changes have affected populations. This highlights the importance for resource stewards to identify potential concerns early and be proactive in developing long-term plans and protective regulations. Oversight of Yukon fisheries management involves developing and maintaining a safety net of proactive regulations and management programs to reduce the risk of long term stock declines. However, since it is not possible to anticipate all potential management issues, reactive approaches continue to be needed to address unforeseen and arising issues.

5.4 Management Decisions & Actions: the Fisheries Management Toolbox

Once a decision has been made for action, the most appropriate solution must be found and implemented. Many of the most effective ways of addressing issues are through regulation, which legally requires anglers to behave in a certain way, and education which gives anglers the knowledge and skill to change their own behaviour.

Regulatory changes

There are many tools available to fisheries managers to address a wide array of problems (Box 4). Regulatory limitations on fish harvest for the most part are very blunt tools. Fish harvest regulations can limit gear, size of allowable fish, and catch and possession limits. They do not necessarily limit overall effort or harvest, nor do they always reduce the total harvest. Stricter and more precise tools such as limited entry or individual annual quotas are available for those situations where they are needed. However, these approaches tend to require additional enforcement and administrative costs.

Regulatory approaches to fisheries management in Yukon have generally used the approach of limiting harvest to sustainable levels while not limiting fishing opportunities. Yukon is a rarity amongst Canadian jurisdictions in that open seasons are maintained year round and there are no closed areas except for those to protect migrating salmon. Instead, harvest control relies upon catch and possession limits, size limits, and some limited gear and bait restrictions.

Box 4. The fisheries management toolbox.

Tool	Goals, method of application, upsides, and downsides
Catch limits	Limit the number of fish an angler may catch and keep in on day. Catch limits are blunt instruments in limiting the overall harvest because without controls on effort (either number of anglers or time spent angling), catch limits cannot guarantee harvest reductions. Additionally, catch limits provide for some distribution of the resources among users and convey information about the state of the resource that helps anglers make decisions about their own effort and harvest. Catch limits assign a value to the resource in that it is finite and subject to impact if harvest is not controlled.
Possession limit	Limits the number of fish an angler may legally possess at any one time, including those fish that have been processed and stored and those in transit. Possession limits have similar advantages and drawbacks as catch limits.
Aggregate catch limit	Limits the number of fish that can be taken by an angler in one day whether fish are kept or released.
Gear restriction	Provides protection for certain species or life stages (e.g., artificial flies). Often used in conjunction with other restrictions such as size limits to facilitate compliance and reduce mortality (e.g., barbless hooks). Provides for an equitable distribution of the resource (e.g., limit on number of hooks or lines allowed).
Bait restriction	Limits catch and harvest. Also addresses issues of disease and parasite transfer and the introduction of Aquatic Invasive Species.
Size limit (general)	Limits the impact on the resources without restricting fishing opportunities.
Size limit: maximum size limit	Where all fish above a certain size must be released; limits the harvest on large fish that are an important component of the spawning population. Can be a hard limit whereby no fish may be taken above a certain size or a soft limit whereby only one or very few fish may be taken above a certain size (“trophy fish”).
Size limit: minimum size limit	Where all fish below a certain size must be released; provides protection of small fish, generally with the intent to allow fish to spawn once before they are susceptible to the fishery.
Size limit: slot limit	Where all fish within a size range must be released (protected slot); limits the harvest of spawning fish while allowing harvest of smaller fish and very large “trophy” fish.
Limited entry	Similar to wildlife management practices, provides complete control over the harvest through access restrictions usually involving a tag system. The downside is that open-access is removed and angling opportunities are limited for those without tags, though

	live release may be allowed.
Annual individual quota	Limits the number of fish an individual angler may harvest in any one year. Provides for a truly equitable share of the resource but is nearly impossible to monitor or enforce.
Seasonal closure	Provides protection for species during certain periods of the year (e.g., fall spawning season for lake trout or spring spawning season for Arctic grayling; may include pre- and post-spawning aggregations). Involve complete fishing closure and so prevent the harvest of all species. The downside is that open-access is removed and angling opportunities are limited.
Non-retention	Provides protection from harvest while allowing live release angling opportunities.
Fishery closure	Provides complete protection from harvest and live release pressure, so that highly imperilled stocks may recover. These closures are not meant to be indefinite, and would be removed once the stock has recovered sufficiently.
Freshwater Protected Area (FPA)	Provides complete protection from harvest and live release fishing on important habitats such as spawning grounds. These are used frequently in marine environments as tools to ensure long term sustainability of the resource.
References: OMNR 2007	

Education and communication

Educating anglers so they consider themselves stewards of the resource and are aware of their impacts may be equally if not more important than regulations in achieving sustainable, high quality fisheries. In addition, by obtaining public support and understanding, Yukoners are more prepared to accept fisheries management decisions. The Yukon government currently runs several programs aimed at promoting understanding of fish and fish resources including the summer educational and school programs.

Communication of the status of the resource, the challenges it faces, changes in rules and regulations, and best practices are all important parts of good fisheries management. The Yukon government and its partners have a number of brochures and pamphlets that provide information on stocked lakes, where and how to fish, live release techniques, a species guide, a guide to fish parasites, and a summary of the fishing regulations. A major education challenge is reaching the 8,000 to 10,000 casual Yukon anglers who may not be interested in attending meetings and reading reports or pamphlets. A targeted, multimedia communications strategy may be useful in reminding anglers of the regulations, convey the state of the resource, and reinforce best practices, especially to the great number of casual anglers.

5.5 Compliance and Enforcement

Data suggest that some anglers do not comply with all regulations. According to conservation officer records, the number of fisheries infractions for the years 2003 to 2008 has varied between 12 and 18 per cent with a slight increase over the last four years. Most infractions are from non-compliance with barbless hook requirements or fishing without a licence. Other infractions like keeping a fish of a non-legal length (either because of a slot limit or maximum size limit), keeping too many fish (exceeding catch or possession limits), and fishing with two rods are encountered less frequently.

In some cases, anglers break the law unintentionally, where they indicate support for the regulations but may not have not taken the time to familiarize themselves with the specific rules for the waterbody they are fishing. Improved communication and explaining the reasons behind regulations will help increase an understanding of the importance of knowing and following the rules.

In those cases where anglers purposefully disregard regulations, focused education may help these anglers appreciate the impact of their actions on a public resource. Enforcement is another key component in addressing this type of non-compliance. However, enforcement capacity in the territory is limited and increased and targeted enforcement efforts will be needed to address this type of non-compliance.

Angler surveys suggest that about one quarter of all anglers feel the Yukon fishing regulations are too complex, which may lead to unintentional infractions. However, almost all anglers claim to understand them (Figure 17) and Yukon's regulations are simple compared to most jurisdictions across the country (Figure 18). In either case, making the regulations as easy to understand as possible will help anglers abide by them.

Figure 17. Opinions of anglers regarding Yukon fishing regulations in 2000-2002 (YG data).

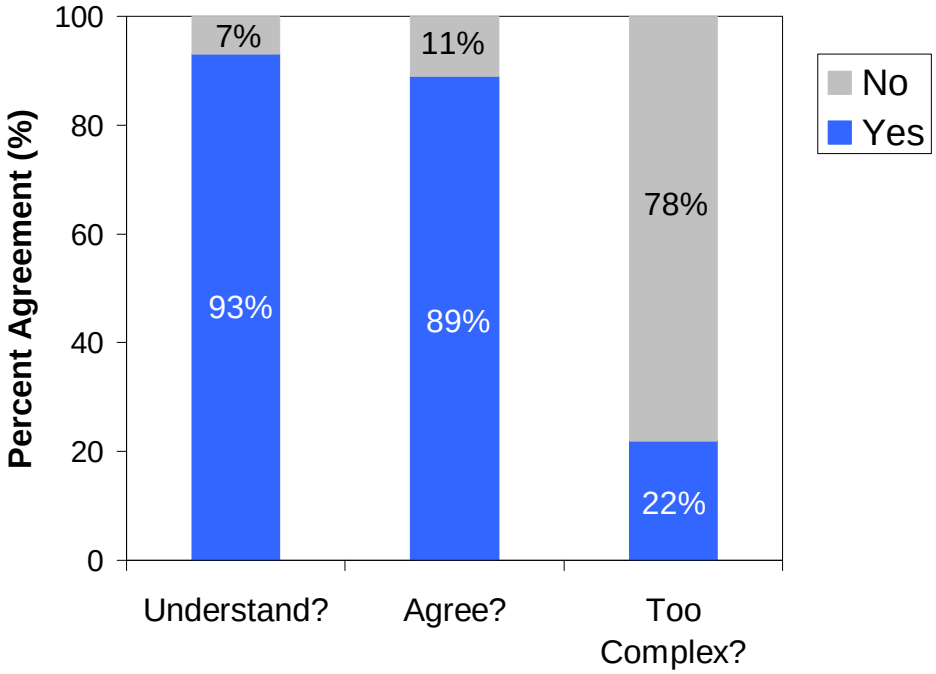
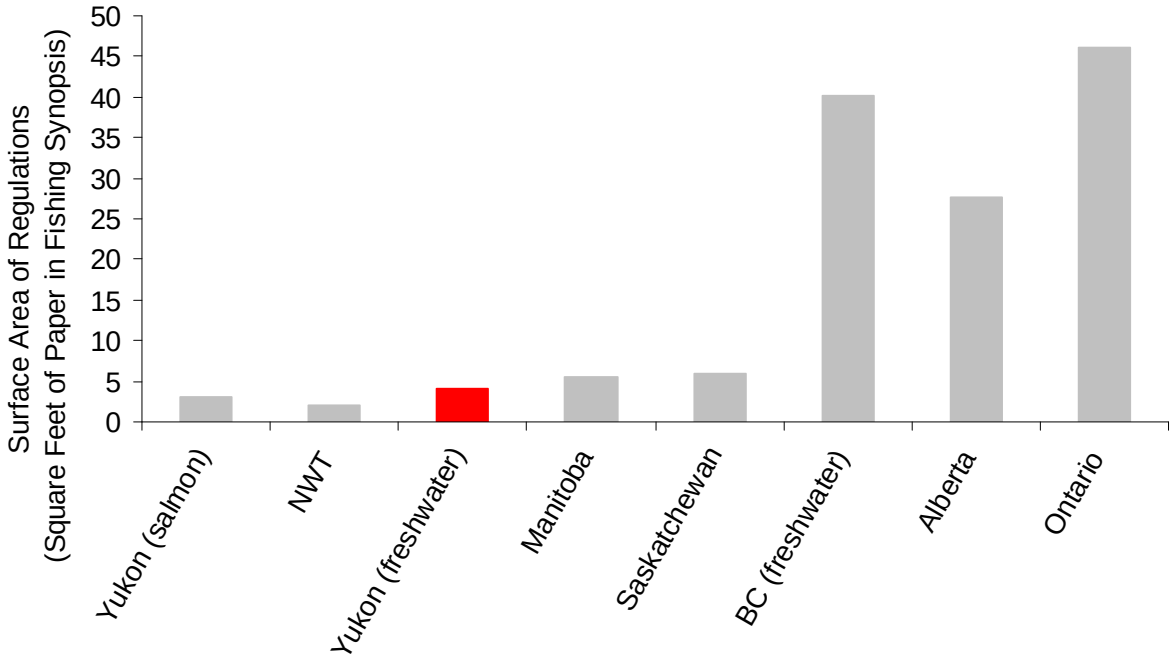


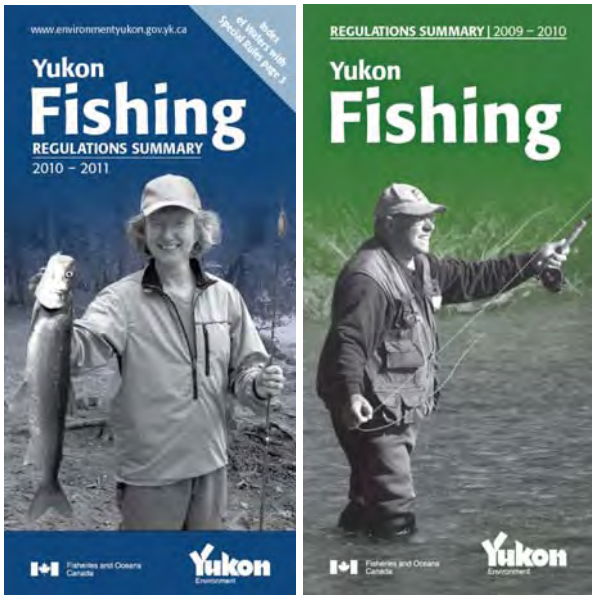
Figure 18. Relative complexity of angling regulations in several Canadian jurisdictions, as measured by surface area of regulations (square feet of paper in fishing regulations).



6 Yukon's Angling Regulations

Yukon's angling regulations adapt in response to new challenges and issues. The regulations are developed based on the best available information and incorporate elements of the precautionary principle. In Yukon, regulations aim to maintain fishing opportunities while providing sufficient protection so that angling remains sustainable and healthy fish resources are here for many generations to come. Several major regulation changes have been introduced to afford special protection to at-risk or sensitive fish populations and to maintain healthy, high-quality fisheries.

Most Yukon anglers understand and agree with the regulations. However, some find them too complex (Figure 17). Yet, compared to almost every other Canadian jurisdiction, Yukon's angling regulations are very simple and easy to interpret (Radford 2004 and Figure 18). Some portion of the disagreement with regulations may arise from an incomplete understanding of the background and purpose behind the regulation. Each regulation is in place to address a specific management concern or to uphold a general principle or meet a goal of fisheries management. Yukon regulations aim to strike a balance between simplicity, which increases comprehension and compliance, and effective population management, which ensures sustainable use of the public resource across the entire territory. Without lake- or river-specific regulations, many populations would be quickly over-harvested.



Continuous work to improve the clarity and comprehension of the angling regulations summary booklet helps anglers to better understand what they are and are not allowed to do. It is also incumbent upon each angler to take the time to read and ask questions. Further explanation of fishing regulations may also help to improve understanding.

6.1 General Regulations

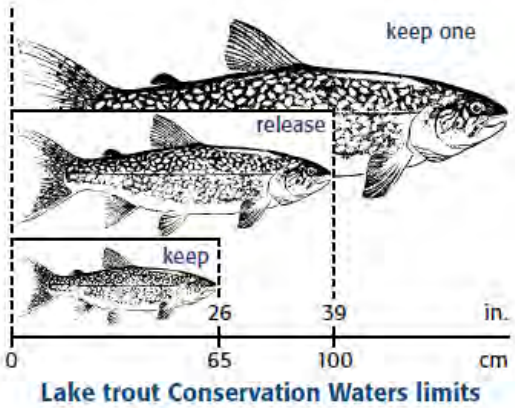
General regulations apply to all Yukon waters. Under these regulations, catch and possession limits are set along with upper size restrictions for each species and all fish less than 20 centimetres must be released. The use of live bait is forbidden, as is the transfer of live fish or other aquatic organisms to prevent the introduction of a fish disease, parasites, or an invasive species. Certain regulations govern how fish are dressed and packaged so that a proper possession inspection can be made. Limitations on gear and equipment are set out so that fishing is conducted safely and to allow for an equitable distribution of the resource. Wasting fish is strictly forbidden as is the sale of fish caught under a recreational licence.

Additional designations can be applied to waters where there are other management concerns. General regulations still apply unless they are replaced by a new, generally more restrictive, regulation. Most alterations involve catch and possession limits, size limits, and restrictions on barbed hooks. These designations are described in the following sections:

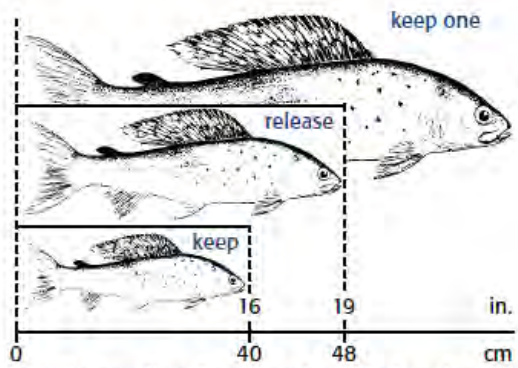
6.2 Conservation Waters

Regulations on Conservation Waters are intended to accomplish two main goals. The first is to reduce harvest pressure overall through reduction of catch and possession limits for lake trout, Arctic grayling, and northern pike. The second goal is to protect a portion of the vulnerable large and older spawning population and is managed through maintaining a size limit or "slot size" requiring the release of certain sizes of fish (see Box 5). In addition, use of barbless hooks on these waters reduces harm to fish by assisting with the easy release of slot-sized fish. The Conservation Water category, originally known as High Quality Waters, was first created in 1991 and included 15 lakes and rivers. There are now 40 lakes and two rivers in this category.

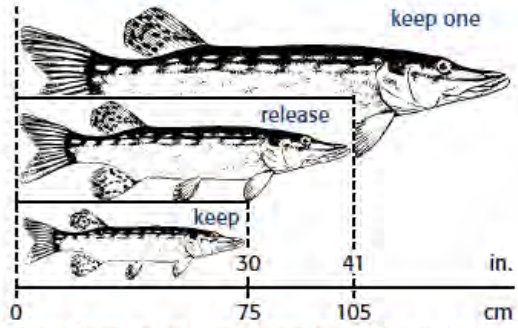
Box 5. Size limits on Conservation Waters: slot limits.



Lake trout Conservation Waters limits



Arctic grayling Conservation Waters limits



Northern pike Conservation Waters limits

Lake trout – all lake trout between 65 and 100cm must be released. Only one trout over 100cm may be kept.

Arctic grayling – all arctic grayling between 40 and 48cm must be released. Only one grayling over 48cm may be kept.

Northern pike – all northern pike between 75 and 105cm must be released. Only one pike over 105cm may be kept.

Why use slot limits? (see Figure 19)

- Lake trout sexually mature at 9-12 years old (45 to 50cm)
- Growth slows as more energy is focused on reproduction
- Protects large spawners while allowing anglers access to a high percentage of the stock
- Old spawners (e.g., lake trout over 65 cm) may be 40-50 years old and will not be replaced in our lifetime if harvested.

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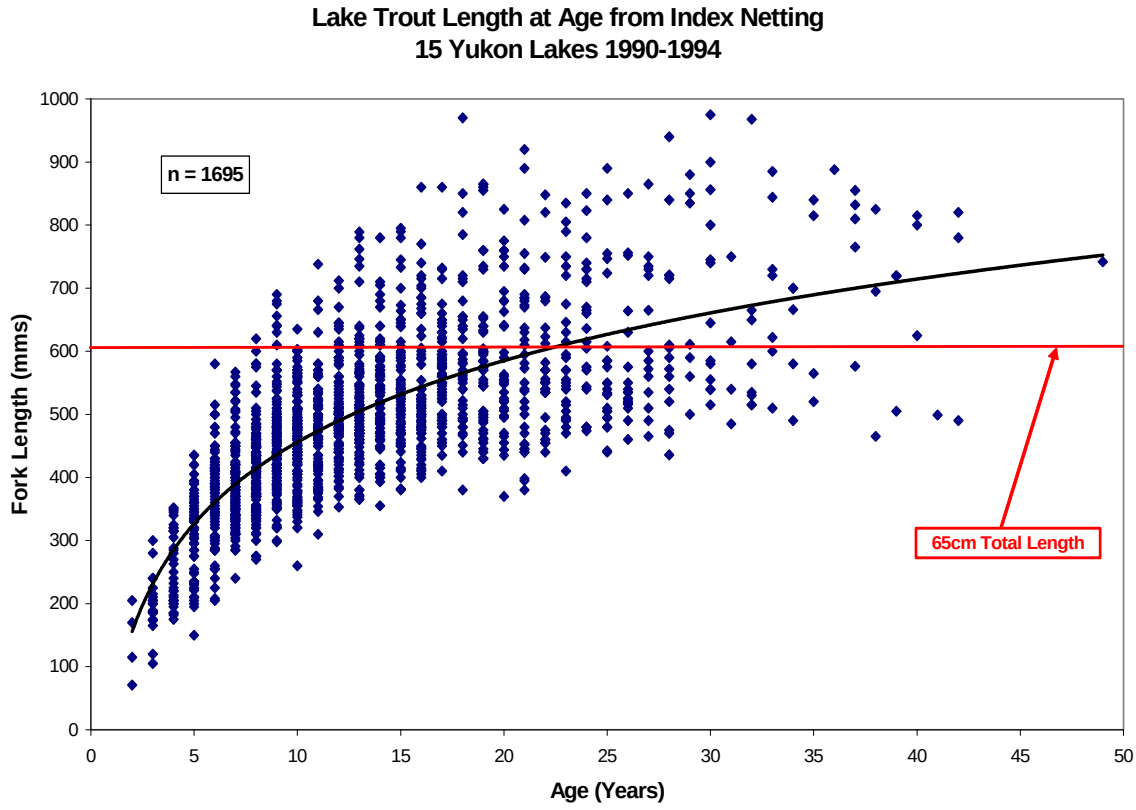
Figure 19. Protecting spawning fish. This figure shows lake trout length-at-age data from 15 Yukon lakes. 65 centimetres total length is used as the bottom of the slot because it corresponds to the length at which the average lake trout matures and growth begins to slow because resources are devoted to reproduction. Eighty-five per cent of the sampled stock is below 65 centimetres and is available to anglers.



Lakes become designated as Conservation Waters for five key reasons (Table 4; see Appendix 1 for more detailed lake by lake assessments and descriptions):

1. *Waters that contain stocks in need of recovery.* These lakes have been fished heavily in the past and fish stocks are known to be depressed compared to historic levels. Given enough time and a sustained reduction in harvest pressure, these stocks are expected to recover.
2. *Remote waters that have high pressure due to the presence of fishing lodges and camps, outfitter camps or mining camps.* Waters may be added to this category if development occurs nearby so that access or pressure on the resource is likely to increase.

3. *Waters with abundant or relatively unexploited stocks where maintenance of high quality angling opportunities is a priority.* These waters include some of Yukon's larger lakes.
4. *Waters that are vulnerable to over-harvest due to high harvest pressure.* These are often accessible and medium to large sized lakes.
5. *Waters that, due to their small size, are vulnerable to overharvest even when angling pressure is light.*

Table 4. Why are waters designated as Conservation Waters?

Reason for designation as Conservation Water	Lakes
Waters with fish stocks in need of recovery	Frances Lake, Frenchman Lake, Morley Lake
Waters with lodges, outfitting camps, fishing camps, or mining camps * denotes waters that are vulnerable because of their small size	Blind Lake*, Chain Lakes*, Claire Lake, Coghlan Lake, Drury Lake, Fire Lake*, Frank Lake*, Glenlyon Lake*, Grass Lakes*, Jim Cook Lake*, Long Lake, McEvoy Lake, Morris Lake*, North Lakes*, Poisson Lake*, Tay Lake, Tchawsahmon Lake*, Ten Mile Lake*, Tincup Lake, Wolf Lake, Whitefish Lake*, Wolverine Lake
Waters that are managed for the maintenance of high quality angling	Aishihik Lake, Alligator Lake, Bennett Lake, Kluane Lake, Sekulmun Lake, Sekulmun River, Tagish Lake
Waters that are vulnerable to over exploitation because they have high harvest pressure, often due to easy access and proximity to population centres	Big Salmon Lake, Big Salmon River, Ethel Lake, Marsh Lake, Quiet Lake
Waters that are vulnerable to over exploitation because of their small size	Frederick Lake, Jojo Lake, Little Wolverine Lake, Pleasant Lake, Sandy Lake, Ten Mile Lake

6.3 Special Management Waters (SMW)

In some cases, waters require more specific regulatory protection than what is afforded by the Conservation Waters designation. As a result, a class known as Special Management Waters has been developed (see Appendix 1 and Table 5 for more detailed descriptions). Many are listed for reasons specific to local fisheries concerns such as declining or depressed stocks. These issues are often identified in Final Agreements, through community management planning processes, and by RRCs. Others waters are designated because they have certain conditions that require particular protection. When possible, waters are grouped into categories to simplify the regulations. Currently there are approximately 50 lakes, rivers, and creeks protected under these regulations.

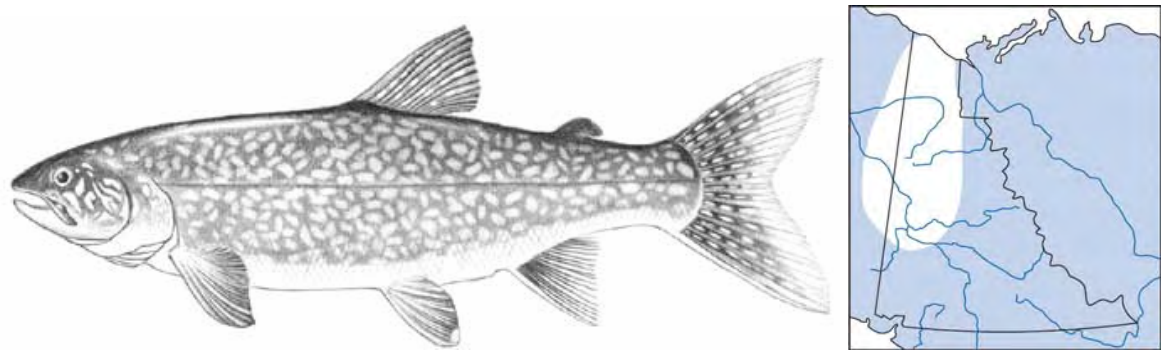
Table 5. Why are waters designated as Special Management Waters?

Reason for designation as Special Management Water	Waterbody
Waters with sensitive or recovering rainbow trout stocks	Kathleen River system, East Aishihik River, McLean Lakes
Waters with depressed Arctic grayling stocks	Lubbock River, Teslin River at Johnsons Crossing
Waters with depressed lake trout stocks	Mandanna Lake (special licence required) Teslin Lake
Easily accessed small lakes with small fish stocks under high harvest pressure	Braeburn, Caribou, Chadburn, Duo, Little Fox, Minto, Pine, Snafu, Tarfu and Twin lakes
Waters vulnerable to over exploitation because they have high harvest pressure, often due to easy access and proximity to population centres	Kathleen River system, Tagish River, Little Atlin, Teslin, and Watson lakes
Waters that are managed for the maintenance of high quality angling	Wellesley Lake (special permit required)
Waters with very restricted lake trout habitat	Dezadeash Lake
Transboundary waters	Atlin and Laidlaw lakes, Rancheria River and tributaries, Swift River and tributaries
Water-specific issues Tagish Bridge Tatlamain (Tatla Mun) Lake	 Inappropriate location for live release Cap on live release; special licence required
Gear restrictions and closures during salmon migration	Village Creek, Blind Creek, Blanchard, Tatshenshini, Klukshu, Takanne, Klondike, Lapie, Morley, Smart, Takhini, Teslin, and Yukon rivers

7 Status of Yukon Fish and Fisheries

Thirty-three species of freshwater fish and four salmon species are native to Yukon. All fish species form integral parts of northern aquatic ecosystems and food webs, but relatively few are targeted in Yukon's fisheries and management is focused primarily on these species. Populations of lake trout, Arctic grayling, northern pike, burbot, and rainbow trout are the most sought after fish in Yukon's fisheries. Whitefish and bull trout are also highly valued species, but less frequently caught so management has focused on them to a lesser degree. In the following section, the status of each of these species and others is outlined. In some cases specific challenges, problems and solutions are presented. Background information on each species is also presented where relevant.

7.1 Lake trout



Lake trout are the primary target of lake fisheries, but can also be found in large rivers. Lake trout are considered, for several reasons, to be an effective indicator for aquatic ecosystems. If lake trout stocks are healthy, stocks of other fish species, populations of other aquatic organisms, and the ecosystem overall must be healthy. The first reason is that adult lake trout are the primary predators in the lake ecosystem and they depend on healthy populations at all lower levels of the food chain to provide them with sufficient prey. Second, they have slow growth rates and low reproductive ability which makes them vulnerable to disturbance. Third, lake trout are highly desired and are frequently targeted and caught by anglers, thus pressure on this species is often higher than for other species. Fourth, lake trout have more restrictive habitat requirements than many other species and are more sensitive to habitat disturbance and environmental conditions like water quality. For these reasons, lake trout is the species that poses the greatest management challenge and is the primary management focus in Yukon's freshwater fisheries. Lake trout have a long history of management and there is much historical information on past management successes, failures and experiences in Yukon and other jurisdictions.

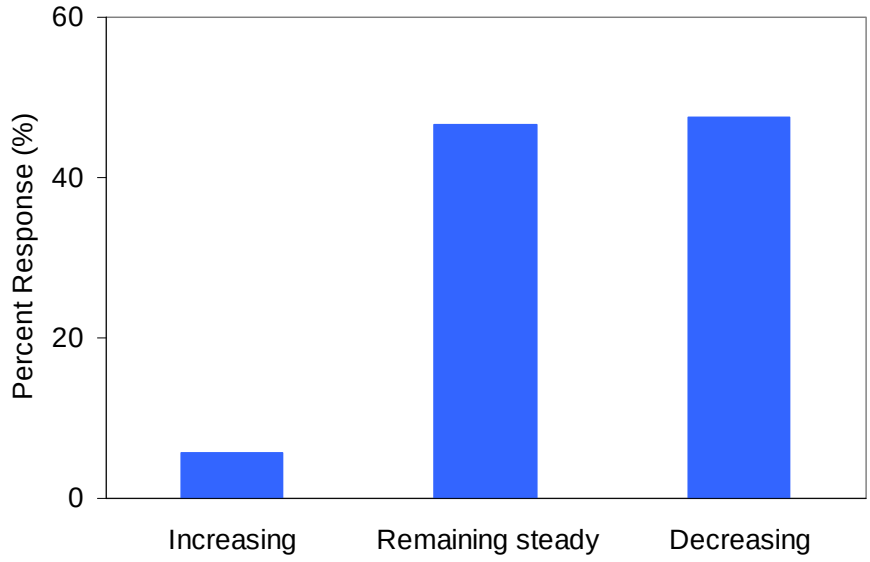
Management approach for lake trout

It is difficult to broadly classify Yukon lake trout stocks into categories of population health, especially since agreement on what defines a healthy population may be difficult to achieve. In addition, what is considered healthy today may be deemed depleted in comparison to the state of the resource as it was fifty years ago (shifting baseline syndrome).

Lake trout are more vulnerable to stressors as they have a relatively low reproductive ability. In Yukon, these fish mature between nine and 12 years of age, spawning occurs every second or third year, and the number of eggs they produce is low. The consequence of these biological traits is that a limited number of lake trout that can be sustainably taken from a lake on an annual basis.

A healthy population may be thought of as one which is self-sustaining while continuing to provide angling opportunities; the majority of Yukon's lake trout stocks fit this definition. In addition, on most lakes where harvest is known it is considered to be sustainable. However, when anglers were polled, almost half felt that stocks were decreasing, though no time frame was given to guide the response (Figure 20). Yukon anglers have been fishing for just over 15 years on average, and many have long memories. This information is especially revealing within the context of the phenomena of invisible collapse and shifting baselines.

Figure 20. Opinion of Yukon anglers on the state of lake trout stocks (DFO 2007).



It is difficult to accurately assess the status or abundance of any particular lake trout stock. The freshwater systems in which they live have many diverse habitats, are sometimes quite complex, and are difficult to

sample effectively (Box 6). Limitations of many survey techniques often make attaining precise estimates of absolute abundance very difficult (Cowx 1996).

Based on an analysis of lake size, lake trout probably inhabit somewhere between 500 and 1000 lakes in Yukon. While it is likely that most lakes containing lake trout have been accessed and fished at one point or another, the Yukon government has conducted netting studies on only 110 of these lakes and angler harvest surveys on 34. Because of resource limitations, research and monitoring is directed towards the most intensively used or important lake trout fisheries.

Box 6. Status case study: Southern Lakes

A particularly difficult lake trout population to assess is in the interconnected southern lakes area. Marsh, Tagish, Atlin, Bennett, and Tutshi lakes are all connected through short stretches of river, with lake trout migration known to occur between some of the lakes based on many years of tagging. To what degree the individual lake populations are segregated or interrelated is unknown. It is likely that an overall population exists within the system with varying degrees of connectivity between lakes. Lake trout depleted in one of the lakes may well be replaced by immigration from other lakes, making the status of any one of the lakes very difficult to assess. Further understanding of this system would require studies which could potentially include radio tagging and DNA analysis.

The total annual harvest of lake trout is estimated from angler harvest surveys. For lakes on which there is angler harvest data, this can be compared to estimated optimal sustainable yield (OSY) which is derived from a model based on physical and chemical parameters of the lake like temperature and nutrient content. Harvest is considered sustainable when it is less than the OSY (Figure 21). Because of uncertainties related to calculating sustainable yield and harvest rates, the specific values of these data must be interpreted conservatively to minimize risk. As long as this is understood, general conclusions of sustainability are very useful to guide management decisions.

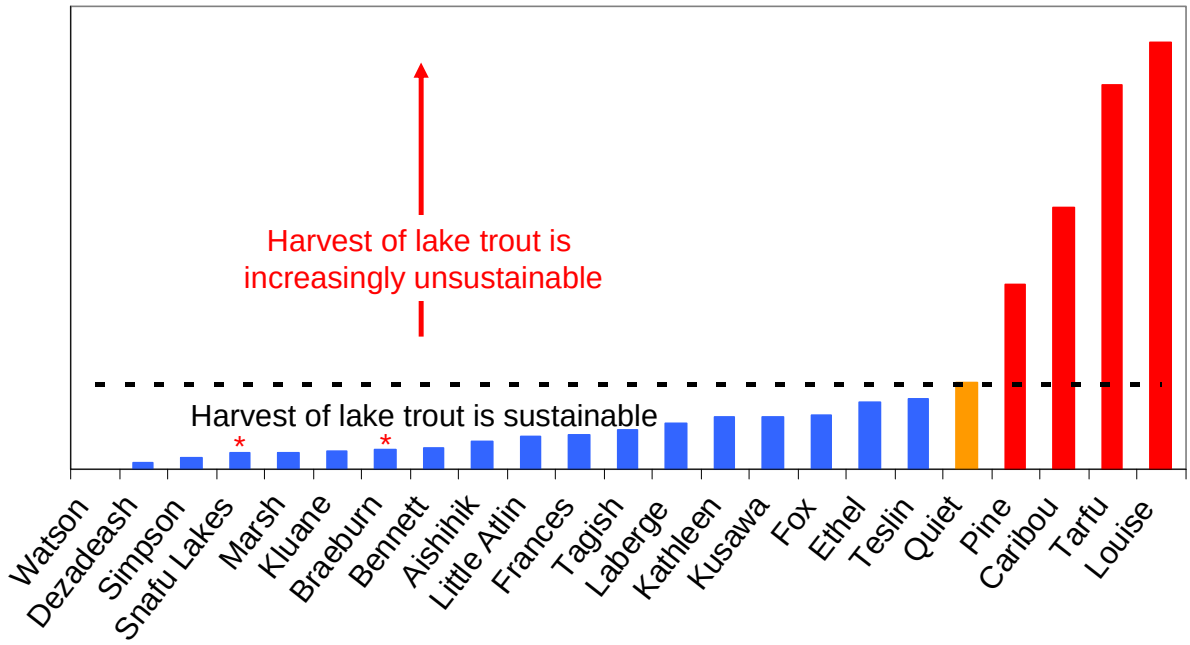
From these data it is clear that several lakes are either approaching or have exceeded their sustainable harvest. Pine, Caribou, Tarfu, and Louise lakes are overharvested and management action needs to be taken. Other lakes like Teslin, Quiet, and Ethel are nearing the point where harvest becomes unsustainable. These lakes should be monitored and anglers should be given information about the state of the resource in these waters. Anglers can then make wise decisions and play their role in protecting fish stocks.

The majority of other fisheries examined are below levels of harvest that would cause concern and should continue to maintain quality fisheries. There are exceptions, however, and in some waters where harvest appears sustainable, the population is actually in very poor shape. When considering Snafu Lake's potential for productivity, harvest is less than what is calculated

to be sustainable, but the population is so depleted that harvest at the projected sustainable level is not possible. In such a case, the sustainable harvest level should be calculated based on actual population size, not on the assumed population estimate. Snafu Lake is a depleted stock in need of stringent regulations to allow recovery of the lake trout.

Ideally, information on angler harvest compared to OSY would be available for every lake in Yukon so that overharvest can be identified and management action taken. However, the costs of running angler harvest surveys currently prohibits this possibility. Decisions and management actions need to incorporate alternative sources of information to estimate impacts and make informed management decisions. Decisions are made using the best available information and take the precautionary principle into account.

Figure 21. Sustainability of angler harvest on select lake trout populations based on the most recent angler harvest data. Harvest is considered to be unsustainable when it exceeds the Optimal Sustainable Yield (OSY). Overharvested populations will decline and the fishing will become poor if no management actions are taken. In some cases, harvest may appear to be sustainable, when in fact a lake trout population has been depressed (e.g., Snafu Lake and Braeburn Lake). Harvest data are available for these lakes because they are where the most intensive fisheries take place. Fisheries on other lakes are expected to be, in most cases, within sustainable levels.



In the absence of good harvest data, a suite of other information has been used to inform the status of lake trout stocks. There is no single piece of information, but rather a series of conditions and factors that makes an estimation of the state of lake trout stocks possible. The following information is considered:

Lake size: lakes are categorized into small, medium, large lakes. Small lakes are often more productive for their size because productivity is inversely related to depth. However, large lakes will be more productive overall because of their size and will have a larger total fish population. So despite high relative productivity, small lakes are much more vulnerable to overharvest because of smaller populations and sustainable yields.

Productivity: lakes are categorized into productivity groupings using Maximum Sustainable Yield as an estimate of lake-wide productivity. Productivity in this case refers to how many fish can be sustainably harvested from this water. Low productivity results in low sustainable harvest. Lake productivity estimates are subject to considerable error, but provide a general understanding of the likely productivity of the lake.

Population density: information from fisheries netting surveys provides a relative density (number of fish per hectare). Density combined with lake size provides a rough approximation of population size. For example, a small lake will have a smaller population than a large lake and a small lake with a low relative density will have a smaller population than a small lake with a high density.

Other information: fishing pressure is recorded for those lakes on which it is available. When it is not available, either it is not taken into consideration or an educated guess is made based on access and knowledge about the fishery. Where available, anecdotal information on population health is included as well as whether lakes are easily accessible or remote.

Box 7. Status case study: Snafu Lake

In the 1980s Snafu Lake had a high abundance of lake trout and supported a commercial fishery. Snafu is a small, accessible lake and one of the few Yukon lakes normally free of ice during the May long weekend when anglers and campers like to get out for the start of the season. Today Snafu Lake has the highest angling pressure of any water in Yukon, with the exception of stocked lakes: 4222 angler hours per year, or 6.5 angling hours per hectare in 1999 and 2005. Compare this with 0.3 hours per hectare on Kusawa and Laberge lakes. However, even with such high angling pressure, very few trout are caught. It takes about 50 hours of angling to catch a lake trout, compared to a Yukon-wide average of six hours.

Only an estimated eight lake trout from Snafu Lake were kept in 2005, though the impact is closer to 20 lake trout if mortality from released fish is considered. This level of harvest falls below the Optimal Sustainable Yield, but this is misleading. Netting studies show that lake trout density had plummeted to very low levels by the early 1990s. Harvest is low because density is so low and the lake trout population in Snafu Lake is by all measures a depleted stock. Even the current low harvest and catch limit of one lake trout is likely impeding recovery and a full closure of the lake trout harvest is likely warranted.

With angler success for lake trout so low, anglers have seemingly “switched” to northern pike and the harvest of this species has escalated over the years to 560 kilograms in 2005, which is above maximum sustainable levels for northern pike. Catchability is still good for anglers, so there may be a lack of support for reduced regulations that could prevent a depletion of pike stocks.

Due to the large amount of information, the status assessments for 90 Yukon lakes are presented in Appendix 2. This information is meant as a guide

to anglers but also as a tool for managers to collate information and identify lake trout waters that are in need of increased protection. Information from Appendix 2 can be used to develop signage that communicates the present status of lake trout stocks, current regulations, harvest recommendations for conservative anglers, and other information.

Management issues and options for lake trout

Several waters contain lake trout populations for which a management issue has been identified. These issues typically fall into one of several categories (Table 6). For each category of management issue, the recommended solutions have been set out.

Table 6. Lakes with identified management issues for lake trout. Management options include education, data needs, planning, and regulatory changes, and are proposed as possibilities not as commitments. Other management options are possible and some management options have already been carried out.

Management Issue	Classification of Water	Waters	Management Options
Depleted stock	Special Management Water	Braeburn, Snafu Lakes	Education: in synopsis and signage at lake Regulatory: non-retention of lake trout
Harvest over sustainable limit	Special Management Water	Caribou, Pine, Tarfu	Education: in synopsis and signage at lake Regulatory: non-retention of lake trout or closed season
	General Regulations	Louise (Jackson)	Education: in synopsis and signage at lake Regulatory: designate as SMW and reduce catch and possession limits or non-retention of lake trout
Harvest approaching or at sustainable limit	Special Management Water	Teslin	Education: in synopsis and signage at lake Data: angler harvest and population surveys Plan: Work with RRC to review Teslin FW Management Plan
	Conservation Water	Quiet, Ethel	Education: in synopsis and signage at lake Data: angler harvest and population

			surveys Regulatory: change to SMW and reduce catch and possession limits
Small unproductive lakes with low sustainable yields which may have easy access	Special Management Water	Chadburn, Little Fox, Twin	Education: in synopsis and signage at lake
	Conservation Water	Lewes, Morley	Education: in synopsis and signage at lake Regulatory: designate as SMW and reduce catch and possession limits
	General Regulations	Crag, Gladstone Lakes, Little Braeburn, Howard (south), Mitchie	Education: in synopsis and signage at lake Regulatory: designate as SMW and reduce catch and possession limits
Medium lakes with sensitive or depleted populations, easily access, and/or high pressure	Special Management Water	Watson	Education: in synopsis and signage at lake Data: angler harvest and population survey
	General Regulations	Fish, Frenchman, Fox, Simpson	Education: in synopsis and signage at lake Data: angler harvest and population survey Regulatory: designate as CW
Large lakes with easy access and high pressure	General Regulations	Laberge, Kusawa	Education: in synopsis and signage at lake Data: angler harvest and population survey Regulatory: designate as CW
Lakes with limited habitat or fish congregations	Special Management Water	Dezadeash	Education: in synopsis and signage at lake Plan: work with RRC and CAFN to complete Dezadeash Lake Management Plan Regulatory: consider closed areas, seasonal closure, or seasonal catch limits

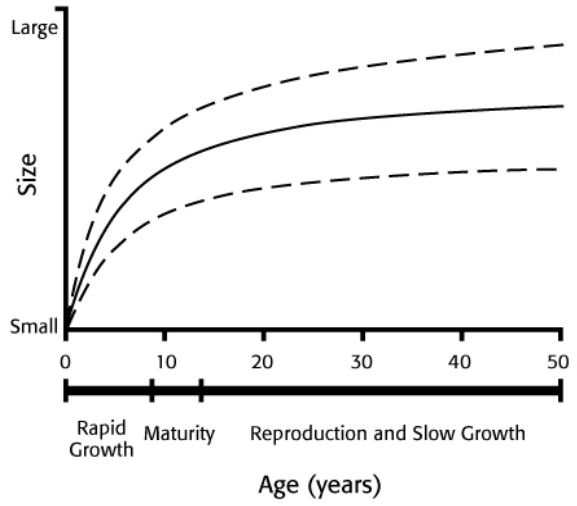
Lakes with lodges, camps, or other activity nearby that results in high angling pressure	General Regulations	Toobally (Upper / Lower)	Data: Conduct angler harvest survey with help of lodge operator Regulatory: designated as CW to maintain quality fishing and maintain standard for lodge lakes

Maintaining size of lake trout

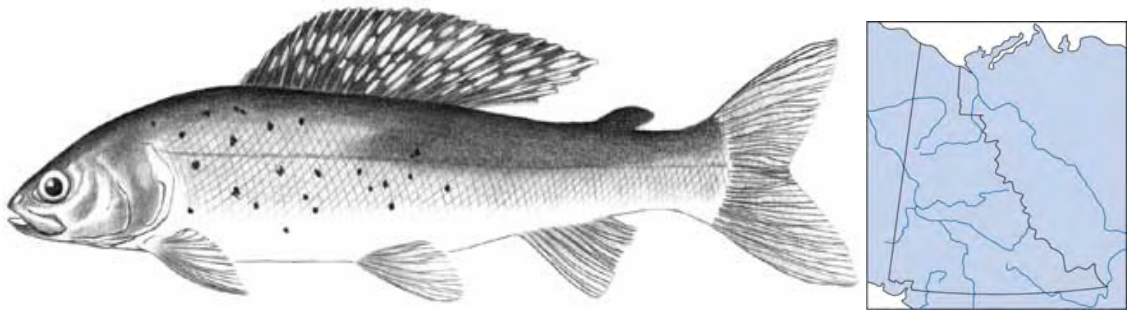
Lake trout grow relatively quickly when they are young but their growth slows considerably once they are mature. Consequently, large lake trout can be as old as 50 years (Figure 22). Because of natural mortality, there are fewer old fish than young fish. The logical consequence of these biological facts is that there are few large lake trout in most lakes. When large fish are removed from a lake, it can take many years before any noticeable population of large lake trout will again be available to anglers. We know that anglers target large fish and there are several important consequences to removing large breeding fish from populations, especially over the long term.

The evidence supporting the decrease in size of fish over time is primarily anecdotal. Several lakes such as Tincup, Wellesley, and Fish were known to contain many large lake trout in the past, which are now rare. There is an anecdotal report from Tincup Lake of two anglers who each caught and kept a 40-pound lake trout in one morning. While the current lodge operator has adopted strict conservation practices and lake trout fishing is very good, trout of this size are seldom caught today. However, there are still large fish caught in other lakes around the territory, some of which are reported.

Figure 22. Growth of lake trout.



7.2 Arctic grayling



Arctic grayling are widespread in Yukon inhabiting both lakes and rivers. Many populations live in rivers and are found in streams of various sizes. Other populations are largely lake dwelling, migrating to small creeks to spawn and feed while over-wintering in the lake. Some populations are known to make considerable migrations between spawning, feeding, and over-wintering areas (McPhail 2007). Because they use streams extensively, barriers to passage such as improperly installed culverts, hydro dams, and beaver dams can block access to habitats and affect populations.

Arctic grayling are the most targeted of all Yukon fish. They are extremely susceptible to over-harvest during the spring when large aggregations of spawning fish are found in streams. They are easily caught and the harvest of breeding fish is especially detrimental to a population.

Management approach for Arctic grayling

The information available for making management decisions on Arctic grayling populations is far less than that available for lake trout. Angler harvest surveys provide estimates of total harvest and some indication of trends in population size when repeated through time. However, judging run strength based on angler success alone is fraught with problems. In contrast to populations of fish in lakes, it is difficult to estimate the sustainable harvest of arctic grayling runs and no value for the Optimal Sustainable Yield is available. As a result, management decisions must be based on other information. The principal sources of information relied upon are angler harvest surveys, feedback from anglers, and anecdotal information on the state of the resource. It is also possible to monitor the strength of grayling runs through population assessment but no methods have been developed in Yukon. The development and implementation of such monitoring tools for key grayling runs may provide greater certainty for making management decisions for grayling.

Despite a lack of data, there is evidence that several heavily-harvested spring grayling runs have declined markedly over the past decades. Two examples of this are the Lubbock River and Johnson's Crossing (Teslin River) grayling fisheries (Box 8). Both have seen precipitous declines, and in spite of restrictive catch and size limits and single barbless hook restrictions, have yet to recover to historic levels. This incomplete recovery to date suggests that

proactive management of grayling runs is needed to identify and address problems before populations decline.

This scenario is likely repeating itself on other accessible, popular grayling fisheries. However, there are no monitoring programs currently in place and only anecdotal information on harvest pressure exists. However, the anecdotal information that does exist suggests that grayling runs have declined or disappeared on several creeks including Truck Trap, Chootla, Fox, and Horse creeks. Many of these fisheries are small scale and the traditional angler harvest surveys would be costly for the amount of information that returns. Other techniques must be developed to provide information for decision making in a timely manner. A continued reliance on feedback from anglers will remain an important aspect of grayling management.

Management issues and options for Arctic grayling

For those rivers and streams where a management concern has been identified, the issues have been compiled into a management needs table in which potential strategies and actions to address these needs are suggested (Table 7). The limited information in the table underlines the main management challenge for grayling, which is to collect reliable information on a resource that is widespread, easily overharvested, and relatively difficult to monitor. Without increased efforts on monitoring, identification of issues, and follow-up management actions including regulatory changes, other spring grayling runs will likely decline and it may not be possible to judge the effectiveness of management actions.

Table 7. Rivers and streams with identified management issues for Arctic grayling. Management options include education, data needs, planning, and regulatory changes, and are proposed as possibilities not as commitments. Other management options are possible.

Management Issue	Classification of Water	Waters	Management Options
Historic decline of run, recovery to date is uncertain	Special Management Water	Johnson's Crossing (Teslin River), Lubbock River	Education: synopsis and signage at fishery access points Data: angler harvest and population survey to document recovery Regulatory: lower catch and possession limits if recovery has not occurred
Past and current decline – mostly suspected through anecdotal information	General Regulations	Truck Trap, Chootla, Fox, Horse, Likely many others	Education: synopsis and signage at fishery access points Data: angler harvest and population survey through time to document change Regulatory: lower catch and possession limits when sufficient information on decline exists

Box 8. Declines in the Johnson's Crossing and Lubbock River grayling runs.

At the Johnson's Crossing fishery, three angler harvest surveys have been conducted (Table 8). Run strength appeared to be up in 2001 but low effort and a higher proportion of released fish may have affected this. Despite the apparent rise in run strength, anecdotal evidence suggests that fishing quality was still poor compared to pre-survey times.

Table 8. Strength of grayling run on the Teslin River at Johnson's Crossing as measured by angler effort and harvest.

Year	Angler Effort (hrs)	Fish Caught	Fish Harvested	Strength of run (as measured by Angler CPUE)
2001	322	610	152	1.90
1997	869	751	451	0.86
1992	941	829	372	0.88

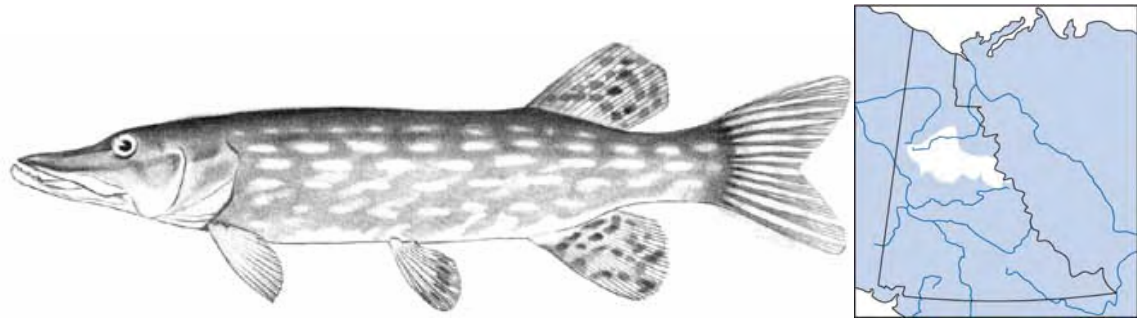
At the Lubbock River fishery, two angler harvest surveys have been conducted (Table 9). Although no angler harvest surveys have been performed since 2001, anecdotal information suggests that the population is still suppressed. Grayling are still less abundant and there is an increased number of pike in the creek.

Table 9. Strength of grayling run on the Lubbock River, as measured by angler effort and harvest.

Year	Angler Effort (hrs)	Fish Caught	Fish Harvested	Strength of run (as measured by Angler CPUE)
2001	470	469	96	1.00
1998	780	1366	196	1.75

Angler surveys were conducted on these systems because they were known to be popular fisheries and likely over-harvested. However, by the time the surveys had been initiated, both runs had likely already experienced serious declines.

7.3 Northern Pike



Northern pike are relatively widespread in Yukon and can be found in both lakes and slow moving rivers of various sizes. Large deep lakes with steep shorelines are less suitable, whereas small, shallow lakes with lots of shallow water and weed beds are excellent pike habitat. Because the species is aggressive, relatively easy to catch, and often found in accessible, shallow water areas along lake shorelines, pike are susceptible to overharvest in waterbodies with heavy angling pressure. Pike are most at risk during spawning season which happens in early spring just after ice-out.

Management approach for northern pike

There are no monitoring programs currently in place specifically for northern pike and the tools used for monitoring lake trout populations are, in most cases, not useful for monitoring this species. Currently, the only data collected on pike and pike fisheries is from angler harvest surveys. There may be a future need for a population assessment to investigate specific populations of concern. To date, there have been few known population declines although some may be at risk.

There are several intensive pike fisheries in Yukon including in Little Atlin, Tarfu, and Snafu lakes. Early ice-out on these systems in particular makes them popular spring fisheries. These systems have seen intensive fishing pressure and harvest in some cases is above what is sustainable. Similar to lake trout, large pike are targeted in fisheries leading to declines in large individuals and associated potential problems. For example, long-time anglers report that numbers of large pike have declined significantly in Marsh Lake following increased access by roads and larger boats.

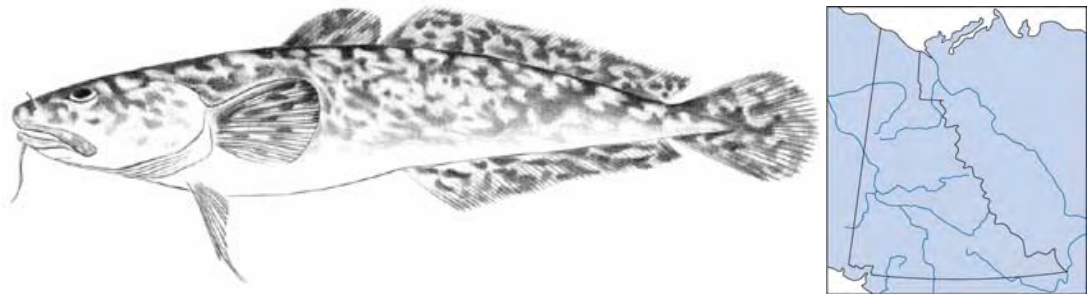
Management issues and options for northern pike

For those lakes where a management concern or need has identified, the issues have been compiled into a management needs table in which potential strategies and actions to address these needs are suggested (Table 10). The limited information in the table underlines the main management challenge for northern pike which is to collect reliable information on a resource that is widespread and relatively difficult to monitor. A continued reliance on feedback from anglers will remain an important aspect of pike management.

Table 10. Lakes with identified management issues for northern pike. Management options include education, data needs, planning, and regulatory changes, and are proposed as possibilities not as commitments. Other management options are possible.

Management Issue	Classification of Water	Waters	Management Options
Overharvested	Special Management Water	Snafu, Tarfu	Education: synopsis and signage at lakes Regulatory: lower catch and possession limits
Harvest approaching or at sustainable limit		Little Atlin, Watson	Education: synopsis and signage at lakes Regulatory: lower catch and possession limits
Harvest likely approaching or at sustainable limit	General Regulations	Tatchun, Frenchman	Education: synopsis and signage at lakes Data: angler harvest and population survey Regulatory: lower catch and possession limits if data point to overharvest

7.4 Burbot



Burbot is the only freshwater species of cod in North America. Burbot are found in a variety of lake and river systems throughout Yukon and are rarely found far from lake or stream bottoms. In Yukon, angling for burbot is typically conducted in the winter when lakes are covered with ice. There is also a setline fishery for burbot that is licensed separately. Burbot are also sometimes caught incidentally by anglers targeting other fish species.

According to angler reports, catches of burbot declined significantly in some areas in Lake Laberge and Fox Lake during the early 2000s. Burbot spawn during the winter and are a popular target for ice fishing, so are vulnerable to over-harvest. This concern of over-harvest resulted in burbot catch and possession limits being implemented in 2003.

There is currently not enough information to determine the status of any burbot population or to assess impacts from the recreational or setline

fisheries. There are no monitoring programs in place for burbot and generally not a lot is known about this species in Yukon. Changes in reporting requirements on setlines will improve understanding of burbot harvest and trends in populations as measured by angler catch per unit effort. Where declining catch is found, management action will be taken. However, relying on angler catch to make management decisions has serious drawbacks. New monitoring methods designed specifically for assessing burbot stocks are needed to provide the information necessary to make informed management decisions about burbot.

7.5 Whitefish species

Least cisco and round, lake, and broad whitefish are common and widespread throughout Yukon. Found primarily in lakes and large rivers, these species constitute the majority of fish biomass in many waterbodies. Juvenile and small adult whitefish are important prey for predatory fish species including lake trout, northern pike, burbot, and inconnu. Lake whitefish are a target species of both First Nations and commercial fisheries. While harvest of whitefish in the recreational fishery has been historically limited, there is growing interest among anglers.

Commercial fisheries of whitefish occur on major lakes and are well within sustainable limits. Traditional First Nation harvest of whitefish occurs in many areas and this fishery is not monitored by the Yukon government. Management relating to whitefish is dealt with on a case-by-case basis when issues arise.

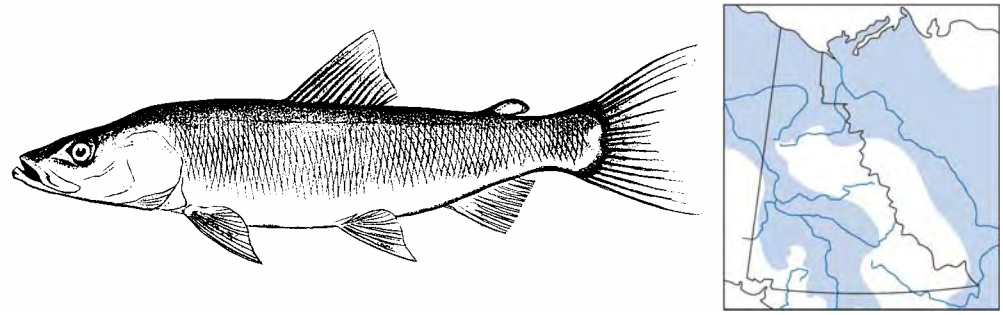
Some of the major impacts to lake whitefish populations are habitat related. Hydro development on Aishihik Lake and impacts to spawning grounds on Braeburn Lake can have marked effects on lake whitefish populations. Year class recruitment failures were documented for lake whitefish in Aishihik Lake resulting from water level fluctuations in the early 1980s. Much work has since been done by the Yukon Energy Corporation, territorial and federal governments, and Champagne and Aishihik First Nations to explore the effect of the water management regime on whitefish in Aishihik Lake. Concerns raised in the Little Salmon Carmacks community-based fish and wildlife management plan about declining whitefish numbers in Braeburn Lake led to an investigation of spawning grounds at the outlet of the lake. There is a well-used crossing at this location with potential impacts on spawning lake whitefish. Investigations are ongoing.

Relatively little is known about broad whitefish and round whitefish populations in Yukon.

Local and traditional knowledge indicated that valued and abundant broad whitefish stocks in Tatlmain (Tatla Mun) Lake declined prior to the 1990s. This was identified as a major issue in the planning for the Tatlmain Special Management Area. Studies have indicated that migrations of this

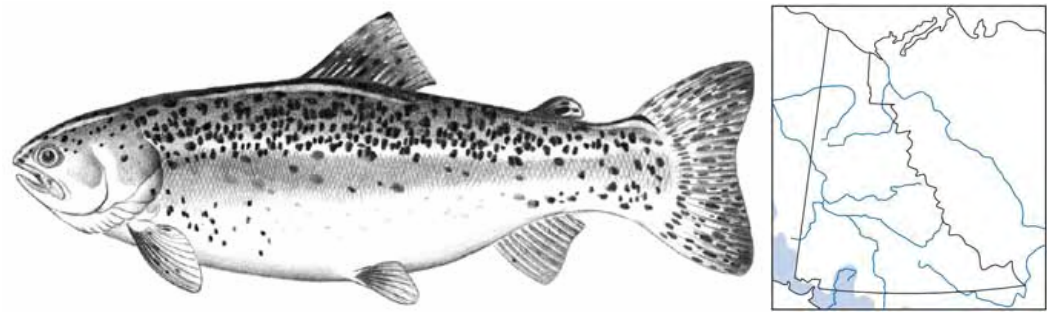
species from the Yukon River to Tatlmain Lake via Mica Creek were affected by increased beaver activity and blockages to fish movements.

7.6 Inconnu



Inconnu are a large predatory whitefish found primarily within the Yukon River system. Some populations in Yukon may be anadromous, making substantial spawning migrations during the late summer and fall. Yukon populations are found primarily in large rivers as well in some large lakes like Teslin, Laberge, and Kluane. Inconnu in Yukon are typically captured incidentally by anglers and in net fisheries. However, they are renowned as a sport fish and there are localized populations that are targeted by knowing anglers. No status of inconnu populations is available.

7.7 Rainbow Trout



Rainbow trout have a limited distribution in the territory. Their natural range is confined to the Alsek drainage where they are found in the Kathleen, Dezadeash, and Aishihik systems. Rainbow trout are present in many stocked lakes and there are introduced and naturally reproducing populations in the McIntyre Creek system, McLean Lakes, and Yukon River near Whitehorse.

Little is known about abundance of rainbow trout populations although there has been concern about several populations and restrictive regulations have been implemented. The East Aishihik rainbow population was once extirpated due to reduced winter flows and was subsequently re-introduced in 1994. The winter water regime controlled by the Aishihik dam now ensures sufficient flow over Otter Falls to maintain fish habitat throughout the winter. Following re-introduction, the East Aishihik River was closed to all angling, a regulation that was unprecedented in Yukon. The area has since been re-opened to angling with non-retention of rainbow trout.

7.8 Species of Special Concern

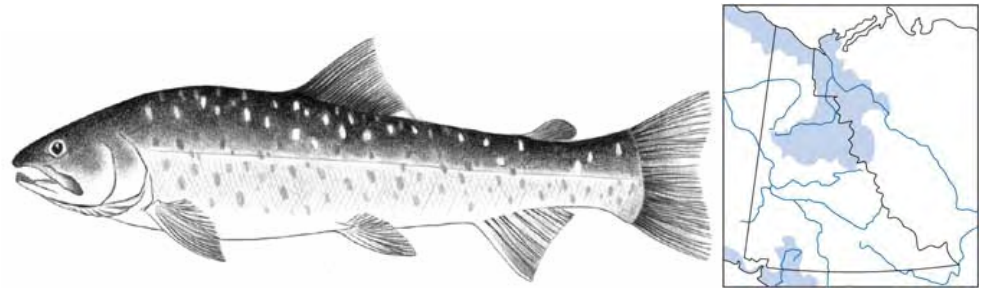
There are several fish species of special concern in Yukon. Status assessments are conducted by a variety of different groups including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), General Status Rankings of the Canadian Endangered Species Conservation Council (CESCC), the International Union for the Conservation of Nature (IUCN), NatureServe, and Yukon government assessments.

Kokanee

Kokanee is a landlocked freshwater sockeye salmon with a very limited distribution in Yukon. Native populations exist in the Kathleen Lake system which includes Sockeye Lake, Louise Lake and associated tributaries, Frederick Lake, and tributaries to Dezadeash Lake within the Alsek River watershed.

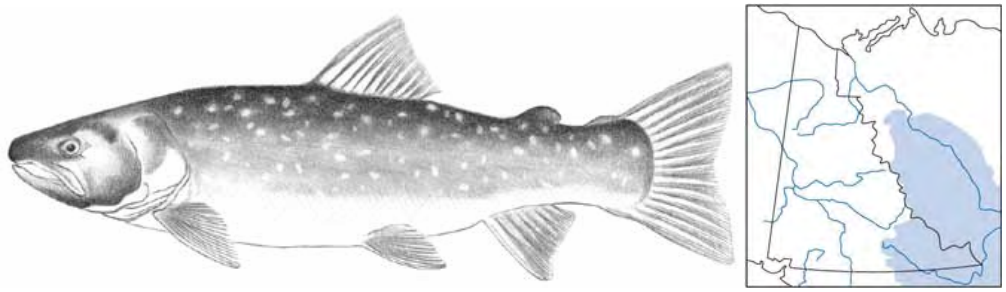
Stock assessment of kokanee in the Kathleen system is performed by Parks Canada. In recent years, the number of kokanee in the Kathleen Lake system has declined drastically and at this time the reason is not known. Kokanee have not been assessed by COSEWIC, but are listed as sensitive (CESCC 2006).

Dolly Varden



Dolly Varden is very similar in appearance to the closely related bull trout. However, the distributions of these two species do not overlap. Dolly Varden are restricted to the North Slope and the Peel and Alsek watersheds whereas bull trout are found in the Liard River watershed. Due to its aggressive nature, this species is susceptible to over-harvest by anglers, particularly in highly accessible areas. The northern form of this species, found in the Peel River Watershed and the Yukon North Slope is currently being assessed by COSEWIC. The southern form of Dolly Varden found in the Alsek River watershed has not yet been assessed by COSEWIC and the distribution of this form of the species in Yukon is not well known or documented. The general status ranking for this species in Yukon considers the two forms together and the 2005 assessment lists this species as secure (CESCC 2006).

Bull Trout



Very similar in appearance to Dolly Varden, bull trout are primarily restricted to the Liard River watershed. Bull trout have also been documented in headwater streams of the Yukon River, most notably the Swift, Morley, Jennings, and upper Teslin rivers which are adjacent to the Liard River watershed.

The bull trout's aggressive behaviour and voracious appetite make this species vulnerable to over-harvesting, particularly in accessible areas. This species requires clean, cold water for successful growth and reproduction which makes it sensitive to development activities. Bull trout is listed as sensitive in Yukon (CESCC 2006). In 2001, catch and possession limits were reduced and size limits were introduced. The bull trout has not yet been assessed by COSEWIC, but it is a likely candidate for assessment in the near future.

In conjunction with the Yukon Placer Secretariat and DFO, Environment Yukon has developed a model of habitat suitability for bull trout in the Liard watershed. This model will be further refined over the years through site assessments as part of the Fish Habitat Management System for Yukon Placer Mining.

Squanga Whitefish

This species is extremely similar to the much more common and widespread lake whitefish. Squanga whitefish, exclusively documented in Yukon, are currently limited to four lakes in southern Yukon including Squanga, Little Teslin, Teenah, and Dezadeash lakes. Historically, there was also a population in Hanson Lake in central Yukon near Mayo, but this population was removed by poisoning in preparation for stocking of rainbow trout (Roberge et al. 2002).

Squanga whitefish are listed by COSEWIC as a species of Special Concern, based primarily on a restricted range within Canada. Primary threats to this species include potential habitat degradation such as increase suspended sediment loads, severe water fluctuations or water temperature fluctuations (COSEWIC 2009).

Bering Cisco

In Yukon, the known distribution of Bering cisco is limited to the Porcupine River and the Yukon River near Dawson City. Very little is known about its biology other than the fact that it is anadromous. This species is listed by COSEWIC as a species of Special Concern, based primarily on a restricted range within Canada and data deficiencies regarding the distribution and spawning sites in Yukon. However this species has not been listed as a species of Special Concern under the federal Species at Risk Act because populations are considered secure in the Alaska portion of the Yukon River drainage with some range extension into Canadian headwaters. Bering cisco are not currently a species of concern and no studies targeting this species are planned.

7.9 Other Species

In total, there are 33 species of freshwater and anadromous fish in Yukon. Many of these are not caught by anglers, but each one plays an important role in the proper functioning of Yukon's aquatic ecosystems. For more information on these species, pick up your own copy of Yukon Freshwater Fishes at any Environment Yukon office.

8 Moving Forward

The Status of Yukon Fisheries has provided insight into the current management programs and aims to lay out the challenges for fisheries management going forward. The goals, unique nature, and circumstances of Yukon's fish and fisheries have been identified and the status of stocks has been reviewed. In this final section, we highlight the successes of fisheries management and review the key challenges and issues. There are several areas where work is needed and it is expected that through discussions with management partners a common vision for sound stewardship of Yukon's fisheries resources can be developed. The solutions to these challenges will provide direction and guide fisheries management in Yukon.

Overall, in Yukon, fish are abundant and populations are healthy and intact. Knowledgeable anglers can go to almost any lake, river, or stream and catch a fish. Yukon has world-class fishing opportunities and fishing remote areas of the Yukon can be an unparalleled experience. There are some exceptions to this generalization of healthy stocks and these have been identified in Section 7. With good management going forward, these fisheries too can be sustainable.

The success of the current fisheries management regime in Yukon should be measured not only by the state of the resource but also by the extent and quality of opportunities available to fishers. Recreational fishing opportunities have been maintained at very high levels while, for the most part, harvest is kept within sustainable limits. It is easy and inexpensive to get a fishing licence and there are few restrictions on when and where fishing can take place. There are no season or area closures nor are there gear restrictions other than the requirement to use barbless hooks on some waters to facilitate live release. Angling has been and continues to be encouraged as a sustainable and healthy activity; 85 per cent of Yukoners have fished at some point in their lives and 97 percent support the activity (YFWMB 2009).

Beyond being maintained, fishing opportunities have been created. Family Fishing Weekend is now an annual event for which Yukon residents can fish licence-free, thus ensuring that even fewer barriers exist for those who want to try it out. Further opportunities for Yukon anglers have been obtained in agreements that facilitate fishing in transboundary waters with BC and reduce fees for fishing in Alaska. Yukoners and visitors alike can use the Fishing on Yukon Time brochure as an introduction to some the Yukon's fine fishing opportunities. Finally, the stocked lake program provides easily accessible and diverse opportunities to anglers, young and old alike, close to towns while simultaneously reducing pressure from more sensitive wild stocks. The Anglers Guide to Stocked Lakes in Yukon sets out how to find these lakes and gives tips on how to catch the variety of stocked species.

Instead of limits to fishing opportunities, harvest has been controlled through measures that limit the numbers and size of fish harvested. The regulations governing angling in Yukon are amongst the simplest in the country and are easy to understand. Outreach programs ensure that anglers know about the regulations, the fish of Yukon, and any new initiatives.

Fisheries management, including the process of developing regulations, has been and continues to be an inclusive and public process that involves the public, boards, councils, First Nations, NGOs, and anglers associations. Among many examples of collaborative management, some that stand out are the Regional Fish and Wildlife Management Plans, lake-specific management plans (e.g., Mandanna Lake), fisheries regulation streamlining, retirement of commercial licence quotas on Laberge and Frances lakes, and the stocked lakes program. Each of these plans, programs, and processes involved many parties and was inclusive. This type of management approach has led to high levels of buy-in such that 89% of anglers agree with fishing regulations (YG data).

Monitoring efforts focus on populations that are most heavily accessed and those that are most susceptible to impacts. Further, monitoring is focused on the most important and / or sensitive resources and species. In Yukon, monitoring has focused primarily on lake trout and for good reason. Lake trout are an indicator species; if lake trout stocks are healthy, then the lake ecosystem as a whole is thought to be healthy. Despite a small staff, over one hundred lakes have been surveyed and a smaller subset of heavily-used lakes has been monitored repeatedly. In major fisheries, the harvest of anglers is measured to ensure that it is sustainable. When harvest is found to be unsustainable, or when monitoring of populations indicates a problem, management actions have been taken after public consultation.

Through this review, several management challenges have been identified that will be important considerations for future fisheries management in Yukon. The following summary highlights these challenges with the intent of providing a focus for discussions with management partners on about how best to proceed. This Status of Yukon Fisheries review has identified priority management issues that can be addressed through short term action and issues that will require a longer term perspective and the development of new or alteration of existing programs. These key areas of focus for fisheries management in Yukon are: Monitoring and Assessment, Education and Communication, Working with Partners, and Aquatic Ecosystem Health.

8.1 Monitoring and Assessment

There are a number of areas where additional information is needed to support moving ahead with key fisheries management directions. While this speaks to improvements in inventory methodologies there is also a need to

ensure that this information is communicated to decision-makers and to the public.

Lake Trout

Current monitoring tools for lake trout are imprecise, making it difficult to detect changes in fish populations. This makes decision making more difficult and results in a heavier reliance on the precautionary principle. An inability to detect change in fish populations means that declines are less likely to be identified or are less likely to be identified at the early stages such that it can be more difficult to respond in a timely manner. It also means that the effectiveness of regulations in reversing declines cannot be assessed with great confidence and it can be difficult to determine the success or failure of a management approach. Addressing this issue may require the adoption of different population assessment tools and methods. There are several means of accomplishing this goal and most would include the use of methods that provide more accurate estimates of fish populations. One such method, called Summer Profundal Index Netting (SPIN) can be used to track population changes through time with a high degree of accuracy and reliability. Testing of this method in Yukon began in 2009 and due to encouraging results, will be continued in 2010. Other monitoring methods aim for an absolute estimate of population abundance and require studies such as mark-recapture or virtual population analysis. To refine sustainable harvest levels, improved resolution of the productivity of freshwater systems in Yukon would be useful.

Arctic grayling

Arctic grayling runs are easily overfished and do not recover quickly even when harvest is reduced. Proactive management of Arctic grayling is therefore necessary to prevent further population declines and to help rebuild currently depleted stocks. Early identification and responsive management relies on monitoring programs, but none are currently in place. Additional effort in monitoring and education on key populations should be considered and could be achieved through field studies and by working with anglers. For a monitoring program to be sustainable, it should be able to be carried out efficiently at a small scale.

Northern pike

Intensive northern pike fisheries are limited to a small number of lakes but no targeted monitoring programs are in place to provide information on stock status. Being able to identify population status is important in setting appropriate regulations. Monitoring efforts of anglers could be increased in systems where high harvest is known to occur. Population assessment methods could also be developed on a case by case basis as required.

Burbot

Burbot harvests have been poorly reported until very recently and some populations are thought to have declined. No information on status of burbot stocks is available despite high catch and possession limits and potentially high harvest on some stocks. Population monitoring tools could be developed and the populations targeted by key fisheries could be assessed.

8.2 Education and Communication

Many of the management challenges facing Yukon fisheries management are associated with communications. Developing an improved understanding and appreciation of the value of our fisheries resources can only enhance and benefit both fisheries and the people that enjoy them.

Promote participation in Yukon fisheries

There are many reasons why fishing as an activity is valued and should be encouraged. First, fishing in all its forms provides huge value and benefits to Yukon and Yukoners. Recreational fishing provides substantial economic returns and multiple and important non-economic values like family togetherness. Second, fishers are often good stewards because they have a vested interest in fisheries resources; they are usually highly interested in maintaining quality fisheries and fish populations. Third, avid and dedicated anglers are often valuable sources of information, which can help identify imperilled stocks. Thus, a decline in the number of anglers would likely result in a decline in public interest in freshwater ecosystems and fish resources, a decline in stewardship of the resource, and a decline in the values that flow from the resources.

Currently, there is a trend of an increasing age of anglers. With this continued trend, there will begin to be a decline in the number of Yukon anglers. To address this trend and maintain the high participation rates in angling, programs could be developed to encourage youth and other sectors of the public to engage in angling and to become resource stewards. This will likely only be possible through inclusive management processes such that anglers can participate in the management of the resource, although there is a perceived paradox between promotion of fishing and limiting fishing through regulation. However, through good management and a compliant and educated angling public, both high participation and healthy fish stocks can be achieved.

Improve communication and outreach

Non-compliance with fishing regulations in Yukon is an issue and needs improvement (between 12 and 18 percent over the last five years). Enforcement capacity is limited and cannot be the only means by which anglers are encouraged to follow the regulations. Amongst the simplest in the country, Yukon's fisheries regulations are still required reading for all anglers. One survey indicated that nearly a quarter of anglers found the regulations too

complex. Non-compliance with regulations indicates either failure to understand, apathy towards understanding, or worse, a disregard for regulations. A compounding difficulty is that a large number of anglers are casual. That is, they do not fish more than a few times a year or even only once every couple of years. These issues all support a need to improve communication with fisheries user groups.

A multi-pronged approach to increase compliance may be required and could include enforcement, angler education, and effective communication and cooperation with partners. Enforcement monitoring of fisheries could be targeted towards areas of concern. Communication and educational programs can be used to remind anglers of the regulations, to inform them of the penalties associated with infractions, to convey the state of the resource, and to reinforce best practices. These could include messages in newspapers, on the radio, and wherever gear and tackle are sold. Continual work on improving the clarity of the synopsis and effectively communicating the regulations may help to address the perceived issue of complexity. Another tool is to incorporate feedback from anglers on changes to the regulations summary as was done through a focus group for the 2010 – 2011 version.

8.3 Working with Partners

Through the status review it is clear that effective fisheries management relies heavily on a collaborative management approach. Land claims bodies, the YFWMB and RRCs, have important roles in the regulatory sense but also in strategic planning and priority setting activities through planning and public consultation in a wide range of areas. Successful fisheries management in the years ahead will ensure that programs are fully collaborative with advisory bodies, stakeholder groups, and First Nation governments.

As this review has identified in a number of areas, harvest is a key variable in the maintenance of sustainable fisheries. In some cases subsistence fisheries may be having impacts on populations, but it is difficult to assess impacts when the harvest is not quantified. To remedy this, First Nations governments and their partners may wish to develop and implement a system to collect harvest information on key fisheries and, where issues are found, work to incorporate this information into management approaches for specific waterbodies or planning areas.

8.4 Aquatic Ecosystem Health

Clearly, healthy ecosystems are needed to support healthy fisheries. For very practical reasons, however, most freshwater fisheries management focuses not on ecosystems, but on specific species of interest and value, and specific areas of impact and habitat types (e.g., lakes). In some circumstances there are good reasons to focus more widely on the health of aquatic ecosystems. As such, examining indicators of ecosystem health could become part of fisheries management in the future. The challenge will be to determine which indicators

will be reliable, robust, and feasible (inexpensive and straight forward to collect) to monitor and track through time.

Ecosystem or watershed based approaches step back from site-specific impact assessments and move towards watershed-based planning and management where the entire fish population can be considered. This also has the benefit of management and monitoring in river and stream systems that have traditionally been a lower priority relative to lake systems where use and impacts are more easily observed. Over the long term, it may be important to develop programs that monitor ecosystems, watersheds, and moving water systems.

Aquatic Invasive Species

Aquatic invasive species (AIS) pose a looming, but as yet, unquantified threat to Yukon's fish and fisheries. In southern jurisdictions, AIS are having huge impacts on ecosystems, biodiversity, fisheries, and infrastructure at enormous costs to taxpayers. Experience from these jurisdictions clearly suggests that prevention is the most cost-effective approach to the management of AIS. This review suggests that a strategic approach for Yukon would be to begin development of a comprehensive plan that could include components on the identification, control, and prevention of the spread of AIS into Yukon, the identification and filling of any regulatory gaps, approaches for education and awareness, and coordination with neighbouring jurisdictions.

Glossary of Terms

Anadromous Fishes that live in the ocean but migrate to fresh water to spawn

Apex predator Apex predators are predators that, as adults, are not normally preyed upon in the wild by other large animals in significant parts of their range. Apex predator species are often at the end of food chains, where they have a crucial role in maintaining the health of ecosystems

Brood Stock Adult fish from local sources that are maintained and artificially spawned to produce fry for stocking

Catch per unit effort A measure of how many fish are caught in a set (standardized amount of time. Can apply to netting studies or angling. This value is a proxy for the density of fish in a lake and can be compared amongst lake or through time to indicate a healthy fish population or a decline / increase in a population

Eutrophication The process by which increased nutrient input into a system leads to an increase in primary productivity (as evidenced by blooms of phytoplankton or algae) with associated affects. Possible effects include deterioration of water quality and clarity, increases in temperature, and decreases in dissolved oxygen

Fecundity The number and quality of eggs that a fish produces. A highly fecund fish produces a great number of offspring

Genotype The genetic constitution of an organism with special reference to a specific trait or quality, like size

Habitat Fragmentation The process by which discontinuities are introduced to fish or wildlife habitats, thereby shrinking habitats into smaller parcels. For example, road construction can cause fragmentation at stream crossings with improper culvert installations which present a barrier to fish movements

Indicator species A species sensitive to environmental disturbance. The presence or abundance of the species is used to indicate ecosystem health and the absence of the species used to indicate ecosystem dysfunction

Limiting nutrients	In an aquatic sense, they are nutrients which are required by primary producers for growth but are in limited supply. Nitrogen and Phosphorus are generally limiting nutrients in aquatic systems. An increase in limiting nutrients will result in an increase in the biomass of primary producers which can lead to eutrophication
Littoral	of or pertaining to the region of a lake from the shore to approximately a point where sunlight penetrates in sufficient quantities to support plant growth
Maximum Sustainable Yield	Theoretical maximum number of fish which can be harvested from a population each year while maintaining population size indefinitely
Non-anadromous	Fishes that are not anadromous (see Anadromous)
Oligotrophic lakes	Nutrient poor lakes with low primary productivity. They are generally clear, deep, and cold with high dissolved oxygen levels and provide good habitat for lake trout
Optimal Sustainable Yield (OSY)	The level of harvest below which a quality fishery will be maintained. This is taken to be 15% of the Maximum Sustainable Yield
Pothole lakes	Lakes that have no surface inflows or outflows
Refugia	Habitats that offer protection against physical (temperature), chemical (oxygen levels), or biological (predators including anglers) stressors.
Riparian areas	Areas adjacent to lakes, rivers, streams, or wetlands which are affected by and in turn affect the waterbody. Riparian areas act as transition zones between terrestrial and aquatic habitats and are vital to the proper functioning of aquatic ecosystems.
Riverine	Of or pertaining to rivers
Traditional foods	First Nations traditional foods are those which would have been traditionally available and in use by a First Nation. Examples are fish, game, birds, berries, and other plants and herbs.
Trophic levels	Hierarchical levels of the food chain

Valued Ecosystem Component	A component of the natural environment that is considered to be of importance based on social and cultural values or scientific relevance

References

BERKELEY, S. A., C. CHAPMAN, AND S. M. SOGARD. 2004. Maternal age as a determinant of larval growth and survival in a marine fish, *Sebastes melanops*. Ecology 85(5):1258–1264.

BIRKELAND, C., AND P. K. DAYTON. 2005. The importance in fishery management of leaving the big ones. Trends in Ecology and Evolution 20(7):356–358.

CCFAM (Canadian Council of Fisheries and Aquaculture Ministers). 2004. A Canadian action plan to address the threat of aquatic invasive species. Aquatic Invasive Species Task Group. Retrieved August 12, 2010 from http://www.dfo-mpo.gc.ca/science/enviro/ais-eae/plan/plan-eng.pdf

CESCC (Canadian Endangered Species Conservation Council). 2006. Wild Species 2005: The General Status of Species in Canada. Retrieved August 12, 2010 from http://www.wildspecies.ca/wildspecies2005/index.cfm?lang=e.

CONOVER, D. O., AND S. B. MUNCH. 2002. Sustaining fisheries yields over evolutionary time scales. Science 297:94–96.

COOKE, S. J., AND I. G. COWX. 2004. The role of recreational fishing in global fish crises. Bioscience 54 (9):857–859.

COSTANZA, R., R. D'ARGE, R. DE GROOT, S. FARBER, M. GRASSO, B. HANNON, K. LIMBURG, S. NAEEM, R. V. O'NEILL, J. PARUELO, R. G. RASKIN, P. SUTTON AND M. VAN DEN BELT. 1997. The value of the world's ecosystem services and natural capital. Nature 387:253–260.

COSEWIC. 2009. Designation of Squanga Whitefish. Retrieved March 2010 from http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=120 .

COWX, I. G. 1996. The integration of fish stock assessment into fisheries management. Pages 495–506 *in* I. G. Cowx, editor. Stock Assessment in Inland Fisheries. Fishing News Books, Blackwell Science, Oxford.

DFO (Department of Fisheries and Oceans Canada). 1986. Policy for the management of fish habitat. Communications Directorate, Department of Fisheries and Oceans, Ottawa, Ontario.

DFO (Department of Fisheries and Oceans Canada). 1994. 1990 Survey of recreational fishing in Canada. Communications Directorate, Department of Fisheries and Oceans, Ottawa, Ontario. Economic and Commercial Analysis Report No. 148.

DFO (Department of Fisheries and Oceans Canada). 1997. 1995 Survey of recreational fishing in Canada. Communications Directorate, Department

of Fisheries and Oceans, Ottawa, Ontario. Economic and Commercial Analysis Report No. 154.

DFO (Department of Fisheries and Oceans Canada). 2003. 2000 Survey of recreational fishing in Canada. Communications Directorate, Department of Fisheries and Oceans, Ottawa, Ontario. Economic and Commercial Analysis Report No. 165.

DFO (Department of Fisheries and Oceans Canada). 2007. Survey of recreational fishing in Canada 2005. Economic Analysis and Statistics, Policy Sector, Fisheries and Oceans Canada. Ottawa, Ontario.

DPA. 1988. Economic potential of the Yukon fishery. Prepared for Yukon Renewable Resources and Economic Development Mines and Small Business. Prepared by The DPA Group Inc., Vancouver, BC.

HAMAZAKI, T. 2009. Examination of Yukon River chinook salmon commercial catch size trends: Is there evidence for decline? Presentation to Yukon River Panel, December 2009, Whitehorse, Yukon.

HEALTH CANADA. 2009. Human health risk assessment of mercury in fish and health benefits of fish consumption. Retrieved March 12, 2009, from http://www.hc-sc.gc.ca/fn-an/pubs/mercur/merc_fish_poisson-eng.php#3

LEVIN, P. S., E. E. HOLMES, K. R. PINER, AND C. J. HARVEY. 2006. Shifts in a Pacific Ocean fish assemblage: The potential influence of exploitation. Conservation Biology 20(4):1181–1190.

LEWIN, W. C., R. ARLINGHAUS, AND T. MEHNER. 2006. Documented and potential biological impacts of recreational fishing: Insights for management and conservation. Fisheries and Aquatic Sciences 54:821–831.

MCPHAIL, J. D. 2007. The freshwater fishes of British Columbia. University of Alberta Press. Edmonton Alberta.

MUCKENHEIM, S. 1998. The importance of fishing and fish harvesting to Yukon First Nations people. Prepared for the Yukon Fish and Wildlife Management Board.

NATURAL RESOURCES CANADA. 2005. Land and freshwater area, by province and territory. Retrieved August 6, 2010 from http://www40.statcan.ca/l01/cst01/phys01-eng.htm.

NUTTALL, M. 2005. Hunting, herding, fishing, and gathering: Indigenous peoples and renewable resource use in the Arctic. Pages 649–690 *in* Arctic Climate Impact Assessment. Cambridge University Press.

OAG (Office of the Auditor General). 2008. Status Report of the Commissioner of the Environment and Sustainable Development Chapter 6 – Ecosystems – Control of Aquatic Invasive Species. Retrieved August 11,

2010 from http://www.oag-bvg.gc.ca/internet/English/parl_cesd_200803_06_e_30132.html.

OMNR 2007. Regulatory guidelines for managing the lake trout recreational fishery in Ontario. Ontario Ministry of Natural Resources, Fisheries Section. Retrieved August 12, 2010 from http://www.mnr.gov.on.ca/stdprodconsume/groups/lr/@mnr/@letsfish/documents/document/stel02_178929.pdf.

OTTO, D. 2001. Assessment of anglers views on the current recreational fishing regulation management approach in the Yukon. Prepared for the Yukon Fish and Wildlife Management Board.

PAULY, D. 1995. Anecdotes and the shifting baseline syndrome of fisheries. Trends in Ecology and Evolution 10(10):430.

POST, J. R., M. SULLIVAN, S. COX, N. P. LESTER, C. J. WALTERS, E. A. PARKINSON, A. J. PAUL, L. JACKSON, AND B. J. SHUTER. 2002. Canada's recreational fisheries: The invisible collapse? Fisheries 27:6–17.

RADFORD, D. 2004. Canada's (Wacky) Fishing Regulations. Alberta Outdoorsmen Magazine.

RUDD, M. A. 2007*a*. The economic rationale for precautionary fishery management. Memorial University of Newfoundland. EVPL Working Paper 07-001.

RUDD, M. A. 2007*b*. Public preferences and willingness to pay for aquatic species at risk conservation programs in Canada. Memorial University of Newfoundland. EVPL Working Paper 07-001.

SÁENZ-ARROYO, A., C. M. ROBERTS, J. TORRE, M. CARIÑO-OLVERA, AND R. R. ENRÍQUEZ-ANDRADE. 2005. Rapidly shifting environmental baselines among fishers of the Gulf of California. Proceedings of the Royal Society B 272:1957–1962.

SWAIN, D. P., A. F. SINCLAIR, AND J. M. HANSON. 2007. Evolutionary response to size-selective mortality in an exploited fish population. Proceedings of the Royal Society B. 274:1015–1022.

TOURISM YUKON. 2006. 2004 Yukon visitor exit survey: Main survey.Retrieved August 12, 2010 from http://www.tc.gov.yk.ca/pdf/Main_Survey_April18.pdf

UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT. 1992. Rio Declaration on Environment and Development. Retrieved February 17, 2010 from http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=78&ArticleID=1163

WALSH, M. R., S. B. MUNCH, S. CHIBA, AND D. O. CONOVER. 2006. Maladaptive changes in multiple traits caused by fishing: Impediments to population recovery. Ecology Letters 9:142–148.

WEIN, E. E., AND M. M. R. FREEMAN. 1995. Frequency of traditional food use by three Yukon First Nations living in four communities. Arctic 48(2):161–171.

YUKON BUREAU OF STATISTICS. 2008. Yukon fact sheet. Retrieved March 31, 2009, from http://www.eco.gov.yk.ca/stats/yukonfactsheet.html#population

YUKON DEPARTMENT OF TOURISM AND CULTURE. 2008. Yukon Wilderness Tourism Status Report. Whitehorse. Yukon. Retrieved August 12, 2010 from http://www.tc.gov.yk.ca/pdf/WEBstatus_report_final(1).pdf

YEC (Yukon Energy Corporation). 2006. 20-Year Resource Plan: 2006–2025 and supplemental materials. Retrieved August 12, 2010 from http://www.yukonenergy.ca/about/projects/resource/

YFWMB (Yukon Fish and Wildlife Management Board) 1999. Social and economic values of angling in the Yukon. Whitehorse, Yukon.

YFWMB (Yukon Fish and Wildlife Management Board) 2009. Yukon fish & wildlife – a 20:20 vision. Yukon Wide Survey. Whitehorse, Yukon. Retrieved August 12, 2010 from http://www.yfwmb.ca/assets/client/File/Reports/2020%20Yukon-Wide%20Telephone%20Survey%20Report.pdf

Appendix 1 Conservation and Special Management Waters

Below are explanations of the rationale behind the designation of particular waters as Conservation Waters or Special Management Waters. These explanations will provide a better understanding of why regulations are in place and what they are trying to accomplish. In addition, two case studies illustrate how regulations have evolved over the years in response to management and community concerns and shifting angling pressure and attitudes. They illustrate how the fisheries management process has worked, from the identification of a fisheries concern, to the implementation of regulations, to a review of the successes and failures of these regulations.

Conservation Waters

Lake/River	***Reason for designation***
Aishihik Lake	Easy access, managed as a high quality fishery, popular lake, campground, easy access
Alligator Lake	Easy access, managed as a high quality fishery, popular lake
Bennett Lake	Easy access, managed as a high quality fishery, close to community, small commercial fishery
Big Salmon Lake	High harvest pressure, popular with canoeists, vulnerable to overharvest
Big Salmon River	High harvest pressure, high quality grayling fishery, popular with canoeists
Blind Lake	Small lake, remote but vulnerable to overharvest, fishing camp
Chain Lakes	Small lake with lodge, remote but vulnerable to overharvest
Claire Lake	Lodge Lake, remote but vulnerable to overharvest
Coghlan Lake	Lodge Lake, remote but vulnerable to overharvest
Drury Lake	Lodge Lake, remote but vulnerable to overharvest
Ethel Lake	Easy access, campground, vulnerable to overharvest
Fire Lake	Vulnerable to overharvest, remote, outfitting camp
Frances Lake	Depressed stock from past commercial fishery, vulnerable to overharvest, campground, small lodge
Frank Lake	Lodge Lake, remote but vulnerable to overharvest
Frederick Lake	Small lake, vulnerable to overharvest
Frenchman Lake	Depressed population, easy access, vulnerable to overharvest
Glenlyon Lake	Fishing camp, remote but vulnerable to overharvest
Grass Lakes	Fishing camp, remote but vulnerable to overharvest
Jim Cook Lake	Fishing camp, remote but vulnerable to overharvest
Jojo Lake	Small lake, remote but vulnerable to overharvest
Kluane Lake	Easy access, close to communities, commercial fishery, managed as a high quality fishery
Little Wolverine L	Small lake, vulnerable to overharvest, close to mining camp
Long Lake	Fishing camp, remote but vulnerable to overharvest

Marsh Lake	Vulnerable to overharvest, depressed stocks, close to large community, popular lake
McEvoy Lake	Lodge Lake, vulnerable to overharvest
Morley Lake	Depressed population, easy access
Morris Lake	Camp, remote but vulnerable to overharvest
North Lakes	Fishing camp, remote but vulnerable to overharvest
Pleasant Lake	Small lake, remote but vulnerable to overharvest
Poisson Lake	Fishing camp, remote but vulnerable to overharvest
Quiet Lake	Vulnerable to overharvest, easy access
Sandy Lake	Small lake with easy access, vulnerable to overharvest
Sekulmun Lake	Easy access, managed as a high quality fishery
Sekulmun River	Easy access, managed as a high quality fishery
Tagish Lake	Easy access, managed as a high quality fishery
Tay Lake	Fishing camp, remote but vulnerable to overharvest
Tchawsahmon Lake	Outfitting camp, remote but vulnerable to overharvest
Ten-mile Lake	Small lake, remote but vulnerable to overharvest, fly in and winter use
Tincup Lake	Lodge, remote but vulnerable to overharvest
Whitefish Lake	Outfitting camp, remote but vulnerable to overharvest
Wolf Lake	Lodge, remote but vulnerable to overharvest
Wolverine Lake	Mining camp, remote but vulnerable to overharvest

Special Management Waters

Transboundary Waters (Category A)
These waters straddle the BC-Yukon border and the regulations that apply to them are harmonized with the regulations on the BC side of the border for consistency and clarity.

Dezadeash Lake (Category B)
Dezadeash Lake contains a healthy population of lake trout. This shallow lake warms up considerably in the summer and the suitable habitat available is greatly reduced causing trout to congregate near cold creek mouths making them susceptible to over-harvest by anglers. Regulations require the use of single barbless hooks to reduce snagging and allow for easier live release.

Small lake trout lakes (Category C)
These easily accessible small lakes have extremely vulnerable populations of lake trout that can be quickly overharvested by anglers. All of these lakes have already seen substantial declines. They include: Braeburn, Caribou, Chadburn, Duo, Little Atlin, Little Fox, Minto, Pine, Snafu, Tarfu and Twin lakes. Catch and possession limits were reduced to one and a maximum size limit of 65 centimetres was put in place to protect spawners.

Wellesley Lake (Category C and Special Permit Required)
All harvest from the sport fishery, including guests at Kluane Wilderness Lodge, is monitored and recorded through a free but mandatory Sport Fishing Licence which has been in place since

1993. This licence enables management agencies to monitor fish harvests and angling effort on the lake through mandatory reporting. In the event where harvest becomes excessive, the number of Sport Fishing Licenses can be managed to control and direct anglers. Catch and possession limits are reduced and barbless hooks are mandatory. These regulations came about for three reasons: recommendation by the past lodge owner; to maintain a healthy lake trout population; and to maintain opportunities to catch large-sized (trophy) lake trout.

Kathleen River System (Category D)

Rainbow trout stocks were given special protection in 1990 because of their unique status as rare self-sustaining populations of native rainbow trout and concerns expressed by the Yukon Fish and Game Association about the possible over-harvest by anglers. This river is easily accessed and currently has a fish guiding operation nearby.

> **Evolving regulations on Kathleen River in response to management concerns**
> In 1990, the catch limits for rainbow trout, Arctic grayling, and lake trout were very liberal. Poor angler success in a 1990 angler harvest survey, as well as the unique nature of the native rainbow population raised public concerns. In response, the Kathleen River system was added to the list of High Quality Waters (Conservation Waters) in 1991, which required the mandatory use of single barbless hooks and reduced catch and possession limits for grayling, lake trout, and pike, and special management regulations were implemented requiring the mandatory release of all rainbow trout. Even with these regulatory changes, the Kathleen River system remained a popular fishing location and there was concern that anglers may have shifted their harvest focus and efforts to other species such as grayling and lake trout. The 1999 angler harvest survey showed a lower grayling catch rate compared with the early 1990s. In response, the Kathleen River system was listed as a Special Management Water in 2004 and catch limits for grayling, lake trout, and pike were reduced and a maximum size limit was imposed for all species.

Lubbock River and Teslin River at Johnsons Crossing (Category D)

Early spring grayling fisheries are important to Yukon anglers, allowing people to get out and fish in open water after the long ice covered winter. Because of this heavy pressure by anglers and close proximity to Whitehorse, overfishing has occurred at two popular locations, Lubbock and Teslin Rivers, and caused serious declines in the grayling stocks. Both rivers now have reduced catch and possession limits for arctic grayling and only barbless hooks are permitted. Unfortunately, due to delays in identifying and confirming the decline through angler harvest surveys, regulation changes did not come soon enough to prevent impacts from overfishing and now both these fisheries are in serious trouble.

East Aishihik River (Category E)

The successful 1994 reintroduction of rainbow trout into these waters created not only new fishing opportunities but re-established a previously exterminated population. Once fish were re-introduced, requirements were put in place to ensure year round water flow. The East Aishihik

was closed to fishing until the population could re-establish. Today, the fishery is open but all rainbow trout must be released.

McLean Lakes (Category E)
McLean Lakes' rainbow trout stocks were given special protection in 1990 because of their unique status as rare self-sustaining populations of rainbow trout. Concerns of overharvest in both the ice-covered and open water fishery because of close proximity to Whitehorse resulted in a regulation requiring the release of all rainbow trout by anglers.

Mandanna Lake (Category F)
There is a current management plan in place for Mandanna Lake. During the planning process community members and First Nation elders in Carmacks expressed concern over the lodge on this small lake. This lake held tremendous cultural value and lake trout stocks were in serious trouble based on angler reports, concerns of the lodge owner and stock assessment surveys. Mandanna Lake is the only lake in the Yukon where lake trout can not be kept. This regulation was put in place to build up the stock and ensure that this population is given the chance to recover. Monitoring will verify the effectiveness of this management action.

Tagish Bridge (Category G)
The Tagish River Bridge is a popular fishing spot, especially for anglers without boat access to the lake system. However, because of the height of the bridge and the distance from shore, it is not a good spot to practice live release fishing. Consequently, while fishing from the bridge, slot limits do not apply and anglers must comply with the one fish catch and possession limit. Anglers are encouraged to keep the first fish that they catch.

Teslin Lake (Category G)
The regulation history at Teslin Lake is long and complicated, but it also shows how governments, communities, and Renewable Resources Councils can work together and respond to an important issue such as long-term recovery of lake trout stocks that have experienced declines.

> **Evolving Regulations for Lake Trout in Teslin Lake**
> In 1990 anglers were allowed to catch three trout and have six in possession, but only one fish over 80 centimetres was allowed. Angler concerns and results from a 1992 netting survey lead to Teslin Lake being designated as a High Quality Water (Conservation Water) in 1993. Catch and possession limits for lake trout were reduced to two and slot limits were instigated such that all lake trout between 65 and 100 centimetres had to be released.
>
> A netting survey in 1997 along with a traditional knowledge survey indicated that the lake trout population was still low. The Teslin Renewable Resources Council recommended reducing limits once again and in 2000 the lake became a Special Management Water with a catch and possession limit of one and a maximum size limit of 65 centimetres. Further concern about lake trout stocks was raised in the 2001 Teslin Fish and Wildlife Management Plan.

Follow up surveys conducted in 2003 and 2009 still show no indication of recovery. Whether the regulation change was effective in protecting large spawning fish and assisting population growth, may become more apparent with time. Lake trout populations are slow growing, and recovery in terms of second generation adult fish might be measured over decades.

Angler harvest surveys in 1992, 1997, 2000, and 2003 have shown that angler success has steadily improved over the years. A fifth survey was conducted recently, but those data have not yet been analyzed. While there may be a temptation to measure recovery by angler success rates, this is ill-advised. Angler effort on Teslin Lake is concentrated in the best lake trout feeding habitats and increased angler success would not necessarily be an indicator of a growing population. An indication of improvement in the population index is needed. So in spite of available data, the status of the Teslin Lake trout population recovery is still uncertain.

Tatlmain Lake (Ta' Tla Mun) (Category H and Special Permit Required)

There is a current management plan in place for Tatlmain Lake. All harvest from the recreational fishery is monitored and recorded in the same way as Wellesley Lake, through the requirement of a free, mandatory Sport Fishing Licence. The management plan also addresses the issue of excessive live release fishing. First Nations members, particularly elders, find the concept of live release disrespectful and believe it will ultimately harm the population. To address this issue and potential high mortality on the trophy-sized lake trout, an aggregate catch limit was placed on fish and fishing. The aggregate catch limit is five fish per day and includes released fish. This means anglers must stop fishing after catching five fish in one day even if some or all of the fish were released.

Categories I and J

These categories of Special Management Waters afford some protection to salmon through gear restrictions and closures during the salmon season.

Appendix 2 – Lake Trout Status Table

When and Why to Use this Table

This table is a guide for anglers to make decisions about where to fish based on the health and sensitivity of fish stocks. It does not tell anglers where the best fishing is, but it provides information they need to make decisions for themselves about where to fish and where to limit harvest. Each angler is a steward and has an individual responsibility towards our common fisheries resources. With this table each angler can play his or her own part in managing and sustaining fish stocks.

While regulation changes are effective tools for managing harvest, implementing changes can be a lengthy process. Readily accessible information on the state of the resource, like this table, provides a personal decision-making tool for each angler that could lead to quicker responses in harvest pressure and avoid more serious declines. This may help avoid more restrictive conservation measures like limiting total harvest and seasonal closures.

How to use the Lake Trout Status Table

Find the lake or river where you intend to fish and observe the colour category associated with the recommendation. These colour categories correspond with the legend table below. Remember that these basic recommendations apply in addition to any specific recommendations that may be made for a lake in the status table.

Category	General recommendations
GREEN	**Low risk** of impacting the resource. Fishery is currently sustainable. **Always abide by the regulations.**
YELLOW	**Medium risk** of impacting the resource. Fishery could easily become unsustainable. **Fish conservatively!** Only harvest what you need to make a meal. Harvest smaller individuals because they are more plentiful and this conserves the larger spawning fish. Spread your harvest effort around several lakes so as to not overburden one system. Limit catch and release. **Always abide by the regulations.**
RED	**High risk** of impacting the resource. Fishery is currently unsustainable / or even small amounts of harvest could be unsustainable. Avoid harvest when possible and limit catch and release **Always abide by the regulations.**

Remember that even live release angling has an impact on fish. There is some mortality associated with your fishing even if every fish you catch is released. Catching and releasing twenty fish is equivalent to harvesting two or three fish.

Remember to always check the fishing regulations summary and follow the regulations in place for the water on which you are fishing. The regulations are the minimal requirements that each angler must adhere to. Recommendations in this table should are additional guidance that, if followed, will help to protect vulnerable stocks and achieve sustainable Yukon fisheries.

Lake	Lake Area (ha)	Sustainable Harvest (OSY)	Lake Trout Population Size	Classification	Road Access	Summary	Recommendation
Aishihik	14500	Moderate-High	Large	Conservation Water	Yes	Large lake, high yield, large population, easy access, moderate pressure	No special recommendation
Alligator	629	Moderate-Low	Medium	Conservation Water	No	Small lake, moderate-low yield, small population, relatively remote, high pressure	Fish conservatively; sustainable harvest is low
Atlin	63450	Very High	Very Large	Special Management Water	Yes	Very large lake, very high yield, large population, easy access, low pressure	No special recommendation
Bennett	9680	Moderate-High	Medium	Conservation Water	Yes	Large lake, moderate-high yield, large population, easy access, moderate pressure	No special recommendation
Big Kalzas	4220	Moderate	Unknown	General Regulations	No	Medium-large lake, moderate yield, unknown population size, remote	No special recommendation
Braeburn	558	Moderate-Low	Small	Special Management Water	Yes	Small lake, moderate-low yield, very small population, low pressure	Depleted population. Fish conservatively: limit harvest and limit catch and release
Canyon	870	Moderate	Small	General Regulations	Yes	Small lake, moderate yield, small population, easy access, moderate pressure	Fish conservatively
Caribou	32	Very Low	Small	Special Management Water	Yes	Very small lake, extremely low yield, small population, high pressure, overharvested	Overharvested. Fish conservatively: limit harvest and limit catch and release
Chadburn	185	Low	Small	Special Management Water	Yes	Small lake, low yield, small population, easy access, likely moderate pressure	Fish conservatively: limit harvest and limit catch and release
Claire (South/North)	2040	Moderate	Small	Conservation Water	No	Medium-sized lake, moderate yield, small population, remote, moderate pressure	Fish conservatively

Lake	Lake Area (ha)	Sustainable Harvest (OSY)	Lake Trout Population Size	Classification	Road Access	Summary	Recommendation
Coghlan	823	Moderate-Low	Medium	Conservation Water	No	Small lake, moderate-low yield, medium-sized population, relatively remote, moderate pressure	Fish conservatively; sustainable harvest is low
Crag	567	Moderate-Low	Small	General Regulations	Yes	Small lake, moderate-low yield, small population, easy access, moderate pressure	Fish conservatively: limit harvest and limit catch and release
Dalayee	1060	Moderate	Medium	General Regulations	No	Medium-sized lake, moderate yield, medium-sized population, fairly remote, moderate pressure	No special recommendation
Dezadeash	8250	High	Large	Special Management Water	Yes	Large lake, high yield, large population, easy access, high pressure	Fish conservatively; local concern about stock
Dogpack	176	Very Low	Small	General Regulations	No	Small lake, very low yield, small population, remote, low pressure	Fish conservatively; sustainable harvest is low
Drury	2700	Moderate	Medium	Conservation Water	No	Medium-large lake, moderate yield, medium-sized population, moderate pressure	No special recommendation
Earn	3553	Moderate	Small	General Regulations	No	Medium-large lake, moderate yield, small population, remote, unknown pressure	No special recommendation
Ess	1330	Moderate	Small	General Regulations	No	Medium-sized lake, moderate yield, lake trout likely absent, remote, unknown pressure	Lake trout likely absent
Ethel	4730	Moderate	Large	Conservation Water	Yes	Medium-large lake, moderate yield, medium-sized population, moderate pressure	Fish conservatively; harvest near sustainable levels
Fairweather	1890	Moderate	Unknown	General Regulations	No	Medium-sized lake, moderate yield, unknown population size, remote, unknown pressure	No special recommendation

Lake	Lake Area (ha)	Sustainable Harvest (OSY)	Lake Trout Population Size	Classification	Road Access	Summary	Recommendation
Finlayson	2070	Moderate	Medium	General Regulations	Yes	Medium-sized lake, moderate yield, medium-sized population, easy access, moderate pressure	No special recommendation
Fish	1320	Moderate	Medium	General Regulations	Yes	Medium-sized lake, moderate yield, medium-sized population, easy access, high pressure	No special recommendation
Fortin	1498	Moderate	Medium	General Regulations	No	Medium-sized lake, moderate yield, medium-sized population, remote, low pressure	No special recommendation
Fox	1660	Moderate	Medium	General Regulations	Yes	Medium-sized lake, moderate-high yield, medium-sized population, easy access, high pressure	Fish conservatively
Frances	9941	Moderate-High	Large	Conservation Water	Yes	Large lake, moderate-high yield, large population, easy access, moderate pressure	Fish conservatively; stock is recovering
Frank	586	Moderate-Low	Small	Conservation Water	No	Small lake, moderate-low yield, small population, remote, moderate pressure	Fish conservatively
Frederick	445	Low	Small	Conservation Water	No	Small lake, low yield, small population size, relatively remote, low pressure	Fish conservatively; sustainable harvest is low
Frenchman	1438	Moderate	Small	Conservation Water	Yes	Medium-sized lake, moderate yield, small population, easy access	Fish conservatively: limit harvest and limit catch and release
Gladstone - Central	29	Very Low	Small	General Regulations	No	Very small lake, very low yield, small population, remote	Fish conservatively: limit harvest and limit catch and release
Gladstone - North	24	Very Low	Small	General Regulations	No	Very small lake, very low yield, small population, remote	Fish conservatively: limit harvest and limit catch and release

Lake	Lake Area (ha)	Sustainable Harvest (OSY)	Lake Trout Population Size	Classification	Road Access	Summary	Recommendation
Gladstone - South	79	Very Low	Small	General Regulations	No	Very small lake, very low yield, small population, remote	Fish conservatively: limit harvest and limit catch and release
Granite	174	Very Low	Medium	Special Management Water	No	Small lake, very low yield, moderate population, remote, low pressure	Fish conservatively; sustainable harvest is low
Howard - North	200	Low	Small	General Regulations	No	Small lake, low yield, small population, fairly remote, unknown pressure	Fish conservatively; sustainable harvest is low
Howard - South	59	Very Low	Small	General Regulations	No	Very small lake, very low yield, small population, fairly remote	Fish conservatively; sustainable harvest is low
Hutshi-Central	324	Moderate-Low	Small	General Regulations	No	Small lake, low yield, small population, remote, low pressure	Fish conservatively; sustainable harvest is low
Hutshi-North	510	Moderate-Low	Small	General Regulations	No	Small lake, moderate-low yield, small population, remote, low pressure	Fish conservatively; sustainable harvest is low
Ibex	31	Very Low	Unknown	General Regulations	No	Very small lake, extremely low yield, lake trout believed absent, relatively remote	Lake trout likely absent
Jo-Jo	639	Low	Medium	Conservation Water	No	Small lake, low yield, medium-sized population, remote, likely low pressure	Fish conservatively; sustainable harvest is low
Kluane	39275	Very high	Very Large	Conservation Water	Yes	Very large lake, very high yield, large population, easy access, moderate pressure	No special recommendation
Kusawa	14200	Moderate-High	Very Large	General Regulations	Yes	Large lake, moderate-high yield, large population, easy access, high pressure	No special recommendation
Laberge	20100	High	Large	General Regulations	Yes	Very large lake, high yield, large population, easy access, high pressure	No special recommendation

Lake	Lake Area (ha)	Sustainable Harvest (OSY)	Lake Trout Population Size	Classification	Road Access	Summary	Recommendation
Lewes	137	Very Low	Small	General Regulations	Yes	Small lake, very low yield, small population, easy access, high pressure	Fish conservatively: limit harvest and limit catch and release
Little Atlin	3790	Moderate-High	Medium	Special Management Water	Yes	Medium-large lake, moderate-high yield, small-medium-sized population, easy access, high pressure	Fish conservatively
Little Braeburn	79	Very Low	Small	General Regulations	Yes	Very small lake, very low yield, very small population, fairly easy access, unknown pressure	Fish conservatively: limit harvest and limit catch and release
Little Fox	216	Low	Small	Special Management Water	Yes	Small lake, low yield, small population, easy access, high pressure	Fish conservatively: limit harvest and limit catch and release
Little Kalzas	993	Moderate	Medium	General Regulations	No	Small lake, moderate yield, medium-sized population, relatively remote, unknown pressure	No special recommendation
Little Salmon	6210	Moderate	Large	General Regulations	Yes	Large lake, moderate yield, large population, easy access, high pressure	No special recommendation
Long	1390	Moderate	Large	Conservation Water	No	Medium-sized lake, moderate yield, large population, remote, low pressure	No special recommendation
Louise	53	Very Low	Small	General Regulations	Yes	Very small lake, very low yield, small population, easy access, high pressure	Overharvested. Fish conservatively: limit harvest and limit catch and release
Mandanna	850	Moderate-Low	Small	Special Management Water	No	Small lake, moderate-low yield, small population	Mandatory release of all lake trout
Marsh	9630	High	Medium	Conservation Water	Yes	Large lake, high yield, medium-sized population, easy access, high pressure	Fish conservatively

Lake	Lake Area (ha)	Sustainable Harvest (OSY)	Lake Trout Population Size	Classification	Road Access	Summary	Recommendation
Mayo	9000	Moderate	Medium	General Regulations	Yes	Large lake, moderate yield, medium-sized population, easy access, low pressure	No special recommendation
McEvoy	1904	Moderate	Medium	Conservation Water	No	Medium-sized lake, moderate yield, medium-sized population, remote, moderate pressure	Fish conservatively
McPherson	927	Moderate-Low	Unknown	General Regulations	No	Small lake, moderate-low yield, unknown population size, remote, likely low pressure	Fish conservatively; sustainable harvest is low
McQuesten	1230	Moderate	Unknown	General Regulations	Yes	Medium-sized lake, moderate yield, unknown population size, easy access	No special recommendation
Michie	388	Low	Small	General Regulations	No	Small lake, low yield, small population, relatively easy access, moderate pressure	Fish conservatively
Moose	1385	Moderate	Unknown	General Regulations	No	Medium-sized lake, moderate yield, unknown population size, remote, low pressure	No special recommendation
Morley	1110	Moderate	Small	Conservation Water	Yes	Medium-sized lake, moderate yield, very small population size, easy access, moderate pressure	Depleted population. Fish conservatively: limit harvest and limit catch and release
Pelly	1980	Moderate	Unknown	General Regulations	No	Medium-sized lake, moderate yield, unknown population size, remote, low pressure	No special recommendation
Pickhandle	163	Very Low	Unknown	General Regulations	Yes	Small lake, very low yield, lake trout absent	Lake trout absent
Pine	548	Moderate-Low	Small	Special Management Water	Yes	Small lake, moderate-low yield, very small population, high pressure, overharvested	Overharvested and depleted population. Fish conservatively: limit harvest and limit catch and release

Lake	Lake Area (ha)	Sustainable Harvest (OSY)	Lake Trout Population Size	Classification	Road Access	Summary	Recommendation
Polecat	168	Low	Small	General Regulations	Yes	Small lake, low yield, small population, remote, likely low pressure	Fish conservatively
Quiet	3780	Moderate	Large	Conservation Water	Yes	Medium-large lake, moderate yield, large population, easy access, high pressure	Harvest at sustainable limits. Fish conservatively: limit harvest and limit catch and release
Sambo	1136	Moderate-Low	Unknown	General Regulations	No	Medium-sized lake, moderate-low yield, unknown population size, remote, low pressure	No special recommendation
Sekulmun	4932	Moderate	Medium	Conservation Water	No	Medium-large lake, moderate yield, medium-sized population, relatively remote, low pressure	No special recommendation
Simpson	2030	Moderate	Small	General Regulations	Yes	Medium-sized lake, moderate yield, small population, accessible, moderate-high pressure	Fish conservatively
Snafu Lakes	651	Low	Small	Special Management Water	Yes	Small lakes, low yield, small depleted population, accessible with very high pressure	Depleted population. Fish conservatively: limit harvest and limit catch and release
Squanga	1020	Moderate	Very small	General Regulations	Yes	Medium-sized lake, moderate yield, very small population, easy access, moderate pressure	No special recommendation
Stevens	709	Moderate-Low	Unknown	General Regulations	Yes	Small lake, moderate-low yield, unknown population size, low pressure	Fish conservatively; sustainable harvest is low
Stewart	1041	Moderate-Low	Medium	General Regulations	No	Medium-sized lake, moderate-low yield, medium-sized population, remote, low pressure	No special recommendation

Lake	Lake Area (ha)	Sustainable Harvest (OSY)	Lake Trout Population Size	Classification	Road Access	Summary	Recommendation
Stokes	1390	Moderate	Very small	General Regulations	No	Medium-sized lake, moderate yield, very small population, remote, low pressure	No special recommendation
Tadru	1360	Moderate	Medium	General Regulations	No	Medium-sized lake, moderate yield, medium-sized population, remote, low pressure	No special recommendation
Tagish	35460	Very High	Very Large	Conservation Water	Yes	Very large lake, very high yield, very large population, easy access, high pressure	No special recommendation
Tarfu	419	Moderate-Low	Small	Special Management Water	Yes	Small lake, moderate-low yield, small population, easy access, high pressure	Depleted and overharvested population. Fish conservatively: limit harvest and limit catch and release
Tatchun	666	Moderate-Low	Very small	General Regulations	Yes	Small lake, moderate-low yield, very small population, easy access, high pressure	No special recommendation
Tatlmain (Tatla Mun)	3381	Moderate	Large	Special Management Water	No	Medium-large lake, moderate yield, large population, remote, low pressure	No special recommendation
Tay (North Canol)	950	Moderate	Medium	Conservation Water	No	Small lake, moderate yield, medium-sized population, remote, low pressure	Fish conservatively; sustainable harvest is low
Taye (Champagne)	977	Moderate	Unknown	General Regulations	Yes	Small lake, moderate yield, unknown population size, unknown pressure	Fish conservatively

Lake	Lake Area (ha)	Sustainable Harvest (OSY)	Lake Trout Population Size	Classification	Road Access	Summary	Recommendation
Tchawshamon	713	Moderate-Low	Unknown	Conservation Water	No	Small lake, moderate-low yield, unknown population size, remote, low pressure	Fish conservatively; sustainable harvest is low
Teenah	240	Low	Small	General Regulations	No	Small lake, low yield, small population, remote, low pressure	Fish conservatively; sustainable harvest is low
Teslin	35400	Very High	Large	Special Management Water	Yes	Very large lake, very high yield, large population, localized high fishing pressure, easy access	Fish conservatively; local concern about stock and harvest near sustainable levels
Thirty-Seven Mile	350	Low	Small	General Regulations	No	Small lake, low yield, unknown population size, remote, low pressure	Fish conservatively
Tillei	2004	Moderate	Unknown	General Regulations	No	Medium-sized lake, moderate yield, unknown population size, remote, low pressure	No special recommendation
Tincup	1790	Moderate	Medium	Conservation Water	No	Medium-sized lake, moderate yield, medium-sized population, remote, low pressure	Fish conservatively; recovering population
Toobally-Lower	1060	Moderate	Medium	General Regulations	No	Medium-sized lake, moderate yield, medium-sized population, remote, low pressure	No special recommendation
Toobally-Upper	983	Moderate-Low	Unknown	General Regulations	No	Small lake, moderate-low yield, unknown population size, remote, low pressure	No special recommendation
Twin Lake	160	Very Low	Small	Special Management Water	No	Small lake, very low yield, very small population, easy access, high pressure	Fish conservatively: limit harvest and limit catch and release

Lake	Lake Area (ha)	Sustainable Harvest (OSY)	Lake Trout Population Size	Classification	Road Access	Summary	Recommendation
Watson	1320	Moderate	Medium	Special Management Water	Yes	Medium-sized lake, moderate yield, small population, easy access, high pressure	Fish conservatively: limit harvest and limit catch and release
Wellesley	7381	Moderate	Large	Special Management Water	No	Large lake, moderate-high yield, large population, remote, high pressure	Fish conservatively; high pressure
Wolf	7350	Moderate	Large	Conservation Water	No	Large lake, moderate yield, large population, remote, low harvest	No special recommendation