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2001-2002 ARCTIC GRAYLING (*Thymallus arcticus*) FRY SURVEYS IN THE OMINECA AND OSILINKA RIVERS

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This report has been approved by the Peace/Williston Fish and Wildlife Compensation Program Fish (or Wildlife) Technical Committee.

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ABSTRACT

Arctic grayling (*Thymallus arcticus*) were once widely distributed throughout the Williston Watershed. Evidence now suggests that over the past few decades, populations of grayling have declined. Many studies are currently being conducted to try and determine the status of the species. As part of these ongoing investigations, two large tributary streams of the Williston Reservoir were examined to determine Arctic grayling distribution, relative abundance and habitat use. Backpack electrofishing was used to look for the presence/absence in the Omineca and Osilinka Rivers. The grayling fry habitat use was compared to studies conducted on the Table/Anzac Rivers in the Parsnip River drainage. Angling surveys were also conducted to collect information on adult distribution.

The Omineca River, 219.5 km in length with a drainage area of 5,851 km^2, was examined in 2001. One hundred and five sites were examined and Arctic grayling fry were found in sixty-three sites, distributed throughout the Omineca mainstem and in three major tributaries (Carruthers Creek, Ominicetla Creek and Silver Creek). No barriers were identified on the Omineca River. Limited resource activity has taken place in this drainage.

The Osilinka River, 141 km in length with a drainage area of 2,051 km^2, was examined in 2002. Seventy-three sites were examined and Arctic grayling fry were captured in eleven sites. The fry were limited to a 38 Km section of the lower Osilinka mainstem. Eighty-five percent of the grayling fry captured from the Osilinka River were caught in isolated pools on mainstem gravel bars. No grayling were caught in any of the tributaries sampled. No barriers were identified on the Osilinka River. Extensive resource activity is evident within the Osilinka watershed.

Arctic grayling fry caught were primarily associated with gravel/fine substrate habitat in both systems. The grayling in the Omineca utilized a broader range of habitats than grayling in the Osilinka River. The Omineca grayling sites average substrate content was 54% gravel/fines, while the Osilinka River average was 76% gravel/fines. In the Table and Anzac Rivers, in the southern region of the Williston Drainage, Arctic grayling showed a preference for shallow low velocity habitat with a high fines content and avoided areas with cobble substrate.

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INTRODUCTION

Background

Arctic grayling (*Thymallus arcticus*) were widely distributed throughout the upper Peace River drainage in the mid and late 1970's but the population is believed to have declined severely in the 1980's (Blackman 2002). Limited historical information is available prior to the construction of the W.A.C. Bennett Dam in the 1960's. Overfishing, habitat degradation and reservoir impacts are probable reasons for the declines. The Peace/Williston Fish & Wildlife Compensation Program (PWFWCP) has conducted numerous Arctic grayling surveys on a select few tributaries of the Williston watershed. Due to this decline in stocks in the Williston watershed, and based on further information obtained from the PWFWCP studies, the B.C. Conservation Data Centre designated Arctic grayling as "red listed" (QS1). This status of QS1 red listed indicates that the species is critically imperiled within the Williston Watershed due to its extreme rarity or limiting factors that make it vulnerable to becoming extirpated or extinct (B.C. Conservation Data Centre 1995). Further conservation measures were then taken by the Ministry of Water, Land and Air Protection (MWLAP) by imposing catch and release regulations in 1995.

One of the original reasons for choosing these systems was a request for additional information of Arctic grayling distribution and identification of critical habitats in the Omineca River by Provincial Habitat Protection Staff, to be used in the development of Land Use Plans for this watershed. At the same time additional surveys were conducted on additional sites of the Omineca River by Chris Schell Consulting, in a project funded though Forest Renewal British Columbia (FRBC), to collect additional data points (Schell 2002).

The objectives of the study were to:

- determine the distribution and relative abundance of Arctic grayling fry in these watersheds,
- identify critical habitats (spawning and early rearing areas) for habitat protection purposes, and
- compare habitat use with those found in other areas.

Study Area

The Omineca and Osilinka Rivers have drainage areas of 5,851 km^2 and 2,051 km^2 respectively and drain into the Omineca Arm of Williston Reservoir (Figure 1), which has a drainage area of 70,000 km^2 (Bruce and Starr 1985). The Osilinka River is the largest tributary of the Omineca. The Omineca River is 219.5 km in length, with a drainage area of 5,851 km^2 (MWLAP, Watershed Code Dictionary, 1995; Bruce and Starr 1985). It drops from an elevation of 1100 m to 700 m giving it an overall gradient of 0.2%. The Osilinka River is 141 km in length, with a drainage area of 2,051 km^2 (MWLAP, Watershed Code Dictionary, 1995; Bruce and Starr 1985). It drops from an elevation of approximately 1400 m down to 700 m giving it an average gradient of 0.5%

Review of Terrestrial Resource Inventory Mapping (TRIM) orthophoto and satellite imagery support the PWFWCP field observation that resource extraction in the Omineca drainage remains relatively low. The Osilinka drainage in contrast has had significant logging and mining operations, and sustains an extensive road network, particularly in the lower half of the system (B. Arthur, Ecosystems Specialist, MWLAP, Prince George, B.C., personal communication). The lower and mid sections of the Omineca drainage have recently been designated as a protected area under the Land and Resource Management Planning (LRMP) process for the Mackenzie and Fort Saint James Forest Districts (B. Arthur, Ecosystems Specialist, MWLAP, Prince George, B.C., personal communication).

A review of EDI Environmental Dynamics Inc. stream video and reach data information (White, 1998) provided an overview of habitat and stream characteristics (appendix 1).

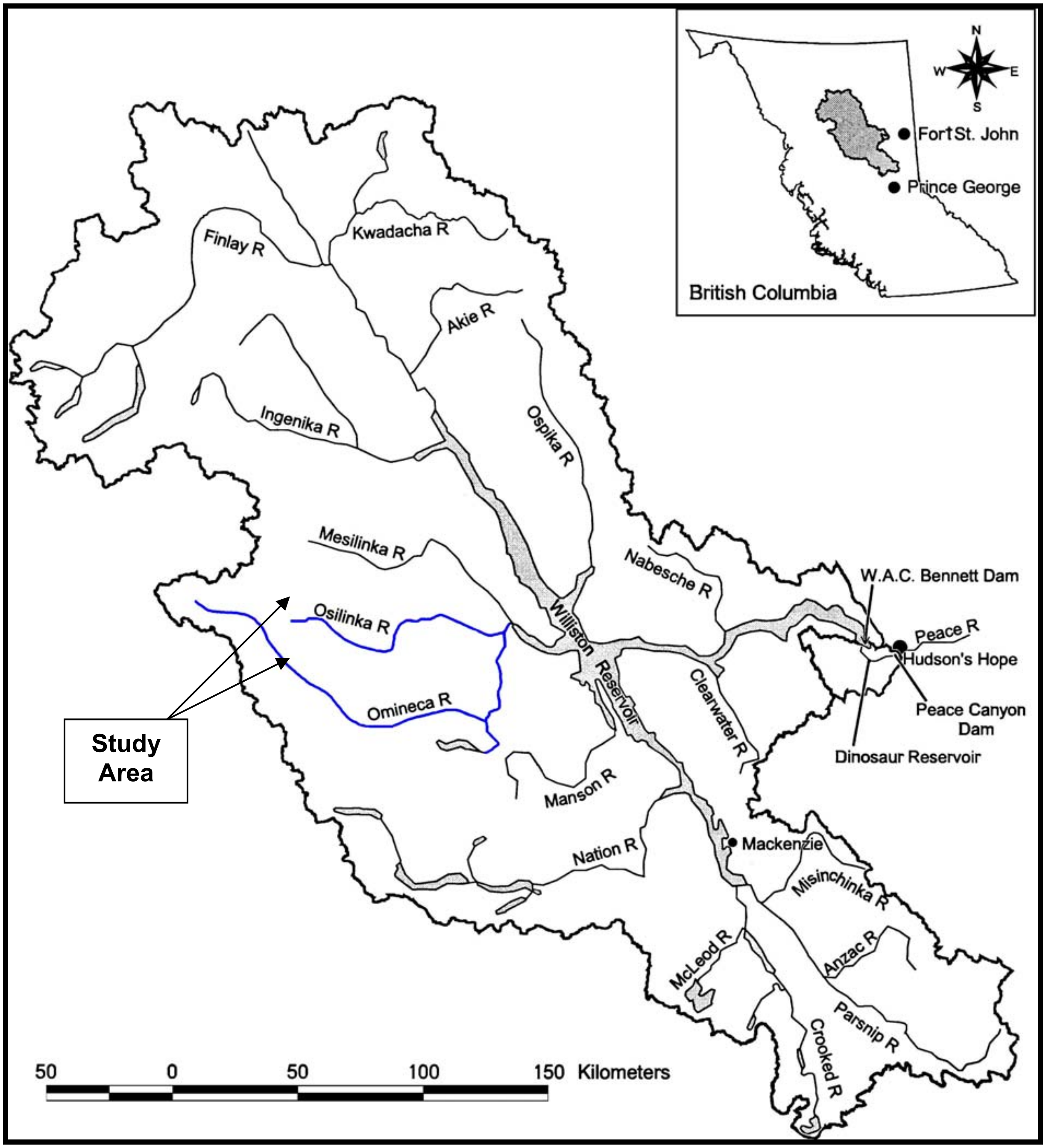

Figure 1. Study Area: Williston Drainage, Highlighting Omineca and Osilinka Rivers.

METHODS

Electrofishing surveys in both systems were conducted during late August/early September in 2001 (Omineca) and 2002 (Osilinka). Access was obtained in the Omineca River by jet boat and helicopter, while the Osilinka River was conducted solely by helicopter.

Site Selection

Stream reaches and habitat typing were completed using orthophoto/satellite imagery, 1:20,000 map sheets and video surveys on file at the PWFWCP and MWLAP offices. Sites were not pre-selected prior to the field program, but were selected on-site based on the following criteria:

- potential of supporting Arctic grayling fry (based on other studies in the Williston watershed),
- available habitat to sample,
- landing /access of site, and
- overall site distribution.

In the process of site selection, crews attempted to maintain a general consistency of distribution (i.e. not clumping sites together or missing large sections). Sites were marked on orthophotos as conducted to track general distribution and to allow for visual checks for large sample area gaps.

Sample Technique

Open site backpack electrofishing was the primary sampling technique. Two Smith-Root Model 12 battery operated back pack electrofishers (EF) were used to capture fish. Electrofishing was conducted in a single upstream pass per site along the shoreline, with an average width of 1-2 m. The width of sites varied slightly with water depth and velocity. No stop nets were used.

Site length target was 100 m but varied upon availability at each site. Some sites had significantly less/more habitat available to effectively be sampled. Some bars were quite diverse in habitat (shoreline vs. isolated pools), which was noted in the site cards for reference. Settings used for the EF varied depending on a variety of factors including water temperature, depth, conductivity, size range of fish, and observed recovery time, but generally it was necessary to set the machines high (e.g. 700 to 1000 volts and 60 to 90 Hz) because of the low conductivity of the water.

Data Collection

The habitat data collected for each site included site length, channel and wetted widths obtained by a range finder, temperature (degrees Celsius), average water depth (cm), average site substrate (% fines-gravel-cobble-boulder), and comments on velocity. The EF settings and effort seconds were recorded for catch-per-unit-effort (CPUE). Fish caught were identified to species, weighed to the nearest gram and measured (fork length) to the nearest mm. Site data is on file at the Peace/Williston Fish and Wildlife Compensation Program office (address on cover).

Angling

Angling was conducted on the Omineca (mainstem and tributaries) and Osilinka River (mainstem only) to provide an initial overview of adult Arctic grayling population distribution in the systems. Angling was conducted at opportunistic sites using both fly and spinning gear. Scale samples were taken from Arctic grayling and age determination and analysis was performed by North/South Consultants (Winnipeg, Manitoba). Prints of the scales and age markings were provided for each fish, and reviewed by PWFWCP fish biologists for accuracy.

Barriers

Major tributaries of the Omineca and Osilinka Rivers were flown from mouth to headwaters (or first barrier) to identify potential barriers to fish passage. Barriers included falls, areas of high velocity or other structures which may impede fish passage (i.e. beaver dams). The barrier location UTM's were noted (appendix 4).

Historical Discharge

Historical discharge data was reviewed from Environment Canada (http://scitech.pyr.ec.gc.ca/waterweb/) to assess discharge rates for the 2001 and 2002 field seasons. Monthly discharge averages for an eleven year period for the Omineca River and a twelve year period for the Osilinka River were examined.

RESULTS

Historical Discharge

The 2001 field season was marked by a high water period in late June / early July due to above normal precipitation. The 2002 field season was marked by extremely high snow melt run off which occurred late into June and July. Historic data indicates that the discharge in 2001 for the Omineca River was the highest in five years, while the Osilinka River discharge in 2002 was the highest in ten years (appendix 2, Figures 2 & 3). These high flows probably resulted in lower survival rates for young of the year grayling. This may have reduced the potential catch-per-unit-effort (CPUE) and restricted fry distribution.

Omineca River Electrofishing

One hundred and five electrofishing sample sites were sampled in the Omineca River (Figure 2). The total length of shoreline sampled was 16.4 km (13.4% of total length). The average site length was 156 m, with the site lengths ranging from 60 to 600 m. Total electrofishing seconds were 62,735, an average of 598 seconds per site.

Ninety four sites were sampled in the Omineca mainstem (14.9 km total sampled length) and 11 sites in tributaries (1.5 km total sampled length), excluding the Osilinka. Arctic grayling fry were relatively evenly distributed throughout the Omineca mainstem (Figure 2), with no extensive areas where grayling were absent, nor were there any areas with high concentrations. Arctic grayling were also caught in Carruthers Creek, Ominicetla Creek and Silver Creek. Sixty three of the 105 sites yielded a catch of 280 Arctic grayling fry (58 mainstem sites and 5 tributary sites) (appendix 5).

Sculpin were the most frequently caught species (866 in 49 sites); mountain whitefish were second (413 in 53 sites); and Arctic grayling were the third (280 fry in 63 sites)(Table 1).

Table 1. Total species caught in Omineca (2001).

	Totals	Arctic grayling	Bull trout	Rainbow trout	Kokanee	Mountain Whitefish	Burbot	Other/ sculpin***	No Fish
Sites	105	63	31	18	1 **	53	10	93	5
Length (km)	16.4	10.2	5.2	2.9	0.2	9.4	1.5	13.2	1.1
# fish	1179	280	28	49	100	413	13	866	0
# fish per km*	72	28	11	17	n/a	44	9	66	0

* Sites where species present
** KO only seen at one site
*** Others includes sculpins among other species

Grayling caught in the upper reaches of the Omineca River were generally smaller than those caught in the lower reaches (Figure 13). Studies completed on the Tanana River in Alaska (Tack, 1974) concluded that Arctic grayling in the upper colder reaches of streams grow slower than those fish which inhabit the lower reaches for age 0 fish.

Omineca River Angling

Angling was conducted at 17 randomly chosen sites on the Omineca River and tributaries (appendix 3). Only eleven Arctic grayling were captured from five of the sites. Other species caught included four bull trout (*Salvelinus confluentus*) and five rainbow trout (*Oncorhynchus mykiss*). Angling conditions were poor because of cold temperatures and heavy rainfall. There were three 6-year olds, one 5-year old, one 1-year old and one 0+ grayling aged from the Omineca River.

Osilinka River Electrofishing

Seventy three electrofishing sample sites were completed for a total shoreline sampled length of 9.4 km (15 % of total length)(7.6 km of mainstem and 1.8 km of tributaries), from the Osilinka headwaters to the confluence with the Omineca River (Figure 1). The average site length was 129 m, with the site lengths ranging from 50 to 650 m. Total electrofishing seconds were 43,025, an average of 589 seconds per site.

Eleven of the seventy-three sites sampled yielded 174 Arctic grayling (appendix 6). These eleven sites are all situated between km 12 and 50, (roughly 38 km) in the Osilinka mainstem (from roughly 5 km upstream of the first bridge crossing to immediately downstream of Tenakihi Creek). One hundred and forty eight (85%) of the grayling caught were found in isolated pools on gravel bars. No Arctic grayling were caught in any of the tributaries sampled.

Sculpin species were the most commonly caught fish (542 in 49 sites); mountain whitefish were the next most common (222 in 20 sites); Arctic grayling were the third most commonly caught species, with 174 in 11 sites (Table 2).

Table 2. Total species caught in Osilinka (2002).

	Totals	**Arctic grayling****	**Bull trout**	**Rainbow trout**	**Mountain Whitefish**	**Burbot**	**Other/ sculpins*****	**No Fish**
Sites	73	11	31	15	20	6	49	2
Length sampled (km)	9.4	2.6	3.8	1.9	3.7	1	6.1	0.2
# fish	1096	174	68	72	222	12	548	0
# fish per km*	117	67	18	38	60	12	90	0

* sites where species present
** 148 GR were from isolated pools; GR only occurred in a 38 km section
*** 1 dace, 5 SU, all rest CC

Osilinka River Angling

Angling was conducted at 14 sites along the mainstem of Osilinka River (appendix 3). Fourteen sites were angled and Arctic grayling were caught at four. Two seven year old, one four year old and one two year fish were collected and aged. Other fish caught included four bull trout and five rainbow trout. Two bull trout were aged as 5 and 8, while the three rainbow aged were determined as 5, 6 and 8.

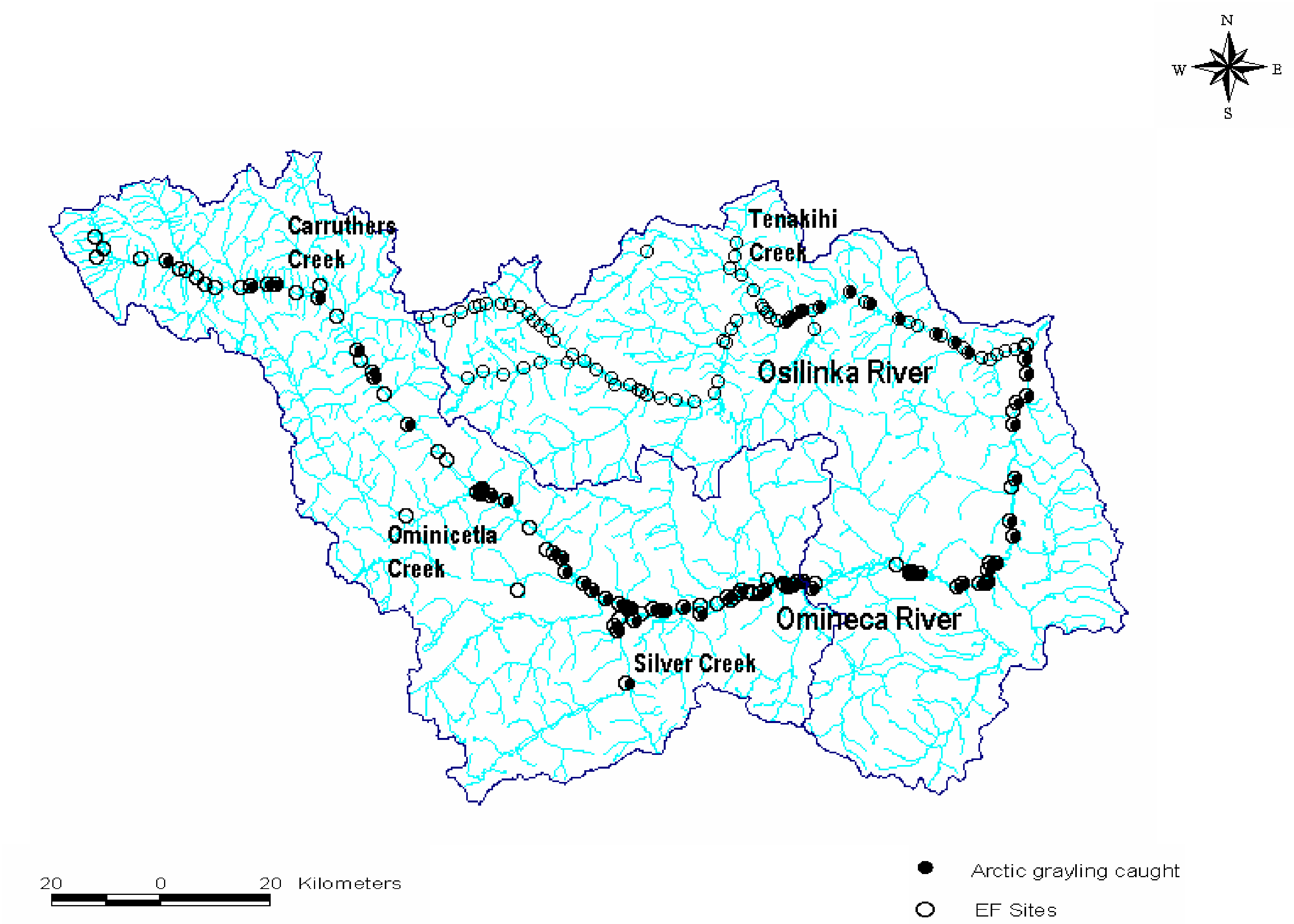

Figure 4. Electrofishing site locations and Arctic grayling caught.

DISCUSSION

Site selection was somewhat determined by access availability, particularly on the Osilinka River. In selecting sites that were accessible for helicopter landing, the site selection may have been somewhat biased, although site coverage of each system is quite evenly distributed. Most but not all accessible bars were sampled. Some reaches such as the section on the Osilinka where grayling were present were more thoroughly sampled than higher gradient, large substrate headwater areas, where it was assumed grayling fry would be less likely to be found.

Omineca River

Arctic grayling were caught throughout the Omineca drainage, including 3 major tributaries. Arctic grayling were distributed from the confluence with the Osilinka River upstream for 182 km (almost the Omineca headwaters). The difference in habitat use of substrate types for sites fish were caught versus sites fish were not caught is not significant. The Omineca River substrate breakdown (Figure 5) of all sites sampled (n= 105) showed 54% gravel/fines, while the sites where grayling were caught (n= 63) have a substrate breakdown (Figure 6) of 53% gravel fines content. This lack of difference may have been a result of site selection bias in that grayling fry were not expected in sites with cobble/boulder substrates based on previous fry distribution surveys.
The population of Arctic grayling utilising the Omineca is relatively pristine in that there has been limited road access and resource extraction in comparison to the other systems in the Williston watershed. Angling is primarily restricted to the areas near three bridge crossings.

Osilinka River

The Arctic grayling fry caught in the Osilinka River were limited to a 38 km stretch of the mainstem (between km 12 and 50). No grayling were caught in any of the tributaries sampled. Sites where Arctic grayling were caught (n= 11 of 73 sites) had a higher percentage of fines in the substrate in comparison to the average site (Figures 7 & 8 and Appendix 6). This preference for sites with a high fines content has also been observed in the Anzac River (Blackman et al. 2001). Reaches with higher gradients and a high percentage of boulder/cobble substrate have been noted in the Table and Anzac rivers to limit the extent of spawning (Blackman et al. 2001).

It is not obvious why grayling fry were restricted only to this area. This 38 km section of river is low gradient (0.1%), and has a higher fines content than most other areas of the river. It also contains numerous small side and back channels. This spawning/rearing area is also downstream from Usilinka Lake, which may help stabilise flows. This could be a significant factor given the flooding during the year of the survey (Figure 3).

The river below this reach does contain pockets of suitable spawning habitat but channel stability is very poor and average gradient is higher. There are also a number of areas upstream from this area that contain suitable spawning substrate and low gradients. The distribution of grayling into the upper watershed may be restricted by Usilinka Lake. In Williston Reservoir Watershed Arctic grayling do not appear to utilize lakes. It is presumed that large lakes in the Nation River system (Figure 1) have blocked grayling distribution and this may also be the case in the Osilinka system.

One hundred and forty-eight of the one hundred and seventy-four grayling captured (85%) from the Osilinka River were caught in isolated pools on gravel bars during the lowest flow period of the summer. The high occurrence of grayling fry in isolated pools has been noted in the Table and Anzac Rivers (Blackman 2001, 2002) and high mortalities of grayling fry by stranding has been noted by numerous authors (deBruyn and McCart 1974, Peterson 1968, McCart et al 1972, Blackman 2002[B]). Stranding does appear to be more severe in heavily logged watersheds where channels widen and bars become more prevalent. The potential impacts of high spring flows and stranding mortalities may have resulted in lower than normal fry abundance. These factors may have restricted distribution of grayling fry.

Extensive surveys were conducted in 1997 on the Table and Anzac Rivers, tributaries of the Parsnip River in the most southerly section of the Williston Reservoir Watershed (Figure 1, Blackman 2002 c). These surveys looked at habitat use and preference in all habitat types in those systems.

Arctic grayling fry in the Table and Anzac Rivers showed a strong preference for shallow low velocity habitat with a high fines content, and avoided areas with cobble substrate. Grayling fry were frequently associated with small woody debris cover. Adult Arctic grayling tended to be further upstream and 63% of those caught were found in pools. Grayling fry in the Table/Anzac system showed a strong preference for velocities <0.06 m/s, with 58% were captured in less than 10 cm of water and 86% in less than 20 cm of water. Also, 80% of the Table and 60% of the Anzac fry were captured from sites that had less than 10% cobble in the substrate.

The Arctic grayling fry caught in the Osilinka preferred shallow low velocity habitats, as found in the Table/Anzac Rivers and other river systems, and therefore may be subject to increased stranding risk when the flows drop in the late summer (Blackman 2002 a,b). Omineca grayling had a wide distribution throughout the drainage.

The relative density of Arctic grayling caught in the Omineca River was 28 fish/km, while the Osilinka River was 67 fish/km (including isolated pools) and 10 fish/km if isolated pools are excluded. The Table and Anzac Rivers calculations did not include grayling caught in isolated pools; densities in those systems were in the range of 30–80 fish/km when all sites within the distribution were included. Using all sites within the grayling distribution areas, the Omineca River had 19 fish/km in the mainstem (89 sites) and 10 fish/km in the tributaries (6 sites); the Osilinka River had 9 fish/km (15 sites within the 38 km section grayling were found).

CONCLUSIONS / RECOMMENDATIONS

Arctic grayling fry appear to be distributed throughout the entire Omineca River mainstem and several of the larger tributaries. No specific areas were identified as critical habitats. It is possible that under different flow conditions areas with higher numbers of fry could be found but for the purpose of this study, most of the watershed is utilized but numbers were lower than expected based on fish densities seen elsewhere.

The distribution of grayling in the Osilinka was restricted to an area from km 12 to km 50. Although numbers of fry and adults encountered were alarmingly low this may have been a result of stream flow patterns. The area where grayling were caught should be considered as significant Arctic grayling habitat in management planning.

The Osilinka River system warrants further investigations to better determine the status and distribution of grayling and how discharge variance between years may be affecting distribution patterns and survival of fry. Key areas that should be focused on for resampling include the section between km 12 and km 50, as numerous pools with potential stranding were noted. To further determine presence/absence of Arctic grayling in the Osilinka River, the area from the confluence with the Omineca River to upstream of Usilinka Lake (approximately km 75) should be targeted, as the type of habitat that grayling are seeking in other drainages is present.

ACKNOWLEDGEMENTS

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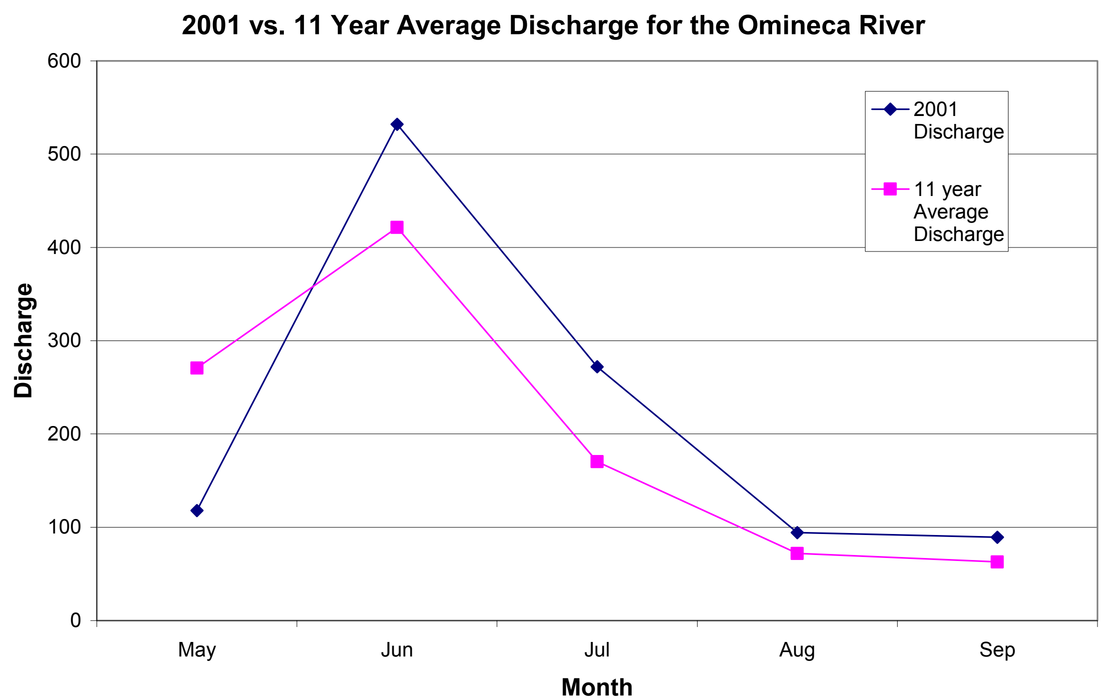

Figure 2. Average Discharge of the Omineca River (1990-2001) vs. flows in 2001

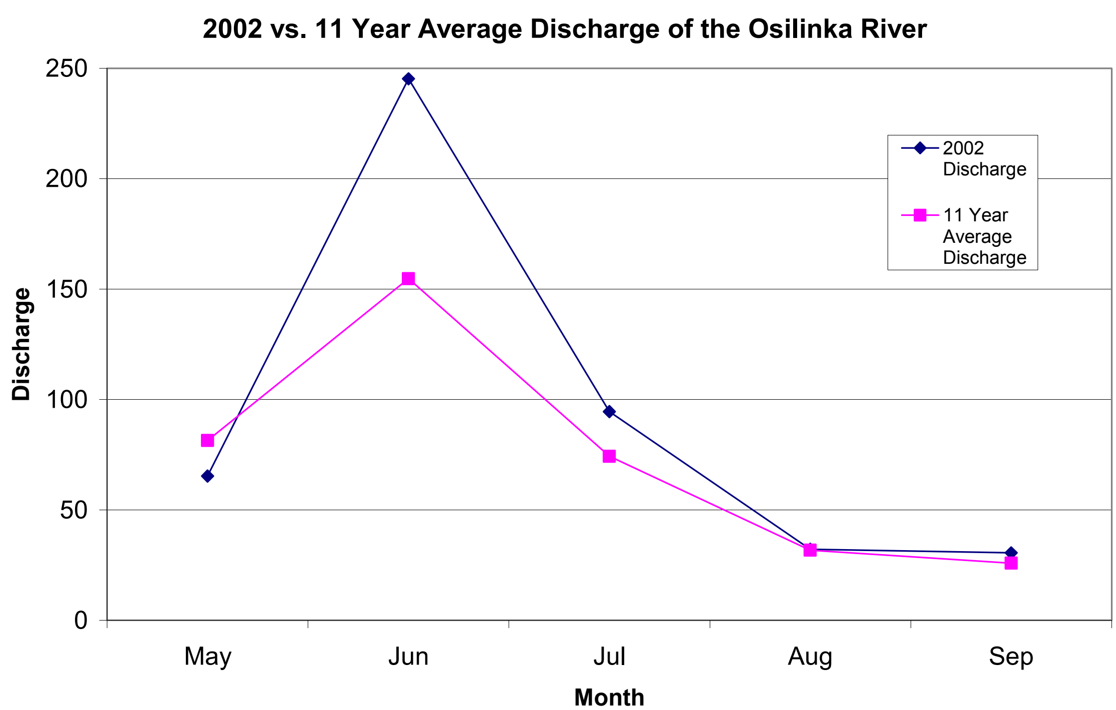

Figure 3. Average Discharge of the Osilinka River (1990-2001) vs. flows in 2002

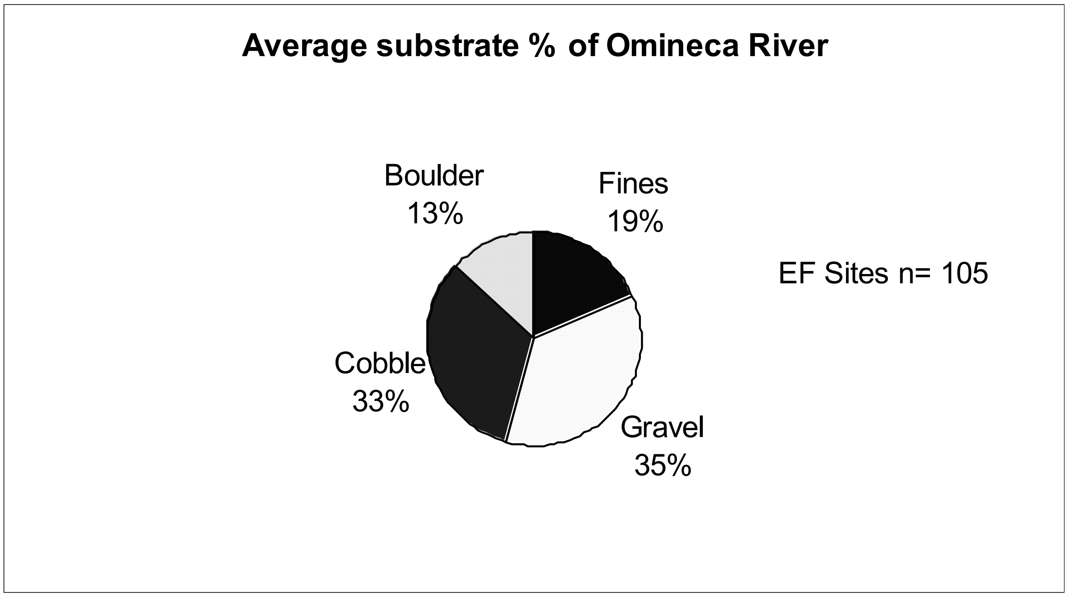

Figure 5. Average substrate % in EF sites in the Omineca River.

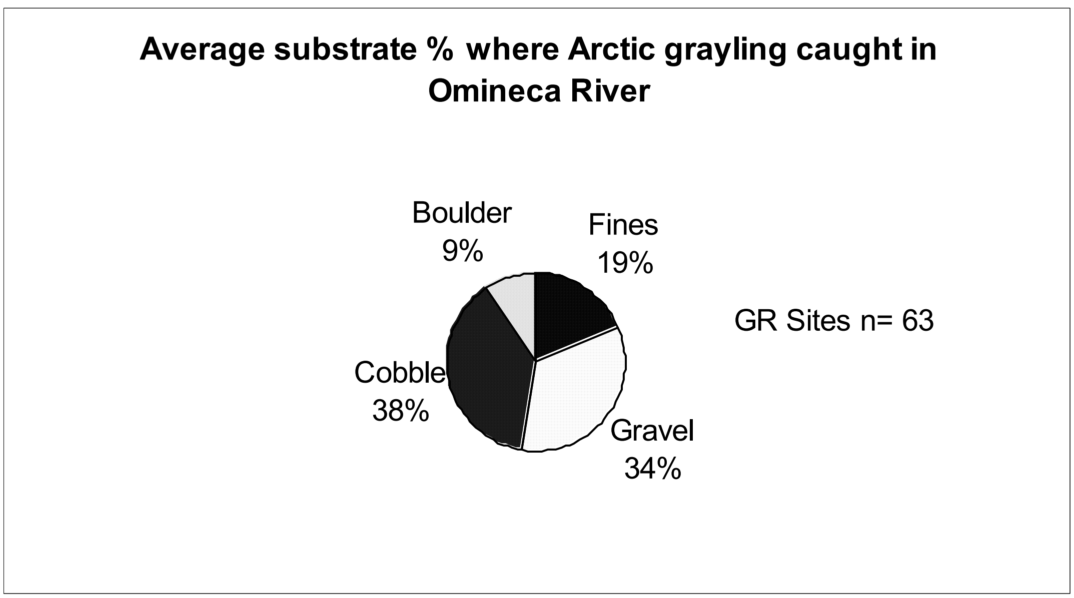

Figure 6. Average substrate % where Arctic grayling were caught in the Omineca River.

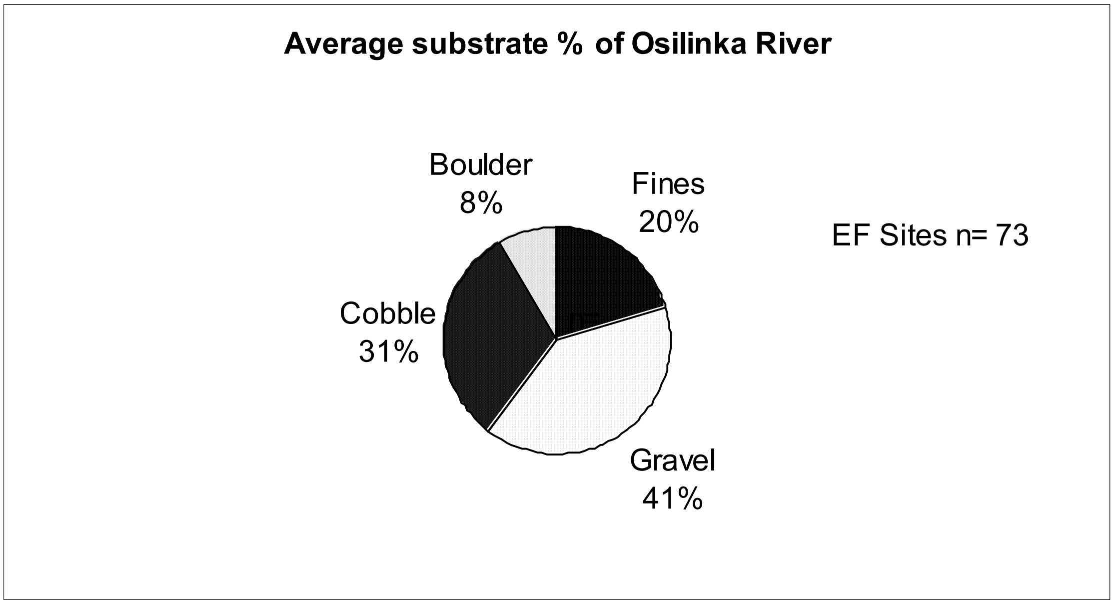

Figure 7. Average substrate % of EF sites in the Osilinka River.

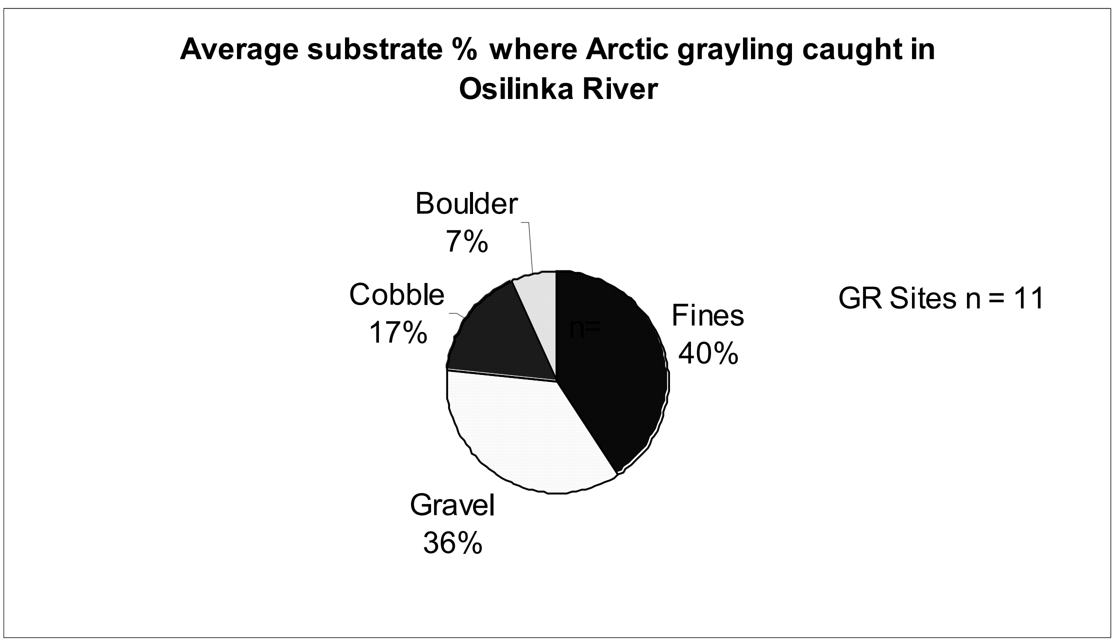

Figure 8. Average substrate % of EF sites where Arctic grayling were caught in the Osilinka River.

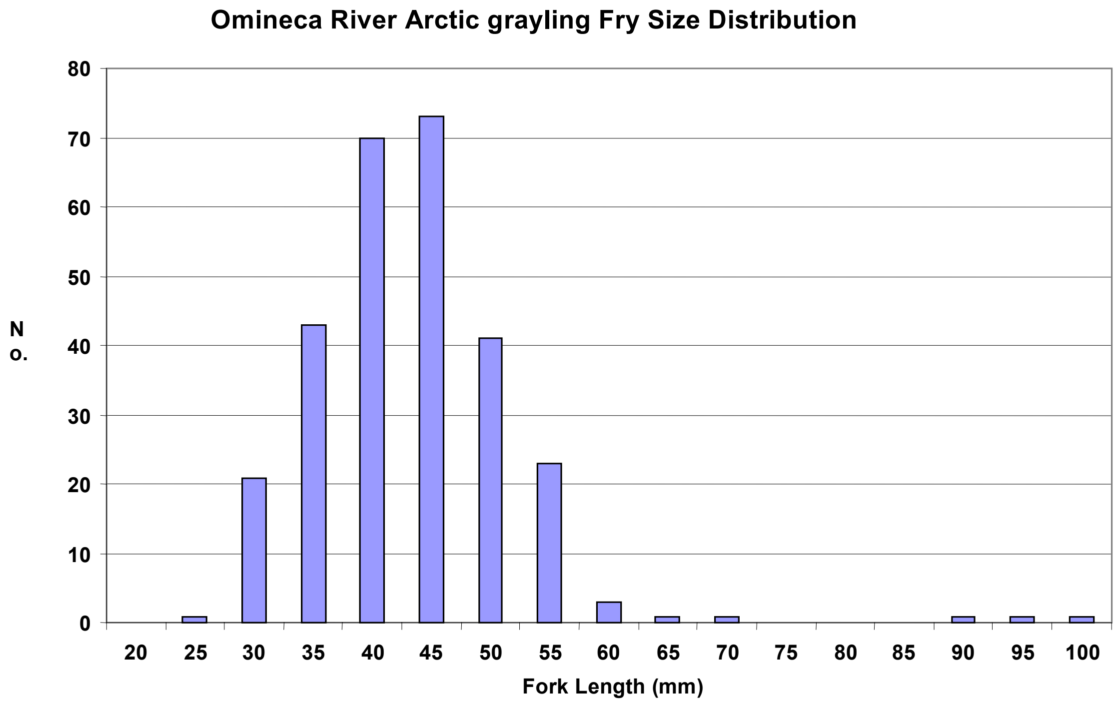

Figure 9. Size distribution of Arctic grayling fry captured from August 28-September 14, 2001 in the Omineca River.

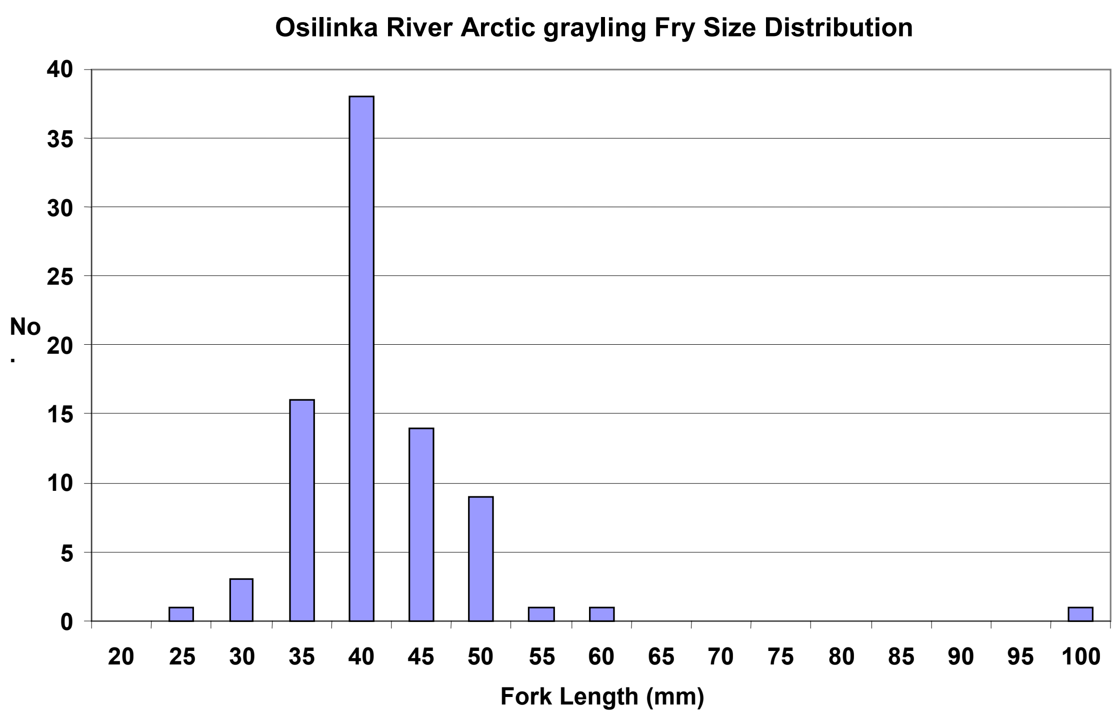

Figure 10. Size distribution of Arctic grayling fry captured from August 27-31, 2002, in the Osilinka River.

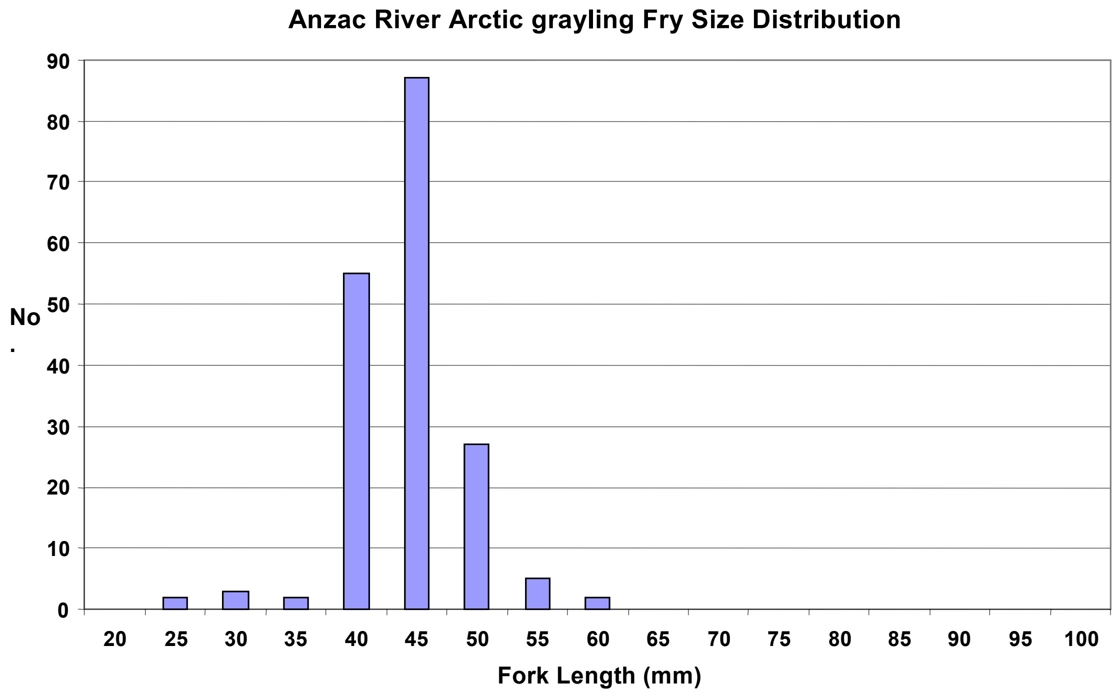

Figure 11. Size distribution of Arctic grayling fry captured from August 19-28, 1997 in the Anzac River.

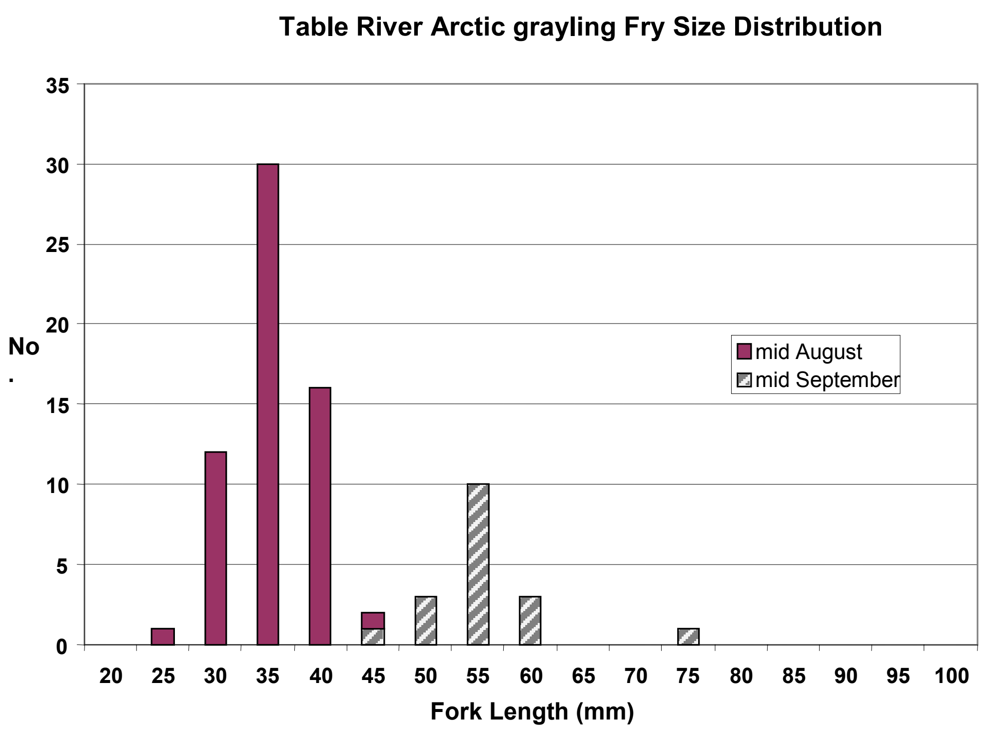

Figure 12. Size distribution of Arctic grayling fry captured from August 12-14 and September 17th 1997 in the Table River.

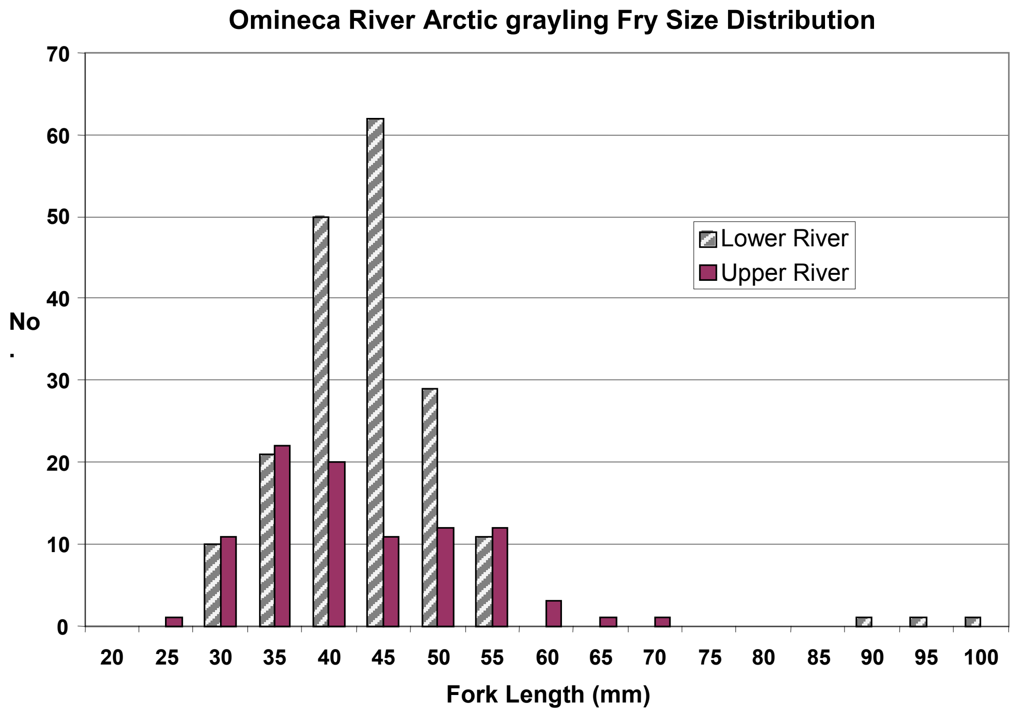

Figure 13. A comparison of upper and lower Omineca River Arctic grayling size distributions captured by electrofishing.

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APPENDICES

Appendix 1

Reach Data from EDI Environmental

Omineca					Substrate					
Reach	Length (Km)	Distance from Mouth (Km)	Channel Width (m)	Wetted Width (m)	Dominant	Subdominant	Spawning potential	Channel pattern	Confinement	Comments
1	6	0	150	70	gravel	fines	high	sinuous	occasionally confined	good rearing potential in sidechannels or few deep pools; LWD minimal; significant riffle habitat
2	18	24	80	70	cobble	gravel	high	sinuous	frequently confined	excellent spawning potential for larger salmonids; low quality rearing in a few deep pools
3		22	80	80	cobble/grave	fines	high	irregular wandering	occasionally confined	Between confluenece of Germansen River & Jackfish Cr.; little cover, small degree bank instability; several large gravel bars; right bank has small ponds and lakes; ideal spawning riffle and substrate quality; few deep pools
4	8	46	60-80	60-80	gravel	no comment	moderate-hig	regular meanders	occasionally confined	substantial channel braiding; numerous vegetated midchanel bars; total cover limited other than overhanging veg.; no LWD; riffle glide habitat; good potential spawning at first observation; some rearing in few deep pools & multiple channels
5	13	54	80-100	80-100	gravel/fines	no comment	low	irregular meanders	unconfined	From Germansen River to Nina Cr.; no brainding or veg. bars; dominated by glide; bank instability; small backchanels + ponds; moderate spawning potential based solely on gravel content; some potential rearing habitat
6	45	67	80-100	80-100	fines	gravel	low	irregular meanders	occasionally confined	between confluenece of Nina Cr. & Duckling Cr.; flows through a small wetland; little total cover; fair amount bank instability; few oxbows; mainly a glide; rearing present in form of glide & pools plus some off channel habitat
7	31	112	70	70	gravel	fines	low-moderate	irregular meanders	occasionally confined	high component of sidechannels, backchannels, braiding and bank instability; little total cover; excellent rearing habitat in off channels, few deep pools & LWD
8	20	143	40	30-40	gravel	fines	high	irregular meanders	occasionally confined	high component of bank stability and riffle habitat; no braiding + sidechannels + bars + LWD jams; good spawning for a range of salmonids; rearing limited to deep pools; some overhead veg. + LWD provide minimal cover
9	39	163	30	30	gravel/cobbl	boulders	moderate-hig	sinuous	frequently confined	and narrows; highly stable banks; few gravel bars & sidechannels; primarily riffle; good spawning potential for a range of salmonids; few sidechannels provide rearing habitat; GR observed jumping at confluence of Ominicetla Cr
10	26	202	30-40	30	gravel/cobbl	boulders	high	irregular wandering	frequently confined	little total cover; lateral gravel bars throughout reach; numerous sidechannels + vegetated midchannel bars; riffle dominant; good spawning for a variety of salmonids; few sidechannels provide rearing + cover from overhanging veg. + deep pools
11	12	228	20	20	gravel/cobbl	boulders	moderate-hig	irregular wandering	frequently confined	primarily riffle; area heavilty vegetated w/ coniferous interspersed amonst wetlands; few sidechannels + midchannel vegetated bars; sidechannels provides some rearing
12	14	240	5-10	5-10	fines	gravel	poor	irregular meanders	occasionally confined	near headwaters; flows through a large wetland; little total cover; primarilty glide; active + breached beaver dams; good rearing in form of deep pools + off channel habitat
13		254	1	1	boulders	cobbles	absent	straight	Confinement	coniferous deciduous), evidence of old fire; lacks any spawning potential; low rearing potential
14			1	1	cobble	gravel	good*	irregular meanders	unconfined	headwater reach out of unnamed lake; open alpine meadow; substantial cover; subsurface flow near lake; good spawning potential for resident salmonids but potential gradient barrier D/S impedes U/S migration; rearing limited by access

Osilinka										
					Substrate					
Reach	Length (Km)	Distance from Mouth (Km)	Channel Width (m)	Wetted Width (m)	Dominant	Subdominant	Spawning potential	Channel pattern	Confinement	Comments
1	6	0	150	30	gravel	fines	high	sinuous	unconfined	minimal, some from deep pools LWD; high component of gravel; riffle dominant; mod-low rearing
2	14	6	80-100	30-40	gravel	cobble	high	sinuous	occasionally confined	sidechannels distinguish this reach; good spawning substrate for a range fo salmonids; small rearing potential in few deep pools + sidechannels
3	13	20	30-40	30-40	fines	gravel	poor	irregular wandering	unconfined	glide; bsubstantial bank instability; spawning potential poor; excellent rearing habitat in deep pools + seasonally flooded wetland, backchannels ponds gopod rearing potential
4	12	33	50	30-40	fines	no comment	poor	irregular meanders	occasionally confined	primarily fines and highly unstable; forest harvetsing present; bank rosion present; glide dominant; LWD jm at bottom of reach may pose barrier to U/S migration; spawning poor potential; moderate rearing w/ LWD jams and deep pools providing majority
5	12	45	50-100	23-30	gravel	fines	moderate-high	sinuous	occasionally to unconfined	bars; vegetated midchannel islands amongst multiple channels; sidechannels frequent; ~80% of gravel suitable for salmonid spawning; moderate rearing present in deep pools
6	4	57	20-30	20-30	cobble	gravel	moderate-high	straight	frequently confined	reach w/ couple short cascades; good spawning for a range os salmonids; rearing low quality + quantity
7	5	61	30-40	30-40	gravel	fines	moderate	straight	frequently confined	glide w/ smaller quantity deep pools; 60% wetted area suitable for spawning; moderate rearing in form of deep pools, sidechannels + seasonally flooded wetland
8	3	66	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Usilka Lake
9	6	69	50	50	fines	no comment	poor	irregular wandering	unconfined	by numerous sidechannels, backchannels; braiding + vegetated midchannel bars present; high component of deep pools; glide dominant; LWD limited; poor spawning potential; excellent rearing in form of oxbows, sidechannels, backchannels + seasonally
10	17	75	30-40	30-40	gravel	cobble	moderate to high	irregular meanders	occasionally confined	instability; total cover provided by class II deep pools; primarily riffle morphology; moderate spawning for a range of salmonids; moderate rearing in form of deep pools +
11	5	92	30-40	30-40	fines	gravel	low	irregular wandering	frequently confined	substantial braiding; few LWD jams; sidechannels abundant; gravel bars evident; riffle dominated; low spawning due to high % fines; rearing avail in/off channel
12	5	97	40-50	30-40	cobble	gravel	high	sinuous	frequently confined	spawning for range fo salmonids; rearing limited
13	8	102	10	10	cobble	gravel	moderate-high	straight	Confinement	of salmonids; moderater rearing in form of deep pools + glide, but cover severely limited
14	9	110	10	10	cobble/gravel	fines	moderate	irregular meanders	occasionally confined	LWD; riffle dominant; sidechannels + backchannels present; spawning moderate; rearing excellent in both in + off channel
15	5	119	8-10	8-10	cobble	boulders	poor	irregular wandering	frequently confined	spawning potential due to boulders + fast velocity; rearing moderate + provided by deep pools + LWD jams
16	6	124	10-12	10-12	gravel + fines	bouldes	moderate-low	irregular meanders	occasionally confined to unconfined	Upper portion of watershed; wetland like habitat; brainding + oxbows characterize rach; few sidechannels; good rearing in form of deep pools + off channel hab.
17	4	130	6	6	fines	no comment	poor	irregular meanders	unconfined	shrubby + herbaceous veg; cover from veg + deep pools; no LWD; glide morphology; good rearing in form of deep pools, glide + seasonally flooded wetland
18	5	134	4-5	4-5	cobble/boulder	no comment	poor	straight	Confinement	large boudlers, over veg. + LWD; dominated by riffle glide; few short wetland anomalies; poor spawning potential; good rearing inf orm of deep pools + glide
19	2	139	1	1	fines	no comment	absent	straight	Confinement	drains headwater lake; heavily vegetated; high component of cover, substantial LWD; numerous avalanche chutes; rearing appeared good due to high component of cover
20	n/a	141	n/a	n/a	n/a	n/a	n/a	n/a	n/a	headwater lake

Appendix 2

Historic Discharge Data

Omineca

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1990	22.1	15	14.7	30.8	263	506	133	44.1	28.7	22.9	16.6	13.8
1991	11.7	12.9	11.7	31.7	296	296	111	51.6	63.6	89.1	34.4	25.4
1992	22.3	18	22.5	86.6	235	**518**	123	33.5	47.7	100	51.1	30.9
1993	17.8	16.4	14	35.3	351	210	100	73.6	39	26.2	25.7	16.2
1994	15.1	11.4	12	31.9	281	287	114	51.9	56.5	55.9	43	24.6
1995	18.6	16.7	14.7	28.5	288	226	119	81.8	52.5	45.2	29.8	20.6
1996	17.5	15.2	12.7	41.1	175	**514**	**320**	**99.1**	77.9	94.3	42.5	24.2
1997	18.2	15.1	14.3	28.5	308	464	163	84.5	64.9	87.6	53.1	35.7
1998	21.1	16.9	15.6	20.9	356	190	61.8	45.8	42	68.6	34.7	23.8
1999	20.4	15.8	14.6	32.5	181	466	177	60.7	50.8	45.8	35.1	21.1
2000	16.8	14.6	12.5	16.6	125	427	180	71.8	79.1	66.3	43.3	25.5
2001	19.8	15.6	12.9	18.1	118	**532**	**272**	**94.3**	89.2	58.5	43.3	28.5

Osilinka

Year	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1990	8.71	6.65	6	9.14	82.1	190	58.3	21.5	13.4	9.4	7.3	6.15
1991	5.17	5.62	5.2	10.4	96.8	122	52.2	23.5	24.1	25	12.9	9.44
1992	8.65	7.23	7.66	21	76.7	**215**	61.6	18.5	24.1	43.3	19.3	11
1993	6.79	7.48	6.58	11.7	120	87	47.4	37.8	20.8	12.7	10.3	7.13
1994	6.72	5.28	5.56	10.7	86.9	114	59	26.5	30.1	23.6	15.8	9.95
1995	8.25	7.52	6.73	9.89	102	106	66.5	33.4	19.9	14.8	10.7	9.05
1996	7.75	6.76	5.91	11.3	51.9	184	135	47.8	34.5	35	16	10.5
1997	8.02	6.72	6.1	8.05	94.5	170	67.7	33.6	25.4	28.6	15.8	10.3
1998	8.57	6.96	5.84	9.68	146	90.5	33.7	21.1	16.8	24.8	13.3	10.6
1999	9.7	7.73	6.3	11.7	59.2	176	82.8	31.4	21	16.6	13	8.29
2000	6.34	5.46	5.55	7.19	41.4	151	81.8	34.4	30.3	23.5	12.4	8.08
2001	7.42	6.09	5.19	7.4	36.2	196	**109**	40.4	33.1	21	14.7	8.39
2002	12.8	10.1	10.3	7.7	65.3	**245.2**	**94.6**	32.2	30.5	n/a	n/a	n/a

Appendix 3

Angling Locations

OMINECA RIVER

Table 1. Omineca River Angle Sites

Site	Zone	Easting	Northing	Fish Caught	Description
1	9	648427	6231825	NONE	Mouth of No-Name Creek (local: Thermal Cr.)
2	10	685225	6217231	2 GR	MS D/S of Ferrison Cr.
3	9			3 GR 1 BT	Mouth of Omincetla Cr
4	9			2 RB 3 BT	MS D/S Big Cr.
5	9	401196	6192775	1 RB	MS, Blue Lake area
6	9	685448	6199465	2 GR	Omincetla Cr; mid section
7	9	675960	6210806	NONE	Omincetla Cr; upper section
8	9	679405	6204039	2 GR	Omincetla Cr; upper section
9	9	670397	6239925	NONE	Carruther's Cr; upper section
10				NONE	Carruther's Cr; upper section
11	10	676252	6230765	2 GR	Carruther's Cr; mid section
12		366805	6191952	NONE	Discovery Cr; mid section
13				NONE (2 visual)	Discovery Cr; lower section
14				NONE	Silver Cr; D/S Kenny Cr
15	10	323679	6213439	1 RB	Lakes east of Denti Cr.
16	10	352921	6196040	NONE	Duckling Cr; upper section
17	10	356655	6185611	1 RB	Duckling Cr; lower section; D/S barrier U/S bridge

OSILINKA RIVER

Table 2. Osilinka Angle Sites

Site	Zone	Easting	Northing	Fish Caught	Description
A	10	0330376	6226377	NONE	Deep clear alpine hole
B	10	0345382	6215211	2 Rb	Deep cold pool below riffle
C	10	0342738	6216792	2 Rb	Deep cold pool below riffle
D	10	0345932	6214315	NONE	
E	10	0354094	6212042	BT	
F	10	0360656	6214188	NONE	2 large pools w/ glide
G	10	0363114	6222447	AG	~ 63 Km; Great hole w/ small back channel; numerous BT visuals + MWF caught; nice gravel
H	10	0367058	6224127	AG BT	~ 57 Km at confluence w/ Tenakihi Cr.; AG caught US at tail out of riffle; BT 1.5lbs
58	10	0379545	6226086	NONE	Deep pool at river bend; silt mainly; site where 4 dead fish on bar
61	10	0396556	6216639	BT	Not sampled
I	10	0398882	6215498	AG	DS of 8Km Osilinka FSR bridge falls/chute (not a barrier); River mark of ~5.8 Km
J	10	0401374	6216688	AG	~ 3.5 Km U/S from confluence w/ Omineca River; Pool riffle; EF Site 65
67	10	0402876	6216985	RB	Not sampled
K	10	0404159	6216866	BT	Confluence w/ Omineca R.

Appendix 4

Barriers on the Omineca and Osilinka River Tributaries.

Mainstem System	Tributary Name	Zone	Easting	Northing	Comment
Omineca River	Duckling Creek	10	0356655	6185611	
Omineca River	Kenny Creek	10	0345308	6171483	Series of falls
Omineca River	Germansen River	10	0395368	6177788	3-4 ft falls
Omineca River	Big Creek	10	0399932	6207520	
Omineca River	Nina Creek	10	0384302	6191561	Velocity barrier
Osilinka River	Thane Creek	10	0359460	6219641	
Osilinka River	Tenakihi Creek	10	0352958	6235287	falls