Photographic Baseline for Dolly Varden Habitat in Three North Slope Rivers

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Abstract

The Northern form of Dolly Varden (*Salvelinus malma*) is made up of genetically distinct populations which are endemic to their respective river systems. Dolly Varden is an important part of the Inuvialuit and Gwich'in subsistence harvest, however stocks in some north slope rivers are thought to be decreasing. This report reviews the issue of Dolly Varden habitat loss and provides a description of the 2007 Dolly Varden habitat photographic baseline survey on three north slope rivers (the Vittrekwa, Rat, and Big Fish Rivers). In areas in and around known Dolly Varden habitat, spatially referenced photographs were taken from a helicopter directly above the river thalweg, including the river banks. Results were posted on the Western Arctic Area Mapping program within DFO and the data were provided to both the Gwich'in and Inuvialuit. Ground work was completed for both the Big Fish and Rat Rivers. Recommendations include creating consistent locations from which to photograph key areas on each river based on the aerial and ground work photos from this project. These benchmarks can provide valuable insight into changes in the river system that may affect Dolly Varden habitat.

Preface

The Canada Inuvialuit Fisheries Joint Management Committee (FJMC) Report Series was initiated in 1986 and reports were published sporadically in a variety of formats until 1998. Information on the earlier publications can be obtained directly from the FJMC office. The Series was re-initiated in 2003 and a common format established with concurrent publication on the FJMC website (www.fjmc.ca).

This report was produced in response to requests from local communities to investigate habitat changes within the Rat, Big Fish, and Vittrekwa rivers. A Dolly Varden planning meeting was held on June 15, 2007, during which it was agreed that DFO-Habitat from the Inuvik office would be responsible for documenting changes in the Big Fish and Rat Rivers. The final report was presented at the Regional Advisory Process on Rat River Dolly Varden meeting held March 17-19, 2008, and at the Fisheries Joint Management Committee meeting on June 21, 2008.

The results of this report should be used as a baseline to study changes in the Big Fish, Rat, and Vittrekwa Rivers from the past to present and present to future. Further photography and habitat studies will take place in 2008 to supplement the data from 2007

Introduction

The Northern form of Dolly Varden (*Salvelinus malma*) is made up of genetically distinct populations which are endemic to their respective river systems. Known populations inhabit the Firth, Big Fish, Babbage, Rat, and Vittrekwa rivers (See Figure 1). Dolly Varden is an important part of the Inuvialuit and Gwich'in subsistence harvest. This report introduces the issue of Dolly Varden habitat loss, briefly reviews past relevant work and provides a description of the 2007 Dolly Varden habitat photographic baseline project.

Currently in two river systems, the Big Fish and the Rat, populations of Northern Dolly Varden have declined, causing concern for the sustainability of the population. This led to the northern form of the species being upgraded to Group 1 on the Committee on the Status of Endangered Wildlife in Canada's (COSEWIC) list of candidate species. As of January 2008, COSEWIC has moved forward and begun the assessment of Dolly Varden. Group 1 contains species of the highest priority for assessment by COSEWIC. The pressure to understand the decline will further increase if Dolly Varden become listed by COSEWIC.

Finally, at the DFO Science Meeting for Dolly Varden, held in Winnipeg on June 15, 2007, it was suggested that *a historical photo record of habitat changes would be an excellent approach to document habitat change.* This record will help Fisheries and Oceans Canada (DFO), the Fisheries Joint Management Committee (FJMC), and the Gwich'in Renewable Resource Board (GRRB) to understand the potential impacts of habitat change on Dolly Varden stocks.

The objective of this project is to create a photographic record of several rivers inhabited by Dolly Varden, namely the Big Fish, Rat, and Vittrekwa rivers, to 1) provide a baseline for comparison between historical, and future records and 2) provide a starting point for a habitat study of the Northern form of Dolly Varden.

This project will provide GRRB, FJMC, and DFO with the data to begin to determine the role of habitat loss in the decline of Northern Dolly Varden in the Rat and Big Fish river systems. This project will also provide information valuable to other Dolly Varden studies occurring in the area (e.g., other rivers like the Vittrekwa).

Related Traditional Knowledge

Habitat deterioration within the spawning reaches of the Big Fish was identified by local traditional resource users as potentially a major factor contributing to the lack of increase in population levels following a five-year closure of the Big Fish fishery (Stabler 1998). Locations of degrading habitat on the Big Fish River (for example the "Fish Hole") have been identified within traditional knowledge reports such as "Aklavik Traditional Knowledge – Big Fish River: A Study of Indigenous Wisdom in Fishery Science" (Byers 1993). Papik et al.'s "Inuvialuit traditional ecological knowledge of fisheries and rivers west of the Mackenzie River in the Canadian Arctic" also collected

traditional knowledge about how changes in habitat likely led to the decline in the Big Fish River population.

There are many informal accounts from community members in Aklavik and Fort McPherson regarding habitat degradation on the Rat River. Community support for research and monitoring projects on the Rat River and Big Fish River dates back to the mid-1990s. As evidence of the community interest in doing habitat work, here are several excerpts from Rat River Char Working Group Meetings (2006 and 2007):

"We need to start a habitat study or monitoring of fish holes."
-Robert Charlie, Chair of the Rat River Char Working Group and the Gwich'in Renewable Resource Board
"Work on habitat is very important."
-Billy Archie, Aklavik Hunters and Trappers Committee
"I am concerned about changes in water flow."
-Robert Alexie, Fort McPherson Renewable Resource Council

Related scientific knowledge

The status of the Rat River Dolly Varden was assessed in 2001 and the remaining populations were assessed in 2002 at formal Fisheries and Oceans stock assessment meetings.

A habitat inventory of the Big Fish River was completed in 1998 by Matt Stabler. This study assessed the quality of spawning/overwintering habitat available to Dolly Varden in the Big Fish River. It also attempted to compare the quantity/quality of the Fish Hole habitat between 1995/96 and historical levels. The feasibility of instream mitigation structures to stabilize habitat was also explored and deemed unfeasible. The study concluded that habitat changes had occurred historically and between the summers of 1995 and 1996. High water in 1996 caused scouring and redeposition, significantly changing the borders and flow direction within the river system. A reduced influx of groundwater into the system and erosion of steep banks along spawning areas is also suspected to be adding to the habitat degradation. No photographs were taken during this study and no studies similar to this have occurred since 1996.

The possibility of the groundwater flow being affected by earthquake activity was explored in 2000. (Clark et al. 2001; Sandstrom and Harwood 2002). As a result of decreased water flows and significantly lower salinity, there could be potentially reduced spawning and over-wintering habitat (Stabler 1998; Sandstrom and Harwood 2002; Papik et al. 2003).

Rat River Dolly Varden have been monitored since 1995 by a community based monitoring program led by Lois Harwood of DFO and funded by the Gwich'in Renewable Resource Board. Monitors sample catches of Dolly Varden in the Rat River subsistence fishery at three sites collecting information on age, length, weight, sex,

maturity, and population trends. Rat River population estimates (Peterson mark-recapture) have been completed in 1989, 1996, 1998, 2002, and 2005, with another planned for 2008.

The GRRB has conducted two summers of field work on the Dolly Varden of the Vittrekwa River. The 2007 field season focused on collecting quality baseline habitat data and performing the initial test aerial survey for this project. A related project that will take place in the spring of 2008 is a traditional knowledge study of Rat River char. This study aims, among other things, to understand from elders any changes in habitat they have seen and to describe the habitat of the spawning grounds as they remember it.

Methodology

The project was a collaborative effort between the Gwich'in Renewable Resource Board, the Fisheries Joint Management Committee and the Department of Fisheries and Oceans.

This is a qualitative study to establish a photographic baseline for the Dolly Varden habitat on the Vittrekwa, Big Fish, and Rat Rivers. The background work involved a literature search on the best practices for an aerial river and fish habitat survey and research of past Dolly Varden spawning and overwintering locations. Information from completed studies on traditional knowledge prepared by the West Side Working Group, the FJMC, and the GRRB was used to determine the historical fishing, overwintering and spawning areas.

A review of habitat mapping techniques in British Columbia showed the average altitude for similar studies to be between 50-200m (160 – 640 feet), depending on the width of the river (Harper 1995). The Mackenzie Pipeline Photographic Record was completed using an altitude of 200 feet (Cott, 2007, p.c.) The methodology was tested while photographing the Vittrekwa River (GRRB project supported by Polar Continental Shelf Project). The height of 200 feet allowed the river to be photographed as well as the banks, without sacrificing detail within the photograph. Therefore, 200 feet was chosen as the altitude for the survey.

The field work entailed flying by helicopter along the known Dolly Varden habitat in each river while taking high-quality, spatially referenced (with a GPS) digital photographs (See Figure 2). The equipment used was a Nikon D2X digital camera with 4 spare memory cards of at least 2GB, and a Garmin GPSmap 60CSx. The resolution of the pictures was 4288 x 2848. If time allowed, habitat that had been deemed similar to that of known Dolly Varden habitat on the same river was photographed (for example, Scho Creek is close to and similar to Fish Creek; both are tributaries of the Rat River, have similar elevation, direction, and length, however Fish Creek is where most of the Dolly Varden habitat is found).

When possible, the photographs were taken above the center of the river. When it was not possible due to environmental conditions (sun glare, steep banks casting a shadow), the photos were taken just above the right side facing downstream. If the photos were facing upstream, they were photographed from the left bank. For areas where the desired photograph would not fit in the whole frame (for example the aufeis of the Big Fish River), the elevation was raised to 400 feet. Overlap of the images was intentional for ease of reference to the previous picture. If the direction of the survey was changed (upstream vs. downstream), a picture of the photographer's hand was taken to indicate a change in direction in the series of photographs.

The aerial photographs and their associated data were inputted into the Western Arctic Area Map Explorer on the DFO Intranet http://intra.cna.dfo-mpo.ca/hfomgeomatics/index_e.htm. This allows the viewer to see the path of the survey on a map, as well as each picture taken on the survey along with its data.

On-the-ground work was opportunistic and focused on recording the historic pool sites; landing sites were chosen based on past ground work data, ease of landing site, and avoidance of areas where fish were observed (team members walked up the banks to the sites instead of disturbing the site with the helicopter). Not all pools may have been recorded as only a small amount of time was allowed for these surveys during the helicopter survey. The pools were recorded with photographs; ideally at least one photograph of each upstream, downstream, and cross-river view was taken. When beginning to record a new pool, a photograph of the ground was taken to discern between the pools. All locations of pools were recorded with a GPS in decimal degrees. Estimates of pool depth, width, presence of inflow, along with a count of fishes within each pool were recorded. The area covered on foot for both the Rat and Big Fish Rivers is shown in Figures 4 and 6. In instances where the channels braided, the main channel was followed.

Results

Photographic records of the known Dolly Varden overwintering and spawning habitat were recorded for the Big Fish, Rat, and Vittrekwa Rivers. The areas covered are shown in Figures 4 and 6.

The GIS pictorial view of each of the rivers along with their associated photographs will be available on the DFO Intranet. Currently, RRCs, HTCs, the GRRB and the FJMC can access the information through DFO. The GRRB and the FJMC were each given a DVD with all of the photographs and the associated data for the river system(s) in their area.

On-ground work

On-ground work occurred on both the Rat River and the Big Fish River. The results of the ground work are seen in Table 1 and 2. The locations of the ground work are seen in Figures 5 and 7. Photos of the groundwork were given to each respective

management board. Figure 8 is an example of the photos taken during the on-ground work.

Table 1 - Rat River Ground Work Data (September 8, 2007)

Pool #	Depth (m)	Width across (m)	Number and type of Dolly Varden	Location (decimal minutes, NAD 27)	Notes
1	2.5	7	1 juvenile in pool	N67°49.613' W136 ° 16.392'	Bottom 60% cobble and 40% silt
2	1.5	5	0	N67°49.598' W136 ° 16.484'	All rocks covered in algae – no clear spot at bottom
3	2.5	6	1 adult above pool	N67°49.555" W136 ° 16.669'	Erosion on right downstream bank; heavily undercut
4	1.5		>2 adults in pool	N67°49.517' W136 ° 16.779'	Patch of rocks with no algae (1m x 3m)
5	3	9	0	N67°49.518' W136 ° 16.837'	Pool created by confluence of another stream
6	1.5		11 adults including at least 1 male moving in and out of pool	N67°49.514' W136 ° 16.874'	Patch of rocks with no algae (6m x 2m)

Further sightings of Dolly Varden and Arctic Grayling were noted when travelling further downstream to meet the helicopter. A total of 4 Dolly Varden and >150 Arctic Grayling were seen in the area between N67°49.514' W136 ° 16.874' and N67°49.201' W136 ° 17.641'.

All of the ground work was done on Fish Creek. The six pools observed by the field team were characterized by overhanging banks and vegetation and algae-covered rocks except for areas on the bottom of the pools with groundwater influx or scouring, which were clear of algae. Dolly Varden were observed within and between the pools. Depth, width and length were all estimated visually, and the measurements were estimated to be the maximum. The pools were numbered moving from upstream to downstream. The temperature of the water at the top of each pool ranged from 4.1-4.8 degrees Celsius. The substrate of all six pools was mostly cobble, with diameters ranging from 2-15 cm in length.

Table 2 - Big Fish River Ground Work Data (September 28, 2007)

Pool #	Depth (m)	Width across (m)	Number and type of Dolly Varden	Location (decimal minutes, NAD 27)	Notes
1a*	1	3.5	0	N68°17.764' W136° 21.800'	
1b	1	4	~ 3 adults		Pool length ~20m
1c	2	3	0		Pool length ~10m
2	1.5	10	6-8 adults	N68°17.779' W136° 21.602'	
3	5	5	~ 5 adults	N68°17.812' W136° 22.007'	Pool length ~25m
4a				N68°17.839' W136° 22.018'	Small shale erosion into water from steep bank almost constant
4b	2.5	12	6 adults		Dark silt deposit on right upstream side; river splits to right from here
5	-	-	-	N68°17.883' W136° 21.660'	Photos taken – due to incoming weather, no time to record other info
BW1	1	2.5	9 adults (3 male, 6 female)	N68°17.856' W136° 21.900'	Video – see CD, 15m in length, clear water with enough flow to create small back eddy. Cliff face forms left upstream bank.
BW2	.5	2	~50-100 juveniles	N68°17.879' W136° 21.758'	No flow – still water. Rocks covered in silt. 35-40 m in length. No banks, flat ground on either side.

*Pool 1 was separated into 3 parts due to the close proximity and connectivity of the 3 small pools. Between Pool 2 and 3, the river changed into a straight stretch of riffles. Possible redds were observed and possible guarding of a redd was observed in this stretch (N68°17.789' W136°21.919'). Two areas of backwater (BW) were observed and recorded.

Communication

Findings from the study will be communicated to the appropriate Renewable Resource Councils and Hunters and Trappers Committees at one of their public monthly meetings. If appropriate, the findings could also be presented to the community in another setting (e.g., FJMC meeting, GRRB bi-annual meeting or Regional Renewable Resource Council meetings). A copy of this report and any other publication arising from the study will be given to the appropriate RRCs and HTCs, and also to DFO-Science and Fisheries Management. All field notes, photos, and reports will be held at DFO and made available upon request.

Budget

Cost (cash):

Helicopter Fuel (drums)		$2,000
Transportation of Helicopter fuel to Aklavik		$500
Helicopter charter		
Inuvik – Rat River return	2 hours	$2,800
Rat River photography	4 hours	$5,600
Inuvik – Big Fish River return	2 hours	$2,800
Big Fish River photography	4 hours	$5,600
TOTAL		**$19,300**

Table 3 – Sources of Funding and Contributions

Funding Source	In-Kind	Cash	TOTAL CONTRUBTION
Fisheries Joint Management Committee	3,000.00	0.00	3,000.00
Department of Fisheries and Oceans	18,300.00	11,400	29,700.00
Gwich'in Renewable Resource Board	3,000.00	0.00	3,000.00
Polar Continental Shelf Project (*Vittrekwa work*)	8,300.00	0.00	8,300.00
NWT CIMP	0.00	8,933.00	8,933.00
TOTAL COST	**$32,600.00**	**$20,333.00**	**$52,933.00**

Recommendations

The main recommendation is to create consistent locations from which to photograph key areas on each river based on the aerial and ground work photos from this project. For example, Figures 8 and 9 are taken at approximately the same location in different years; you can notice the change in the amount of loose shale on the left bank. Quantitative measurements of the habitat may be considered by taking aerial photos at a specific height (200 m) for a site and then landing to take some measurements using a tape measure. This may allow for better estimate of changes in the future, in a more quantitative manner.

Acknowledgements

Many thanks go to the Gwich'in Renewable Resource Board, the Fisheries Joint Management Committee, Steve Sandstrom, and Lois Harwood of DFO.

Figures

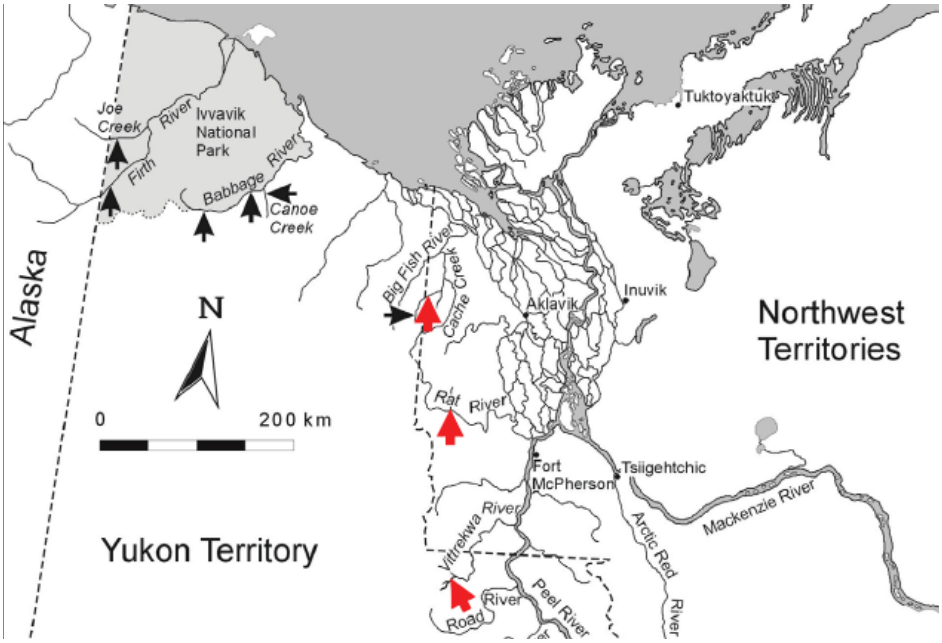

Figure 1 – Location of known populations of Dolly Varden. Red arrows indicate the Rat, Big Fish, and Vittrekwa Rivers

Figure 2 – Example image of the photographs taken (Big Fish River - Sept. 28, 2007)

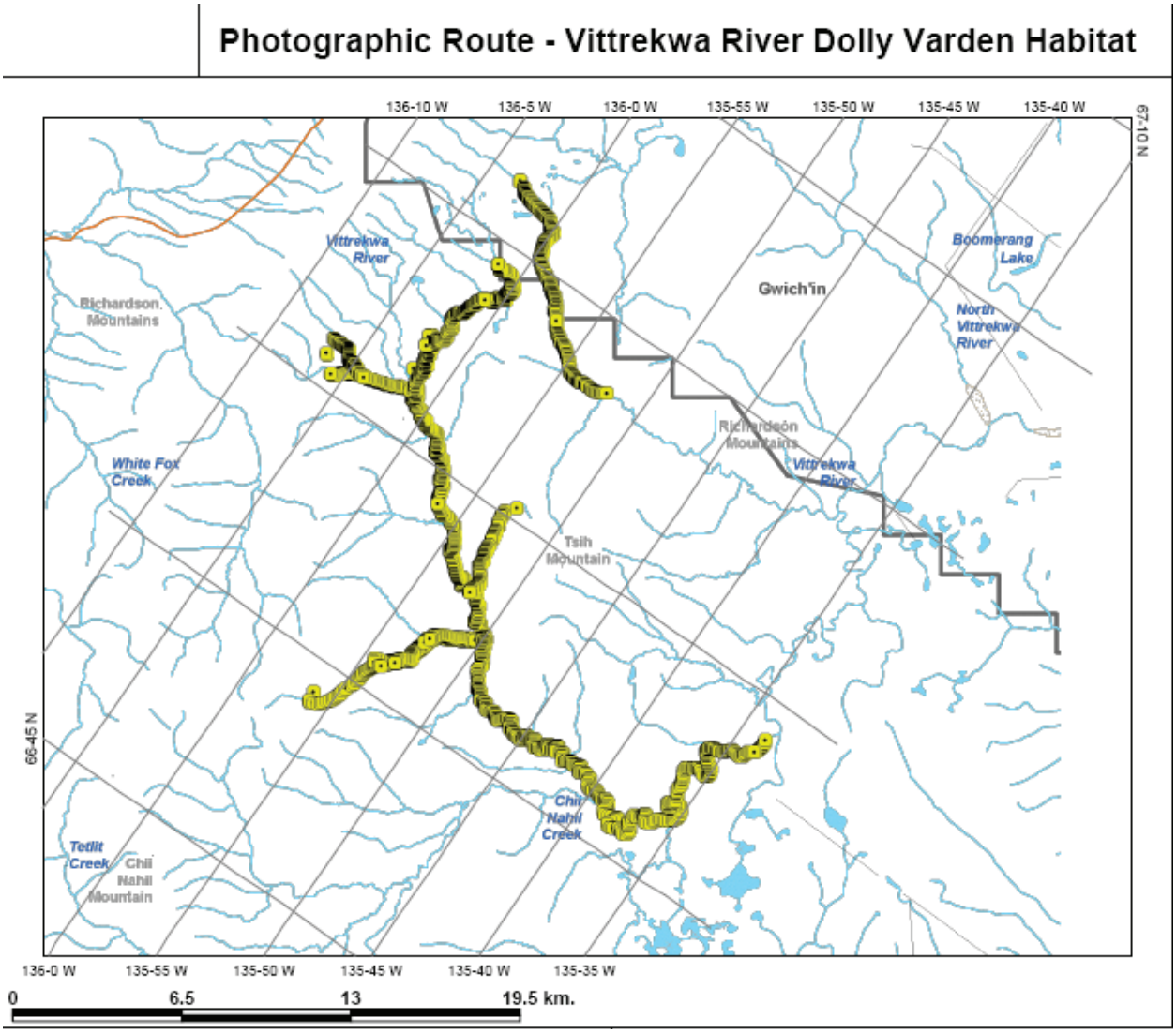

Figure 3 – Photographic Route of Dolly Varden Habitat on the Vittrekwa River, mid-August 2007

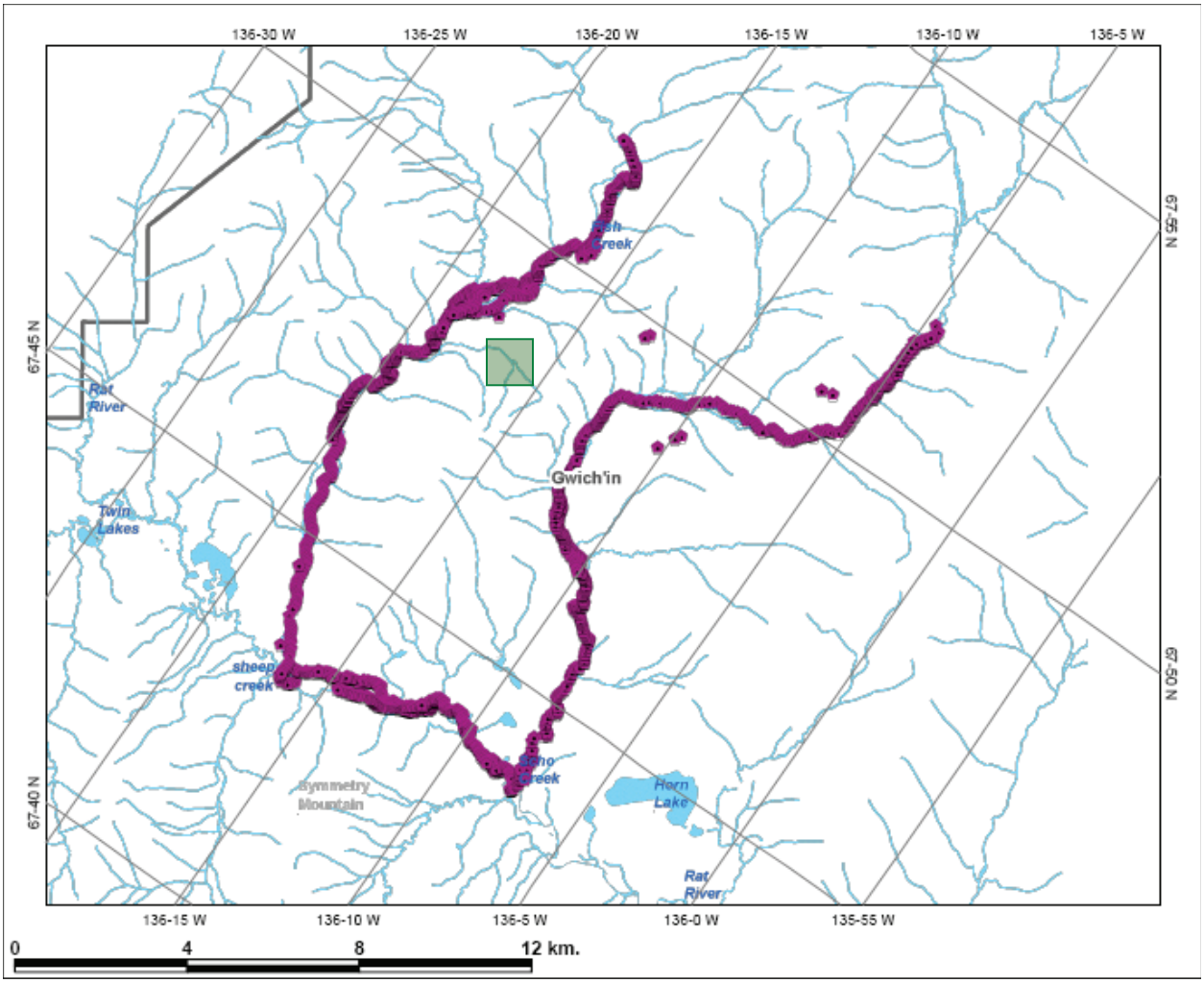

Figure 4 – Photographic Route of Dolly Varden Habitat on the Rat River (Fish Creek and Scho Creek), September 8, 2007. The green highlighted box represents the approximate location of the ground work.

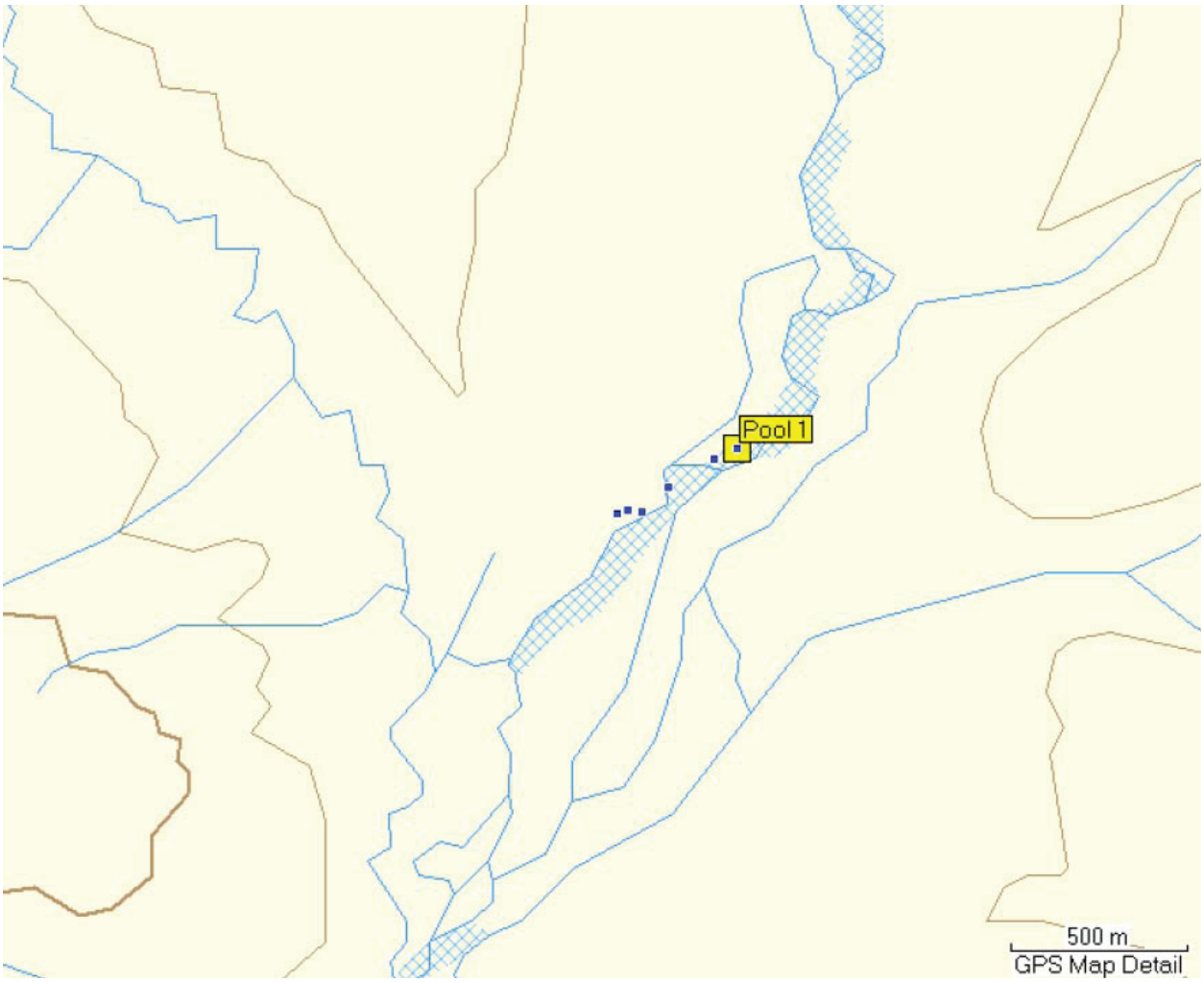

Figure 5 – Small scale view of ground work area on Fish Creek (Rat River), Sept. 8, 2007. Blue hatching indicates braided areas. The boxes indicate recorded pool locations.

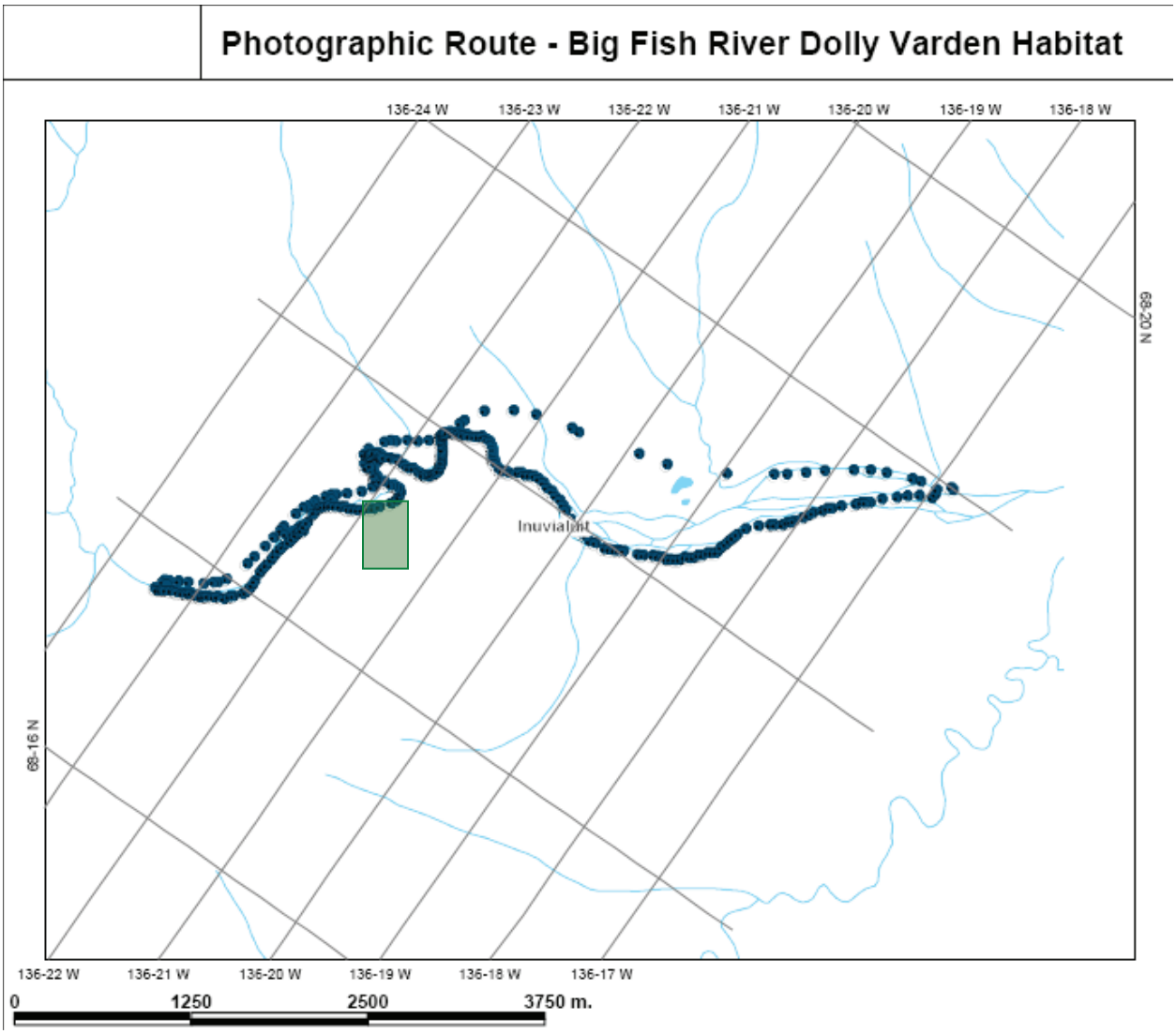

Figure 6 – Large scale view of ground work area (in green) on Big Fish River, Sept. 28, 2007. The green highlighted box represents the approximate location of the ground work.

Figure 7 – Small scale view of ground work area on Big Fish River, Sept. 28, 2007. The blue hatching represents the aufeis area. The black boxes indicate recorded pool locations.

Figure 8 – Example of ground work photo (Big Fish River, Pool 2, upstream view) Sept. 28, 2007

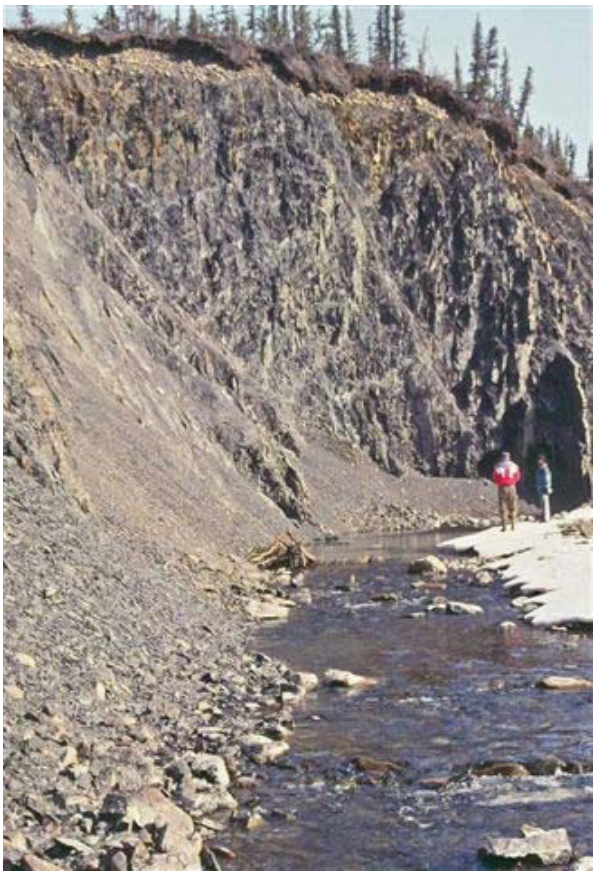

Figure 9 – Ground work on Big Fish River, near Pool 2 as defined in 2007 fieldwork, upstream view – taken in 1997 or 1998

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