

Dolly Varden *Salvelinus malma*:
Combining traditional and scientific knowledge
to protect critical habitats

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Abstract

By the end of the 20th century, many fisheries declined or been driven to collapse. Dolly Varden (*Salvelinus malma*), populations have drastically declined across Canada. In response to these declines, Dolly Varden was added to the 'Species at Risk' list as a species of special concern in 2010. Dolly Varden have specific niches within their home range not only for feeding, but for other activities such as critical breeding and over-wintering areas. These specific areas are vulnerable to habitat change by impacts from threats that may limit populations including: low ground water levels and flows; climate change- warmer, drier trends can alter water flows; and other industrial threats which may contaminate Dolly Varden habitats. Without conducting DNA analysis on every small fish sampled, juvenile stages of Dolly Varden captured using the most commonly used G-trap method, Dolly Varden could be misidentified as other local known species of fish. Recent studies were conducted in the Yukon by comparing two knowledge collection methods: western science (e.g., field studies) and traditional/local knowledge (personal interviews). Although I was unable to confirm the presence of Dolly Varden through field investigations, traditional/local knowledge suggested that Dolly Varden are present in the Yukon River main stem. Presence of a targeted species can often be confirmed at a specific location or within a specific habitat, but absence is generally impossible to confirm because individuals may currently be elsewhere within its home range. Traditional/local knowledge of the Tatchun Creek, Big Salmon River, Lubbock River, Carmacks and Dawson City regions contributes to the understanding that Dolly Varden are potentially wider spread within the Yukon, including the mainstem Yukon River. Future studies should be conducted to gain a better understanding of critical breeding and over-wintering habitats and the potential management direction and protection of those critical habitats.

Introduction

By the end of the 20th century, many fish populations around the world have declined or been driven to collapse altogether (Post et al. 2011). One of those species, the Dolly Varden (*Salvelinus malma*), can be found around the entire globe, although populations have recently been observed to be drastically declining across Canada (COSEWIC 2010). In response to these drastic declines, Dolly Varden were added to the 'Species at Risk' list as a species of special concern in November 2010 (COSEWIC 2010).

Dolly Varden and other types of fish in the char genus (*Salvelinus*) play important ecosystem roles by providing nutrients to plants, animals, and even soils. For example, from egg to pre-smolting sizes, Dolly Varden provides a large amount of food as prey to other species. However, as they grow, they become predators and may drive prey response. As a result, prey respond in increased numbers in responses to their level of predation (National Research Council 2005). This means, when predation is high, prey respond by producing increased gametes; and when predation is low, fewer gametes are produced. Recent investigations of predator/prey driven interactions suggest that the local extirpation or drastic declines in populations may have wider impacts than commonly recognized (COSEWIC 2010; Reist 2011; National Research Council 2005),

Dolly Varden have specific niches within their home range not only for feeding, but for other activities such as critical breeding and over-wintering areas. These critical habitats are vulnerable to habitat change by impacts from potential threats that may limit populations including: low ground water levels and flows; climate change- warmer, drier trends can alter water flows; and, other impacts from industrial development which may alter the environment or habitats of Dolly Varden (COSEWIC 2010).

In the Yukon, Dolly Varden are not a targeted species for subsistence harvest or even sought after by sports/recreation fishing (von Finster, personal communications

2011). Netting of species such as salmon rarely results in incidental catches of Dolly Varden because smaller size fish such as Dolly Varden escape capture in the larger mesh nets used for target species (von Finster, personal communications 2011). As a result of not being a highly sought after fish in the Yukon, Dolly Varden are not a species of high priority for management or immediate research. To date, population sizes of Dolly Varden are widely unknown in the Yukon, with current information limited to reconnaissance data for some sites only, which makes it critical for further investigations for managing and protecting critical Dolly Varden habitats. (COSEWIC 2010).

Dolly Varden are members of a genetically closely related group of chars with extremely small changes within their alleles. With only these small changes, identification is difficult (if not impossible) without conducting DNA comparisons between Dolly Varden and three other species of fish which reside in the same habitats: bull trout (*Salvelinus confluentus*), arctic char (*Salvelinus alpinus*), and lake trout (*Salvelinus namaycush*) (Dunham et al. 2008; Reist 2011; National Research Council 2005).

Without conducting DNA sampling on every small fish sampled, juvenile stages of Dolly Varden currently captured within this area using the g-trap method (i.e., a commonly used method for trapping juvenile fish) could be misidentified as one of the other local species (von Finster, pers. Comm. 2011; Reist 2011). This misidentification can lead to managers and decision-makers to misunderstanding the demands of fish like Dolly Varden within the ecosystem such as: finite spawning and overwintering habitats, fresh flowing waters, and predator and prey driven interactions (Estes and Orsborn 1986).

The purpose of this report is to confirm the presence of Dolly Varden, *Salvelinus malma*, in the Yukon River at traditionally known locations such as the confluence of Tatchun Creek, Big Salmon River, Lubbock River, Carmacks and Dawson City. I used two approaches to obtain evidence for the presence of Dolly Varden in the Yukon River.

First, I conducted interviews with elders, fishermen, government officials and other experts in the region; second, I conducted field surveys at sites where Dolly Varden were expected to be present.

Methods

The study area (Figure 1) is located at 62° 17' 13.92"N, 136° 19' 09.06"W, at an elevation of 515m on the Yukon River main stem, downstream of the confluence of Tatchun Creek with the Yukon River, Yukon. Little Salmon Carmacks First Nation currently maintains a traditional subsistence harvesting camp beside the former location of a public campground. The public campground was historically heavily used, during the Chinook salmon run for local subsistence harvesting. This was prior to Yukon Government moving the campground to its new location on the east side of the highway along Tatchun Creek during the 1980's.



Figure 1. Map showing the study area below the confluence of Tatchun Creek along the Yukon River.

In March 2012, I began collecting traditional knowledge information through letters, emails, social networking and personal communication meetings to confirm the presence of Dolly Varden within the Yukon River watershed. I conducted correspondence and communication meetings with Little Salmon Carmacks First Nation, Carmacks Renewable Resources Council, the Yukon Government Regional Conservation

Officer, as well as, 5 fishermen and 2 First Nation Elders who use the Chinook salmon fishery. In order to protect the traditional knowledge contributed to this report, names and exact locations of catches were not used.

Surveys consisted of 3 two-day sampling periods chosen randomly during the predicted Chinook salmon (*Oncorhynchus tshawytscha*) run. Chinook salmon migrate to their spawning grounds in this location from mid-late July through late August-early September. Other fish species such as Arctic grayling, juvenile Chinook, chars, northern pike, burbot, and whitefish, feed heavily upon the Chinook salmon roe laid in these spawning grounds.

A CPUE (catch per unit effort) method was conducted to catch Dolly Varden using a fishing rod and hook baited with salmon roe. Dolly Varden or other unknown species that were caught were measured and photographed, and 10 individuals were intended to be kept for DNA testing. A G-type minnow trap method was considered in the study proposal as an additional tool for data collection complimentary to the rod and reel CPUE method. However, at the request of the Carmacks Renewable Resource Council (CRRC), this method was not used. The CRRC had expressed concern about the possibility of cumulative effects of multiple activities based around Tatchun Creek and the concern for the declining Tatchun Creek Chinook salmon population and area habitat.

Sampling locations were within 400 meters below the confluence of Tatchun Creek and the first large land slide downstream on the Yukon River main stem. Sampling locations were chosen and recorded by characteristics such as visual observation and on-the-spot analysis, as well as, physical attempts using a fishing rod and baited hook to catch Dolly Varden. Overall river zone characteristics (e.g., littoral, ripples, back eddys) provide evidence as to which species were expected to be caught there. Dolly Varden prefer a specific 'back eddy' zone along the edge of the shoreline so that when a hook is

placed within the water column, the hook does not get pulled down stream with the currents; rather, the baited hook is suspended within the zone. Because these suspended zones are difficult to see, specific Dolly Varden catch zones can only be found by placing a hook along the shore lines and actually testing the waters and visually observing hook reactions within the flow.

Results

Traditional Knowledge

On March 21, 2012, prior to the Chinook salmon run and sampling period, I interviewed 2 elders and staff from the Little Salmon Carmacks First Nation Lands department about traditional subsistence harvesting along the Yukon River. I discussed harvesting Chinook salmon and other species of fish using methods other than nets. Both elders remembered that, as young girls, they used a hook attached to braided strands of long hair baited with salmon roe to catch *£uk zra*, small fish in Southern Tutchone dialect. However, both women thought that the small fish they had caught were young salmon. Since there was no additional information held within the lands department database, a Fish and Wildlife Officer requested a copy of this report for their records.

Individual interviews were conducted with 5 fishermen who fish the Yukon River for subsistence annually. Two out of the 5 interviewees remembered catching Dolly Varden in the Yukon River occasionally. One interviewee from Dawson subsistence fished under the ice in the Yukon River during winter from 1994-2001, and caught Dolly Varden at least three years in a row using a set line hook. Another interviewee described how each year since she was a small girl her father fished for Dolly Varden in the Lubbock River located about 180km upstream from the study location. The final interviewee remembered fishing at the Tatchun Creek confluence location for Dolly Varden every year when she was young.

As Dolly Varden become adults, they are more distinguishable by their commonly

known pink spot markings. With these distinguishable markings identifying species of the Char family, fishermen and other subsistence users are catching Dolly Varden as by-catch with species which fisheries resource users are targeting.

Western Scientific Knowledge

I conducted the first sampling period on June 16th and 17th, 2012. Although sampling took place over an 8 hour period each day, no fish were caught. It was noted that there were extremely high levels of water on those days (Figure 2),



Figure 2- Photograph showing water levels on June 16, 2012 looking down stream along the Yukon River within the study area.

I conducted the second sampling period on August 4th and 5th, 2012. Although waters were still higher than average, turbidity was decreased from the prior sampling period with considerably less silt and debris. Six Arctic grayling and 12 juvenile Chinook salmon were caught during the first 8 hours of sampling. Eight juvenile Chinook salmon and no Arctic Grayling were caught in the final 8 hours. No Dolly Varden were caught over the sampling period. Arctic Grayling were caught in faster waters, whereas the juvenile Chinook were caught within the shallow littoral zones of shore which consisted of slower to almost no river flows.

I conducted the final sampling period on August 25th and 26th, 2012. The river

water levels had subsided considerably (Figure 3) and river zone characteristics were easier to decipher with more defined areas in clearer water conditions. In the first 8 hours of the sampling period, I caught 12 Arctic Grayling and 20 juvenile Chinook salmon.



Figure 3- Photograph showing water levels on August 25, 2012 looking down stream along the Yukon River within the study area.

On final day of the sampling period, I caught 6 Arctic Grayling and 14 Chinook salmon within the first 4 hours of the survey. Within a back eddy at the sampling location, I captured one fish that appeared to be different from the others caught in that location. I measured and photographed the individual (Figure 4 and Figure 5 below). In comparison to the other fish caught at this location, the individual in Figures 4 and 5 was brighter silver, or almost white overall, with a stark white belly; and had translucent yellowish to orange fins, a triangular dorsal fin, forked tail and a relatively stout head and nose.

These descriptions closely resemble those of Lake Trout, but Lake Trout are also

known to rarely be present in this area and within the main stem Yukon River (O'Donoghue, per. com. 2012). DNA testing would be required to confirm the species of the small fish; however, the unconfirmed species was stolen by a juvenile mew gull (*Larus canus*) after photographs and measurements were collected.



Figure 4- Photograph of the 'unknown' small fish caught on August 26, 2012.



Figure 5- Photograph of the 'unknown' small fish caught on August 26, 2012.

Discussion

Although I was able to find and identify the appropriate river zone characteristics where Dolly Varden could be caught, I was not able to confirm the presence of Dolly

Varden within the Yukon River main stem through field surveys. However, traditional knowledge suggests that Dolly Varden are present in the Yukon River main stem.

There were extremely high levels of water on those days (Figure 2), which may have affected the presence of Dolly Varden. Since Dolly Varden rely primarily on their keen sight for finding prey, actually locating prey in the high water levels would have been difficult with the excessive amount of turbidity from silt and debris. As a result, our success of capture could have affected as Dolly Varden likely avoided these highly turbid areas.

The presence and absence of species to assess habitat use within habitats is a concept widely used by managers and decision-makers in wildlife related disciplines (MacKenzie 2005, Mackinson and Nottestad 1998, Tsuji and Ho 2002). Where presence of a targeted species can often be confirmed at a specific location or within a specific habitat, absence is generally impossible to confirm because a species may currently be elsewhere within their home range (MacKenzie 2005, Mackinson and Nottestad 1998, Tsuji and Ho 2002). As such, absence of solid scientific data, can lead to imperfect detection and ineffective management decisions (MacKenzie 2005).

Alternatively, individual variation in catch success (that is, in abundance, effort and catching power; Hilborn 1985), may be interpreted as an absence of that species in that area. The longer that an individual spends in a location, with the right amount of luck, and the right hook or bait, the better the individual's chances are at a successful catch (Hilborn 1985). In other words, just because you cannot see or catch a fish today, does not mean that fish are not there all together and you will not catch a fish there tomorrow either. The fish could be absent at that moment, season or simply just in that small area.

Traditional knowledge is based on the long time accumulation of hands on experiences of consistently repetitive activities and has been recognized as a method for

collecting additional information about the natural world (Mackinson and Nottestad 1998, Tsuji and Ho 2002). Although there is a desire to use traditional knowledge to complement scientific knowledge in order to acquire a more holistic understanding of the natural world, traditional knowledge is still not considered on equivalent levels in decision-making processes (Mackinson and Nottestad 1998, Tsuji and Ho 2002). As a result, science may overlook a source of information which includes first hand experiences, as well as generational knowledge, that is shared and passed down from generation to generation (Mackinson and Nottestad 1998, Tsuji and Ho 2002).

Traditional and Local Knowledge of the Tatchun Creek, Big Salmon River, Lubbock River, Carmacks and Dawson City regions contributes to the understanding of Dolly Varden for which the current scientific knowledge may be misunderstood proving that populations are potentially wider spread within the Yukon, including the mainstem Yukon River. Future studies should focus on identification, management, and protection of critical breeding and over-wintering habitats.

With the drastic declines in many species of fish across Canada today, it is critical to gain a better understanding of the natural world around us. Using traditional knowledge and scientific knowledge to complement each other, we can gain a vast source of information and a wider span of understanding of the natural world. This complementary information can provide managers with better estimates of the use and occupancy of habitats, and can help with decision-making, planning, and protecting resources.

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Chapter) of the Umbrella Final Agreement and may include initiating, sponsoring, **funding**, directing and carrying out measures to achieve those objectives” (WWW.yfwet.ca, 2012).

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