A Survey of Morice River Steelhead Anglers in 2004

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ABSTRACT

Morice River steelhead anglers were surveyed during the 2004 Classified Waters Period using a combination of interviews and aerial counts. The Classified Waters Period consisted of the early Classified Waters Period (September 1st to September 30th) and the late Classified Waters Period (October 1st to October 31st). During the early Classified Waters Period, fishing was restricted to fly fishing only above Lamprey Creek, and the river was closed to fishing between Gosnell Creek and Morice River. During the late classified water period, gear and fly rods could be used in the entire river. To conduct the study, the Morice River was divided into five sections of roughly equal length. Anglers were surveyed to provide information on angler demographics, distribution, effort and catch. Most interviews were conducted using roving surveys (incomplete trip information) with some exit interviews conducted on an opportunistic basis. Interviews were stratified by week and day type (weekend and weekday), with surveys occurring five days per week, and covering two river sections per day. Two aerial counts were conducted per week (one on a weekday and one on a weekend day). Angler demographics, angling trip characteristics, and catch rates were determined for each week of the study, while total effort and catch was determined for four separate time periods (each time period was two to three weeks in length).

Two guardians approached 455 of 502 anglers observed (90.6%) for interviews. Three anglers refused the interview (0.7%). Of anglers approached for an interview, 310 (68.1%) were interviewed for the first time, and 145 (31.9%) had been interviewed before. The majority of anglers interviewed were BC residents (57.9%), followed by non-Canadian alien anglers (36.3%) and Canadian non-resident anglers (6.1%). Of the BC resident anglers, 46.3% were Skeena Region residents, and 53.7% were from elsewhere in BC. Sixty-one (13.4%) of anglers were guided, and 394 (86.6%) non-guided anglers were interviewed. Most guided anglers were non-Canadian aliens (90%), accounting for 33.8% of all non-Canadian alien anglers. Most anglers used fly rods (82.2%), and 13.3% of anglers used gear rods while 4.5% of anglers used both, gear and fly rods. Gear rods were primarily used by Skeena Region residents (33.9% for gear, and 8.5% for fly and gear), followed by BC resident anglers (11.6% gear and 5.9% both methods). Non-Canadian aliens were least likely to use gear (0.6%) or fly and gear rods (1.3%). Most anglers accessed the river by jet boat (51.4%), while 25.1% of anglers used drift boats, 23.1% of anglers accessed the river from shore and 2 anglers (0.5%) used a helicopter to access the river.

Anglers indicated that they intended to fish for an average of 7.46 hours. Individual anglers intended to fish for 8.8 days on the Morice River, which extrapolated to 2507 rod days. From angler interviews, anglers reported fishing for 1086 hours, and catching 163 steelhead. The observed catch rate was 0.17 steelhead per hour, or 1.27 steelhead per rod day.

Four-hundred and fifty three anglers were counted during 19 aerial flights. The highest number of anglers observed during aerial flights was 45 on October 2nd and October 7th (week 5 and week 6 of time period 10-1). The lowest number of anglers observed on the aerial flights was one angler on November 7th (week 10, time period 10-2). During aerial flights, most anglers were counted in Section 1 (The Forks to Knapper Creek; 34%) and Section 4 (Lamprey Creek to Gosnell Creek; 21%). The lowest number of anglers was noted in Section 5 (Gosnell to Morice Lake; 10.8%) and Section 2 (Knapper Creek to Owen Canyon; 15.2%). The low angler count in Section 5 is largely due to this section of the river being closed to fishing from September 1st to September 30th, 2004.

The total estimated effort for the Morice River for the study period was 1750 (± 488) rod days, with a total estimated catch of 2233 (± 1298) steelhead. Most effort was estimated for the late Classified Waters Period (945 ± 228 rod days) with a catch of 1253 ± 1134 steelhead. The estimated effort for the early classified water period was 622 ± 373 rod days with a catch of 485 ± 350 steelhead. Effort (626 ± 288 rod days) and catch (699 ± 2640 steelhead) was estimated to be highest in Section 1 (The Forks to Knapper Creek).

EXECUTIVE SUMMARY

The Morice River, a main Bulkley River tributary, is one of 42 Class II rivers in BC, and is well known for its high quality steelhead angling. An angler survey was conducted on the Morice River between August 31st and November 7th, 2004. This time period encompassed the Classified Waters Period (September 1st to October 31st, 2004). The Classified Waters Period for the Morice River was divided into the early-Classified Waters Period (September 1st to September 30th) and the late Classified Waters Period (Octobers 1st to October 31st). Fishing upstream of Lamprey Creek was restricted to fly fishing only, and the river upstream of Gosnell Creek was closed during the early-Classified Waters Period. The entire river was open to fly and gear angling in the late classified period. Access was not restricted on the Morice River, and anglers accessed the river primarily with jet boat, drift boat and from shore.

During the angler survey, two guardians conducted primarily roving interviews on five randomly chosen days in each week, and aerial counts were conducted on one weekend and weekday day during each week. Aerial counts coincided with roving days so that interview data were collected for the days when aerial counts were conducted. Exit interviews were conducted opportunistically. To choose sampling days, the study period was stratified by week and day type, and the river was divided into five sections of roughly equal length. Two river sections were chosen randomly for each roving survey day. In total, 19 aerial counts were conducted, and roving surveys were completed on 48 days. Except for the first aerial count, all aerial counts covered the entire section, including Section 5, which was closed during the Classified Waters Period.

Interviews

Morice River guardians were able to interview a significant proportion of anglers encountered, and most anglers agreed to be interviewed. This resulted in a high response rate. The distribution of roving surveys and resulting interviews is similar to the availability of day types (weekend and weekday), and river sections (Sections 1-5), indicating that data collected is likely representative of the study period.

- Five hundred-and-two steelhead anglers were observed during the study period, and 455 anglers were approached for an interview (90.6%). Of the 455 anglers approached for an interview, 452 agreed to complete the interview (99.3%).

- Interviews consisted primarily of roving interviews (428; 94%), and exit interviews (27; 6%) were conducted opportunistically. Most exit interviews were conducted on weekdays (24; 89%), and all exit interviews were conducted in river Sections 1, 2 and 3.

- Of the 455 anglers approached for an interview, 310 anglers (68.1%) were interviewed for the first time, and 145 anglers (31.9%) were repeat interviews.

- Most anglers were interviewed between the third week in September and the second week in October (72% of interviews), which forms part of the Classified Waters Period. Most interviews were conducted in between "The Forks" and Knapper Creek (29%), and between Lamprey Creek and Gosnell Creek (21%).

Angler Characteristics

Data on angler characteristics collected and summarized for this study included angler residence, gender and age, guided status, and conservation club membership. Most anglers were BC residents (primarily from Skeena Region), but the proportion of non-Canadian anglers was also high. Canadian non-resident anglers residing outside of BC were least frequently encountered. Most anglers were male. Guided anglers were predominantly non-Canadian aliens (mainly US origin), with a low proportion being Canadian non-residents or BC residents. Non-Canadian alien anglers and guided anglers were more likely to be members of a Conservation club than BC resident anglers. Comparisons of angler characteristics reflect that a significant proportion of non-Canadian alien anglers are guided.

Residence, Gender and Age

- Fifty-eight percent of anglers were BC residents, 6% were Canadians and 36% were non-Canadians. Of BC resident anglers, 46.3% were Skeena Region residents and 53.7% came from elsewhere in BC.

- The highest number of non-Canadians was interviewed in week 4 (23.8% of non-Canadians interviewed), while the highest number of BC residents was interviewed in week 5 (18.7% of BC residents interviewed). More BC residents were interviewed in all weeks of the study, except in week 4 where the number of non-Canadians interviewed exceeded the number of BC residents interviewed. Most BC residents were interviewed in Section 1 ("The Forks" to Knapper Creek), while most non-Canadians were interviewed in river Section 2 (Knapper Creek to Owen Canyon) and Section 4 (Lamprey Creek to Gosnell Creek).

- Most anglers were male (95.1%), and angler age averaged 48.5 years for male anglers and 47.9 years for females.

Guided Status

- Guided anglers constituted 13.4% of all anglers. Most guided anglers (90%) were non-Canadians. Few guided anglers were Canadian non-residents (6.7%) and the remaining 3.3% of anglers were BC resident. No Skeena Region anglers were guided.

- Guided anglers were primarily interviewed in September (weeks 1 to 4), on weekdays (86.9%) and in river Section 4 (54.1%).

Conservation Club Membership

- Thirty-four percent of anglers interviewed were members of one or more conservation club. Female anglers were more likely to be members of a conservation club than male anglers (50% compared to 33.2%), though this difference was not statistically significant.

- Non-Canadian alien anglers (44.7%) and Canadian non-resident anglers from outside BC (38.1%) were more likely to be members of a conservation club than BC resident anglers (23.3% for Skeena Region anglers and 34.4% of BC resident anglers).

- Guided anglers were more likely to be members of a conservation club (62.2%) than non-guided anglers (31.4%).

- Of the conservation clubs mentioned, most anglers were members of Trout Unlimited Canada (18.4%), the BC steelhead society (12.5), the BC Fly Fishers Federation (5.9%) and the BC Wildlife federation (3.7%).

Angler Trip Characteristics

Angler trip characteristics include summaries of gear type, access method, and trip lengths. Most anglers used fly rods, and most accessed the river with jet boats, followed by drift boats, foot, and helicopter. All guided anglers were fly anglers, and most accessed the river by jet boat. Most non-Canadian non-guided anglers accessed the river by drift boat. Rod-day length was slightly longer for guided anglers and non-Canadians than for other anglers. This is likely due to the fact that most guided anglers are non-Canadians, which confounds the comparisons of rod-day length between guided status and residence category. Angler trip characteristics differed significantly between anglers of different residence categories and guide status, though these comparisons are not independent of each other since most guided anglers are non-Canadian aliens.

Angling Method

- Most anglers interviewed used fly rods (82.2%), while 13.3% of anglers used gear rods, and 4.5% of anglers used both fishing methods.

- More non-Canadians (98.1%) were fly anglers, compared to 88.9% of Canadians, 83.3% of BC residents, and 57.6% of Skeena Region residents. All guided anglers used fly rods.

- Of the anglers interviewed, 51.4% used jet boats, 25.1% used drift boats, 23.1% used foot, and 0.5% used helicopter to access the river. The predominance of jet boat access was consistent across residence category. Access by drift boat was highest for non-Canadian anglers (35.0%), followed by BC residents (34.3%), Canadian non-residents (14.8%) and Skeena Region residents (4.2%). A significant proportion of non-Canadian aliens that accessed the river by jet boat were guided anglers.

- Most guided anglers accessed the river by jet boat (98.4%), followed by 1.6% who accessed the river by drift boat.

- Eighty-one percent of jet boat anglers used fly rods, compared to 90.4% of anglers accessing the river by drift boat, 75.5% of anglers accessing the river on foot, and 50% of anglers accessing the river by helicopter.

- Gear rods were predominantly used in Section 5 (36.6% gear anglers, and 11.3% of anglers using both gear and fly rods). By contrast, only 2.1% of anglers in Section 4 used gear rods or a combination of gear and fly rods.

Trip Length

- On average, anglers indicated that their angling day length was 7.5 hours.

- Rod day length was longer in the middle of the study period (weeks 3 to 7) when compared to rod day length in weeks 1 and 2, or rod day length in weeks 8 to 10.

- On average, angling day length was longer for non-Canadian aliens (7.98 hours) and angler from BC outside of Skeena Region (7.82 hours), and shorter for Canadian non-resident anglers from other provinces (4.04 hours). Average rod day length for Skeena Region anglers was 6.14 hours.

- Guided anglers fished significantly longer than non-guided anglers (8.72 hours compared to 7.24 hours). Angler accessing the river with drift boats fished longer than anglers accessing the river with jet boats or on foot (8.36 hours, 7.66 hours, and 6.18 hours respectively).

- Rod day length was longer for weekdays (7.79 hours) compared to weekends (6.75 hours).

- Individual anglers indicated that they intended to fish for 8.8 days. Skeena residents intended to fish an average 17.6 days, compared to 7.3 days for BC resident anglers, 4.1 days for Canadian non-resident anglers, and 5.3 days for non-Canadian anglers.

- Average trip length for guided anglers was 6.9 days, which was significantly shorter than mean trip length for non-guided anglers (9.1 days).

Angling Licences

Most anglers purchased an annual licence, though non-Canadian and Canadians from outside of BC also frequently carried an 8-day licence. All BC residents purchased an annual classified waters licence. Most non-Canadian and Canadian non-resident anglers residing outside of BC purchased a 1 day classified waters licence, followed by a 7 day classified waters licence. Almost all guided anglers purchased a 7 day classified waters licence and an 8-day angling licence, and this accounts for most 7 day classified waters licences purchased by Canadian and non-Canadian anglers.

- Most BC residents (99.4%), non-Canadian aliens (49.0%), and Canadian non-residents (40.6%) purchased an annual fishing licence. The second most commonly purchased licence class was an 8-day licence (0.6% of BC residents, 42.3% of non-Canadians residents, 40.6% of Canadian non-residents). Most guided anglers (62.2%) purchased an eight day licence.

- A significant number of non-Canadian aliens and Canadian non-residents planned to fish for more days than their classified waters licence specified. Most Canadian non-resident and non-Canadian alien anglers purchased one day classified waters licences (40.0%), followed by seven day (27.8%), two day (18.3%), four day (3.8%), three day (3.8%) five day (1.7%), and six day (1.7%) classified waters licences. Most guided anglers (75.0%) purchased seven day classified waters licences, and accounted for 82% of seven-day classified waters licences purchased. Non-guided anglers appear to purchase their classified waters licences in one to two day blocks. All BC resident anglers purchased an annuals classified water licence.

Angler Compliance

- About 3.3% of anglers interviewed had one or more angling violation. In addition, 0.9% of anglers refused to show their angling licence during the interview, and may have been non-compliant. At most, 4.2% of anglers interviewed were non-compliant with angling regulations. Most non-compliant anglers (80%) had one licence violation, while 20% of non-compliant anglers had two violations. The proportion of licence violations was highest for non-Canadian alien anglers (3.8%), followed by BC resident anglers (2.9%), Skeena Region anglers (2.5%) and Canadian non-resident anglers (0%). All guided anglers interviewed had valid licences, and were compliant with angling regulations.

- The most common licence violation was failure to carry/produce and angling licence (45%), followed by the lack of a classified waters licence (40%). Only one angler (5%) did not have steelhead stamp, and two anglers were fishing from a boat (10%).

Angler Catch and Effort

Angler catch and effort for the study period, the early and late Classified Waters Period, the four time periods, and for the five river sections included in the study were determined by combining catch rate estimates from angler interviews with effort estimates (rod days) from aerial counts. Catch rates differed significantly between time periods and river sections, but did not differ between day type. The highest catch rate was reported for week 10 (Nov. 1 to Nov. 7), though overall catch for this week was low owing to low overall effort. During the Classified Waters Period, catch rate was highest in week 6 (Oct. 4 to Oct. 10). Catch rates were lowest at the start of the Classified Waters Period (weeks 1 and 2, Aug. 30 – Sept. 12). Catch rates were higher in River Sections 3 and 5 than in other river sections. Steelhead catch rates did not differ significantly between residence categories, guide status, gear type or day type, however, catch rates differed significantly by access method, with jet boat anglers having the highest catch rate, and shore based anglers the lowest catch rate. Total effort and catch was estimated to be higher for the late Classified Waters Period than for the early Classified Waters Period. The highest effort and catch was estimated for time period 10-1 (Sept. 27 to Oct. 17). Effort and catch declined after time period 10-1. This is partly attributable to the sharp decline in guided effort towards the end of the Classified Waters Period. Total estimated effort and catch for the study period was highest in river Section 1, and lowest in river Section 5, likely because this section was closed during the early classified period.

Catch Rate

- Anglers interviewed during roving surveys fished for a total of 1086 hours, with an average effort of 3.16 hours at the time of the interview. A total of 163 steelhead were reported caught by anglers interviewed. The catch rate for anglers interviewed was 0.17 steelhead per hour, or 1.27 steelhead per rod day.

- Catch rates differed significantly between weeks, with the highest catch rates recorded for week 10 of the study (0.76 steelhead per hour), and the lowest catch rate recorded in week 2 (0.05 steelhead per hour).

- Steelhead catch rates were highest in Section 3 (Owen Canyon to Lamprey Creek; 0.28 steelhead/hour) and lowest in Section 4 (Lamprey Creek to Gosnell Creek; 0.09 steelhead/hour).

- Hourly catch rates did not differ significantly between residence categories, guided status or day type, but catch rates differed significantly for access type. Catch rates were 0.12 steelhead/hour for BC resident anglers, 0.13 steelhead/hour for Canadian non-resident anglers, 0.18 steelhead/hour for non-Canadian anglers, and 0.25 steelhead/hour for Skeena Region residents. Guided anglers averaged 0.19 steelhead/hour compared to 0.17 steelhead per hour for non-guided anglers. On average, 0.15 steelhead/hour were caught with fly rods, 0.28 steelhead/hour with gear rods, and 0.23 steelhead/hour for anglers using a combination of fly and gear rods. The catch rate for steelhead for both day types (weekend and weekday) was 0.17 steelhead/hour. Shore based anglers caught 0.11 steelhead/hour, drift boat anglers caught 0.14 steelhead/hour, jet boat anglers caught 0.21 steelhead/hour, and helicopter based anglers caught 0 steelhead/hour.

Aerial Flights

- There were 453 anglers counted during 19 aerial counts conducted on the Morice River between August 30th and November 7th, 2004. The highest count of anglers occurred on flights conducted on October 2nd (week 5, time period 10-1) and October 7th (week 6, time period 10-1) when 45 anglers were counted. The lowest number of anglers observed was one angler on November 7th, 2004 (week 10, time period 10-2). On average 24 anglers were counted during aerial flights.

- Most anglers were observed in Section 1 (34%), followed by Section 4 (21%), Section 3 (19%), Section 2 (15.2%) and Section 5 (10.8%). No gear anglers were observed during aerial flights conducted in Sections 4 and 5. Gear anglers were most commonly observed in Section 1 (19.6% of anglers), and Section 2 (17.3% of anglers).

- Most guided anglers were observed in Section 4 (46.7%), followed by Section 3 (30%), Section 1 (20%), and Section 2 (3.3%). No guided anglers were observed in Section 5. All guided anglers accessed the river by jet boat and used fly gear. The highest number of guided anglers was counted on October 11th (week 7, time period 10-1), and no guided anglers were counted on September 3rd, October 31st, November 1st or November 7th.

- A total of 195 boats (56.9% jet boats, 43.1% drift boats) were observed during aerial flights. Most jet boats (41.4%) were observed in Section 1, and the lowest number (9.9%) in Section 2. Drift boats were most commonly observed in Section 1 (29.8%), and least commonly in Section 5 (4.8%).

Catch and Effort Estimates

- The total estimated effort for the entire study period was 1750 rod days (± 488 rod days), with 622 rod days (± 373) estimated for the early classified water period, and 945 rod days (± 228) estimated for the late Classified Waters Period.

- The total steelhead catch for the study period was estimated as 2233 steelhead (± 1298 steelhead), with 485 steelhead (± 350) for the early Classified Waters Period, and 1253 steelhead (± 1134) for the late Classified Waters Period.

- The majority of effort (626 ± 288 rod days) and catch (699 ± 2640 steelhead) occurred in river Section 1 (The Forks to Knapper Creek), and the lowest overall effort (214 ± 53 rod days) occurred in river Section 5. The lowest estimated catch occurred in Section 4 (149 ± 647 steelhead).

Quality Angling Experience

Most anglers rated the quality of their angling experience highly. The quality experience ratings did not differ significantly between guide status, angler residence, access method or gear type. However, guided anglers rated their experience slightly lower than non-guided anglers, and Skeena region resident anglers appeared somewhat more critical of their angling experience than anglers from other residence categories. Quality angling ratings differed significantly between the 10 weeks of the study, with ratings being higher in the late Classified Waters Period, and lowest in weeks 1 and 2. Quality angling experience ratings also differed significantly between river sections, with ratings being highest in Section 2, and lowest in Section 4. Anglers were asked what characteristics affect the quality of their angling experience. Abundance of fish, solitude/peaceful characteristics, river attributes, and weather/water level were the most commonly mentioned attributes. Abundance of fish was most often mentioned by anglers of all residence categories, and by guided and non-guided anglers, and this might explain the somewhat lower

quality ratings in weeks 1 and 2 of the study and in Section 4 of the river, where catch rates were also low.

- Three-hundred and seven anglers (67.5%) of anglers interviewed provided criteria, which affect the quality of their angling experience. In total, 527 comments were provided by these anglers, which were grouped into 17 categories. Most commonly, anglers mentioned that fish abundance affected the quality of their angling experience (22.6%), followed by solitude/peaceful setting (14.6%), river attributes (11.2%), and weather/water quality (10.6%).

- Anglers of all resident categories most frequently indicated that fish abundance was an important factor in determining the quality of their angling experience. Non-Canadian and Canadian non-resident anglers listed wildlife, wilderness, solitude/peacefulness and scenery more frequently than BC residents.

- Three-hundred and seventy-nine anglers (83.3%) rated their angling experience on a scale of 1 (very poor) to 5 (excellent). The ratings averaged 3.98. Most anglers (43.8%) rated their angling experience as excellent, and few anglers rated their experience as poor (6.3%) or very poor (4.7%).

- All non-Canadian aliens rated their angling experience as excellent (5), while Canadian non-residents', BC residents' ratings averaged between good and excellent (4.48 and 4.06 respectively). An average rating of quality angling experience was lowest for Skeena Region residents (3.89). Guided angler ratings averaged 3.76, while non-guided angler ratings averaged 4.01.

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1.0 INTRODUCTION

The Morice River, a major tributary to the Bulkley River within the Skeena River Watershed located in northwestern British Columbia (BC) is renowned for it's high quality steelhead (*Oncorhynchus mykiss*) and chinook (*O. tsawytscha*) recreational fishery (Schell 2003). In order to protect high quality recreational fisheries, the province implemented a classified waters system in 1990 (Morten and Parken 1998). The classified waters system currently distinguishes between two types of water bodies: Class I, and Class II. Class I rivers are generally remote, while Class II systems are more accessible but still provide quality angling experience. Fourty-two rivers, including the Morice River, were classified as Class I or Class II rivers in BC in 2004 (Anonymous 2004b). The Classified Waters Period for each classified river is implemented for the portion of the year where fish are deemed most vulnerable, and these times generally coincide with the preferred steelhead angling season.

Two River Guardians collected and compiled information on angler effort, catch, harvest, demographics, preferences and compliance with sport fishing regulations on the Morice River between August 30th and November 7th, a time period that including the Classified Waters Period. During the same period, aerial counts were conducted to document spatial and temporal patterns of angler effort, and to estimate total angler effort for the Morice River. The Morice River Guardians provided a Ministry presence on the river, but the guardians were not involved in enforcement activities, though the guardians did collect data on compliance with regulations, and promoted stewardship of the resource while on the river.

The objectives of the 2004 River Guardian Project on the Morice River were:

1. To collect catch and effort data for estimation of total catch and effort by recreational anglers on the river;
2. To collect demographic data describing recreational anglers on the river;
3. To document non-compliance of fishing regulations; and
4. To provide a Ministry presence and encourage river stewardship among anglers.

2.0 STUDY AREA

The Morice River is a major tributary to the Bulkley River, and drains into the Bulkley River about 6.75 km west of the community of Houston in northcentral BC (Figure 1). At the confluence, the Morice River is larger than the Bulkley River, and contributes an average of 90% of the flow to the Bulkley River at their confluence (Gottesfeld et al 2001). The Morice River drains a catchment area of 4,349 km^2, which is bounded by the Telkwa River and Burnie River drainages to the west, the Bulkley River drainage to the north and tributaries to the Nechako River to the south and east (Gottesfeld et al 2001, Bustard and Schell 2002). The Morice River originates at Morice Lake, the largest lake in the watershed, and drains over a distance of approximately 88.5 km in a northeast direction towards the Bulkley River. Major tributaries to the Morice River include Houston Tommy, Owen, Lamprey, and Gosnell creeks. The Atna River and the Nanika River are two main inlet streams to Morice Lake.

Fish species in the Morice Watershed include nine species sought by recreational anglers: coho salmon (*Oncorhynchus kisutch*), chinook salmon, sockeye salmon (*O. nerka*), kokanee (*O. nerka*), pink salmon (*O. gorbusha*), summer run steelhead trout, rainbow trout (*O. mykiss*), cutthroat trout (*O. clarki*), bull trout (*Salvelinus confluentus*), Dolly Varden (*S. malma*), and lake trout (*S. namyacush*) (Gottesfeld et al 2001, Bustard and Schell 2002). In addition, burbot (*Lota lota*), three species of whitefish, as well as cyprinids, catastomids and cottids utilize fluvial and lacustrine habitat in this watershed. Of the species in the Morice Watershed, bull trout, Dolly Varden and cutthroat trout are blue listed (CDC 2004). In recent years, chinook, steelhead and coho have had relatively strong escapements to the Morice Watershed (Bustard and Schell 2003), but sockeye escapements continue to be depressed.

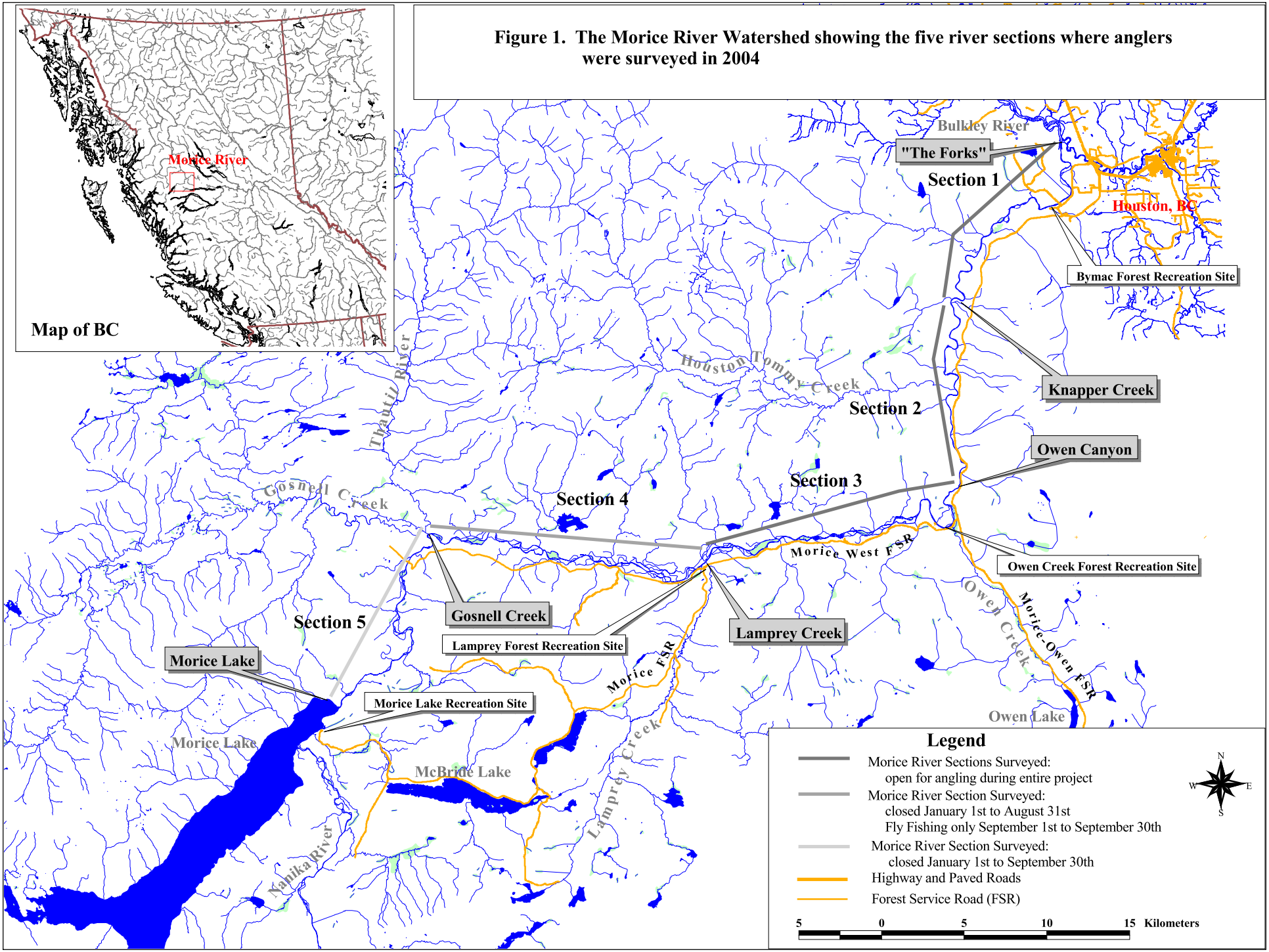
Figure 1. The Morice River Watershed showing the five river sections where anglers were surveyed in 2004
Map of BC
Morice River
Bulkley River
"The Forks"
Section 1
Houston, BC
Bymac Forest Recreation Site
Knapper Creek
Houston Tommy Creek
Section 2
Owen Canyon
Section 3
Twautti River
Gosnell Creek
Section 4
Morice West FSR
Owen Creek Forest Recreation Site
Owen Creek
Morice-Owen FSR
Gosnell Creek
Section 5
Lamprey Forest Recreation Site
Lamprey Creek
Morice Lake
Morice FSR
Morice Lake Recreation Site
Owen Lake
Morice Lake
McBride Lake
Lamprey Creek
Nanika River
Legend
Morice River Sections Surveyed: open for angling during entire project
Morice River Section Surveyed: closed January 1st to August 31st Fly Fishing only September 1st to September 30th
Morice River Section Surveyed: closed January 1st to September 30th
Highway and Paved Roads
Forest Service Road (FSR)
N
W
E
S
5 0 5 10 15 Kilometers

Recreational anglers access the Morice River by boat or on foot. Both motorized and non-motorized boats are currently permitted on the Morice River. Most motorized boats are jet boats due to the shallow and treacherous nature of some sections of the river. Boat launches are located at the Bymac Forest Recreation Site, just upstream of the Aspen Recreation Site, at the Owen and Lamprey Recreation Sites, as well as on Morice Lake at the Morice Lake Forest Recreation Site, all of which are accessed via the Morice River Forest Service Roads which branches off Highway 16 about 5 km west of the community of Houston, and the Morice West Forest Service Road. A boat launch is also located at Cedric Creek, though the general public does not appear to use this launch. A steep road to the Aspen boat launch restricts the use of this launch. Drift boats can be launched at a number of road access points along the Morice River, as well as at the three bridges that cross the Morice River. The Morice River is accessible on foot in some locations where the Morice Forest Service Road or spur roads are located in close proximity to the river, and at bridge crossings.

The entire length of the Morice River is classified as Class II from September 1st to October 31st (Anonymous 2004b). Two guides operate on the river. Guides are limited to the number of rod days they are permitted to guide during the Classified Waters Period. A total of 433 rod days for guided anglers were allocated to the two Morice River guides in 2004 (Lough personal communications).

The Morice River generally provides among the best fall angling conditions in the Bulkley Watershed due to consistent water clarity. Angling success is often influenced by weather and water conditions, which can be highly variable in the fall. Fall storms, and rain-on-snow events can result in increased discharge and turbidity, and render rivers unsuitable for fishing. Historically, the Morice River has remained fishable when other steelhead rivers in the region (e.g. Telkwa, Bulkley) are "out" (Bustard and Schell 2002), except during periods of very high discharge when even the Morice River may become unfishable. During these times, the Morice River is generally among the first in the region to become fishable again as precipitation subsides. The Thautil River (tributary to Gosnell Creek) and Houston Tommy Creek, as well as Lamprey Creek contribute significant silt to the Morice River downstream or Morice Lake. During periods of high turbidity in the lower and mid sections of the Morice River, the upper Morice River from Gosnell Creek upstream to the lake (Section 5) still remains relatively clear due to the lack of major silt contributing tributaries in this section, and the ability of Morice Lake to settle out sediments from inlet streams to the lake (such as Atna and Nanika Rivers).

Angling regulations for the Morice River are published in the B.C. Freshwater Fishing Synopsis (Anonymous 2004b), and the 2003-2005 Freshwater Salmon Supplement (Anonymous 2003). The entire Morice River is closed to fishing from January 1st to June 15th. No fishing is permitted in the Morice River from Morice Lake to Lamprey Creek from January 1st to August 31st, and from Morice Lake to Gosnell Creek from January 1st to September 30th. Fly fishing only is permitted from Gosnell Creek to Lamprey Creek from September 1st to September 30th, and a bait ban is in effect for the entire river. No angling is permitted from boats from August 15th to December 31st. The Morice River is classified as a Class II water from September 1st to October 31st, and a steelhead stamp is mandatory for this time period (Anonymous 2004b). The cost for "classified waters" licences was $15/year for BC resident anglers, and $20/day for all non-residents in 2004 (Anonymous 2004c). Fishing for salmon is prohibited upstream of Lamprey Creek year round (Anonymous 2003). Up to four chinook (including one over 65 cm) may be retained per day between the boundary signs 100 m downstream of Gosnell Creek and Lamprey Creek from June 16th to July 31st, but no fishing for chinook is permitted in this section from September 1st to December 31st (Anonymous 2004a). Up to two pink salmon may be retained per day from June 16th and August 31st between The Forks and the Bymac Bridge at Walcott Road, but no fishing is permitted for pink salmon upstream of the Bymac Bridge (Anonymous 2003). In 2004, Fisheries and Oceans Canada announced an in-season coho opening on the Morice River down-stream of Lamprey Creek, which permitted the retention of four coho per day (two of which may be > 50 cm), between August 15th and September 30th (Anonymous 2004c). This in-season opening was expanded to include the Morice River between Lamprey and Gosnell creeks on September 1st (Anonymous 2004c).

3.0 METHODS

The Morice River Guardian Project was designed to collect data on angler demographics, distribution, effort, and catch. A combination of roving surveys, aerial counts and exit surveys were used to collect data from August 31st, 2004 to November 7th, 2004.

3.1 STUDY DESIGN

The study was scheduled to survey anglers from September 1st, 2004 to November 30, 2004, encompassing the Classified Waters Period for the Morice River. On the river training was conducted on August 31 (unclassified period) and September 1 (classified period). Due to deteriorating weather conditions and low angling pressure, the study was terminated on November 7th, 2004. The sampling period was stratified by week, and each week was further divided into weekend and weekday days. Statutory holidays were considered to be weekend days. For analysis, the study period was divided into four time periods (Table 1). The Morice River was divided into five sections of similar length (Table 2, Figure 1). Section breaks were determined in part by section length, as well as easily identifiable features, and access sites to facilitate logistics. Section 5 (Gosnell or Morice Lake) was closed to fishing until October 1st, 2004 (Anonymous 2004b).

The study period was stratified into weeks, and sampling days were chosen randomly within these weeks (stratified random sampling design). Roving surveys were scheduled for five of every seven days of each week. Because roving survey sampling intensity was high, weeks were not stratified by weekend and weekdays. For each roving day, two sections of the Morice River were randomly selected for survey. Section 5 was not included in the random selection until October 1st, because this section of the river was closed to fishing prior to that date. Due to mechanical problems, roving surveys could not be conducted on two of the 48 randomly chosen days in the study period (October 1 and October 24).

Exit surveys were conducted opportunistically on days where time permitted, and on two days where the same reach was selected for both morning and afternoon roving surveys (September 11 and 28, October 1, 6 and 24).

Table 1. The specific dates included in the time periods used for analysis.

Time period	Week	Dates (2004)	Classified period
9-1	1	Aug. 30 – Sept. 5	Unclassified (to Aug. 31) - training; Early Classified (after Sept. 1)
	2	Sept. 6 – Sept. 12	Early Classified (no fishing in Section 5)
9-2	3	Sept. 13 – Sept. 19	Early Classified (no fishing in Section 5)
	4	Sept. 20 – Sept. 26	Early Classified (no fishing in Section 5)
10-1	5	Sept. 27 – Oct. 3	Early Classified (no fishing in Section 5 to Oct. 1)
	6	Oct. 4 – Oct. 10	Classified
	7	Oct. 11 – Oct. 17	Classified
10-2	8	Oct. 18 – Oct. 24	Classified
	9	Oct. 25 – Oct. 31	Classified
	10	Nov. 1 – Nov. 7	Unclassified

Table 2. The Morice River sections used for study design and analysis.

Section	Description	Approximate Length
1	The Forks (confluence with Bulkley River) to Knapper Creek confluence	17.5 km
2	Knapper Creek to Owen Canyon	15 km
3	Owen Canyon upstream to Lamprey Creek confluence	19 km
4	Lamprey Creek confluence to Gosnell Creek confluence	19 km
5	Gosnell Creek confluence to Morice Lake	18 km

Aerial counts were scheduled for two of every seven days of the week. Days in each week were stratified by weekdays and weekend days. Statutory holidays were considered to be weekend days. An angler survey conducted in 1989 in the Skeena Watershed documented that about 50% of angler effort occurred on weekdays and 50% of effort occurred on weekend days (Lewynsky and Olmsted 1990). Aerial counts were allocated proportional to each day-type stratum (i.e. 50% weekend and 50% weekday) for each week, according to expected daily angling effort (Pollock *et al*. 1994), and were randomly selected to coincide with roving survey days. No aerial counts were omitted due to weather; however, the aerial count on October 1st was not conducted as the roving surveys were cancelled due to boat problems.

Three data forms were used during the angler survey conducted on the Morice River in 2004, including the angler interview form (used for roving and exit interviews), the roving survey form, and the aerial count form (Appendix 1).

3.1.1 Aerial Counts

A helicopter was used to conduct the aerial flights over the Morice River. Except during the first flight, the entire Morice River, from the confluence with the Bulkley River to Morice Lake was flown for each aerial count. On the first flight, Section 5 (Gosnell Creek to Morice Lake) was excluded from the aerial count, since this section of the river was closed to fishing. Section 5 was included in all subsequent flights to evaluate angler compliance (to September 30th), and to count anglers (after September 30th). Two aerial flights were conducted during each week: one flight on a weekday, and one flight on a weekend day or statutory holiday. Aerial flight days coincided with days chosen for the roving surveys. A total of 21 flights were conducted out of the 22 scheduled from September 1st to November 7th, 2004. One flight was cancelled, as the boat used for the roving surveys was not operational for those days.

All aerial counts were conducted between 12:25 and 15:00. This time period represents the time when most anglers are expected to be on the river based on previous studies conducted on other rivers in the region (Lewynsky and Olmsted 1990, Morten 2000). Flight times ranged between 0.9 and 1.2 hours. The count of anglers was recorded during the helicopter flights while proceeding upstream along the river. For each flight, the total number of anglers, the number of fly or gear anglers, drift boats and motorized boats were recorded for each river section (Appendix 1). Guided anglers were noted, where possible, and guides were included in the count of total guided anglers. Inactive boats (e.g. tied up at campsites with no anglers nearby) were not counted during the aerial flights. The aerial count data were used for effort calculations. In addition, date, time, personnel, weather, water level and water clarity were recorded for each flight.

3.1.2 Roving Survey

The river guardians conducted roving surveys by traveling up and down selected sections of the river on five randomly chosen days in each sample week. For each roving survey day, two of the five sections (four from August 30th to September 30th) of the Morice River were randomly chosen, with one section selected for survey in the morning, and one in the afternoon. Roving shifts commenced no earlier than 8:00 am and no later than 10:00 am, and did not last beyond one hour before sun down. All roving shifts covered the anticipated peak angling period (11:00 – 15:00) by traveling along the selected river section in a jet boat. The river guardians interviewed almost all anglers encountered in their sections of the river. Interviews documented the effort, catch, demographics, compliance and preferences of anglers (Appendix 1). If anglers did not agree to be interviewed, if there was a language barrier, or if the angler had been interviewed previously, the interview team only recorded information on access method, angling method, hours fished, angler license details, and catch. These roving surveys represent incomplete catch and effort data because anglers continued fishing after their interview was completed.

3.1.3 Access Point (Exit) Survey

Access Point (Exit) surveys were conducted opportunistically as time permitted. Because of time constraints, all exit interviews were conducted on five days (September 11 and 28, October 1, 6 and 24). Exit interviews were conducted primarily at Bymac (23 interviews), though some exit interviews were also conducted at Owen (2 interviews). The majority of anglers accessed the river at Bymac, however anglers also accessed the river elsewhere, and these anglers were not represented in the Access Point Surveys. The exit interviews mirrored the roving interviews by collecting the same type of information. However, exit interviews represent complete fishing trips (i.e. complete fishing effort and catch for each angler day).

3.1.4 Public Perception of the Program

To assess the public's response to the guardian program, and monitor the ability of guardians to conduct the projects in a courteous, professional manner, guardians were provided with "*Let us know how we are doing*" cards. The cards were handed out to anglers interviewed on the river, and provided contact information for the project manager (for questions/concerns about the project), Fisheries and Oceans Canada (for questions/concerns around Salmon management), and Ministry of Water Land and Air Protection (for questions/concerns around Freshwater Fisheries Management).

3.1.5 Weather Conditions

Weather and water conditions were recorded on each roving day, and for each aerial flight. Staff gauge readings were taken at a staff gauge installed at a back eddy at Bymac for each roving day. Temperature and Secchi depth were recorded in a deep pool encountered along the roving section selected for the morning, between 8:00 and 10:00 am. Water level was also categorized subjectively low, rising, high, flood or dropping. Water level and clarity were recorded subjectively during aerial flights.

3.1.6 Relevant Definitions

Definitions of terms used throughout the report are provided below. Terms are organized alphabetically.

Angling Day: The time elapsed (in hours) from the time an angler indicated that they started fishing to the time of the exit interviews for anglers that were finished fishing. For roving surveys, the angling day was estimated to be the time elapsed (in hours) from the time an angler indicated that they started fishing to the time they anticipated ending their fishing day.

B.C. Resident: An angler whose primary residence is in BC, and who has been physically present in BC for the greater portion of each of six calendar months within the 12 calendar months immediately preceding the date of purchasing the license (Anonymous 2004b).

Canadian Non-Resident: An angler whose primary residence is outside of BC but within Canada. The angler resided outside of BC for more than 6 months within the 12 calendar months immediately preceding the date of purchasing the license (Anonymous 2004b).

Non-Canadian Alien: An angler whose primary residence was outside of Canada. The angler resided outside of Canada for more than 6 months within the 12 calendar months immediately preceding the date of purchasing the license (Anonymous 2004b).

Rod Day: One day of angler effort. The length of a rod day varies with angler demographics, and time period in the study.

Fishing Time: The time (hr) the angler spent fishing, determined by subtracting the time the anglers started fishing from the time of the angler interview.

3.2 DATA ANALYSIS

Data entry was performed using an MsAccess database for interviews, and an excel spreadsheet for aerial counts. Data analysis was performed using Excel, and Systat 9.

3.2.1 Interviews

The number of anglers interviewed was summarized by time period and day type (weekend day or weekday) for both roving and exit surveys and river sections. In addition, the proportion of repeat interviews was summarized by time period.

3.2.2 Angler Characteristics

Roving surveys resulted in repeat interviews of some anglers that fished the Morice River on more than one day during the study period. The number/percentage of angler interviews attempted, and the number/ percentage of individual anglers were summarized by residence. For BC residents, the MWLAP region of origin for anglers was determined by using the postal code obtained from the angling licences. For Canadians from other provinces, the province of origin was recorded. Non-Canadians were asked for their country of origin. Age and gender were recorded from fishing licences, and the numbers of male and female anglers were summarized by age categories. All angler interviews were used to summarize the proportion of anglers interviewed by each day type and time period.

Guide status for each angler (non-guided or guided) was recorded and summarized by day type, time period, number of repeat interviews, and residence category. Angler characteristics were compared using chi-square tests of homogeneity. Angler ages between different categories of anglers were compared using Mann-Whitney U tests and KS tests, unless assumptions of t-tests were met in which case t-tests were used.

Anglers were asked if they are members of a conservation club, and to identify which club they were members of. Responses were summarized by the percentage of individual anglers belonging to at least on type of conservation club. A chi-square test of homogeneity was used to compare the frequency of membership in a conservation club with residence categories and guided status. A Yates correction for continuity or a Fisher's exact test was used when necessary (Zar 1984, SPSS 1999). Anglers were also asked what they feel are the key characteristics of a high quality angling experience on the Morice River. Up to three characteristics were listed in the interviews.

3.2.3 Angler Trip Characteristics

Angling method (fly or gear) and access method (motorized or non-motorized boat, foot) was summarized by angler residence category and guided status. Angling method was also summarized by access method. A chi-square test of homogeneity was used to compare frequencies for all summaries (Pearson's and Fisher's Exact test as appropriate; SPSS 1999). For angling and access methods, all angler interviews were used as the unit of analysis, and not the individual angler.

Anglers were asked when they commenced fishing on the day of the interview. The start time of the angling day was recorded, as indicated by the angler. The interview time was also recorded. Anglers were asked to estimate when they intended to finish fishing that day (for roving surveys) or indicate when they had finished fishing that day (for exit surveys). The start time, and anticipated (for roving survey) or known end time of the fishing day (for exit survey) was used for each interview to calculate the duration of each angling day. The angler day length for roving surveys was summarized by time period, residence category, guided status, angling method and access method. Angler day lengths were compared using non-parametric statistics (Kruskal – Wallis test or Mann-Whitney U test). For the angler day, the angler interview was the unit for analysis, not the individual angler. The angler day information was used to

construct an angler activity profile, representing the frequency of anglers that fished during each hour of the day (between 6:00 am and 10:00 pm) for each time period throughout the study, and for the whole study period.

Anglers were asked to estimate how much time (excluding driving, hiking, and prep time) they fished the Morice River that day. Due to the proximity to other fishable waterbodies (e.g. Bulkley River) and the relative mobility of anglers, data was collected on the actual fishing time on the Morice River (fishing time) for comparisons to the angler day length (angler day). However, most interviews indicated that anglers spent their entire time fishing the Morice River, and were vague in estimating the total angling time on the river. Guardians deemed responses to start time, time at interview, and expected end times to be more accurate than the angler's estimated time fishing on the river. Therefore, the difference between the time and the interview, and the start time as determined from the angler was used in the catch rate calculations.

Anglers were asked how many days they had already fished, and how many more days they planned to fish on the Morice River. The total number of planned angling days in the 2004 steelhead season was calculated by summing the responses to these two questions. Differences in the number of planned days among angler residence categories were compared using a Kruskal Wallis test. Differences in the number of planned days between guided and non-guided anglers were compared using a Mann-Whitney U test. Anglers were asked to rate their quality experience on a scale of 1 (very poor) to 5 (excellent). The individual angler was the unit of analysis, not the angler interviewed.

3.2.4 Angling Licenses

The Morice River guardians asked anglers if they could examine the angler's fishing licences. The licence class, and the number of Classified Waters day purchased were recorded by examining the angling licences. The licence class (one-day, eight-day, annual) and the number of Classified Waters days purchased (one to eight days for non BC residents, annual for BC residents) were summarized by residence category and guided status. Angling licence information was requested only the first time anglers were encountered, unless the angler did not have the required licence on the initial interview.

Anglers were not required to have a Classified Waters licence before September 1st or after October 31st. For the Classified Waters Period, anglers were not required to purchase all Classified Days at one time, nor were they required to carry all the used Classified Water licences they purchased with them. Therefore, the guardians recorded only the number of classified days purchased by anglers just before the day the angler was interviewed.

The number and type of infractions observed by River Guardians were recorded on interview forms. The frequency and type of infractions were summarized by residence category and time period. For repeat interviews of anglers, infractions were compared to document if anglers addressed infractions pointed out to them on the initial interview. The angler interview rather than the individual angler was the unit of the analysis.

3.2.5 Angler Catch and Effort

3.2.5.1 *Catch Rate*

Observed effort and catch rates were calculated using data from the roving interviews. To collected data on catch, guardians asked anglers what species and how many of each species the anglers landed that day. The time spent fishing to the time of the interview, steelhead landed, and other species kept and released (e.g. bull trout/Dolly Varden, coho, chinook) were recorded on the roving interview forms. The angler interview was the unit of analysis and not the individual angler.

Because anglers were typically interviewed during their fishing trip, roving interviews represent incomplete angler catch and effort data. The probability of encountering an angler during a roving survey is proportional to the length of the fishing trip (Robson 1991). Thus, the mean of the ratios was used instead of the ratios of the means since anglers were sampled while they were still fishing (Pollock *et al* 1994, Pollock *et al*. 1997). Also, short incomplete trips (< 0.5 hours) were excluded to prevent the variance from being influenced by extreme catch rates that may occur during short trips (Pollock *et al*. 1994, Pollock *et al*. 1997). Catch rate (*R*) was estimated by:

Equation 1

$$\hat{R} = \frac{\sum_{i=1}^{n} c_i / L_i}{n}$$

where $\hat{R}$ = catch rate of the sample, n = the number of sampling units (interviews), L_i = the length of the fishing trip at the time of the *ith* interview, and c_i = the catch for the *ith* sampling unit (angler interview).

Catch rate, steelhead caught, and effort (in rod days and in angling hours) were summarized by time period, river section, angler residence, guided status, access method and angling method. Steelhead per rod day was determined by multiplying the estimated hourly catch rate by the mean expected angling day length for each time period, river section, gear type, access method, residence, and guide status obtained during roving interviews. In addition, the catch rate of other species landed was summarized.

3.2.5.2 *Aerial Flights*

The number of anglers observed by the aerial counts was summarized by week and river section. The relationship between the number of anglers observed by aerial counts and the number of anglers encountered during roving surveys was examined by week, and river section using a Pearson correlation coefficient. In addition, the number/percentage of jet and drift boats observed were summarized by week and river section.

3.2.5.3 *Effort and Catch Estimates*

Time Period Effort and Catch

Catch and effort were estimated by using data collected during aerial counts and catch rate estimates determined from roving surveys. Catch and effort were estimated for each day type (weekend and weekday, *dt*), and summed for each time period (*tp*) in each river section. All time periods were then summed to equal effort and catch estimated within each river section. Estimates of total catch and effort were derived by summing estimates of catch and effort for all weeks (and methods) or river sections. In addition, catch and effort estimates were determined for the early and late Classified Waters Period, and for the post-Classified Waters Period.

Aerial counts were corrected for anglers that were not observed on the river during the aerial flight. The daily aerial count (e_{daily}) was divided by the proportion of anglers that were observed on the river during the aerial flight (sampling probability; $P_{sampprob}$) and to derive a corrected effort estimate ($e_{dailycorr}$; Equation 2). The sampling probability was the mean probability that the angler was on the river during the flight for each day type within the time period stratum. The sampling probability was obtained during roving interviews by asking anglers when they started fishing and when they anticipated to finish fishing.

Equation 2

$$e_{dailycorr} = \frac{e_{daily}}{P_{sampprob}}$$

For each time period, the corrected daily effort estimates were used to calculate the mean daily effort within each day type ($\varsigma_{tp,dt}$). During the study period, conditions in Section 5 remained fishable even at times of high discharge and turbidity elsewhere in the Morice River. Therefore, no days within the study period were deemed un-fishable. The total effort within each day type stratum in each time period ($\hat{E}_{tp,dt}$) was estimated by multiplying the mean daily effort by the number of days in each stratum in each time period (Equation 3). Statutory holidays were counted as weekend days.

Equation 3 $$\hat{E}_{tp,dt} = N \cdot \varsigma_{tp,dt}$$

The variance in the estimate of the total effort for each day type within each time period ($VAR(\hat{E}_{tp,dt})$) was estimated using Equation 4.

Equation 4 $$VAR(\hat{E}_{tp,dt}) = N^2_{tp,dt} \cdot (s^2_{tp,dt} / n) \cdot fpc_{tp,dt}$$

Where $N_{tp,dt}$ was the total number of days in the stratum, $s^2_{tp,dt}$ was the sample variance of the daily effort within the stratum, n was the number of observations of the total daily effort within the stratum, and fpc was the finite population correction factor ($(N- n)/N$), Schubert 1988 as in Morten 1998). The variance of the total effort ($VAR(\hat{E})$) was estimated by summing the variance for each week ($VAR(\hat{E}_{week})$, Schubert 1988 as in Morten 1998).

The total estimated effort for each time period ($\hat{E}_{tp}$) was the sum of the day type effort within that time period (weekday and weekend day effort; Equation 5).

Equation 5 $$\hat{E}_{tp} = \Sigma \hat{E}_{tp,dt} = \hat{E}_{tp,weekday} + \hat{E}_{tp,weekend}$$

The variance for the total effort for each time period ($VAR(\hat{E}_{tp})$ was the sum of the day type effort variance within that time period (weekday and weekend day effort; Equation 6).

Equation 6 $$VAR(\hat{E}_{tp}) = \Sigma VAR(\hat{E}_{tp,dt}) = VAR\,\hat{E}_{tp,weekday} + VAR\,\hat{E}_{tp,weekend}$$

Approximate 95% Confidence Intervals (95% CI) for the effort estimate in each time period were calculated using Equation 7.

Equation 7 $$95\ \%\ CI = 2 \cdot \sqrt{}\ VAR(\hat{E}_{tp})$$

The total effort ($\hat{E}$) for the study period was calculated by summing the estimated effort for all time period strata ($\hat{E}_{tp}$, Equation 8).

Equation 8 $$\hat{E} = \Sigma \hat{E}_{tp}$$

The variance for the total effort (VAR $\hat{E}$) for the study period was determined by summing the variance for all of the time period strata (VAR $\hat{E}_{tp}$, Equation 9).

Equation 9 $$VAR(\hat{E}) = \Sigma VAR(\hat{E}_{tp})$$

Confidence intervals for the total effort were calculated using Equation 10.

Equation 10 $95\ \%\ \mathrm{CI} = 2 \cdot \sqrt{VAR(\hat{E})}$

To convert the fishing effort in rod days to angling hours for each time period ($\hat{E}_{tp,dt,daily(hr)}$), the daily effort from aerial counts ($\overline{e}_{tp,dt}$) was multiplied by the anticipated mean fishing time ($\overline{L}_{tp,dt}$) in hours determined from roving interviews (i.e. the difference between start time and anticipated end time of the fishing trip, as indicated by anglers during the interview) (Equation 11).

Equation 11 $\hat{E}_{tp,dt,daily(hr)} = \overline{L}_{tp,dt} \cdot \overline{e}_{tp,dt}$

The total daily effort ($\hat{E}_{tp,dt,daily(hr)}$) was multiplied by the mean daily catch rate ($\overline{R}_{tp,dt,daily}$) to obtain the daily catch ($_{tp,dt,daily}$) (Equation 12).

Equation 12 $_{tp,dt,daily} = \overline{R}_{tp,dt,daily} \cdot \hat{E}_{tp,dt,daily(hr)}$

The mean catch for each day type ($\overline{C}_{tp,dt}$) was determined by averaging the estimated daily catches within that day type for each time period (Equation 13).

Equation 13 $$\overline{C}_{tp,dt} = \frac{\Sigma\ _{tp,dt,daily}}{n}$$

The total catch rate for each day type in each time period ($_{tp,dt}$) was determined by multiplying the mean catch for that day type ($\overline{C}_{tp,dt}$) by the number of days in that day type in the time period (Equation 14).

Equation 14 $_{tp,dt} = N_{tp,dt} \cdot \overline{C}_{tp,dt}$

The variance in the estimate of total catch within each day type was calculated using Equation 15.

Equation 15 $VAR(\ _{tp,dt}) = N^2_{tp,dt} \cdot (s^2_{tp,dt} / n) \cdot fpc_{tp,dt}$

Where $N_{tp,dt}$ was the total number of days in the stratum, $s^2_{tp,dt}$ was the sample variance of the daily catch within the stratum, n was the number of observations of the total daily effort within the stratum, and fpc was the finite population correction factor ($(N- n)/N$, Schubert 1988 as in Morten 1998). The variance of the total effort ($VAR(\hat{E})$) was estimated by summing the variance for each week ($VAR(\hat{E}_{week})$, Schubert 1988 as in Morten 1998).

The total catch for each time period ($_{tp}$) was the sum of the catch for each day type (weekday and weekend; $_{tp,dt}$) (Equation 16).

Equation 16 $_{tp} = \Sigma\ _{tp,dt} = _{tp,weekday} + _{tp,weekend}$

The variance for the total catch for each time period (VAR_{tp}) was the sum of the variance for each day type in that time period (Equation 17).

Equation 17 $VAR_{tp} = \Sigma VAR_{tp,dt} = VAR_{tp,weekday} + VAR_{tp,weekend}$

Approximate 95% Confidence Intervals (95% CI) for the effort estimate in each time period were calculated using Equation 18.

Equation 18 $95\ \%\ CI = 2 \cdot \sqrt{VAR(\ _{tp})}$

The total catch for the study period ( ) was calculated by summing the estimated catch for all time period strata ($_{tp}$; Equation 19).

Equation 19 $= \Sigma\ _{tp}$

The variance for the total catch (VAR) was calculated by summing the variance for all time period strata (VAR $_{tp}$; Equation 20).

Equation 20 $VAR = \Sigma VAR_{tp}$

Approximate 95% Confidence Intervals (95% CI) for the effort estimate in each time period were calculated using Equation 21.

Equation 21 $95\ \%\ CI = 2 \cdot \sqrt{VAR(\ )}$

Effort and Catch for River Sections

Effort and catch were estimated for each of the five river sections of the Morice River. Effort in each river section was estimated by time period and day type stratification (weekend and weekday) because of the sampling design used for aerial counts. However, catch was estimated only by day type stratification because too few angler interviews were conducted for time period stratification.

Effort and Catch for Residence and Guided Status

Total effort was estimated for anglers in different guide categories (guided and non-guided), different gear types (gear and fly), and different access methods (motorized boat, non-motorized boat, foot). The corrected daily effort estimates (Equation 2) for each angling method ($e_{flydailycorr}$, $e_{geardailycorr}$, $e_{unidentifiabledailycorr}$), guided status ($e_{guideddailycorr}$, $e_{non\text{-}guideddailycorr}$) and access method ($e_{motorizeddailycorr}$, $e_{non\text{-}motorizedailycorr}$, $e_{footdailycorr}$) were substituted for the total daily effort estimate ($e_{dailycorr}$) in equations 2 through 10. No all fly and gear anglers were recognizable from the helicopter, and an estimate was calculated for an unknown angling method category.

Effort estimates for residence category could not be determined using the above equations, since residence status could not be determined during aerial counts. The proportion of anglers in each residence category was determined from the roving interviews conducted on each flight day. Within each day type, the effort for each residence category ($\hat{E}_{residence}$) was determined as the proportion of anglers in each residence category ($\hat{a}_{resdience}$) multiplied by the total effort ($\hat{E}_{tp,dt}$) (Equation 22).

Equation 22 $\hat{E}_{tp,dt,residence} = \hat{E}_{tp,dt} \cdot \hat{a}_{tp,dt,resdience}$

31) where Section 5 was open to fishing. To obtain effort estimates for the two classified water periods ($tp_{early\text{-}cw}$ and $tp_{late\text{-}cw}$) were substituted for the time periods in Table 1, and into Equations 3 to 10. Only aerial counts and roving interviews within the classified water periods were used. Equations 11 through 20 were used to estimate steelhead catch within the Classified Waters Period. The total daily effort for the classified water period days was used in Equation 12 instead of the total daily effort in the whole study period.

3.2.6 Survey Bias

The distribution of aerial counts and interviews for time periods and river sections were summarized to assess the likelihood of sampling bias. The likelihood of response and non-response errors was also discussed.

4.0 RESULTS

4.1 INTERVIEWS

The Morice River guardians conducted roving interviews on 48 (69%) of the 70 days in the study period. Exit surveys were conducted on four (6%) of the 70 days. A total of 502 anglers were observed during the study period, and 455 (90.6%) anglers were approached for an interview.

Of the 455 anglers approached for an interview, 452 (99.3%) agreed to complete the interview, one angler (0.2%) was not angling, and two anglers (0.4%) refused the interview. Of the anglers interviewed, 310 (68.1%) were being interviewed for the first time, and 145 (31.9%) had been previously interviewed.

4.1.1 Temporal and Spatial Sampling Intensity

Random stratified sampling resulted in interviews conducted in 94 shifts (including 2 shifts where only exit interviews were conducted in reach 1 on October 1 and October 24). Of the five sections, guardians conducted surveys most frequently in Section 3 (29.7%), and least frequently in Section 5 (12.8%, Table 3). Section 5 was not sampled in the first four weeks of the study as this section of the Morice River was closed to fishing. Sampling intensity in Section 5 in the last six weeks of the study was more similar to that of other sections.

While more shifts were allocated to Section 3 than to other sections of the Morice River, most interviews were conducted in Section 1 (28.6%, Table 3). The fewest interviews were conducted in Section 5 (15.6%) and Section 3 (15.8%). The relatively low proportion of interviews from Section 5 is largely attributable to the fact that Section 5 was closed to fishing for the first four weeks of the study. The low number of interviews in Section 3 is due to a low number of anglers present in Section 3 during the days when this section of the Morice River was sampled (Table 3).

Table 3. Number of interviews and number of sampling shifts for each river section in each of the weeks and time periods during the study.

Time Period[a]	Week[a]	Number of anglers interviewed (number of shifts sampled)					
		Section 1	Section 2	Section 3	Section 4	Section 5	Combined
9-1	1	6 (2)		6 (4)	4 (3)	Closed	**47 (19)**
	2	14 (2)	4 (3)	9 (4)	4 (1)	Closed	
	Total	20 (4)	4 (3)	15 (8)	8 (4)		
9-2	3	10 (2)	14 (2)	2 (2)	18 (4)	Closed	**122 (19)**
	4	22 (2)	12 (2)	3 (1)	41 (4)	Closed	
	Total	32 (4)	26 (4)	5 (3)	49 (8)		
10-1	5[b]	33 (3)	19 (1)	2 (2)	8 (1)	16 (1)	**207 (28)**
	6[c]	5 (1)	20 (2)	38 (3)		16 (2)	
	7[c]	6 (3)	0 (1)	1 (4)	21 (3)	22 (1)	
	Total	44 (7)	39 (4)	41 (9)	29 (4)	54 (4)	
10-2	8	12 (1)	0 (1)	6 (4)	0 (2)	13 (2)	**79(28)**
	9	17 (2)	16 (4)	2 (2)		0 (2)	
	10	6 (2)		3 (2)		4 (4)	
	Total	35 (5)	16 (5)	11 (8)	0 (2)	17 (8)	
Combined		130 (20)	86 (16)	72 (28)	96 (18)	71 (12)	**455 (94)**

[a] for definition of sample week and time period, please see table 1;
[b] Section 5 was closed to fishing to Oct. 1, 2004;
[c] only four days were selected for roving surveys in week 6, and 6 days were selected in week 7

Table 4. The number of anglers approached for an interview, and the total number of anglers interviewed during roving and exit surveys on weekdays (Wday) and weekends (Wend) within each sampling period.

Time Period[a]	Week	Number (Percent) of Interviews Initiated								
		Exit			Roving			Total		Grand Total (%)
		Wday	Wend	Total	Wday	Wend	Total	Wday	Wend	
9-1	1	0 (0)	0 (0)	0 (0)	10 (63)	6 (37)	16 (4)	10 (63)	0 (4)	16 (4)
	2	0 (0)	2 (100)	2 (7)	13 (45)	16 (55)	29 (7)	13 (42)	18 (58)	31 (7)
9-2	3	0 (0)	0 (0)	0 (0)	32 (73)	12 (27)	44 (10)	32 (73)	12 (27)	44 (10)
	4	0 (0)	0 (0)	0 (0)	56 (72)	22 (28)	78 (18)	56 (72)	22 (28)	78 (17)
10-1	5	22 (100)	0 (0)	22(81)	40 (71)	16 (29)	56 (13)	62 (79)	16 (21)	78 (17)
	6	2 (100)	0 (0)	2(7.4)	59 (77)	18 (23)	77 (18)	61(77)	18 (23)	79 (17)
	7	0 (0)	0 (0)	0 (0)	24 (48)	26 (52)	50 (12)	24 (48)	26 (52)	50 (11)
10-2	8	0 (0)	1(100)	1(4)	17 (57)	13 (43)	30 (7)	17 (55)	14 (45)	31 (7)
	9	0 (0)	0 (0)	0 (0)	20 (57)	15 (43)	35 (8)	20 (57)	15 (43)	35 (8)
	10	0 (0)	0 (0)	0 (0)	10 (77)	3 (23)	13 (3)	10 (77)	3 (3)	13 (3)
Total		24 (89)	3 (11)	27 (6)	281 (66)	147 (34)	428 (94)	305 (67)	150 (33)	455 (100)

[a] for definition of time period, please see table 1;

The distribution of interviews among day type corresponds well with the distribution of day type in the study period. Of the 70 days in study period. 48 days (68.6%) were weekdays, and 22 days were weekend days (31.4%). Roving interviews were conducted on 48 days including 17 weekend days (35.5%) and 31 weekdays (64.5%). The majority of interviews were completed on weekdays (67%), while the remaining interviews (33%) were completed on weekends (Saturday, Sunday, statutory holidays) (Table 4). Most of the exit surveys were conducted on weekdays (89%), with only 11% of exit surveys conducted on weekends.

The distribution of interviews between weekend and weekdays in Morice River sections were generally similar to the distribution of these day types among the study period. Most interviews (65% to 87%) were conducted on weekdays for Sections 1, 2, 3, and 4 (Table 5). However, most of the interviews in Section 5 were conducted on weekends (94%). Exit interviews were only conducted in Sections 1, 2 and 3.

Table 5. The number of anglers (percent) interviewed during roving and exit surveys on weekdays (Wday) and weekends (Wend) within each river section. Note that River Section 5 was closed to fishing until October 1, 2004.

River Section	Number (Percent) of Interviews Initiated								
	Exit			Roving			Total		Grand Total (%)
	Wday	Wend	Total	Wday	Wend	Total	Wday	Wend	
1	20 (87)	3 (13)	23 (85)	70 (65)	37 (35)	107 (25)	90 (69)	40 (21)	130 (29)
2	2 (100)		2 (7)	64 (74)	20 (26)	84 (20)	66 (77)	20 (23)	86 (19)
3	2 (100)		2 (7)	61 (87)	9 (13)	70 (16)	63 (88)	9 (12)	72 (16)
4				82 (85)	14 (15)	96 (22)	82 (85)	14 (15)	96 (21)
5				4 (6)	67 (94)	71 (17)	4 (6)	67 (94)	71 (16)
Total	24 (89)	3 (11)	27 (6)	281 (66)	147 (34)	428 (94)	305 (67)	150 (33)	455

Table 6. The number and percentage of initial and repeat interviews in each week.

Time Period[a]	Week[a]	Number (percent) of initial interviews	Number (percent) of repeat Interviews	Total number of interviews
9-1	1	16 (100)		16
	2	24 (77.4)	7 (22.6)	31
	Sub-total	**40 (85.1)**	**7 (14.9)**	**47**
9-2	3	28 (63.6)	16 (36.4)	44
	4	38 (48.7)	40 (51.3)	78
	Sub-total	**66 (54.1)**	**56 (45.9)**	**122**
10-1	5	66 (84.6)	12 (15.4)	78
	6	61 (77.2)	18 (22.8)	79
	7	32 (64.0)	18 (36.0)	50
	Sub-total	**159 (76.8)**	**48 (23.2)**	**207**
10-2	8	17 (54.8)	14 (45.2)	31
	9	19 (54.3)	16 (45.7)	35
	10	9 (69.2)	4 (30.8)	13
	Sub-total	**45 (57.0)**	**34 (43.0)**	**79**
Total		310 (68.1)	145 (31.9)	455

[a] for definition of sample week and time period, please see table 1;

The Morice River guardians encountered some anglers more than once, and therefore, some anglers were interviewed on more than one occasion. Repeat interviews constituted 31.9% of all angler interviews (Table 6). The percentage of repeat interviews was highest in weeks 4, 8 and 9 of the study.

4.1.2 Public Perception

Public perception of the project was evaluated using responses to the "How are we doing" cards. Cards were offered to each angler during the initial interview. Only one angler called the SKR office, indicating that most of the anglers were not significantly affected by the presence of the guardians on the river. The angler that called in was from Kamloops, and reported that he was pleased to see the guardians on the river. The caller commented on the professional conduct of the guardians, and noted that the presence of the guardians was a good public relations tool for the Ministry. No anglers called the Ministry of Water Land and Air Protection office as a result of the Morice River Guardian project.

The guardians also noted public perception indirectly while on the river. Most anglers responded positively to the interviews, as indicated by the generally good response rate during the roving surveys (Tables 3 and 4). Guides were also positive about the presence of the guardians on the Morice River, though one assistant guide repeatedly indicated that the interview process was onerous, and affected his clients' trips significantly. Efforts to address the assistant guide's concerns included repeated meetings with the guide on and off the river, and continued efforts on the part of the guardians to facilitate the interviews in a fashion that would limit the interaction while still following the sample plan. Overall, anglers and guides were positive about the presence of the guardians on the river.

4.1.3 Weather Conditions

Weather information was collected during roving surveys and during aerial counts. Detailed weather data are summarized in Appendix 3. All of the 48 days sampled within the study period were considered fishable. During period of high discharge, some sections of the Morice River were turbid, and received low to no fishing pressure, but the upper section of the Morice River, upstream of Gosnell Creek (Section 5) remained fishable during the entire study period. No sample days were lost due to weather or river conditions.

4.2 ANGLER CHARACTERISTICS

4.2.1 Characteristics of All Anglers Combined

4.2.1.1 *Angler Residence*

The majority of angler interviews represented anglers from BC (57.9%), followed by non-Canadians (36.3%) and Canadians residing outside of BC (6.1%). Residence was not recorded for 11 angler interviews (2.4%). The angler interviews represented 302 individual anglers, with 173 anglers from BC, 21 anglers from other Canadian provinces and 108 anglers residing outside of Canada (Table 7). Of all BC resident interviews, 120 (46.5%) were Skeena Region residents, and 138 (53.3%) resided in other regions of BC Twenty-seven interviews were conducted for Canadian non-residents residing outside of BC, representing 21 individual anglers. The 160 non-Canadian alien interviews represented 108 individual anglers. Most of the 142 repeat interviews represented non-Canadians (36.6%) and Skeena Region residents (32.4%), followed by BC residents from outside Skeena Region (26.7%) and Canadian non-residents (4.2%).

For BC residents, the postal code was used to determine the regional residents status (Figure 2). Most BC residents interviewed were from the Skeena Region (42.2%, 73 angler), followed by the Lower Mainland (23.1%, 40 anglers), Omineca-Peace (16.8%, 29 angler interviews), Vancouver Island (8.1%, 14 anglers), Cariboo and Okanagan (each with 2.9%, 5 anglers), Thompson-Nicola (2.3%, 4 anglers) and the Kootenay Region (1.7%, 3 anglers).

For the 128 Canadian non-resident and non-Canadian alien anglers, the province or country of residence was recorded. Twenty (95.2%) of the 21 Canadians residing outside of BC indicated their province of residence. Of these interviews, 16 (80%) were from Alberta, two (10%) were from Ontario, and one (5%) was from each of the Northwest Territories and Quebec. Three of the residents from Alberta and one of the residents from Ontario were interviewed on more than one occasion. Most of the interviews for non-Canadian aliens represented anglers from the United States (76.9%, 83 anglers), followed by Italy (12.0%, 13 anglers), Holland (2.8%, 3 anglers), and Norway (1.9%, 2 anglers). Less than one percent of anglers (1 angler) were from Denmark, England, Ireland, New Zealand, Scotland and Switzerland.

The temporal distribution of angler interviews by residence category is illustrated in Figure 3. The number of interviews conducted peaked in time period 3 (weeks 5, 6 and 7). The highest number of non-Canadian alien angler interviews were conducted in week 4 (38 interviews, 23.8% of non-Canadian interviews), while the highest number of BC resident interviews were conducted in week 5 (48 interviews, 18.7% of BC resident interviews). A relatively low number of Canadians non-residents were interviewed in each of the weeks of the study period, except for week 10.

Table 7. The proportion of interviews initiated and individual anglers for residence categories.

Residence	Number of Angler Interviews Initiated	Number (%) of Individuals Anglers
BC Total	257 (57.9)	173 (57.3)
Skeena Region	**119 (46.3)**	**73 (42.2)**
Rest of Province	**138 (53.7)**	**100 (57.8)**
Canadian	27 (6.1)	21 (7.0)
Non-Canadian	160 (36.3)	108 (35.7)
Total	**444 (100)**	**302 (68.0)**

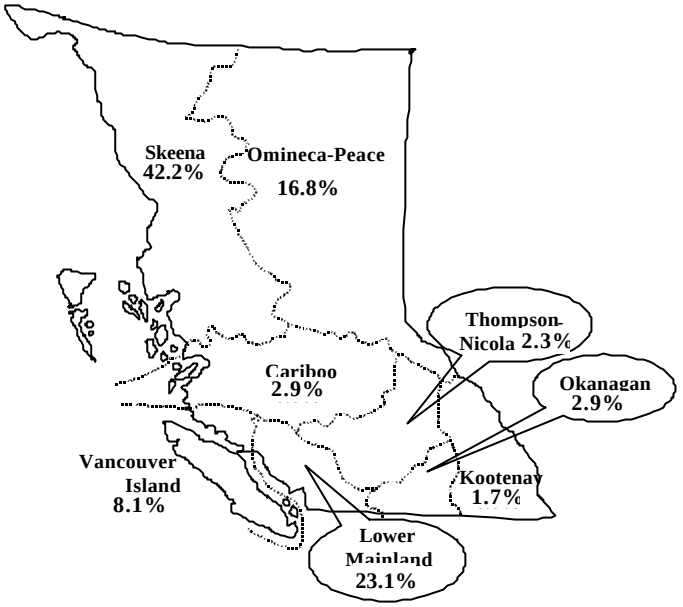

Figure 2. The percentage of individual anglers interviewed who were from different MWLAP regions of the province of B.C..

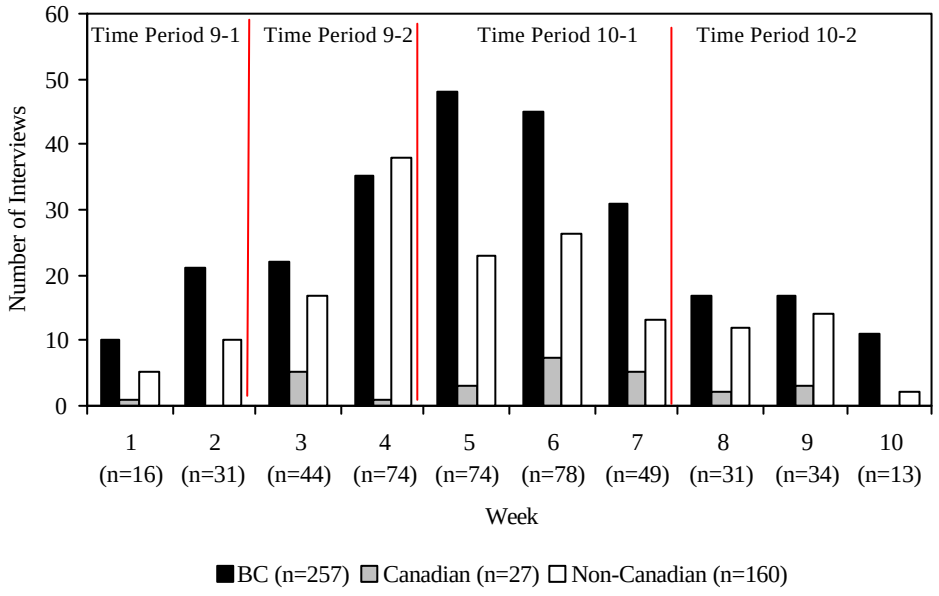

Figure 3. The number of angler interviews in each residence category in each week.

Table 8. The percentage of residence category for anglers interviewed on weekend and weekdays for the entire study period.

Residence	Number (%) of Anglers Interviewed on: Weekday Days	Weekend Days
B.C.	153 (51.3%)	104 (71.3%)
Skeena Region	52 (34.0%)	67 (64.4%)
Rest of Province	101 (66.0%)	37 (35.6%)
Canadian	19 (6.4%)	8 (5.5%)
Non-Canadian	126 (42.3%)	34 (23.3%)

The study period encompassed the early-Classified Waters Period (September 1-30), and the late classified water period (October 1-31). The number of anglers interviewed in September (213 interviews) was similar to the total number of anglers interviewed in October (215 interviews). The number of non-Canadian interviews was higher in September (89 interviews) than in October (69 interviews). However, the number of interviews for Canadians was slightly higher in September than in October. In September, 114 BC residents and 10 other Canadians were interviews, while in October 129 BC residents and 17 other Canadians were interviewed.

Angler residence differed significantly between weekends and weekdays (Pearson's chi-square χ^2 = 41.82, df = 3, P = 0.000; Table 8). Anglers from the Skeena Region were more frequently interviewed on weekends (45.9% of weekend interviews), than on weekdays (17.4% of weekday interviews). All other residence categories were more frequent on weekdays than on weekends.

Angler residence differed significantly between river section (Pearson chi-square χ^2 = 45.57, df = 8, P = 0.000; Figure 4). Most interviews were conducted in Section 1, and the fewest interviews were conducted in Section 5. This is partly due to the fact that Section 5 was closed to fishing in September. Relatively few interviews were conducted in Section 3 (72), despite the fact that Section 3 was most frequently sampled (Table 3). Of anglers interviewed in Section 1, 3 and 5, BC residents were the most frequent, followed by non-Canadians, and lastly by Canadians from other provinces. Of anglers interviewed in Sections 2 and 4, non-Canadians were most frequent, followed by BC residents, and lastly by Canadians from other provinces.

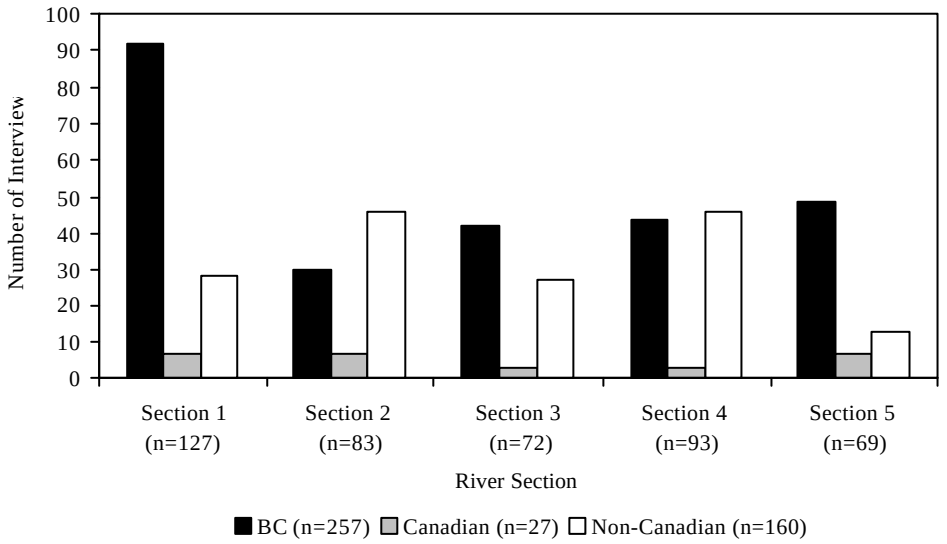

Figure 4. The number of angler interviews in each river section.

4.2.1.2 *Angler Gender and Age*

Gender was recorded for all 455 interviews, and the majority of angler interviews were male (437 angler interviews, 96.0%). These 437 angler interviews represent 298 individual male anglers. The 18 angler interviews where the angler was female represent a total of 12 individual female anglers. The proportion of repeat interviews for males (139, 31.8%) is similar to female anglers (6, 33.3%). Of the 455 angler interviews, year of birth was recorded for 434 interviews (95.4%). Percent male and percent female anglers by age category are summarized in Table 9. No female angler under the age of 29 or over the age of 67 was encountered during the Morice River guardian project. On average, male anglers were similar in age to female anglers, and the mean age of male and female anglers was not significantly different (Mann-Whitney U test statistic = 3572, $P = 0.741$).

Gender did not differ significantly between residence (Pearson chi-square $\chi^2 = 2.281$, df = 3, $P = 0.516$; Table 10), and neither did mean age of anglers (KS = 4.803, df = 3, $P = 0.187$).

Table 9. The number and percentage of male and female anglers within each age category, and the mean age of male and female anglers.

Age categories	Number (%) of Male Angler interviews	Number (%) of Female Angler Interviews
<16[1]	1 (2.4%)	0 (0%)
16-24	11 (2.6%)	0 (0%)
25-34	71 (17.1%)	3 (16.7%)
35-44	99 (23.8%)	5 (27.8%)
45-54	107 (25.7%)	6 (33.3%)
55-64	67 (16.1%)	3 (16.7%)
≥ 65	60 (14.4%)	1 (5.6%)
Total	**416 (95.1%)**	**18 (4.9%)**
Mean (SD) Age	**48.5 (13.66)**	**47.9 (9.67)**

[1]anglers less than 16 years of age do not require a fishing licence in B.C. (Anonymous 2004b)

Table 10. The number of male and female anglers, and mean angler age by residence category.

Residence	# Male	# Female	Mean Age (SD)
B.C.	247	10	48.1 (14.08)
Skeena Region	113	6	46.5 (13.22)
Rest of Province	134	4	49.5 (14.70)
Canadian	27	0	52.8 (10.28)
Non-Canadian	152	8	48.4 (12.94)

4.2.1.3 *Angler Guide Status*

During the Morice River guardian project, 394 (86.6%) non-guided, and 61 (13.4%) guided anglers were interviewed. Guides and assistant guides were not included in the number of guided anglers interviewed, but were included in the number of non-guided anglers if they were fishing. The majority of guided anglers were interviewed in September (weeks 1, 2, 3, and 4) during the early Classified Waters Period (Figure 5). Fewer guided anglers were interviewed in October, and none were encountered in the last two weeks of the study. By contrast, the majority of non-guided anglers were interviewed in weeks 5 and 6 (late classified water period).

Guided and non-guided anglers were not equally distributed between weekend and weekdays (Pearson chi-square $\chi^2 = 12.645$, df = 1, $P = 0.000$; Table 11). The proportion of guided anglers on weekdays is higher than the proportion of guided anglers on weekends.

The gender and age distribution of guided and non-guided anglers were compared (Table 12). Because of the low expected frequencies for female guided anglers, the Fisher's Exact Test was used. The gender distribution did not differ significantly between guided and non-guided anglers (Fisher's Exact Test $P = 0.489$). Guided anglers were, on average, older than non-guided anglers (difference between means = 9.56 years). The age difference between guided and non-guided anglers was statistically significant (separate variance *t* statistic = -5.156, df = 71.8, $P = 0.000$).

The majority of guided anglers were non-Canadians (90.0%, Table 13). Only six Canadian non-resident anglers (including 2 anglers from BC) were guided. The difference in residence categories between guided and non-guided anglers is statistically significant (Pearson chi-square $\chi^2 = 91.550$, df = 3, $P = 0.000$).

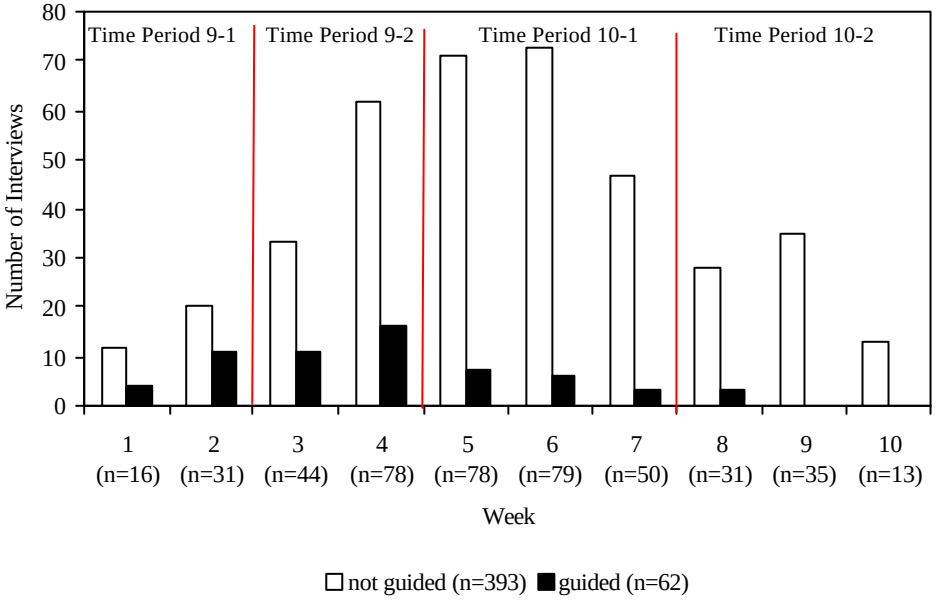

Figure 5. The number of guided and non-guided anglers interviewed in each week.

Table 11. The number and proportion of guided and non-guided anglers interviewed on weekend days and weekdays during the study period.

Guided Status	Number (%) of Anglers Interviewed on: Weekday Days	Weekend Days
Guided	53 (17.7%)	8 (5.3%)
Non-Guided	251 (82.3%)	142 (94.7%)

Table 12. The number male and female anglers, and mean angler age by guided status.

Guided Status	# Male	# Female	Mean Age (SD)
Guided	60	1	57.0 (12.78)
Non-guided	376	17	47.2 (13.17)

Table 13. The guided status of anglers by residence category.

Residence	Guided	Non-guided
B.C.	2	254
Skeena Region	0	119
Rest of Province	2	135
Canadian	4	23
Non-Canadian	54	106
Combined	**60**	**383**

The number of guided anglers interviewed were not equally distributed among the five Morice River sections. Guided anglers were not encountered in Sections 2 or 5 (Figure 6). The majority of guided anglers were interviewed in Section 4 (33 angler interviews, 55.0%), followed by Section 3 (18 angler interviews, 33.0%) and Section 1 (10 anglers interviews, 17.0%). However, the majority of interviews were conducted in Section 1, followed by Section 4, Section 2, Section 3 and Section 5. Of the 96 anglers interviewed in Section 4, 33 (34%) were guided, the highest proportion of guided anglers among the five Morice River sections.

Twenty-four (40.0%) of guided angler interviews and 122 (31.0%) of non-guided interviews were repeat interviews. There was no significant difference between the distribution of guided and non-guided number of anglers that were interviewed more than once (Pearson chi-square χ^2 =1.55, df = 1, P = 0.214).

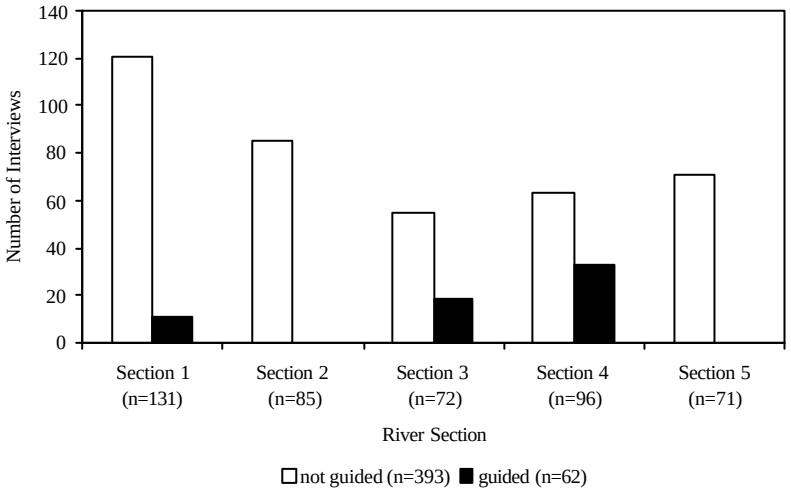

Figure 6. The number of guided and non-guided anglers interviewed in each river section.

4.2.1.4 *Angler Conservation Club Membership*

Of the 310 anglers interviewed, 105 (33.9%) indicated that they were members of one or more conservation club. Conservation club membership was not recorded for 12 anglers (3.9%), and 193 (62.3%) anglers indicated that they were not members of a conservation club. Of the 105 anglers that indicated they were members of a conservation club, 81 anglers (77.1%) were members of one club, 17 anglers (16.2%) were members of two clubs, and five anglers (4.8%) were members of three or more clubs. Female anglers were more likely to be members of a conservation club (6 of 12 female anglers, 50%) then male anglers (99 of 298 anglers, 33.2%), although this difference is not statistically significant (Fisher exact test $P = 0.056$).

Non-Canadian alien anglers and Canadian non-resident anglers from outside of BC were more likely to be members of a conservation club than BC resident anglers (Pearson chi-square $\chi^2 = 8.645$, df = 3, $P = 0.034$; Table 14). Of anglers interviewed, 23.3% of Skeena Region anglers, 34.4% of other BC resident anglers, 38.1% of other Canadian non-resident anglers, and 44.7% of non-Canadian anglers indicated that they were members of one or more conservation organization.

Seven female anglers (63.6%) and 98 male anglers (51.9%) belonged to at least one conservation club. The difference in gender distribution between anglers that were members of at least one conservation club, and those that were not members did not differ significantly (Yates corrected chi-square $\chi^2 = 2.848$, df = 1, $P = 0.091$). The proportion of club membership differed significantly between guided and non-guided anglers (Pearson chi-square $\chi^2 = 13.413$, df = 1, $P = 0.000$). More guided anglers were members of at least one conservation club than non-guided anglers (62.2% compared to 31.4%).

Of the conservation clubs listed by anglers, Trout Unlimited Canada(18.4%) was the most common, followed by the BC Steelhead Society (12.5%), and the BC Fly Fishers Federation (5.9%, Table 15). Fewer anglers were members of the BC Wildlife Federation and Ducks Unlimited (each with 3.7%), or the Atlantic Salmon Federation and Federation of Fly Fishers (each with 2.9%). The American Fisheries Society, Bulkley Valley Steelhead Society, Osprey Fly Fishers Club, Peninsula Fly Fishers, and the Rod and Gun Club were represented by two anglers each (2.2%). The remaining 45 conservation clubs that were mentioned had one member each (Appendix 2).

Table 14. The number of anglers that were members of one or more conservation club by residence category.

Residence	Conservation Club Member	
	Yes	**No**
B.C.	40 (25.2%)	119 (74.8%)
Skeena Region	17 (23.3%)	56 (76.7%)
Rest of Province	33 (34.4%)	63 (65.6%)
Canadian	8 (38.1%)	13 (61.9%)
Non-Canadian	46 (44.7%)	57 (55.3%)
Combined	**94 (33.2%)**	**189 (66.8%)**

Table 15. The top 12 conservation clubs that anglers reported they were members of.

Conservation Club[1]	Number (%) of Individual Anglers that are Members	Percent of all anglers interviewed
Trout Unlimited Canada	25 (18.4%)	8.1%
BC Steelhead Society	17 (12.5%)	5.5%
BC Fly Fishers Federation	8 (5.9%)	2.6%
BC Wildlife Federation	5 (3.7%)	1.6%
Ducks Unlimited	5 (3.7%)	1.6%
Atlantic Salmon Federation	4 (2.9%)	1.3%
Federation of Fly Fishers	4 (2.9%)	1.3%
American Fisheries Society	3 (2.2%)	1.0%
Bulkley Valley Steelhead Society	3 (2.2%)	1.0%
Osprey Fly Fishers Club	3 (2.2%)	1.0%
Peninsula Fly Fishers	3 (2.2%)	1.0%
Ron and Gun Club	3 (2.2%)	1.0%

[1] See Appendix 2 for the complete list of conservation clubs mentioned by Morice River anglers.

4.3 ANGLER TRIP CHARACTERISTICS

4.3.1 Angling Methods

Anglers were predominantly fly anglers (82.2%) on the Morice River during the study period (Table 16). Gear preference differed significantly between residence categories (Pearson chi-square $\chi^2 = 78.914$, df = 6, $P = 0.000$) Among residence categories, the proportion of fly anglers was highest for non-Canadians (98.1%), followed by Canadians from outside of BC (88.9%), BC residents outside of Skeena Region (83.3%) and Skeena Region residents (57.6%). Few of the anglers interviewed (4.5%) used both fly and gear methods during the same angling trip.

Most anglers accessed the river by jet boat (227 angler interviews, 51.4%), followed by drift boat (111 angler interviews, 25.1%), shore (102 angler interviews, 23.1%) and two anglers (0.5%) accessed the river with a helicopter. Differences in access methods (excluding helicopter due to low sample size) between residence categories was statistically significant (Pearson chi-square $\chi^2 = 50.570$, df = 9, $P = 0.000$). Drift boats were most frequently used by Non-Canadian alien anglers (35.0% of non-Canadian angler interviews), whereas jet boats were mot frequently used by Skeena River anglers (70.3% of angler interviews). Canadian non-resident anglers from other provinces accessed the Morice River primarily by jet boat (51.9%) and on foot (33.3%). BC resident anglers residing outside of Skeena Region primarily accessed the river by jet boat (40.1%) and drift boat (34.3%).

Table 16. The number and percentage of anglers using different access methods and gear types by residence category.

Residence	Number (%) of Anglers				Number (%) of Anglers		
	Drift Boat	Jet Boat[1]	Shore	Helicopter	Fly	Gear	Both
B.C.	51 (20.0)	138 (54.1)	64 (25.1)	2 (0.7)	183 (71.5)	56 (21.9)	17 (6.6)
Skeena Region	5 (4.2)	83 (70.3)	29 (24.6)	1 (0.8)	68 (57.6)	40 (33.9)	10 (8.5)
Other B.C.	47 (34.3)	55 (40.1)	35 (25.5)	1 (0.7)	115 (83.3)	16 (11.6)	7 (5.9)
Canadian	4 (14.8)	14 (51.9)	9 (33.3)	0 (0)	24 (88.9)	2 (7.4)	1 (3.7)
Non-Canadian	56 (35.0)	75 (46.9)	29 (18.1)	0 (0)	157 (98.1)	1 (0.6)	2 (1.3)
Total	**111 (25.1)**	**227 (51.4)**	**102 (23.1)**	**2 (0.5)**	**364 (82.2)**	**59 (13.3)**	**20 (4.5)**

[1] jet boats include all motorized boats

All guided anglers were fly anglers, and the majority (79.1%) of non-guided anglers were also fly anglers (Table 17). Gear type used by guided anglers differs significantly from gear type distribution among non-guided anglers (Pearson chi-square $\chi^2 = 15.828$, df = 2, $P = 0.000$). Most guided anglers accessed the river with jet boat (98.4%), and only one guided angler accessed the river with drift boat (1.6%). No guided anglers accessed the river on foot or with a helicopter. The majority of non-guided anglers (43.7%) also accessed the river by jet boat, with 28.9% of non-guided anglers accessing the river by drift boat, 26.9% on foot, and 0.5% with a helicopter. Due to low sample size, the two non-guided anglers that accessed the river by helicopter were excluded from statistical comparisons of access methods between anglers with different guide status. Access method differs significantly between guided and non-guided anglers accessing the river by jet boat, drift boat or from shore (Pearson chi-square $\chi^2 = 63.052$, df = 2, $P = 0.000$).

Angling method did not differ significantly between male and female anglers (Pearson chi-square $\chi^2 = 2.084$, df = 2, $P = 0.353$). All but one female angler (94.4%) were fly anglers, while 81.4% of male anglers were fly anglers. Eight female anglers (44.4%) and 223 (51.4%) male anglers accessed the river by jet boat. Seven female anglers (38.9%) accessed the river on foot, compared to 99 (22.8%) of male anglers. Three female anglers (16.7%) and 112 (25.8%) of male anglers accessed the river with a drift boat. The sample size for female anglers was insufficient for statistical comparisons of access methods between genders.

Most of the anglers that used drift boats were fly fishing (90.4%), while 7.8% were gear fishing, and 1.7% used both fly and gear methods (Table 18). Similarly, 81.0% of jet boat anglers were fly fishing, 5.6% were gear fishing, and 13.4% were using both. Anglers that accessed the river from shore were also predominantly fly fishing (75.5%), while 4.7% of shore based anglers were gear fishing, and 19.8% used both methods. Of the two anglers that accessed the river with a helicopter, one was fly fishing, and one used gear. The composition of angling methods did not differ significantly between access types (Pearson chi-square $\chi^2 = 12.328$, df = 6, $P = 0.055$).

Angling methods differed significantly between river sections (Pearson chi-square $\chi^2 = 68.658$, df = 8, $P = 0.000$). Fly anglers were most prevalent in river Section 4 (97.9% of angling interviews), and least prevalent in Section 5 (52.1% of anglers interviewed).

Table 17. The number and percentage of anglers using different access methods and gear types by guided status.

Guided Status	Number (%) of Anglers				Number (%) of Anglers		
	Drift Boats	**Jet Boats[1]**	**Shore**	**Helicopter**	**Fly**	**Gear**	**Both**
Guided	1 (1.6)	60 (98.4)	0 (0)	0 (0)	61 (100)	0 (0)	0 (0)
Non-Guided	114 (28.9)	172 (43.7)	106 (26.9)	2 (0.5)	311 (79.1)	62 (15.8)	20 (5.1)
Total	**115 (25.3)**	**232 (51.0)**	**106 (23.3)**	**2 (0.4)**	**372 (81.9)**	**62 (13.7)**	**20 (4.4)**

[1] jet boats include all motorized boats

Table 18. The number and percentage of anglers using different access methods that fished with fly, gear, or both types of rods.

Angling Method	Number (%) of Anglers			
	Drift Boats	**Jet Boats[1]**	**Shore**	**Helicopter**
Fly	104 (90.4)	187 (81.0)	80 (75.5)	1 (50)
Gear	9 (7.8)	13 (5.6)	5 (4.7)	1 (50)
Both	2 (1.7)	31 (13.4)	21 (19.8)	0 (0)
Total	**115**	**231**	**106**	**2**

[1] jet boats include all motorized boats

Table 19. The number and percentage of anglers using different angling methods by river section.

River Section	Number (%) of Anglers		
	Fly	Gear	Both
1	113 (86.3)	11 (8.4)	7 (5.3)
2	71 (83.5)	9 (10.6)	5 (5.9)
3	57 (80.3)	14 (19.7)	0 (0)
4	94 (97.9)	2 (2.1)	0 (0)
5	37 (52.1)	26 (36.6)	8 (11.3)

4.3.2 Trip Length

Eleven of the 455 anglers interviewed fished other rivers as well as the Morice River. All of these anglers indicated that they had fished the Bulkley River on the day of the interview. The amount of time fished on the Bulkley River was not recorded consistently on these interviews, and these 11 interviews were excluded for the analysis of trip length, effort, and catch. Start or anticipated end time was not recorded for 27 of the remaining 444 interviews, and trip length analysis was based on 417 interviews for which data were complete.

On average, anglers expected to fish 7.5 hours on the Morice River per day (Table 20). Trip length was compared between exit interviews and roving interviews. Exit interviews indicated that anglers fished an average of 7.2 hours per day (N = 26, SD = 2.647), and roving interviews indicated that anglers fished an average of 7.5 hours per day (N = 382, SD = 2.339). The hours per angling day determined from roving or exit surveys did not differ significantly (Mann-Whitney U statistic = 4605, $P = 0.534$), and the two interview types were combined for the analysis of angling day length.

The mean expected angling day length was longest in week 5 (time period 10-1), with 8.35 hours (SD = 1.83), and shortest in week 10 (5.84 hours, SD = 3.09; Table 20). Angling days were generally shorter in the end of October and beginning of November, than in September or beginning of October. Angling day length differs significantly between weeks (KS = 35.416, $P = 0.000$) and by time period (KS = 29.711, $P = 0.000$).

Table 20. The mean angling day length (and standard deviation) of anglers interviewed by week.

Time Period	Week	Angling day (hr)		
		N	Mean	SD
9-1	1	14	6.73	2.63
	2	25	7.19	2.00
	Time period	*39*	*7.02*	*2.22*
9-2	3	42	7.61	2.48
	4	62	7.82	2.56
	Time period	*104*	*7.74*	*2.52*
10-1	5	72	8.35	1.83
	6	73	7.44	2.45
	7	46	7.79	2.06
	Time period	*191*	*7.86*	*2.16*
10-2	8	28	6.27	1.84
	9	33	6.35	2.25
	10	13	5.84	3.09
	Time period	*74*	*6.23*	*2.25*
Total		**408**	**7.46**	**2.357**

Average angling day length differed significantly between residence categories, guide status, access method, angling method, and day type (Table 21). On average, angling day length was longer for non-Canadian anglers (7.98 hours), and anglers from BC outside of Skeena Region (7.82 hours), and shortest for Canadians form other provinces (4.04 hours). Guided anglers (8.72 hours) fished significantly longer than non-guided anglers (7.24 hours). Anglers accessing the river with drift boat fished longest (8.36 hours), followed by anglers using jet boats (7.66 hours). Average angler day length was shorter for anglers accessing the river from shore (6.18 hours), and angler days average 2.0 hours for the two anglers that accessed the river by helicopter. Anglers using fly rods planned to fish longer (7.74 hours) than those using gear rods (6.14 hours), or anglers using a combination of fly and gear rods (6.74 hours). On average, angling days were statistically longer on weekdays (7.79 hours) than on weekends (6.75 hours).

Daily fishing activity resembled a normal distribution for all weeks combined (Figure 7). Peak fishing effort was observed between 11:00 a.m. and 2:00 p.m. The timing of peak fishing effort during each day was similar for all weeks of the study (Appendix 7). The activity profile indicates that most angler effort occurred during the aerial counts (between 12:25 and 3:00 p.m.).

Table 21. The mean expected angling day length (hr) by angler residence category, access method, angling method, and day type with corresponding statistical test results.

	Expected angling day length (hr)			
	N	**Mean**	**SD**	**Statistical Test Result**
Residence				
BC	221	7.09	2.56	KS = 39.129, df = 2, *P* = 0.000
Skeena Region	96	6.14	2.44	
Other BC	125	7.82	2.41	
Canadian	27	4.04	4.09	
Non-Canadian	150	7.98	2.02	
Guided Status				
Guided	59	8.72	1.802	Mann-Whitney U = 5905.50, *P* = 0.000
Non-Guided	349	7.24	2.374	
Access Method				
Drift Boat	105	8.36	2.21	KS = 47.310, df = 3, *P* = 0.000
Jet Boat[1]	202	7.66	2.02	
Shore	99	6.18	2.50	
Helicopter	2	2.00	0.71	
Angling Method				
Fly	327	7.74	2.31	KS = 27.816, df = 2, *P* = 0.000
Gear	122	6.16	2.12	
Both	20	6.74	2.48	
Day Type				
Weekend	133	6.75	2.412	Mann-Whitney U = 22634, *P* = 0.000
Weekday	275	7.79	2.257	

[1] jet boats include all motorized boats

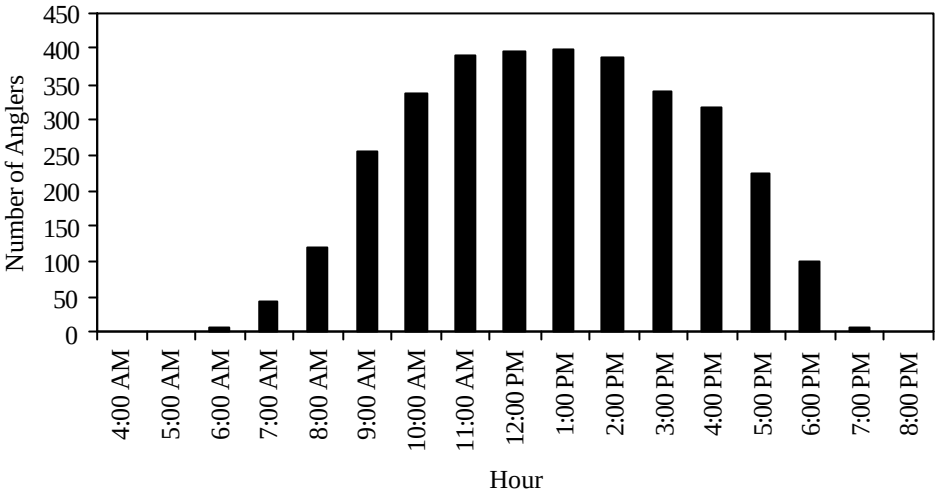

Figure 7. The number of anglers that fished during each one hour time block.

Individual anglers indicated that they intended to fish for an average of 8.8 days on the Morice River (SD = 11.23). Of the 310 individual anglers interviewed, 284 (91.6%) indicated how many days they had already fished, and how many more days they intended to fish on the Morice River. On average, Skeena Region resident planned to fish 17.6 days, other BC residents intended to fish 7.3 days, other Canadian intended to fish 4.1 days, and non-Canadians intended to fish 5.3 days (Table 22). The overall average trip length for BC residents was 11.6 days. The difference in fishing trip length between different residence types is statistically significant (KS = 29.928, $P = 0.000$). Average trip length for guided anglers (6.9 days) was significantly shorter than for non-guided anglers (9.1 days; Mann-Whiney U = 3336.5, $P = 0.041$).

Individual anglers that were interviewed planned to fish for 2507 rod days. Because not all anglers were interviewed during the study, this is an underestimate of the total number of rod days that all anglers planned to fish.

Table 22. The number (percent) of days angler planned to fish for steelhead within each residence and guide status category.

	Number (%) of Anglers in each category of days they planned to fish							
	1-5 days	**6-10 days**	**11-15 days**	**16-20 days**	**21-25 days**	**26-30 days**	**31+ days**	**Mean (SD) (n)**
Residence								
BC	79 (48.8)	30 (18.5)	17 (10.5)	10 (6.2)	4 (2.5)	4 (2.5)	18 (11.1)	11.6 (14.00) (157)
Skeena	31 (44.3)	5 (7.1)	8 (11.4)	4 (5.7)	2 (2.9)	4 (5.7)	16 (22.9)	17.6 (18.81) (62)
Other BC	48 (52.2)	25 (27.2)	9 (9.8)	6 (6.5)	2 (2.2)	0 (0)	2 (2.2)	7.3 (6.54) (92)
Canadian	15 (71.4)	5 (23.8)	1 (4.8)	0 (0)	0 (0)	0 (0)	0 (0)	4.1 (3.26) (21)
Non-Canadian	55 (54.5)	37 (36.6)	8 (7.9)	0 (0)	1 (0.9)	0 (0)	0 (0)	5.3 (3.63) (101)
Guided Status								
Guided	5 (14.7)	24 (70.6)	5 (14.7)	0 (0)	0 (0)	0 (0)	0 (0)	6.9 (2.85) (34)
Non-guided	144 (57.6)	48 (19.2)	21 (8.4)	10 (4.0)	5 (2.0)	4 (1.6)	18 (7.2)	9.1 (11.91) (250)

4.4 ANGLING LICENCES

Of licence categories available to anglers, annual and eight day licences were most commonly observed on the Morice River (Table 23). Ten anglers had a one-day licence (1 Canadian and 9 non-Canadian). One BC resident purchased an eight-day licence, and the remaining 99.4% of BC resident anglers purchased an annual licence. Ten Canadian non-resident anglers from outside BC (40.6%) purchased an eight day licence, and ten purchased an annual licence. Approximately half (49.0%) of Non-Canadians purchased an annual licence, 42.3% purchased an eight-day licence, and 8.7% purchased a one-day licence. Most guided anglers purchased an eight-day licence (62.2%), while most non-guided anglers (84.2%) purchased an annual licence. The distribution of licence class differed significantly between residence categories (Pearson chi-square $\chi^2 = 103.82$, df = 8, $P = 0.000$) and guide status (Pearson chi-square $\chi^2 = 54.075$, df = 2, $P = 0.000$).

Table 23. The number (percent) of individual anglers with one-day, eight-day and annual fishing licences.

	Number (%) of Anglers in Licence Class[1]		
	One-Day	**Eight-Day**	**Annual**
Residence			
BC	0 (0)	1 (0.6)	169 (99.4)
Canadian	1 (4.8)	10 (47.6)	10 (47.6)
Non-Canadian	9 (8.7)	44 (42.3)	51 (49.0)
Guided Status			
Guided	1 (2.7)	23 (62.2)	13 (35.1)
Non-Guided	9 (3.5)	32 (12.4)	218 (84.2)
Combined	**10 (3.4)**	**55 (18.6)**	**231 (78.0)**

[1] no licence class data for 14 interviews

4.4.1 Classified Waters Days Purchased

Classified Waters Days can be purchased in daily increments up to 8 days for non-BC resident anglers. All BC residents purchase an annual classified waters licence, and are therefore excluded from the analysis of classified waters days purchased. Because classified waters days are purchased in one to eight day increments, anglers interviewed may have purchased classified waters days on more than one occasion, and the classified waters days purchased only refer to the number of days purchased just prior to the interview.

Daily classified water licences purchased were analyzed by grouping Canadian and non-Canadian anglers together. In total, classified waters licence information was collected for 115 (89.1%) Canadian and non-Canadian angler interviews (Table 24). One-day classified water licences were most commonly purchased (40.0% each), followed by seven-day (27.8%), two-day (18.3%), four-day (3.8%), three-day (3.8%), five-day (1.7%) and six-day (1.7%) classified waters licences.

Table 24. The number (percent) of classified waters days purchased at the time of the interview in each licence class for Canadian non-resident and non-Canadian aliens (grouped together).

Licence Class	Number (Percent) of Classified Waters Days Purchased[1]							
	1 – Day	**2 – Day**	**3 – Day**	**4 – Day**	**5 – Day**	**6 – Day**	**7 – Day**	**8 – Day**
1 Day	10 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
8 Day	7 (14.0)	14 (28.0)	1 (2.0)		2 (4.0)		23 (46.0)	5 (6.0)
Annual	29 (52.7)	7 (12.7)	3 (5.5)	4 (7.3)		2 (3.6)	9 (16.4)	2 (1.8)

Most Canadian non-resident and non-Canadian alien anglers planned to fish between 1 and 5 days (70 anglers, 57.9%). Fourty-two (34.7%) of Canadian non-resident and non-Canadian alien anglers planned to fish 6-10 days, and 9 (7.4%) of Canadian non-resident and non-Canadian alien anglers planned to fish for more than 10 days. A significant number of non-Canadian alien and Canadian non-resident anglers planned to fish for more days than their classified waters licence specified (Figure 8), reflecting the fact that anglers could have or intended to purchase more days than specified on their Classified Waters Licence.

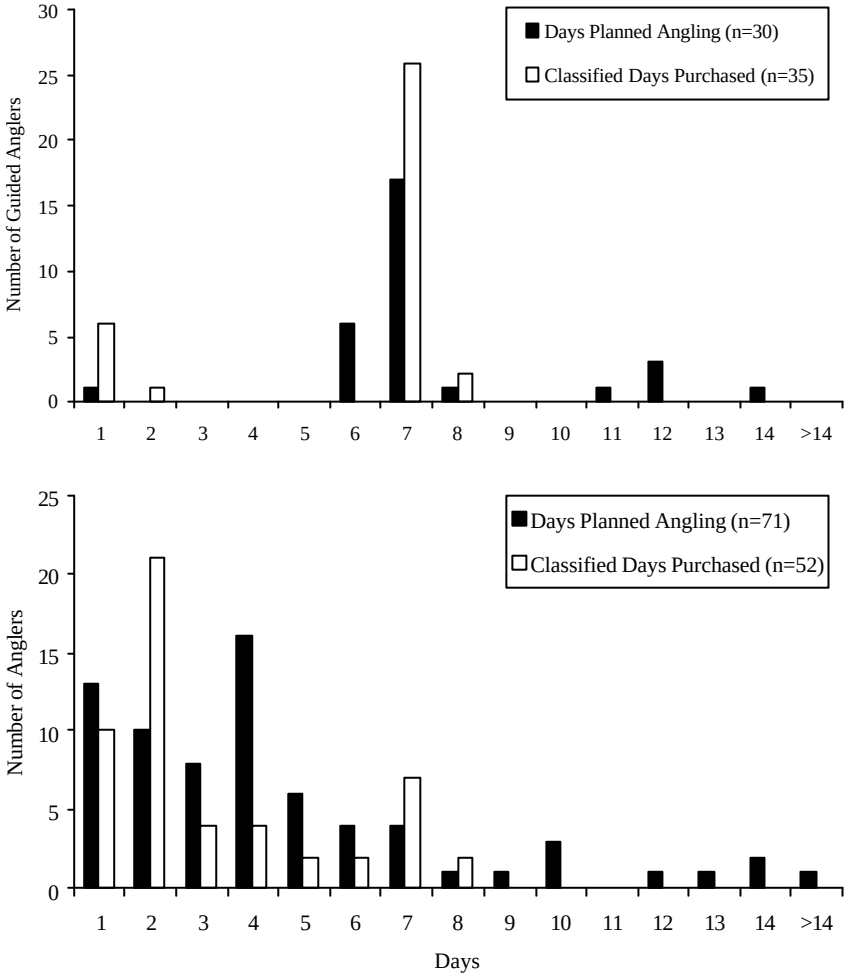

Figure 8. The number of classified purchased, and the number of days planned angling for guided and non-guided anglers (Canadian non-residents and non-Canadian aliens only) at the time of the interview.

4.4.2 Angler Compliance

Angling licences were inspected for compliance, and infractions were recorded by guardians. Anglers were not required to show their licence to the guardians since the interview process was voluntary. For analysis of compliance, the anglers that did not let guardians examine their licence were identified as potentially non-compliant.

Licence violations were noted during 15 of the 455 (3.3%) interviews. Of these 15 interviews, 12 (80.0%) anglers had one violation, and three anglers (20%) had two violations. In addition, potential licence violations were identified during 4 interviews where anglers refused to show their licence (0.9%). These potential violations are not included in the data summarized in Table 25. The most common infraction was the failure to carry/produce a licence (45.0%), followed by the lack of a classified water licence (40.0%). One angler did not have a steelhead conservation stamp, and a pair of anglers were observed illegally fishing out of a boat. One of the BC resident anglers that failed to produce a licence was previously interviewed, and had an appropriate angling licences at that time.

No licence violations were noted while interviewing guided anglers. The proportion of interviews with licence violations was highest for non-Canadian anglers (3.8%), followed by BC resident anglers outside of Skeena Region (2.9%), Skeena Region anglers (2.5%) and Canadians from outside of BC (0%).

Most licence violations were noted during interviews conducted in week 4. Seven of the 18 interviews (38.9%) were licence violations were noted, or where anglers refused to show their licence were conducted in week 4. However, only 17% (78 of 455) of the interviews were conducted in week 4. Three interviews (16.7%) with infractions were from week seven, where 50 interviews were conducted (11.0%). Two infractions (11.1%) were noted during interviews in weeks 1 and 9, one infraction (5.6%) was noted in interviews in weeks 3, 5, 6 and 8, and no infractions were noted in weeks 2 and 10 of the study.

Licence violations appeared to be more uniformly distributed among river sections. Five interviews (27.8%) where licence infractions were noted were conducted in Sections 2 and 5, four interviews (22.2%) were from Section 1, three interviews (16.7%) were from Section 3, and two (11.1%) were from Section 2. However, interviews were not equally distributed among different river sections, and Sections 2 and 5 where most of the infractions were found, had among the lowest proportion of interviews (18.9% and 15.6% respectively).

Table 25. The number (percent) of angler interviews with licence infractions by residence category.

	N (percentage) of angler interviews with infractions			
	Total	**B.C.**	**Canadian**	**Non-Canadian**
Failure to carry/produce a licence[a]	9 (2.0)	4 (2.9)	0 (0)	2 (1.3)
No classified waters licence	8 (1.8)	2 (1.4)	0 (0)	6 (3.8)
No steelhead conservation stamp	1 (0.2)	1 (0.7)	0 (0)	0 (0)
Illegal fishing[b]	2 (0.4)	2 (1.4)	0 (0)	0 (0)

[a] failure to carry/produce a licence included those that refused to show the guardians their licence; residence was unknown for some of these anglers; [b] fishing out of a boat

4.5 ANGLER CATCH AND EFFORT

4.5.1 Catch Rate

Effort and catch rates were calculated from roving interviews. For estimates of effort and catch, all guides that were actively guiding were deleted from the dataset. Interviews where anglers did not provide a start time, or where anglers fished other rivers and did not indicate the length of time fished on these rivers were excluded. In addition, interviews where anglers had fished for less than 0.5 hours were excluded from the analysis. The analysis was therefore based on 337 roving interviews.

Anglers were asked when they started fishing, and how many hours they had spent fishing on the Morice River. The data collected during roving surveys allowed for two estimates of effort. Effort at the time of the interview was estimated by the amount of hours angler indicated they had been fishing (excluding hiking, prep. time), and by the difference between the time at the interview and the start time. During roving interviews, guardians felt that angler's responses to how long they had actually been fishing was often vague and inaccurate. Nineteen (18.8%) of the 101 anglers that provided an estimate of their actual fishing time indicated that they had fished longer than possible, given the start time and interview time. For these 101 anglers, the mean effort at the time of interview from angler estimates of fishing time was 2.85 hours (SD = 2.304), while the difference between interview and start time averaged as 3.62 hours (SD = 2.704). The difference between mean angling time at the time of interview determined by these two methods was not statistically significant (Mann-Whitney U = 4287.5, $P = 0.05$). The difference between the time at the interview and the start time was used to estimate effort.

Anglers interviewed during roving surveys fished a total of 1086 hours (343 interviews), with an average effort of 3.16 hours (SD = 2.079) per angler at the time of the interview (Table 26). The highest catch rate was noted in week 10 (4.44 steelhead per rod day), followed by week 9 (1.72 steelhead per rod day), week 6 (1.56 steelhead per rod day), week 3 (1.29 steelhead per rod day), week 5 (1.17 steelhead per rod day), week 8 (1.07 steelhead per rod day), week 4 (1.02 steelhead per rod day), week 7 (0.62 steelhead per rod day), week 1 (0.54 steelhead per rod day) and week 2 (0.34 steelhead per rod day). Hourly steelhead catch rates differed significantly between weeks (KS = 27.422, $P = 0.001$). Increased water levels and decreased water clarity (decreased secchi disk depth) at the end of week 6, and during week 7 likely accounts for the relatively low steelhead catch rates for that time period (Appendix 3).

Table 26. The number of steelhead landed, hours fished, catch rate and steelhead per rod day by week.

Week	Steelhead Landed	Total Hours Fished	Catch Rate (st/hr) (SD)	Mean Expected Angling Day (hr)	Steelhead per Rod Day
1	2	28.90	0.08 (0.195)	6.73	0.54
2	1	61.95	0.05 (0.261)	7.19	0.36
3	20	117.00	0.17 (0.310)	7.61	1.29
4	19	199.23	0.13 (0.293)	7.82	1.02
5	30	194.03	0.14 (0.193)	8.35	1.17
6	33	228.63	0.21 (0.500)	7.44	1.56
7	7	98.65	0.08 (0.195)	7.79	0.62
8	10	59.73	0.17 (0.289)	6.27	1.07
9	15	61.25	0.27 (0.769)	6.35	1.72
10	26	36.13	0.76 (0.922)	5.84	4.44
Total	**163**	**1085.52**	**0.17 (0.415)**	**7.46**	**1.27**

1. The average of the individual catch rates for each angler for each week were ignored for all short trips (less than 0.5 hours)
2. The time (hr) the angler spent fishing, determined by deducting the time the angler started fishing from the time at the interview
3. Steelhead per rod day was calculated using the mean expected angling day for that time period.

Catch rates were estimated for each of the five river sections in the Morice River by grouping all weeks in the study period (Table 27). Catch rates was highest in Section 3 (2.21 steelhead/rod day), followed by Section 5 (1.56 steelhead per rod day), Section 1 (1.09 steelhead per rod day), Section 2 (0.81 steelhead per rod day) and Section 4 (0.75 steelhead per rod day). The difference in hourly steelhead catch rates between river sections was statistically significant (KS = 13.384, $P = 0.010$).

Steelhead catch rates for residence categories, guide status, access method, gear type, and day type are summarized in Table 28. Hourly steelhead catch rate did not differ significantly between residence categories (KS = 4.126, $P = 0.248$), guide status (Mann-Whitney U = 6898, $P = 0.409$), gear type (KS = 5.761, $P = 0.056$), or day type (Mann-Whitney U = 12878, $P = 0.173$). However, hourly steelhead catch did differ significantly between access method, excluding helicopter (KS = 9.85, $P = 0.007$). Because of low sample size, helicopter access was excluded from the analysis of hourly steelhead catch rates with access type.

Table 27. The number of steelhead landed, hours fished, catch rate and steelhead per rod day for each of the five Morice River Sections.

River Section	Steelhead Landed	Total Hours Fished	Catch Rate (ST/hr) (SD)	Mean Expected Angling Day (hr)	Steelhead per Rod Day
Section 1	37	232.87	0.16 (0.378)	6.79	1.09
Section 2	21	173.42	0.11 (0.288)	7.40	0.81
Section 3	35	208.85	0.28 (0.677)	7.89	2.21
Section 4	20	253.32	0.09 (0.253)	8.36	0.75
Section 5	50	217.07	0.22 (0.378)	7.09	1.56

1. The average of the individual catch rates for each angler for each week were ignored for all short trips (less than 0.5 hours)
2. The time (hr) the angler spent fishing, determined by deducting the time the angler started fishing from the time at the interview
3. Steelhead per rod day was calculated using the mean expected angling day for that time period.
4. River sections are described in Table 2.

Table 28. The number of steelhead landed, hours fished, catch rate and steelhead per rod day within each residence, guided status and access method and angling method category.

	Steelhead Landed	Total Hours Fished	Catch Rate (st/hr) (SD)	Mean Expected Angling Day (hr)	Steelhead per Rod Day
Residence					
B.C.	104	623.4	0.18 (0.46)	7.09	1.28
Skeena Region	62	256.1	0.25 (0.60)	6.14	1.54
Other BC	42	367.4	0.12 (0.29)	7.82	0.94
Canadian	5	80.9	0.13 (0.29)	4.04	0.53
Non-Canadian	52	359.6	0.17 (0.38)	7.98	1.36
Guided Status					
Guided	19	133.3	0.19 (0.34)	8.72	1.66
Non-Guided	140	930.7	0.17 (0.43)	7.24	1.23
Access Method					
Drift Boat	48	340.0	0.14 (0.26)	8.36	1.17
Jet Boat[4]	101	547.7	0.21 (0.44)	7.66	1.61
Foot	14	194.3	0.11 (0.51)	6.18	0.68
Helicopter	0	3.58	0 (n.a.)	2.00	0
Angling Method					
Fly	104	880.1	0.15 (0.34)	7.74	1.61
Gear	44	159.3	0.28 (0.65)	6.16	1.73
Both	15	46.2	0.23 (0.62)	6.74	1.55
Day Type					
Weekend	75	416.9	0.17 (0.33)	6.75	1.15
Weekday	88	668.6	0.17 (0.46)	7.79	1.32

1. The average of the individual catch rates for each angler for each week were ignored for all short trips (less than 0.5 hours)
2. The time (hr) the angler spent fishing, determined by deducting the time the angler started fishing from the time at the interview
3. Steelhead per rod day was calculated using the mean expected angling day for that time period.
4. Jet boats include all motorized boats

Anglers reported catching 31 bull trout (*Salvelinus confluentus*), 56 Dolly Varden (*S. malma*) or bull trout, seven chinook (*Oncorhynchus tsawytscha*), 15 coho (*O. kisutch*), one cutthroat trout (O. clarki), 23 mountain whitefish (*Prosopium williamsoni*) and ten rainbow trout (*S. mykiss*) during 343 roving interviews. Hourly catch rate for each species is summarized for each week in the study period (Table 29). Hourly catch rate over the study period was lowest for cutthroat trout (0.0005 CT per hour), and chinook (0.003 CH per hour). The highest catch rate for these species was for bull trout (0.33 bull trout per hour), and for Dolly Varden/bull trout (0.15 DV/BT per hour) in week 10. Only one angler reported harvesting one coho on September 19, 2004 (week 3, reach 2). The angler was from the Skeena Region, and was not guided. No other fish were reported harvested during the Morice River Guardian project.

Hourly catch rates for bull tout, Dolly Varden/bull trout, chinook, coho, cutthroat trout, mountain whitefish and rainbow trout were also summarized by river section (Table 30). Chinook were only captured in Section 5, and bull trout were captured only in Sections 3, 4 and 5. However, Dolly Varden/bull trout were captured in all five river sections. Cutthroat trout were only captured in Section 3, and rainbow trout were only captured in Section 1, 2, and 5. Coho were captured in all sections except Section 1, and mountain whitefish were captured throughout the Morice River. The highest catch rate by river sections was for bull trout in Section 3 (0.8 bull trout per hour).

Table 29. The hourly catch rate for bull trout (BT), Dolly Varden/bull trout (DV/BT), chinook (CH), Coho (CO), cutthroat (CT), Mountain whitefish (MW), and rainbow trout (RB) by week.

Week	BT catch rate (SD)	CH catch rate (SD)	CO catch rate (SD)	CT catch rate (SD)	DV/BT catch rate (SD)	MW catch rate (SD)	RB catch rate (SD)
1	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.11 (0.30)	0.086 (0.30)	0.00 (0.00)
2	0.00 (0.00)	0.00 (0.00)	0.04 (0.21)	0.00 (0.00)	0.05 (0.26)	0.08 (0.39)	0.00 (0.00)
3	0.00 (0.00)	0.00 (0.00)	0.004 (0.25)	0.00 (0.00)	0.00 (0.00)	0.03 (0.14)	0.00 (0.00)
4	0.005 (0.03)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.05 (0.25)	0.004 (0.03)	0.01 (0.07)
5	0.01 (0.03)	0.03 (0.09)	0.01 (0.05)	0.00 (0.00)	0.08 (0.18)	0.04 (0.10)	0.02 (0.11)
6	0.02 (0.12)	0.00 (0.00)	0.04 (0.21)	0.003 (0.02)	0.01 (0.04)	0.003 (0.03)	0.00 (0.00)
7	0.01 (0.04)	0.00 (0.00)	0.06 (0.13)	0.00 (0.00)	0.08 (0.29)	0.00 (0.00)	0.00 (0.00)
8	0.00 (0.00)	0.00 (0.00)	0.01 (0.04)	0.00 (0.00)	0.05 (0.18)	0.05 (0.23)	0.07 (0.24)
9	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.07 (0.34)	0.04 (0.19)	0.00 (0.00)
10	0.33 (0.52)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.15 (0.18)	0.05 (0.14)	0.04 (0.11)
Total	**0.02 (0.11)**	**0.003 (0.03)**	**0.02 (0.12)**	**0.0005 (0.001)**	**0.05 (0.21)**	**0.03 (0.16)**	**0.01 (0.08)**

1. The average of the individual catch rates for each angler for each week were ignored for all short trips (less than 0.5 hours)
2. The time (hr) the angler spent fishing, determined by deducting the time the angler started fishing from the time at the interview
3. Steelhead per rod day was calculated using the mean expected angling day for that time period.

Table 30. The hourly catch rate for bull trout (BT), Dolly Varden/bull trout (DV/BT), chinook (CH), Coho (CO), cutthroat (CT), Mountain whitefish (MW), and rainbow trout (RB) by river section.

River Section	BT catch rate (SD)	CH catch rate (SD)	CO catch rate (SD)	CT catch rate (SD)	DV/BT catch rate (SD)	MW catch rate (SD)	RB catch rate (SD)
Section 1	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.04 (0.16)	0.01 (0.05)	0.004 (0.04)
Section 2	0.00 (0.00)	0.00 (0.00)	0.02 (0.13)	0.00 (0.00)	0.07 (0.33)	0.02 (0.11)	0.01 (0.07)
Section 3	0.08 (0.25)	0.00 (0.00)	0.01 (0.03)	0.003 (0.02)	0.04 (0.11)	0.05 (0.29)	0.00 (0.00)
Section 4	0.004 (0.03)	0.00 (0.00)	0.02 (0.09)	0.00 (0.00)	0.05 (0.23)	0.01 (0.12)	0.00 (0.00)
Section 5	0.01 (0.04)	0.02 (0.08)	0.05 (0.22)	0.00 (0.00)	0.06 (0.17)	0.04 (0.16)	0.04 (0.17)

1. The average of the individual catch rates for each angler for each week were ignored for all short trips (less than 0.5 hours)
2. The time (hr) the angler spent fishing, determined by deducting the time the angler started fishing from the time at the interview
3. Steelhead per rod day was calculated using the mean expected angling day for that time period.
4. River sections are described in Table 2.

4.5.2 Aerial Flights

A total of 453 anglers were observed in 19 aerial counts conducted over the Morice River. Twenty aerial counts were originally scheduled for the study period, but the flight on October 1, 2004 (week 5, time period 10-1) was cancelled as the boat was not operational at that time, and guardians were unable to conduct roving surveys. The highest counts of anglers occurred during flights conducted on October 2nd (week 5, time period 10-1) and October 7th, 2004 (week 6, time period 10-1), and 45 anglers were observed on each of those two flights. The lowest number of anglers observed on the aerial counts was one angler on the flight conducted on November 7th, 2004 (week 10, time period 10-2). On average, 24 anglers were counted on the aerial flights conducted. Angler counts were lower outside of the Classified Waters Period (12 on Nov. 1, 1 on Nov. 7) then during the Classified Waters Period.

Gear type was determined for 326 of the 453 anglers observed (72.0%). Most of the anglers used fly rods (295, 90.5%), and 9.5% (31) used gear rods (Figure 9). The proportion of fly rod anglers was higher in the earlier part of the study period (time period 9-1) than in the later part of the study period. In time period 9-1, gear anglers comprised 31% of anglers while in time period 9-2, time period 10-1 and time period 10-2 gear anglers comprised 6.7%, 7.4% and 4.1% of anglers, respectively.

Most anglers were observed in Section 1 (34.0%, 154 anglers). Twenty-one percent of anglers (95) were observed in Section 4, 19% (86) in Section 3, 15.2% (69) in Section 2, and 10.8% (49) in Section 5. No gear anglers were observed during aerial flights in Sections 4 and 5 (Figure 10). Gear anglers were most commonly observed in Section 1, where they comprised 19.6% of anglers, and in Section 2, where they comprised 17.3% of anglers. Two gear anglers were noted in Section 3 during the early Classified Waters Period.

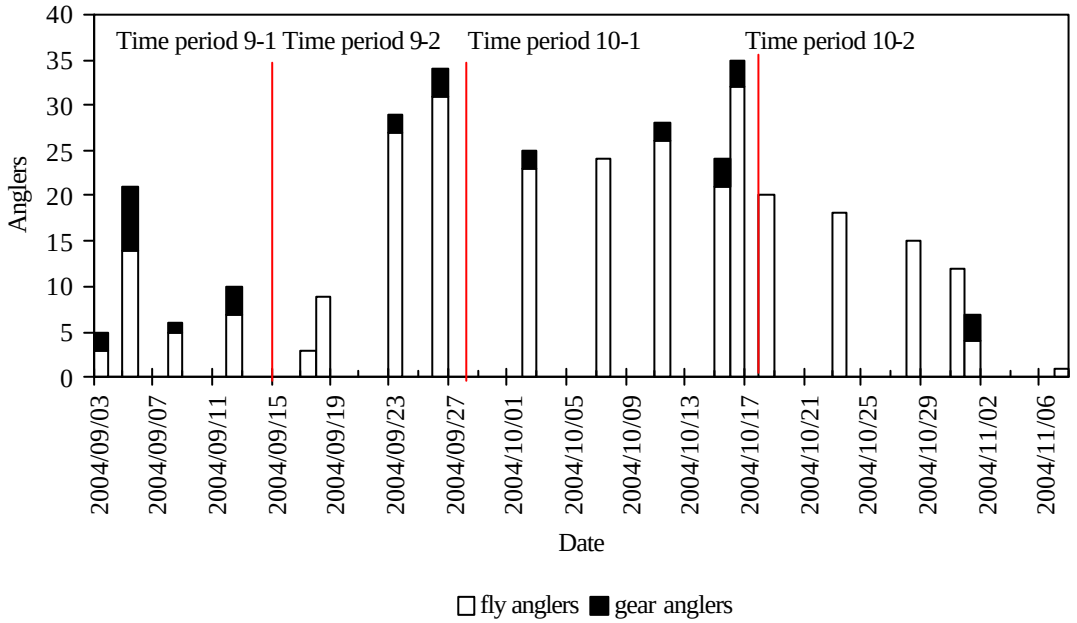

Figure 9. The number of fly and gear anglers observed during each of the 19 aerial counts.

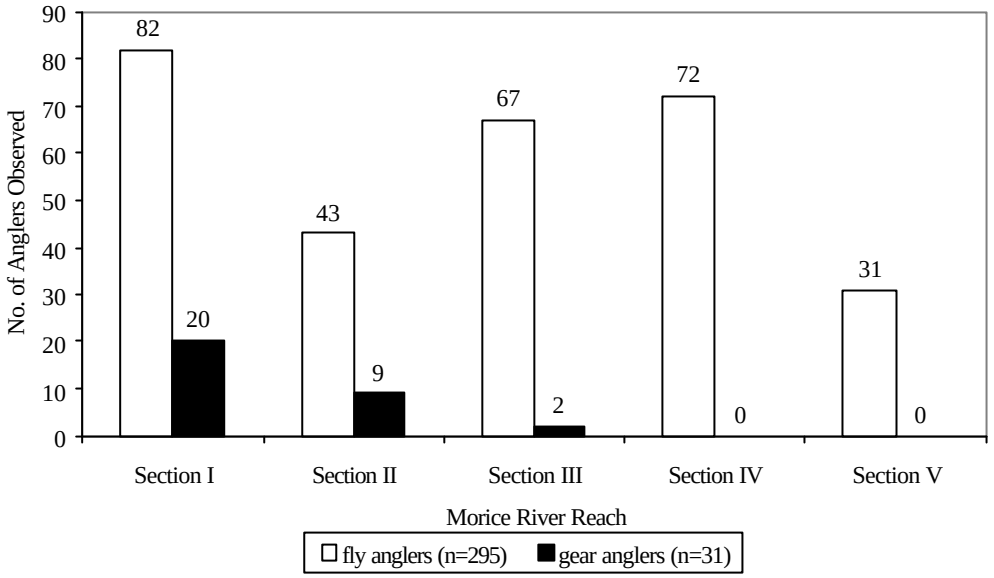

Figure 10. The number of fly and gear anglers observed in each river section during the 19 aerial counts conducted.

A total of 90 guided anglers and guides were observed during the aerial counts conducted during the study period. The highest number of guided anglers and guides noted during the aerial counts was 11 on October 7th, 2004 (time period 10-1). No guided anglers or guides were observed on four of the 19 aerial counts (the first flight on September 3, and the last three flights on Oct. 31, Nov. 1 and Nov. 7).

The highest number of guided anglers and guides was observed in Section 4 (46.7% of guided anglers). No guided anglers or guides were observed in Section 5, and only 3 (3.3%) guided anglers and guides were observed in Section 2. Twenty percent of the guided anglers and guides were counted in Section 1, and 30% were counted in Section 3.

A total of 195 boats (84 drift boats and 111 jet boats) were observed during the 19 aerial counts. Overall, there was an average of 4.4 drift boats and 5.8 jet boats counted per day. Some anglers accessed the river from shore. The highest number of jet boats (17, 15.3%) was observed on October 2nd, 2004 (time period 10-1), and the highest number of drift boats (19, 22.6%) was observed on October 7th, 2004 (time period 10-1).

Most jet boats (46, 41.4%) were observed in Section 1, and the lowest number was observed in Section 2 (11, 9.9%). Nineteen (17.1%), 18 (16.2%) and 17 (15.3%) of the jet boats were observed in river Sections 3, 4 and 5 respectively. Drift boats were most commonly observed in Section 1 as well (25, 29.8%). Drift boats were also relatively common in Section 2 (23, 27.4%), Section 4 (17, 20.2%) and Section 3 (15, 17.9%). Only four drift boats (4.8%) were observed in Section 5. Jet boats and drift boats combined were similar to anglers in distribution along the Morice River.

4.5.3 Effort and Catch Estimates

4.5.3.1 *Catch and Effort Estimates for All Anglers*

Effort and catch were estimated by combining data collected during aerial counts, and in roving interviews. Due to low numbers of interviews in some river sections, and in some weeks, data were pooled by river section for time period analysis, and by time period for river section analysis. This resulted in increased variability, since effort and catch per unit effort appear to be influenced by time and river section.

The total effort for the entire study period was estimated as 1750 rod days (Table 31). Effort was also estimated for the early Classified Waters Period (September 1 – September) and the late Classified Waters Period (October 1 – October 31). The effort for the early Classified Waters Period was estimated as 622 rod days, and the effort for the late classified water period was estimated as 945 rod days. Steelhead catch for the entire study period was estimated as 2233 steelhead, including 485 (21.7%) for the early Classified Waters Period, and 1253 (56.1%) for the late Classified Waters Period. The total effort and catch estimates were the sum of all time periods, and included some days outside of the Classified Waters Period.

Effort and steelhead catch was estimated for each of the four time periods (Table 32). Time periods 9-1 and 9-2 spanned two weeks each, while time periods 10-1 and 10-2 spanned three weeks each. The largest effort estimated occurred in time periods 10-1 (779 rod days), combined with the greatest estimated steelhead catch (1510). The lowest effort (214 rod days) and lowest catch (161 steelhead) was observed in time period 9-1.

Effort and catch were estimated for each river section (Table 33). Due to the low sample size and consequent large variance around mean daily effort, and steelhead catch, confidence intervals are large around the estimates, particularly for steelhead catch. Most effort was estimated for river Section 1 (626 rod days), followed by Section 4 (362 rod days), Section 3 (343 rod days), Section 2 (231 rod days) and Section 5 (214 rod days). Section 5 was closed to fishing in September, resulting in an overall low fishing effort for the entire study period. Steelhead catch was estimated to be highest in Section 1 (699 steelhead), followed by Section 3 (629 steelhead), Section 5 (301 steelhead), Section 2 (199 steelhead) and Section 4 (149 steelhead).

Table 31. Angler catch and effort estimates with 95% confidence intervals for the whole study period, the early Classified Waters Period and the late classified water period.

	Effort Estimate		Catch Estimate	
	Rod day	95% CI	Steelhead	95% CI
Study Period	1750	± 488	2233	± 1298
Early Classified Waters Period	622	± 373	485	± 350
Late Classified Waters Period	945	± 228	1253	± 1134

Table 32. Angler catch and effort estimates with 95% confidence intervals for each time period.

	Effort Estimate		Catch Estimate	
Time Period	Rod day	95% CI	Steelhead	95% CI
9-1	214	± 53	161	± 71
9-2	378	± 374	314	± 318
10-1	779	± 284	1510	± 1218
10-2	379	± 121	247	± 308

Table 33. Angler catch and effort estimates with 95% confidence intervals for river section.

River Section	Effort Estimate		Catch Estimate	
	Rod day	95% CI	Steelhead	95% CI
1	626	± 288	699	± 2640
2	231	± 125	199	± 585
3	343	± 181	629	± 1359
4	362	± 167	149	± 647
5	214	± 53	301	± 568

4.5.3.2 *Catch and Effort Estimate for Angler Residence, Guide Status and Angling Method*

Catch and effort estimates were derived for BC residents, Canadian non-residents, and Non-Canadians, as well as guided and non-guided anglers, and anglers using different gear types (Table 34). Canadians were estimated to fish 1098 rod days during the study period, and caught and estimated 1282 steelhead. Non-Canadian alien anglers are estimated to have fished 573 rod days, catching 835 steelhead. Canadian non-resident anglers from outside of BC spent the fewest rod days on the Morice River, with an estimated 79 rod days for the study period. Canadian non-resident anglers are estimated to have caught 116 steelhead. Non-guided anglers exerted more fishing effort (estimated 1351 rod days) and caught more steelhead (estimated 1759 steelhead) than guided anglers (estimated 399 rod days, 474 steelhead). Guides were not included in the aerial counts. Most anglers used fly rods for angling, and this angling method is estimated to account for 1132 rod days, resulting in the capture of 1331 steelhead. Gear rods are estimated to account for 112 rod days, and a catch of 145 steelhead. Gear could not always be identified during aerial counts. An estimated 505 rod days were spent fishing with unknown gear type, resulting in the capture of an estimated 729 steelhead. Due to the predominance of fly gear during angler interviews, it is fair to assume that most of the unidentified effort and catch is attributable to fly gear.

Table 34. Angler catch and effort estimates with 95% confidence intervals for angler residence, guide status, access and angling method.

	Effort Estimate		Catch Estimate	
	Rod day	95% CI	Steelhead	95% CI
Angler Residence				
B.C.	1098	± 287	1282	± 689
Canadian	79	± 55	116	± 141
Non-Canadian	573	± 221	835	± 625
Guided Status				
Guided	399	± 163	474	± 364
Non-Guided	1351	± 378	1759	± 949
Angling Method				
Fly	1132	± 287	1331	± 551
Gear	112	± 56	145	± 102
Unidentifiable	505	± 312	729	± 791

[1] Access method estimates exclude shore access anglers and helicopters due to low sample size

4.5.3.3 *Effort Estimates for Boats*

Aerial counts of jet and drift boats were used to estimate the number of boat days for both access methods. Based on aerial observations, 277 jet boat days (95% CI = ± 101 days), and 1080 drift boat days (95% CI = ± 180 days) were estimated for the entire study period. Other access methods used by anglers included shore based angling and helicopter.

4.6 QUALITY ANGLING EXPERIENCE

4.6.1 Key Characteristics of Quality Angling Experience

Anglers were asked what they felt the key characteristics of a high quality angling experience were. Of the 455 angler interviews, 307 (67.5%) angler interviews included comments on these key characteristics. A total of 527 comments on key angling characteristics were recorded on the 307 angler interviews. The 527 responses were sorted into 17 categories (Figure 11, Appendix 4). The most common key characteristic mentioned was a high abundance of fish (22.6%), followed by solitude/peaceful setting (14.6%), river attributes (11.2%), and weather/water quality (10.6%). Low angling pressure (6.5%), wilderness experience and wildlife (6.5%), wild/native fish (6.6%), and scenery (7.4%) were also frequently mentioned as key characteristics to a quality fishing experience. Six responses (1.1%) mentioned that banning of motorized boats would add to their quality fishing experience, while two responses (0.4%) mentioned that permitting motorized boats enhances their quality fishing experience. Seven responses (1.3%) felt that the Morice River exemplified a quality angling experience.

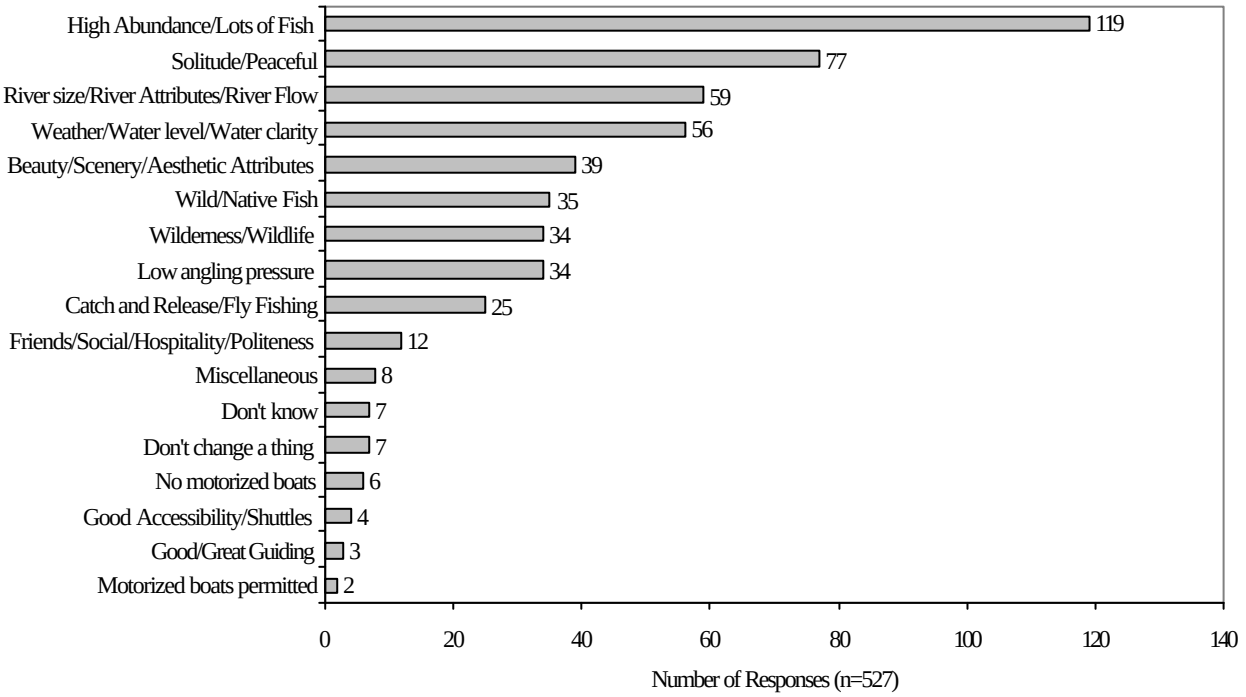

Figure 11. The key characteristics that anglers described as contributing to a high quality angling experience. See appendix 4 for detailed comments within each category.

Key angling characteristics were summarized by residence category (Figure 12). Most of the responses were obtained from interviews of Non-Canadian alien anglers (38.5%), followed by BC resident anglers (33.3%), Skeena region anglers (19.5%), and other Canadian non-resident anglers (8.7%). Non-Canadian alien anglers most frequently mentioned high abundance of fish (22.0%), followed by solitude/peaceful setting (15.5%), wilderness and wildlife (10%), beauty/scenery/aesthetic attributes (10%), wild/native fish (9.5%), and river size/attributes and flow (9.5%). Similarly, BC resident anglers most frequently mentioned abundance of fish (21.4%), solitude/peaceful setting (15.0%), and river size/attributes and flow (13.9%). Fewer BC resident angler responses mentioned wilderness/wildlife (4.6%), wild/native fish (5.2%) or beauty/scenery/ aesthetic attributes (5.2%), but more BC resident anglers mentioned weather and water quality (12.1%). Skeena Region anglers also most frequently mentioned fish abundance (25.7%), and solitude/peaceful setting (13.9%). In addition, Skeena anglers' responses frequently included low angling pressure and weather/water quality (12.9% each). Only four (4.0%) Skeena Region anglers' responses included wilderness/wildlife or wild/native fish and only five (5%) included beauty/scenery/aesthetic attributes as key characteristics for a quality angling experience. Canadian angler responses most frequently included fish abundance (26.7%), beauty/scenery/aesthetic attributes (15.6%), river size/attributes and flow (11.1%), and solitude/peaceful setting (11.1%). Anglers in all residence categories most frequently identified high abundance of fish as a key characteristic contributing to the quality of their angling experience.

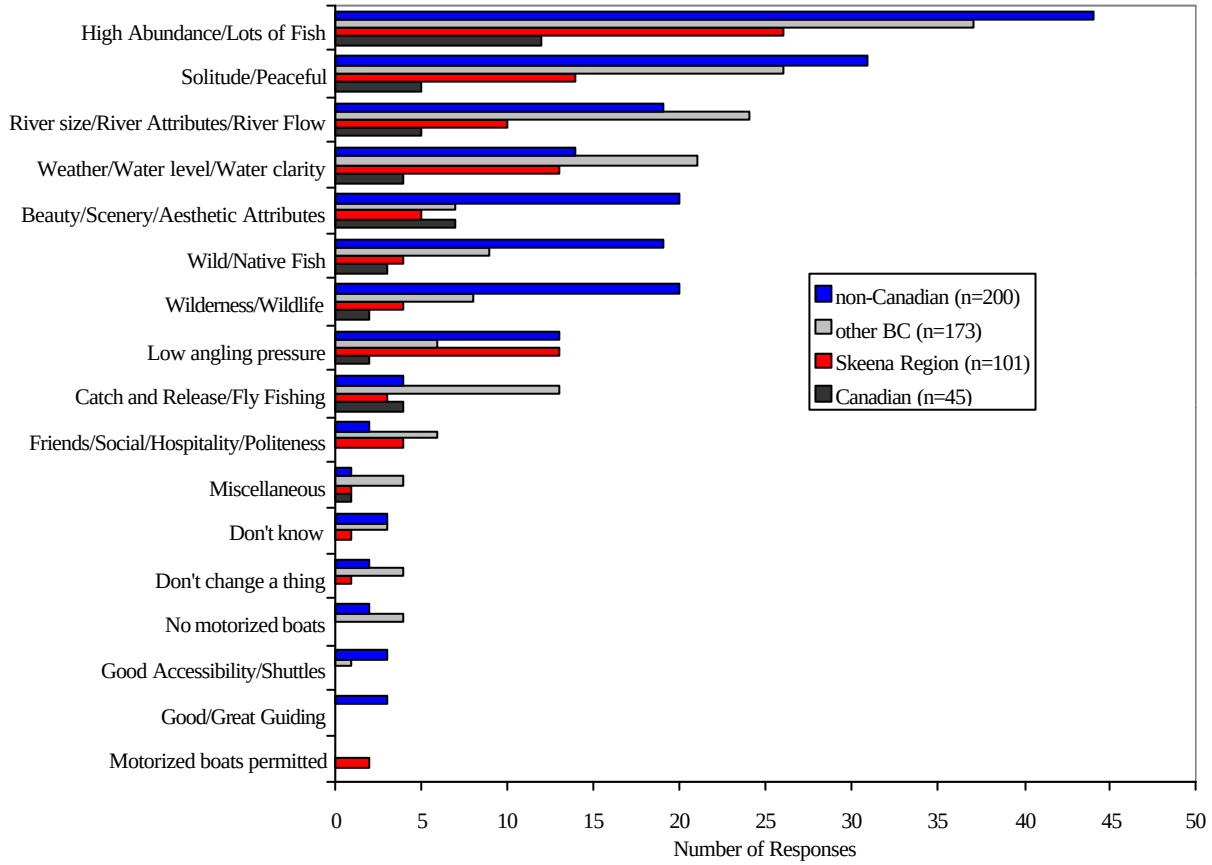

Figure 12. The key characteristics that anglers of different residence categories described as contributing to a high quality angling experience.

Key characteristics contributing to the quality of angling experience mentioned by guided and non-guided anglers are summarized in Figure 13. Both, guided and non-guided anglers most frequently identified fish abundance as a key characteristic (25.3% of guided angler responses, and 22.1% of non-guided angler responses). Guided anglers also frequently indicated the solitude/peaceful setting (16.9%) was an important contributing characteristic, followed by weather and water quality (10.8%), and wilderness/wildlife (8.4%). Fourteen percent of non-guided angler responses indicated that they considered solitude/peaceful setting to be a contributing characteristic; 12.4% mentioned river size/ river attributes and flow, and 10.6% mentioned weather and water quality.

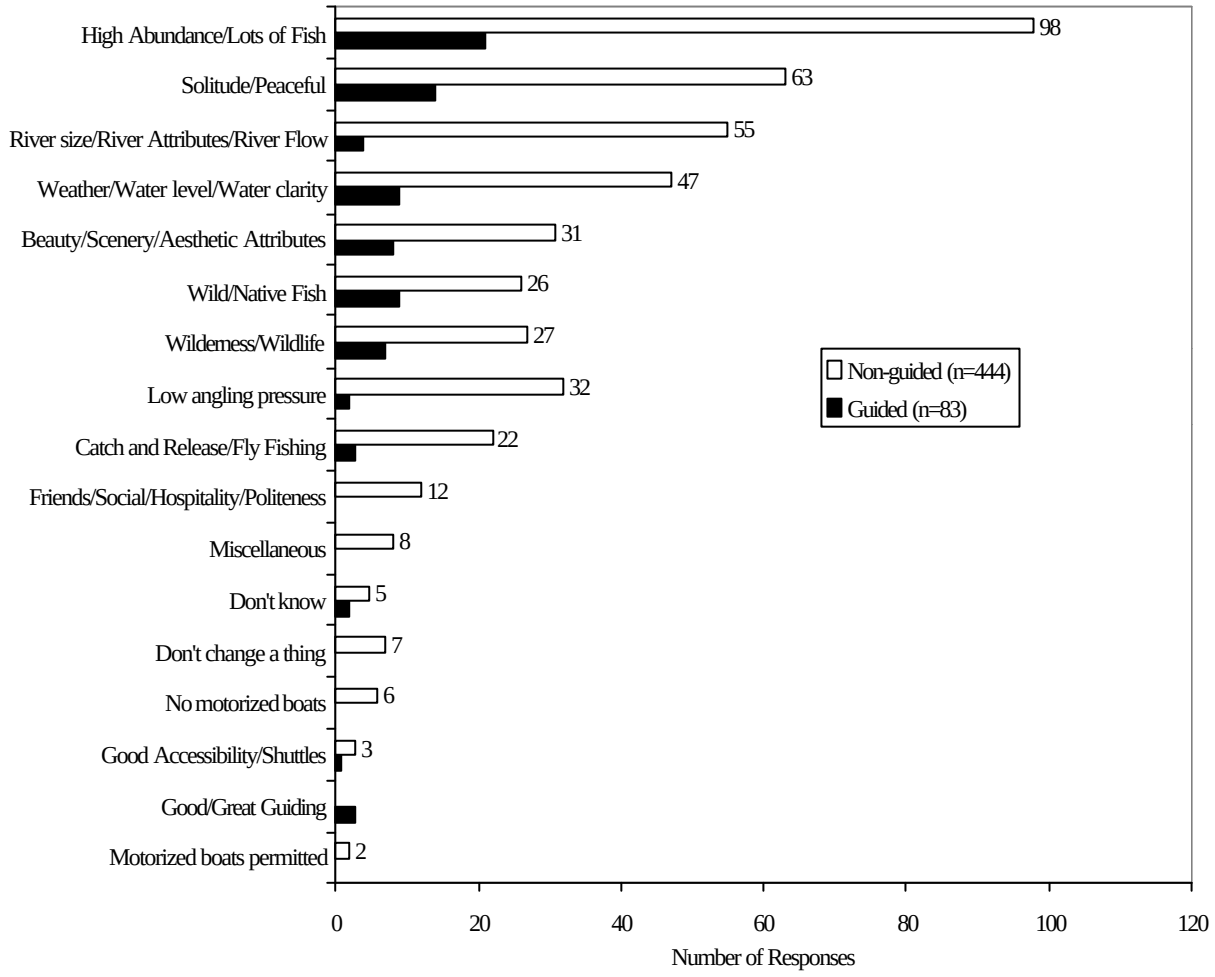

Figure 13. The key characteristics that guided and non-guided anglers described as contributing to a high quality angling experience.

4.6.2 Ratings of Quality Angling Experience

Anglers were asked to rate their quality angling experience on a scale of 1 (very poor) to 5 (excellent). The mean rating obtained from 379 angler interviews was 3.98 (Table 35). The majority of anglers rated their experience as excellent (43.8%), followed by good (26.1%), fair (19.0%), poor (6.3%) and very poor (4.7%). Ratings of quality angling experience did not differ significantly between anglers in different residence categories, between guided and non-guided anglers, between anglers using different access methods, and between anglers using different gear types.

The quality rating of the angling experience changed significantly between the 10 weeks of the study (KS = 31.528, $P = 0.000$). The mean rating was highest in week 8 of the study (4.48), and lowest in weeks 1 and 2 (3.06, Table 36). Changes in the proportion of ratings reported in angler interviews for each week are illustrated in Figure 14.

Table 35. Mean ratings of the angler quality angling experience by residence category, guided status, access method and angling method

	Mean (n) Rating [1]	Standard Deviation	Statistical Test Result
All Anglers	3.98 (n = 379)	1.145	NA
Angler Residence			KS = 6.617, $P = 0.158$
BC	3.98 (n=218)	1.164	
Skeena	3.89 (n=101)	1.191	
Other BC	4.06 (n=117)	1.139	
Canadian	4.48 (n=25)	0.586	
Non-Canadian	5.00 (n=49)	0.000	
Guided Status			Mann-Whitney U = 9042.0 $P = 0.324$
Guided	3.76 (n = 51)	1.152	
Non-Guided	4.01 (n = 328)	0.954	
Access Method			KS = 8.332, $P = 0.080$
Jet boat [2]	3.90 (n=191)	1.271	
Drift Boat	4.27 (n=90)	0.884	
Foot	3.85 (n=96)	1.066	
Helicopter	4.50 (n=2)	0.707	
Angling Method			KS = 2.514, $P = 0.473$
Fly	3.97 (n=298)	1.162	
Gear	3.95 (n=61)	1.071	
Both	4.2 (n=20)	1.152	

1. The mean rating is derived from the scale of 1 = very poor, 2 = poor, 3 = fair, 4 = good, 5 = excellent
2. Jet boats included all motorized boats

Table 36. Mean ratings of the angler quality angling experience in the 10 weeks of the study.

Week	Mean (n) Rating	Standard Deviation
1	3.06 (16)	1.482
2	3.06 (31)	1.590
3	4.36 (39)	1.038
4	3.83 (48)	1.078
5	4.12 (66)	1.045
6	3.99 (69)	1.131
7	4.08 (40)	0.944
8	4.48 (27)	0.802
9	4.20 (30)	0.714
10	4.08 (13)	0.954

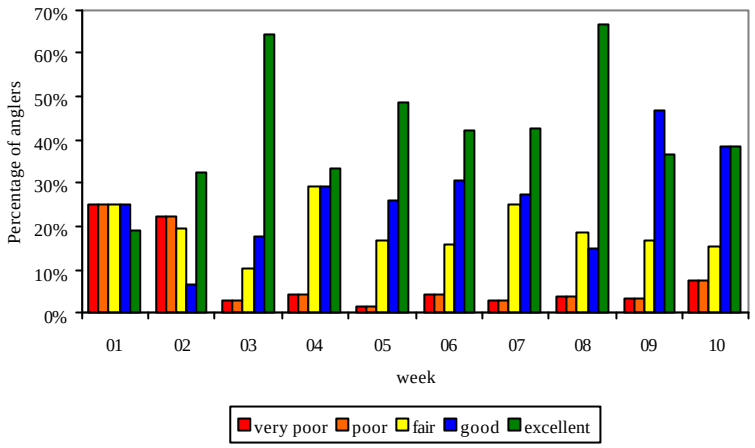

Figure 14. The proportion of anglers that rated their quality angling experience as very poor, poor, fair, good and excellent in each week of the study.

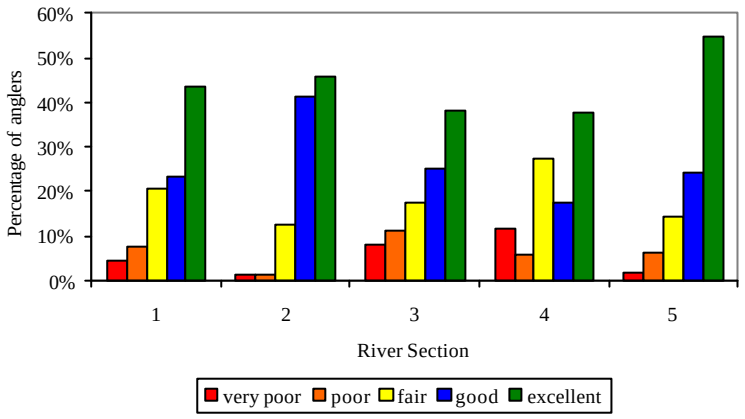

Figure 15. The proportion of anglers that rated their quality angling experience as very poor, poor, fair, good and excellent in each river section.

The mean rating of angling experience also differed significantly between river sections (KS = 13.509, *P* = 0.009). Mean ratings of angling experience in each river section are summarized in Table 37. Angling experience was rated highest in Section 2 (4.33), and in Section 5 (4.27), but was rated lowest in Section 4 (3.64). Proportions of ratings (very poor, poor, fair, good and excellent) for each river section are illustrated in Figure 15.

Table 37. Mean ratings of the angler quality angling experience in each of the five river sections.

River Section	Mean (n) Rating	Standard Deviation
1	3.94 (n=115)	1.164
2	4.33 (n=70)	0.696
3	3.75 (n=63)	1.295
4	3.64 (n=69)	1.350
5	4.27 (n=62)	0.944

4.7 SURVEY BIAS

The Morice River guardian project results are susceptible to survey bias. Results should therefore be interpreted with caution, and conclusions drawn from the study should be cognitive of these limitations. With creel survey projects, three types of general sample bias have been identified: sampling, response, and non-response bias (Pollock *et al*. 1994). Each of these bias types applies to this study, and these biases affect the validity of the data collected, results presented, and conclusions formed from the study.

4.7.1 Sampling Bias

Sampling bias occurred from several sources, including improper sample selection, incomplete sampling frames, duplication and avidity bias or length-of-stay bias (Pollock *et al*. 1994).

Improper sample selection affected this study because sample days were randomly chosen among week and day type strata. Aerial flights were the most limiting sampling aspect, with only one aerial flight selected in each week and day type stratum. One sample in each stratum is insufficient to estimate variance, and data needed to be pooled for analysis. Therefore weekly strata were pooled into time period strata (2-3 weeks in length), yet the day type stratification was maintained due to differences in angler residence composition, and rod day length. Consequently, results from aerial counts were highly variable within each stratum because each stratum spanned a longer time period. This increased variability resulted in larger confidence intervals around estimates of catch and effort.

In addition, too few anglers were interviewed on some aerial count days to estimate catch. Steelhead catch rate determined from interviews conducted on eight of the 19 aerial count days were 0. On one of the days (Nov. 7, 2004) no anglers were interviewed, and only one angler was observed during the aerial count. On the remaining seven days, the number of interviews on aerial count days ranged between one (October 18th, 2004) to eight (October 11th, 2004). Low sample size on at least some of these aerial count days likely resulted in an underestimate of steelhead catch rate. However, the spatial and temporal distribution of all angler interviews was sufficient to collect representative angler characteristics (Figures 16 and 17).

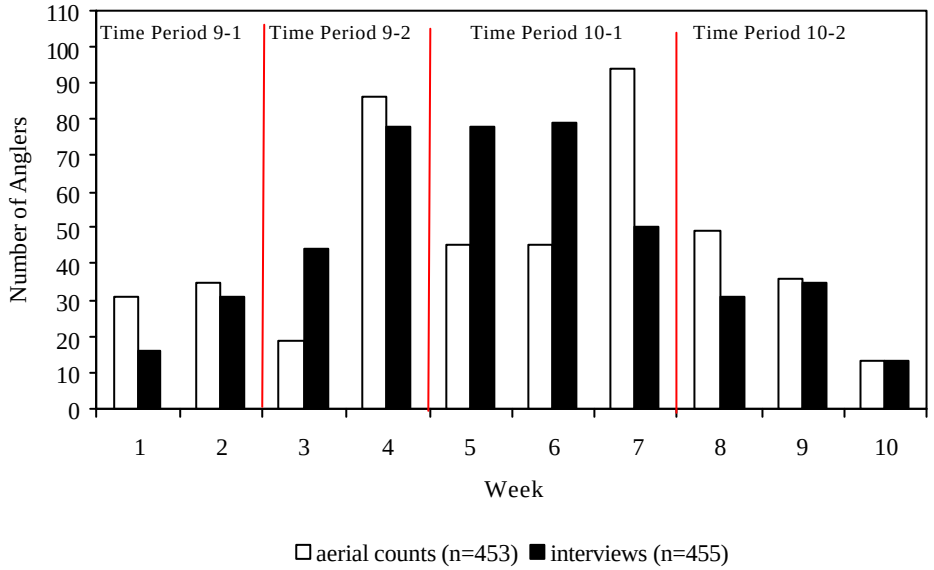

Figure 16. The number of anglers observed during aerial counts, and interviewed, for each of the weeks of the study period. Two flights were conducted in each week, except in weeks 5 and 6 where only one flight was conducted, and in week 7, where three flights were conducted.

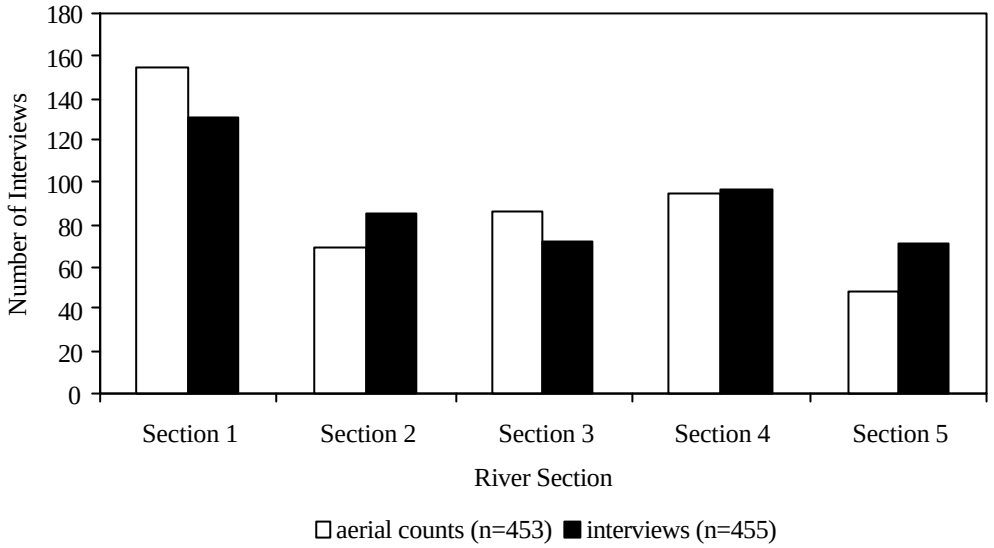

Figure 17. The number of anglers observed during aerial counts, and interviewed in each of the Morice River Sections.

The study period did not encompass the entire steelhead fishing season on the Morice River. The study did, however, encompass both the early and late classified water period. Steelhead fishing on the Morice River can often continue well into November and early December, though generally at low angling pressure, and this portion of the steelhead sport fishing activity was not included in the study.

Aerial count observer efficiency (inability to see all anglers) may have affected angler counts on some flights. Some sections of the Morice River are heavily braided (particularly Sections 3 and 4), and some areas have overhanging vegetation along the banks that may obscure vision of the river banks. In addition, anglers may have been driving to another access point. The potential of anglers driving between river access points is likely relatively low because most anglers access the river by boat.

Some anglers had a higher probability of being counted during the roving surveys due to the inherent nature of these types of surveys. Anglers that fish more often are more likely to be interviewed (Pollock *et al*. 1994). Therefore, anglers who fished more frequently than average anglers had a higher potential of being interviewed. Anglers who fish longer on a given day are also more likely to be interviewed, resulting in length-of-stay bias (Pollock *et al*. 1994). Therefore, anglers who fished longer each day, and those anglers that fished on more days had a higher potential to be interviewed than average anglers.

4.7.2 Non-Response Error

Non-response error is a bias that results from the lack of interviews obtained from anglers because they are unwilling to be interviewed, or because the guardian is unable to interview the angler. Non-response error in this survey is likely low, since most (99.6%) anglers approached for an interview agreed to be interviewed. However, some anglers were noted to exit a fishing section as the guardians approached. For example, guardians reported that some guides exited the area as they approached, or left the river section as the guardians were noted. No interviews were missed because of language barriers in this survey.

4.7.3 Response Error

Response error may have biased the sampling results in this survey. The interview process may have caused some anglers to give responses that were not indicative of their actual perception, as well as their trip length and catch rate. Anglers may exaggerate their catch for prestige purposes. Other sources of error include rounding bias (e.g. for reporting start time), intentional deception (strategic bias), question misinterpretation, and species misidentification (Pollock *et al* 1994). Rounding bias was noted when anglers were asked to estimate the actual time (excluding hiking, prep time) that they had actually spent on the river. Several anglers reported that they had been fishing longer than possible, given the start time provided, and the time of the interview. Recall bias was expected to be minimal during this study because anglers were asked questions that only pertained to the day of the interview.

5.0 DISCUSSION

The Morice River guardian study collected information on angler demographics, fishing effort, and catch rates for the Morice River from August 31st to November 7th, 2004. This time period encompasses the entire Classified Waters Period. Primarily roving interviews were used to collect angler specific information (e.g. residence, age, gender, fishing effort, catch, angling quality perception). Exit surveys were conducted opportunistically to provide comparisons with roving survey information, and to provide additional data on angler demographics and trip length. Aerial counts were conducted to count anglers on the entire river for estimates of overall effort and catch. Combining aerial counts of angler densities with data on trip length and catch rates obtained from interviews, resulted in estimates of overall effort and catch for the Morice River for the entire study period.

An angler survey was conducted for the Morice River in the mid 1970's (1975 and 1976), and data were summarized by Whately et al (1978). At this time, regulations for the Morice River allowed for the retention of two steelhead per day (4 in possession, 40 /year for resident and 20/year for non-resident anglers; Anonymous 1975, 1976). The retention limit for steelhead was reduced by 50% in 1978/1989 for the Morice River (Anonymous 1978). Data collected in the 2004 study was compared to data collected in 1976 and 1977 where possible. In addition, historical surveys for the Bulkley River conducted in 1997 (Morten and Parken 1998) and 1998 (Morten 1999) included the lower portion of Section 1 of the Morice River ("The Forks" to Bymac), allowing some comparisons of data collected for this section of the Morice River to data collected in 2004. Data collected in the current study were also compared to angler surveys conducted in the 1990's and in 2001 for the Zymoetz (Copper), upper Babine, Kispiox, and Bulkley rivers. .

5.1 INTERVIEWS

The Morice River guardian project relied on the collection of angler characteristic and trip information through angler interviews. Roving interviews were collected on randomly chosen days, and exit interviews were to be conducted opportunistically, with the goal that exit interviews would be representative of the entire study period and all river sections. Five roving survey days were randomly selected for each week within the study period. Roving interview distribution among day types, river sections, and weeks was expected to be representative of the study period and river.

Interviews were conducted by two guardians traveling together in a jet boat in pre-determined sections of the river. Guardians were unable to conduct roving surveys on two days identified for sampling (4%, 2 of 50) due to boat malfunction (5%; 2 of 50 days). On most days, guardians were able to sample both river sections randomly chosen. However, on some days (4.2%; 2 of 48 days), guardians were only able to sample one of the two sections chosen for that day. Relatively long river sections (15 km to 19km), long travel times for upper sections, and limited day length for guardians resulted in shortage of time for some roving days. Guardians could not complete the second section chosen for some days where transit and boating resulted in long shifts. Extending the length of river sections, and choosing only one river section for each day would reduce the potential of missing a river section due to time constraints, and would also increase time available for exit surveys.

On some days (18.8%; 9 of 48 days), random selection resulted in the same river section being chosen for both, the morning and the afternoon sample. This resulted in repeat interviews of a greater proportion of anglers, and may have increased avidity bias for those days. More representative data may be collected by choosing river sections randomly without replacement for individual sample days, resulting in an avoidance of a section being sampled twice in one day.

Interviews conducted on aerial count days are used to estimate catch rates for each individual aerial count. On some aerial count days, few angler interviews were conducted, resulting in an estimated catch rate of 0, or large variance around catch rates. Angler densities observed during aerial flights could be used to

adjust river sections selected for roving surveys that day if angler densities in a section are expected to be low in predetermined sections for roving surveys, in order to maximize the number of angler interviews conducted.

The numbers of anglers interviewed in the five river sections, and in each week, appear to be representative of the spatial and temporal distribution of anglers observed during aerial counts. In addition, sampling intensity during roving surveys on weekend and weekdays were proportionate to the number of weekend and weekday days in the study period. Temporal and spatial distribution of angler interviews proportionate to angler densities observed during aerial flight, and to day-type strata in the sampling design indicates that the roving survey data is representative of anglers on the Morice River during the study period.

While roving survey days and river sections were chosen randomly at the start of the Morice guardian project, some alterations to the study design were required throughout the project, primarily due to equipment malfunction and time constraints. This was expected, and it was anticipated that deletion or substitution of some sampling would have little influence on the outcome of the study due to the relatively high sampling intensity. Fewer exit surveys than anticipated were conducted, and exit surveys were not distributed among all river sections or sampling weeks. It would be desirable for exit surveys to be representative of effort in river sections, weeks and day types, and this may be accomplished by randomly selecting some days and locations in the study period for exit surveys. However, trip length did not differ significantly between exit and roving interviews, indicating that trip length estimates from roving surveys are adequate for the 2004 Morice guardian project. The final sampling distribution of interviews appears representative of the day type distribution in the study period, and was similarly distributed between river sections open to fishing, and weeks throughout the project.

5.2 ANGLER CHARACTERISTICS

Angler characteristics evaluated during this project include residence, gender, age, guided status, and conservation club membership. Anglers were grouped by residence (Skeena Region, BC residents, Canadian and non-Canadian aliens), and angler residence was summarized by week, day-type river section and guided status. The distribution of guided and non-guided anglers between day types, river sections, and weeks in the study period differed significantly for the Morice River in 2004. Significant differences in angler characteristics over time and space, and comparisons of angler characteristics on the Morice River in 2004 to previous studies on rivers in the Skeena Region are discussed below.

Most of the angler interviews on the Morice River were from BC (57.9%), with the majority of BC resident anglers residing in Skeena Region (46.3%). Non-Canadian were also frequently interviewed on the Morice River, and accounted for 36.3% of angler interviews conducted. Most Non-Canadians were from USA (76.9%). Anglers from other Canadian provinces were least frequently encountered (6.1%). Angler residence has changed considerably since the angler surveys conducted in 1976 and 1977, when most anglers were noted to be BC residents (86% in 1976, 87% in 1977; Table 38); five percent (1976) and 7% of anglers (1977) were Canadian non-residents while 9% (1976) and 6% (1977) of anglers were non-Canadian aliens (Whatley et al 1978). Angler residence in the Morice appears similar to residence distribution for the Bulkley River in more recent angler surveys (Table 38) (Morten & Parken 1998, 1999). The proportion of BC resident anglers was lower on the upper Babine River (Morten 1997) and the Kispiox River (Morten 1998, Morten and Giroux in prep.). The Kispiox River is world renowned for its' large steelhead (Morten 1998), and the Babine River recreational fishery has traditionally been dominated by Non-Canadian alien anglers (Whately et al 1978, Morten 1997). On the surface, specialized recreational fisheries offering unique fishing experience (e.g. larger steelhead in the Kispiox) appears to result in a greater attraction of non-Canadian anglers than the recreational steelhead fishery for the Morice River.

Table 38. A comparison of angler characteristics from the Morice River and other historical Skeena Watershed angler surveys.

Year of Study and Reference	River and Months of study	Angler Residence[1] (%)	Gender	Age	Conservation Club Member (%)[2,3]	Proportion Guided
1976 Whatley et al 1978	Morice	86% BC Res. 5% Cdn 9% Non-Cdn	Not recorded	Not recorded	Not recorded	Not recorded
1977 Whatley et al 1978	Morice	87% BC Res. 7% Cdn 6% Non-Cdn	Not recorded	Not recorded	Not recorded	Not recorded
1996 Morten 1997	Upper Babine	45% BC Res. 9% Cdn. 46% Non-Cdn	97% Male 3% Female	42.4 (male) 48.0 (female)	25% BC Res. 63% Cdn Res. 65% Non-Cdn Res.	18% guided
1997 Morten 1998	Kispiox Sept, Oct.	28% BC Res. 1% Cdn. 71% Non-Cdn	96% Male 4% Female	44.5 (male) 43.6 (female)	29% BC Res. 50% Cdn Res. 61% Non-Cdn Res.	15% guided
1997 Morten & Parken 1998	Bulkley Sept, Oct.	50% BC Res. 13% Cdn. 30% non-Cdn	96% Male 4% Female	44.9 (male) 45.4 (female)	40% BC Res. 82% Cdn Res. 64% Non-Cdn Res.	16% guided
1998 Morten 1999	Bulkley Sept, Oct.	62% BC Res. 6% Cdn. 33% Non-Cdn	94% Male 6% Female	44.5 (male) 41.4 (female)	35% BC Res. 53% Cdn. 63% Non-Cdn	15% guided
1999 Morten 2000	Zymoetz Aug 19 – Dec 5	65% BC Res. 4% Cdn 31% Non-Cdn	96% Male 5% Female	40 (male) 35 (female)	27% BC Res. 22% Cdn 42% Non-Cdn	6% guided
2001 Morten & Giroux in prep.	Kispiox Aug 27 – Nov. 18	30% BC Res. 2% Cdn. 68% Non-Cdn.	93% Male 7% Female	38.9 (male) 43.2 (female)	17% BC Res. 25% Cdn Res. 50% Non-Cdn Res.	16% guided
2004 Current Study	Morice Aug 30 – Nov 7	58% Cdn 6% Cdn 36% Non-Cdn	95% Male 5% Female	48.5 (male) 47.9 (female)	25% BC Res. 38% Cdn Res. 45% Non-Cdn Res.	13% guided

[1] Cdn = Canadian, Non-Cdn = Non-Canadian; [2] Proportion of anglers that are members of one or more conservation club.

Angler residence in Section 1, where most anglers were BC resident (72.4%), followed by non-Canadian aliens (22.0%), and Canadian non-residents (5.5%), is similar to residence distribution for that section of the river reported in previous Bulkley River angler surveys in 1998 (Morten 1999), although in the 1997 survey of Bulkley River anglers, the proportion of non-Canadian anglers was similar to BC resident anglers for this section of the river (Morten and Parken 1998).

Angler residence on the Morice River differed between weekends and weekdays. Anglers from Skeena Region formed a larger proportion of anglers interviewed on weekends than on weekdays. It is likely that a significant portion of Skeena Region anglers fish recreationally on weekends, and possibly after work, while non-resident anglers are more likely to fish several consecutive days on their visit to the area, regardless of day type. The mean adjusted number of anglers observed on weekend flights (mean = 27.72, SD = 14.533) was similar to the adjusted number of anglers observed on weekday flights (mean = 22.17, SD = 15.344), and increased numbers of local anglers on weekends alone does not explain the difference in angler residence categories between weekend and weekday days. Rather, it is likely that non-Canadian anglers form a smaller proportion of anglers fishing on weekends when compared to weekdays. I speculate that this is due to largely to guided angler effort. Guided anglers form a significant portion of the angler effort (16% of anglers), and most guided anglers are non-Canadian (90.0%). Most

rod days are allocated to a guide operating primarily in Sections 3 and 4 of the Morice River. Clients for this guide generally arrive on Saturday, and leave on Friday. This results in little guided fishing effort on Saturdays, and a reduced potential for guided anglers fishing on Saturdays to be interviewed by guardians. Only 16% (2 of 8) of guided anglers interviewed on weekends were interviewed on a Saturday, and those two anglers were interviewed in Section 2. Differences in angler residence types between weekend and weekday days are therefore speculated to be largely due to guided angling effort, which predominates on weekdays.

Angler residence also differed significantly among river sections. BC resident anglers were the most common anglers in Sections 1, 3 and 5, while non-Canadian anglers were the predominant anglers in Sections 2 and 4. The higher proportion of non-Canadian anglers in Section 4 is speculated to be due to guided angling effort in that section of the river. Most guiding effort is directed at Section 4, accounting for the relatively high proportion of non-Canadian anglers. No guided anglers were encountered in Section 2, and the predominance of non-Canadian anglers in that section of the river is more difficult to explain. Section 2 received relatively little effort, and most anglers accessed this river section by drift boat (52.9%) and on foot (41.2%). By contrast, most anglers accessed the remaining river sections by jet boat (57.3% for Section 1, 52.8% for Section 3, 54.2% for Section 4 and 90.1% for Section 5). A higher proportion of Non-Canadian alien anglers, particularly those without guides, use drift boats to access the river. Drift boats are less flexible in take out and put in location than jet boats, since by nature, drift boats can only proceed downstream, and anglers in Section 2 may have been encountered on their transit from put in to take out locations.

Most anglers interviewed on the Morice River in 2004 were male (95.1%). This is similar to gender distribution in other Skeena Region rivers where angler surveys have been conducted (Table 38). The proportion of male anglers on the Morice River is somewhat higher than the proportion of male anglers reported for the Skeena Region in 2000 (74% to 85% depending on residence category) (Levey & Williams 2003). Average age for male and female anglers interviewed on the Morice River appears to be somewhat higher than ages of anglers interviewed on the Bulkley, Kispiox, Babine, and Zymoetz in previous years (Table 38). Angler age for Morice River anglers (48.5 for males and 47.9 for females) was similar to angler age reported for Skeena Region anglers in 2000 (ages ranged between 43 and 55 years, depending on gender and residence) (Levey & Williams 2003).

The proportion of guided anglers on the Morice River in 2004 is similar to the proportion of guided anglers documented in previous angler surveys on the Bulkley, Kispiox, Babine and Zymoetz rivers (Table 38). No guided anglers were reported in the Morice River angler surveys conducted in 1975 or 1976 (Whatley et al 1978), but it is unclear if the criteria of guided status was not collected, or if in fact none of the anglers were guided. Guided anglers were similar in gender distribution, but significantly older than non-guided anglers (mean difference in age = 9.56 years). Guided anglers were predominantly non-Canadians (90%), and only six Canadian non-resident anglers (including 2 from BC) were guided. Most non-Canadian guided anglers were from the USA (98%), with only one angler (2%) from another country (Ireland).

Guided angler distribution varied with day type, river section and from week to week during the Morice River Classified Waters Period. The predominance of guided anglers on weekdays when compared to weekends is speculated to be due to the timing of arrival and departure of most guided anglers at the guide camp (see above). Most guided anglers fished in Section 4 of the Morice River, with some guided effort in Section 3, and in Section 1. The main guide camp is located in Section 4, and the other guide operates out of Bymac (Section 1). Spatial distribution of guided anglers is therefore in proximity to guide camps. Most guided anglers were interviewed in the first 4 weeks of the study, during the early Classified Waters Period. This may be in part be due to deteriorating weather later in the season, and the increased potential of poor fishing conditions in October due to greater chances of precipitation, low temperatures, and silty river conditions. I speculate that anglers traveling long distances for their trip to

the Morice River would attempt to combine the best period for steelhead fishing with good weather conditions, and attempt to fish early rather than later in the steelhead season.

Almost thirty four percent (33.9%) of all anglers interviewed were members of one or more conservation club. Non-Canadian alien anglers were most likely to be members of a conservation club, followed by Canadian non-resident anglers. BC resident anglers were least likely to be members of a conservation club. About one quarter (25.2%) of BC resident anglers surveyed were members of one or more conservation club. Of BC resident anglers, Skeena Region anglers (23.3%) were less likely to be members of a conservation club than other BC resident anglers (34.4%). The proportion of non-Canadian Morice River anglers in 2004 that are members of a conservation club is lower than the proportion of non-Canadian anglers in angler surveys conducted on the Bulkley, Kispiox, upper Babine rivers, but is similar to the proportion reported for the Zymoetz River in 1999 (Table 38). The proportion of BC residents that are members of a conservation club is similar to previous angler surveys conducted on the Bulkley, Kispiox, upper Babine and Zymoetz Rivers. Club membership of BC resident anglers on the Morice in 2004 is higher than the proportion reported for the Kispiox River in 2001 (Morten and Giroux in prep.), and lower than reported for the Bulkley River in either 1997 or 1998 (Morten & Parken 1998, 1999). The proportion of Canadian non-resident anglers that were members of a conservation club on the Morice River in 2004 was higher than the proportion reported for the Zymoetz River in 1999 (Morten 2000) and the Kispiox River in 2001 (Morten and Giroux in prep.), but lower than the proportion reported for the upper Babine River, the Bulkley River (Morten & Parken 1998, 1999), and the Kispiox River in 1997 (Morten 1998).

The most common conservation clubs that anglers on the Morice River in 2004 were members of included Trout Unlimited (18.4%), followed by the BC Steelhead Society (12.5%), and the BC Fly Fishers Federation (5.9%). In addition, 2.2% were members of the Bulkley Valley Steelhead Society, a Chapter of the BC Steelhead Society. The BC Steelhead Society and Trout Unlimited were among the most common conservation clubs mentioned during previous angler surveys on the upper Babine River (Morten 1999), the Bulkley River (Morten and Parken 1998, Morten 1999), Kispiox River (Morten 1998, Morten and Giroux in prep.) and the Zymoetz River (Morten 2000).

Comparisons of angler characteristics of the Morice River guardian project conducted in 2004 indicates that characteristics examined are inter-related. For example, most guided anglers are non-Canadian, and guided anglers are significantly older than non-guided anglers. Angler distribution for guided anglers differs from non-guided anglers since most guided anglers fish in Section 4, while most non-guided anglers were reported fishing in Section 1 of the Morice River. Temporal distribution of guided anglers also differs from non-guided anglers because most guided effort is on weekdays, and early in the season, with minimal effort after week 8 of the study, while non-guided effort is higher for weekends, and continues later into the study period. In addition to differences in angler characteristics between river sections, weeks and day types in the study period, angler characteristics also differ significantly from the angler survey conducted in 1976 and 1977, most notably in angler residence.

5.3 ANGLER TRIP CHARACTERISTICS

Angler trip characteristics evaluated during the 2004 Morice guardian project included gear type, access type, rod day length, and trip length. Angler trip characteristics were compared between river sections, and study week, and between various groups of anglers (e.g. by residence and guided status). Angler trip characteristics for the Morice River in 2004 is discussed below, and compared to previous angler surveys conducted in the Skeena Region.

The majority of Morice River anglers used fly rods (82.2%). Thirteen percent of anglers used gear rods, and 4.5% of angler used both, fly and gear rods. By contrast, most anglers surveyed in 1976 and 1977

used gear rods (78.6% and 68% respectively; Whatley et al 1978). In more recent surveys, anglers on other Skeena River systems were also predominantly fly anglers in previous anglers surveys (Table 39). Anglers fly fished exclusively in Section 4 during the early classified period, indicating compliance with regulations that restrict fishing in this section of the Morice River to fly fishing only to September 30. All guided anglers used fly rods. The proportion of fly anglers was highest for non-Canadians, followed by Canadians, BC residents and finally Skeena Region residents. The greater proportion of fly anglers among non-Canadian aliens is related to the fact that all guided anglers were fly anglers, and most (90%) of guided anglers are non-Canadians. Trends in gear type between residence categories is similar to that observed for other Skeena River tributaries (Morten 1997, Morten 1998, Morten and Parken 1998, Morten 2000, Morten and Giroux in prep.).

Table 39. A comparison of angling methods, mean rod day length, and steelhead catch rate from the Morice River and other historical Skeena angler surveys.

Year of Study and Reference	River and Months of study	Angling Method	Mean rod day length (hr) (STD)	Catch Rate Sthd/rod day
1976 Whatley et al 1978	Morice	21.4% Fly 78.6% Gear	Not reported	0.2
1977 Whatley et al 1978	Morice	32.0% Fly 68.0% Gear	Not reported	0.34
1996 Morten 1997	Upper Babine	70% Fly 30% Gear	Assumed as 8 hrs	1.15
1997 Morten 1998	Kispiox Sept, Oct.	84% Fly 16% Gear	Assumed as 8 hrs	0.98
1997 Morten and Parken 1998	Bulkley Sept., Oct.	81% Fly 19% Gear	Assumed as 8 hrs	1.26
1998 Morten 1999	Bulkley Sept, Oct.	80% Fly 20% Gear	7.0 hours	1.33
1999 Morten 2000	Zymoetz Aug 19 – Dec 5	62% Fly 31% Gear 7% Both	5.2 hours	1.19
2001 Morten & Giroux in prep.	Kispiox Aug 27 – Nov. 18	75% Fly 19% Gear 6% Both	7.7 hours	0.93
2004 Current study	Morice Aug 30 – Nov 7	82% Fly 13% Gear 5% Both	7.5 hours	1.27

Of the anglers interviewed on the Morice River, the proportion of gear anglers was lowest for drift boat access type (9.5%), followed by jet boat access (19%), shore based anglers (24.5%) and helicopter based anglers (50%). This trend is similar to the Bulkley River, where most drift boat (95% in 1997, 94% in 1998) and jet boat anglers (92% in 1997, 84% in 1998) were fly anglers, with a lower proportion of fly anglers among shore based anglers (68.5% in 1997, 68% in 1998) (Morten and Parken 1998, Morten 1999).

The predominant access method for steelhead anglers on the Morice River in 2004 was jet boat (51.4%), followed by drift boat (25.1%), foot (23.1%) and helicopter (0.5%). Jet boats were most frequently used by Skeena Region resident anglers, BC resident anglers and Canadian non-resident anglers, whereas about 53.1% of non-Canadian anglers used either drift boats or jet boats. Most of the non-Canadian anglers using jet boats to access the river were guided (72%). All guided anglers accessed the river by jet boat. Predominant access method for the Morice River differs from access methods for other Skeena

River tributaries. Access for the Kispiox River and the Zymoetz River is restricted to non-motorized access, and no anglers accessed the river by jet boat (Morten 1998, 2000, Morten and Giroux in prep.). Access on the Bulkley River, and to a popular fishing location on the Babine River (just downstream of the DFO weir) is unrestricted, and most anglers accessed these rivers from shore (Morten 1997, Morten and Parken 1998, Morten 1999). The relatively low proportion of shore based anglers on the Morice River is likely due to limited shore access, particularly to the upper three sections of the Morice River.

Angling method differed between river sections on the Morice River in the 2004 steelhead season. Gear anglers or anglers using both fly and gear methods were most common in Section 5 (47.9%). Section 5 was closed for angling in September, and no gear restrictions were in place in the late Classified Waters Period for this section, or Section 4. The higher proportion of gear anglers in Section 5 represents primarily BC resident anglers (94.1%, 32 anglers). By contrast, the proportion of fly anglers was highest in Section 4 (97.9%). This is likely due to the predominance of guided anglers in Section 4, all of which were fly anglers, and the fact that angling regulations restrict fishing to fly gear during early Classified Waters Period (September 1 – 30). Gear angling effort increased in the late classified period, consistent with the fact that parts of the Morice River (Section 4) was only open to fly anglers in the early classified period.

Rod day length averaged 7.46 hours (SD = 2.357), intermediate to the angling day length reported for the Bulkley River in 1998 (7.0 hrs; Morten 1999), and the Kispiox River in 2001 (7.7 hrs; Morten and Giroux, in prep.) (Table 39). Similar to findings reported for the Bulkley River in 1998, average angling day length for the Morice River in 2004 was longer in the middle of the steelhead season, than early or late in the season. Mean angling day length was shortest at the conclusion of the steelhead season (mean 6.23 hours in time period 10-4), likely due to decreasing day length, and because of deteriorating weather conditions. Weekday rod day length, on average, was longer than weekend days. Canadian non-resident anglers fished for shorter days (mean = 4.04 hours) compared to anglers from BC (7.09 hours) or non-Canadian anglers (7.98 hours). Rod day hours were longer for drift boat access anglers (8.36 hours) compared to anglers accessing the river by jet boat (7.66 hours), or anglers accessing the river on foot (6.18 hours). On average, fly anglers fished for more hours each day (7.74 hours) than gear anglers (6.16 hours) or anglers using both methods (6.74 hours). Guided angler rod day length was significantly longer than rod day length for non-guided anglers, similar to results for the Bulkley (Morten 1999) and Kispiox rivers (Morten and Giroux in prep.). The fact that fishing hours on weekend days were shorter than weekday length, and rod day length was longer for non-Canadian anglers was longer than for other residence categories, may be partly attributable to the fact that guided angler effort was less on weekends. Similarly, the fact that most drift boat and guided anglers fished with fly rods compounds the significantly longer rod days for fly anglers compared to those using gear or a combination of fishing methods.

Trip length averaged 8.8 days, and trip length differed significantly between residence and guided status. On average, Skeena resident anglers planned to fish for more days (17.6 days) than BC residents (7.3 days), non-Canadian anglers (5.3 days), or Canadian non-resident anglers (4.1 days). Similarly, Bulkley Valley resident anglers planned to fish for more days (27.1 days), followed by BC resident anglers (10.6 days), and Canadian and non-Canadian anglers (7.0 days) on the Bulkley River in 1998 (Morten 1999). Guided anglers planned to fish for fewer days (6.9 days) compared to non-guided anglers (9.1 days). The number of anticipated days for guided anglers corresponds with the fact that most guided anglers arrive on the river on Saturdays, and depart on Fridays. Longer average trip length for non-guided anglers is likely due to the greater proportion of Skeena and BC resident anglers in this group compared to guided anglers, which are predominantly non-Canadian.

Angling trip characteristics for the Morice River 2004 anglers is comparable to recent angler surveys conducted elsewhere in the Skeena River, but differs somewhat from angler characteristics described for the Morice River in the angler surveys conducted in 1976 and 1977. As in other rivers recently surveyed, most effort on the Morice River consisted of fly rods, while most angling effort in 1976 and 1977

consisted of gear rods. This is probably a reflection of two major changes in the Morice sport fishery since 1976 and 1977: an increase in non-local anglers that fish predominantly with fly gear, and a general shift towards fly angling as gear and angling methods have become more sophisticated, and as anglers have shifted from a steelhead retention to a non-retention fishery. As for the Bulkley River angler survey, most Morice River anglers accessed the river by jet boat, with some anglers using drift boats and foot. Rod day length was comparable to other studies on nearby systems (e.g. Bulkley River), as was gear type and access methods.

5.4 ANGLING LICENCE CLASS

Most anglers fishing on the Morice River purchased an annual or an eight day licence. Almost all (99.4%) of BC residents purchased an annual licence. Non-Canadian and Canadians purchased primarily 8 day licences (42.3% and 40.6% respectively) or an annual licence (49.0% and 40.6% respectively). This is comparable to the proportion of anglers that intended to fish for eight or more days. Similarly, Canadian and non-Canadian anglers fishing on the Bulkley River purchased primarily annual and eight day licences in 1998 (Morten 1999). Most anglers from outside BC purchased one or seven day classified water licences. Most guided anglers (75.0%) purchased seven day classified waters licences, and accounted for 82% of seven-day classified waters licences purchased. A significant proportion of anglers purchased a classified waters day that extended for fewer days than they actually intended to fish. This is likely because classified waters day purchased are specific for days and river, and anglers may alter their specific fishing days or location depending on conditions.

Angling licence and regulation violations on the Morice River was estimated as 3.3% of interviews conducted. In addition, 0.9% of angler interviews were not completed due to refusal of the interview. Angler compliance could not be verified in these interviews, and the overall potential non-compliance may be as high as 4.2%. Compliance on the Bulkley River was 94% in 1997 (Morten and Parken 1998) and 95% in 1998 (Morten 1998). Non-compliance was somewhat lower on the Kispiox River in 2001 (3% non-compliance, Morten and Giroux in prep.). Violations on the Morice River in 2004 included one party of two anglers (0.4% of angler interviews) fishing illegally from a boat. About 1.8% of anglers did not have a valid classified water licence. One angler mentioned that he was unable to purchase a classified water licence that day since the vendor was out of such licences. Other anglers from outside BC expressed frustration in having to buy classified waters licences on a daily basis, presumably as they decided where to fish on a daily basis. As on the Bulkley River in 1997 and the Kispiox River in 2001, most infractions consisted of the failure to carry or produce a licence. The presence of the guardians may have resulted in higher compliance as anglers became aware that guardians were checking licences.

5.5 ANGLER CATCH AND EFFORT

The total effort estimated for the Morice River study period was 1750 rod days, based on aerial count data. By comparison, the anglers indicated that they planned to fish a total of 2507 days on the Morice River in 2004. The discrepancy between these two estimates may result from the fact that some anglers fish well into November (Whatley et al 1978), while the study period only extended to November 7th, 2004. In addition, anglers' estimated trip length, particularly for Skeena Resident anglers, was vague, and may have resulted in an overestimate of the expected number of rod days on the river. However, fishing effort in 1976 and 1977 was relatively low in November and December (Whatley et al 1978), and low aerial counts at the conclusion of this study also indicate that angler effort past November 7th is likely low. Aerial counts may have resulted in an underestimate of the actual effort on the river. The large confidence interval around the estimated number of rod days (± 488 rod days) indicates the estimate is rather imprecise.

Hourly steelhead catch rates differed significantly between weeks and river sections. One possible explanation for this difference is differences in spatial and temporal distribution of fish resulting in

differences in abundance, which may translate in reduced catch rates. Another potential explanation is differences in angler types with varying success rates over time and space. Catch rates appeared to be highest in week 10 (0.922 steelhead per hour), and in week 9 (0.769 steelhead per hour). Effort was lowest during these two weeks of the study period. Steelhead catch rates were highest in Section 3 (0.28 steelhead per hour) and Section 5 (0.22 steelhead per hour). All of the effort in Section 5 was extended in weeks 5 to 10, since this section of the river was closed to fishing in weeks 1-4. Catch rate, on average, was higher during this time then during the early classified water period. Higher catch rates later in the season are intertwined with the opening of Section 5 during the late classified period, where catch rates were higher than in other sections of the river.

Steelhead catch rates differed significantly between access method, but not angling methods, residence or guided status. Anglers using jet boats caught more fish than those accessing the river by drift boat or on foot. This may be due to the ability of jet boats anglers to access different section of the river more easily and faster than is possible for either drift boat or shore based anglers. Anglers can cover more water, and shift to more "productive" runs more easily with a jet boat than with other access methods. In addition, anglers fishing in Section 5, where catch rates were highest, are generally jet boat anglers, since this section of the river is difficult to access by other means. The higher catch rates in Section 5 confounds the overall higher catch rate for jet boat based anglers compared to those using other access methods.

Average catch was estimated as 1.27 steelhead per rod-day. This catch rate is considerably higher than the catch rate of 0.2 steelhead and 0.34 steelhead per rod day reported for the Morice River in 1976 and 1977 respectively (Whatley et al 1978). Average length of rod days was not reported, and it is unknown if differences in steelhead catch per day is due to shorter rod days, or other factors (e.g. abundance, fishing patterns, angler and fish distribution etc.).

Daily catch rates estimated for the Morice River was based on the time the angler spent on the river between the start time and the time at the interview and the estimated rod-day length. In contrast, catch rate for previous angler surveys conducted on the Kispiox River in 2001 (Morten and Giroux in prep.) and the Bulkley River in 1997 and 1998 (Morten and Parken 1998, Morten 1999) were based on the estimated time the angler actually spent fishing. Hourly steelhead catch rates on the Morice River are similar to those reported for the Bulkley River in 1997 (1.26 steelhead per rod day), and somewhat lower than those reported for the Bulkley River in 1998 (1.33 steelhead per rod day). However, these estimates were based on the estimated time the angler actually spent fishing, rather than the total time between start time and interview time. Because actual fishing time should be similar or less to the time between arrival and interview, catch rates are expected to be similar or higher than those estimated by simply deducting the start time from the time of the interview. For the Morice River study, the actual time fishing did not differ significantly from the time between the interview and arrival on the river, and the two methods of determining catch rates should be comparable in this case.

Extrapolating hourly catch rate to rod day catch rate was conducted by multiplying the average hourly catch by the respective rod day length. For the Bulkley River angler survey in 1997, the actual rod day length was not evaluated, and was assumed to be 8 hours for this extrapolation (Morten and Parken 1998). For the 1998 angler survey on the Bulkley River, day length was evaluated, and averaged 7.0 hours (Morten and Parken 1999). The rod day length in our study and in the Bulkley River 1998 angler survey was determined by asking angler when they intended to finish fishing, and by deducting the start time from the anticipated end time. This time period includes inactive fishing times (e.g. lunch, transit etc.). Using a catch estimator that only includes active fishing time and multiplying this by a day length estimator that includes inactive fishing time may not provide a suitable daily catch estimator. The hourly catch estimator and the day length estimator used in the Morice River angler survey in 2004 should provide a more accurate estimate, assuming that both parameters used include a similar proportion of inactive fishing times.

Total angler effort was estimated to be higher for the late classified water period (945 ± 228 rod days) compared to the early Classified Waters Period (622 ± 373 rod days). Most guided anglers were encountered in the early Classified Waters Period and fewer guided anglers were encountered in the late classified water period.

The estimated rod days for guided anglers on the Morice River in 2004 was 399 rod days (± 163 rod days). Allocated rod days for the classified waters day for guided anglers is 433 rod days. The estimated guided rod days for the Morice River is similar to the allocated number of rod days, and indicates that the estimated guided rod days is relatively accurate. The number of guided rod days reported by guides for the 2004 season on the Morice River were not available at the time of writing, and could not be compared to the estimated number of rod days based on aerial counts of anglers.

The 2004 steelhead harvest analysis (SHA, also known as steelhead angler survey) data was not available at the time of writing, but estimated effort (rod days) and catch were obtained for previous years (1968 to 2003, Table 40). The effort estimate from the guardian program for the 2004 steelhead season (1750 rod days) was less than the SHA estimate of effort for 2003 (4015 rod days) or 2002 (3752 rod days). In fact, the 2004 estimate of effort for the Morice River is lower than the effort for any years contained in the steelhead harvest analysis database since 1968. This may, in part be due to the fact that this study does not encompass the entire steelhead season, though most effort is expected to be expended during the Classified Waters Period. Also, there are inherent biases in the SHA, which generally err on the upward side of the estimated effort and catch. The upward discrepancy around effort estimates in the SHA was reported as 58%, and the upward discrepancy around steelhead catch is 106% (DeGisi 1999). Adjusting the 2002 and 2003 angler days by this factor reduces the angler days to 2375 and 2541 angler days respectively. Adjusting the estimated number of wild fish released in 2002 and 2003 by the 106% results in 1815 and 2405 fish released in 2002 and 2003 respectively. These estimates bracket the steelhead catch estimates on the Morice River in 2004 (2233 steelhead). The estimated number of rod days and steelhead catch reported in the SHA for 2002 and 2003 exceeds the estimated rod days and catch determined through angler surveys and aerial counts in 2004, which is consistent with the documented upward bias reported in the SHA.

5.6 QUALITY ANGLING EXPERIENCE

Most anglers rated their quality angling experience on the Morice highly. The average rating was 3.98 (between fair and good) on a scale of 1 (very poor) to 5 (excellent). The majority of anglers rated their experience as excellent (47.8%), and the lowest proportion of anglers rated their experience as very poor (4.7%). Ratings of angler experience did not differ between resident categories, between guided and non-guided anglers, or between anglers using different gear or access types. Mean ratings changed over the duration of the study, with the lowest mean rating at the beginning of the classified waters season, and the highest rating in week 8 of the study period. This may be a reflection of increased catch rates. Catch rates were lowest in weeks 1 and 2 of the study, when quality ratings were also lowest. Since the highest contributing factor towards quality angling experience mentioned by anglers was fish abundance, it is reasonable to speculate that the relatively low ratings in weeks 1 and 2 can be attributed to low catch rates. Quality ratings also differed between different river sections. The quality of the angling experience was rated highest in Section 2 and 5, and lowest in Section 4 (4.33, 4.27 and 3.64 respectively). This also correlates with higher steelhead catch rates in Section 5 (0.22 steelhead/hour) and the low catch rates in Section 4 (0.09 steelhead/hour). However, catch rates were low in Section 2 as well (0.11 steelhead/ hour), yet quality ratings were higher for this section of the river. This indicates that while catch rates may explain low experience ratings in weeks 1 and 2, and in Section 4, but that catch rate is not the only factor determining quality angling experience. Aside from fish abundance, anglers indicated that solitude/peacefulness, as well as the river attributes and angling conditions (e.g. weather conditions, water conditions) influence the quality of their angling experiences.

Table 40. Summary of rod days, and catch for the Morice River obtained from the Steelhead Harvest Analysis (SHA).

Year	Number of anglers	Number of days fished	Wild Steelhead		Hatchery Steelhead	
			Kept	Released	Kept	Released
1968	1328.0	4295.0	1535.0	0.0	0.0	0.0
1969	960.0	3064.0	962.0	0.0	0.0	0.0
1970	1136.0	4997.0	1464.0	0.0	0.0	0.0
1971	1211.0	4242.0	164.0	843.0	0.0	0.0
1972	1146.0	4851.0	1279.0	1256.0	0.0	0.0
1973	1064.0	4340.0	1402.0	1061.0	0.0	0.0
1974	1050.0	5476.0	930.0	961.0	0.0	0.0
1975	804.0	4344.0	697.0	511.0	0.0	0.0
1976	675.0	4447.0	1027.0	1152.0	0.0	0.0
1977	764.0	3087.0	553.0	595.0	0.0	0.0
1978	892.0	3836.0	630.0	952.0	0.0	0.0
1979	865.0	3783.0	643.0	1314.0	0.0	0.0
1980	1053.0	5329.0	786.0	2112.0	0.0	0.0
1981	995.0	5339.0	704.0	1700.0	0.0	0.0
1982	803.0	4243.0	320.0	1398.0	11.0	48.0
1983	992.0	5562.0	643.0	1980.0	23.0	24.0
1984	921.0	4947.0	458.0	2527.0	15.0	46.0
1985	737.0	4562.0	436.0	2316.0	15.0	73.0
1986	779.0	4276.0	333.0	1911.0	0.0	24.0
1987	1115.0	7302.0	709.0	4570.0	18.0	128.0
1988	773.0	3799.0	145.0	2187.0	0.0	44.0
1989	773.0	4129.0	139.0	2984.0	12.0	284.0
1990	531.0	3137.0	9.0	2488.0	0.0	53.0
1991	574.0	2929.0	54.0	2523.0	0.0	13.0
1992	369.0	1850.0	3.0	1271.0	0.0	4.0
1993	243.0	1435.0	0.0	1610.0	0.0	21.0
1994	387.0	1748.0	6.0	2160.0	0.0	59.0
1995	495.0	2809.0	0.0	3094.0	0.0	62.0
1996	549.0	3072.0	0.0	2976.0	0.0	113.0
1997	593.0	2913.9	0.0	3009.8	0.0	93.4
1998	590.0	3522.4	0.0	3930.6	4.1	66.4
1999	791.0	4175.0	46.6	5399.8	0.3	151.0
2000	823.0	4212.8	19.9	4505.4	0.0	142.5
2001	773.0	4033.8	84.8	5090.7	0.0	32.0
2002	834.0	3752.0	6.1	3738.7	0.0	72.4
2003	755.0	4014.9	13.3	4954.5	6.7	119.7

6.0 RECOMMENDATIONS

1. The Ministry should continue to conduct periodic angler surveys on Skeena River tributaries, including the Morice River. These surveys should collect data to monitor potential changes in angler demographics, angling effort and angling catch. This information will assist MWLAP in protecting the quality of angling experiences on Class II water bodies.

2. Due to differences in angler effort and demographics, day type stratification (weekend and weekday) should be maintained in future angler surveys conducted on the Morice River.

3. To decrease sampling error and variance in catch and effort estimates, the study period should be divided into two – week time periods with at least three weekday and three weekend days sampled by aerial counts. If aerial counts are cancelled, aerial counts should be conducted on alternate days and should coincide with days when interviews are conducted during roving surveys.

4. Morice River sections were designated based on access and other logistics, but the length of the river section occasionally presented difficulties in successfully completing surveys in both river sections on each roving survey day. Particularly on days when two disjunct river sections were chosen for roving surveys, guardians were pressed to complete all interviews and survey the entire river section in the time allotted. River sections could be extended to divide the river into three sections, with one section chosen for roving surveys each day.

5. Two river sections were randomly chosen for each survey day, resulting in the same section being sampled in the morning and afternoon for some days. Most anglers fish for extensive periods of time, resulting in a high proportion of repeat interviews on those days. Guided anglers, in particular, expressed that they found repeat daily interviews onerous and intrusive. If more than one section is to be sampled on each day, consideration should be given to randomly select sample sections for surveys without replacement for each day. This would result in no duplicate reaches sampled on the same roving days, and reduce the number of repeat interviews of the same anglers.

6. To refine the estimate of observer efficiencies (anglers not counted on the flight because they were not seen), the guardians should ask the anglers if they were on the river during the flight. Aerial counts can be adjusted by the proportion of anglers not visible during the aerial counts.

7. To assess catch rates, anglers were asked how much time they had actually fished, excluding hiking, prep time etc. Anglers gave vague answers, and often appeared uncertain on how to answer this question. Anglers may find it easier to estimate how much time they spent in non-angling activities (e.g. hiking, lunch, prep time.).

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9.0 APPENDICES

Appendix 1. The angler interview form and angler count data form
Appendix 2. The conservation clubs mentioned
Appendix 3. A summary of weather and water conditions during the classified water period
Appendix 4. The method of grouping 'quality characteristics' mentioned by Morice River anglers
Appendix 5. A summary of time spent interviewing
Appendix 6. A summary of the flight data
Appendix 7. Weekly summaries of the number of anglers that fished during each one hour time block
Appendix 8. Correlation matrix for key angling variables (aerial counts, catch rate, quality rating and secchi depth)

Appendix 1. The angler interview form and angler count data form

Interview Type: ROVING or EXIT

Interview No:_____ Interviewer _____ Time_____ Date_____ Day Type WEND WDAY

Gender MALE FEMALE **Location**: REACH 1 REACH 2 REACH 3 REACH 4 REACH 5

People per party: _____ Site Name (if known): _____

Hello, my name is _ _ _ _ _ I am a River Guardian and we are collecting information from anglers on the Morice River. **Are you willing to allow me to examine your fishing license and answer a few questions for me?** The interview is voluntary and will only last about 5 minutes. All of your answers will be confidential.

YES NOT APPLICABLE (*not angling*) DOES NOT SPEAK ENOUGH ENGLISH REFUSED

Have you been interviewed before? NO YES

Angler License #_____ Classified Waters License #_____ Steelhead Stamp: YES NO

Angler Name _____ **Year of Birth** _____

Guided YES NO If yes by WHOM? _____

Residence B.C. postal code _____, CDN province _____, NON-CDN country _____

License Class 1 DAY 8 DAY ANNUAL **Classified Days Purchased** _____

Observed License Violations NONE NO STEELHEAD STAMP NO CLASSIFIED WATERS NO LICENSE
OTHER _____

Did you use a fly or gear rod today? FLY GEAR BOTH **Did you fish any other rivers today?** Bulkley Telkwa Babine Skeena Morice River tribs/Other (specify): _____

How did you access the river today? JET BOAT DRIFT BOAT FOOT

When did you START fishing today? _____ AM/PM **When did you QUIT fishing today?**_____ AM/PM

(If roving) **When do you expect to finish fishing today?** _____

Excluding driving, hiking and prep time how long did you fish the MORICE River? _____*hrs.*
(If YES about fishing other rivers) **the above mentioned river?** _____*hrs.*

What species of fish have you landed today? How many did you keep or release?

Species	MORICE RIVER SECTION (1, 2, 3, 4, or 5)	Rel./Kept	Fly or Gear	Time for each method

Have you retained any fish today? _____ Can we measure and sample the fish you retained?

Species	FL (cm)	Sample #

How many days have you already fished for steelhead on the Morice River this year? _____

How many *more* days do you plan to fish for steelhead on the Morice River this year? _____

Are you a member of a conservation club or organization? YES NO

If YES, what organization(s) *(list first 3)* ? _____, _____, _____

What do you feel are the key characteristics of a high quality angling experience on the Morice River*(list top 3)***?**

_____, _____, _____

On a scale of 1-5, 1 being very poor and 5 being excellent, how would you rate your quality angling experience today?

1 VERY POOR 2 POOR 3 FAIR 4 GOOD 5 EXCELLENT 6 *(Don't Read)* NOT SURE

Please describe any additional comments the angler had on the back of this form.

Morice River Guardian Project: Aerial Count Form

Personnel: _____ **Date:** _____ **Day Type:** Weekday Weekend

Weather: Sun Partial Cloud 100% Overcast Rain Snow

Water Clarity: Clear Turbid **Water Level:** Low Rising High Flood Dropping

Time	Location	Anglers			Boats		Guided?
		Total	Fly	Gear	Jet	Drift	
	Leave Base						
	Section 1: ("The Forks" – Knapper Creek)						
	Section 2: (Knapper Cr. – Owen Canyon)						
	Section 3: (Owen Canyon – Lamprey Recsite)						
	Section 4: (Lamprey Recsite – Gosnell)						
	Section 5: (Gosnell – Morice Lake)						
	Return Base						
	Total						

PLEASE NOTE RIVER GUARDIAN CREW LOCATION & TIME OBSERVED

Morice River Guardian: Roving Survey Form

Interviewer: _____ **River Section:** _____ **Other:** _____

Date: _____ **Day Type:** Weekday Weekend

Time Start: _____ **Time Stop:** _____

Weather: Sun Partial Cloud 100% Overcast Rain Snow

Secchi Depth: _____**S. Gauge Height**: _____ **Temp.** _____

Water Level: Low Rising High Flood Dropping

Route Description:

_____

_____

_____

Area	Anglers Observed	Jet[1] Boats Observed	Drift Boats Observed	Anglers Interviewed	Time entered area	Time exited area
Section 1: "The Forks" – Knapper Creek (~17.5 km)						
Section 2: Knapper Creek – Owen Canyon (~ 15 km)						
Section 3: Owen Canyon – Lamprey Recsite (~19 km)						
Section 4: Lamprey Recsite – Gosnell Creek (~19 km)						
Section 5: Gosnell Creek – Morice Lake (~18 km)						
Total						

[1] include props.

Comments:

_____

_____

_____

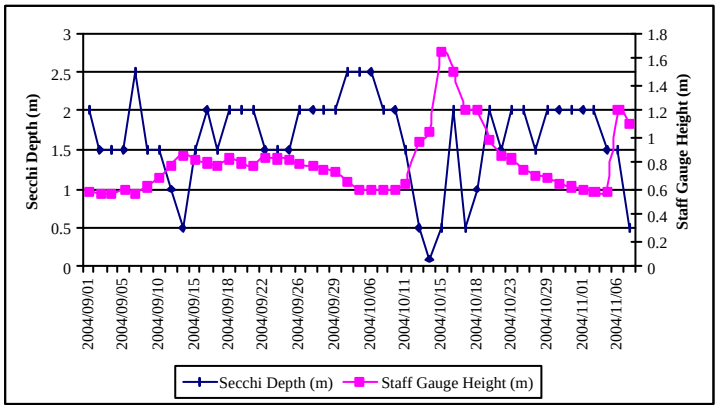
_____

Appendix 2. Names and codes used for conservation clubs mentioned

code	conservation organizations	# anglers	%
ACA	Alberta Conservation Association	1	0.74%
AFS	American Fish Society	3	2.21%
AHEIA	Alberta something	1	0.74%
ASF	Atlantic Salmon Federation	4	2.94%
ASFA	Alberta Sports Fishing Association	1	0.74%
BCCFS	BC Conservation Fund Society	1	0.74%
BCFFF	BC Fly Fishers Federation	8	5.88%
BCSS	BC Steelhead Society	17	12.50%
BCWF	BC Wildlife Federation	5	3.68%
BLSR	Burns Lake search and Rescue	1	0.74%
BVSS	Bulkley Valley Steelhead Society	3	2.21%
CDF	Chilliwack Drift Fishers	1	0.74%
CFF	Cowichan Fly Fishers	2	1.47%
CLFF	Colorado Fly Fishers	1	0.74%
CFGC	Courtney Fish &Game Club	1	0.74%
CWC	Cold Water Conservation	1	0.74%
DFC	Desert Fisher council	1	0.74%
DRFC	Drift Fishers Club	2	1.47%
DFFA	Dutch Fly Fishing Association	1	0.74%
DU	Ducks Unlimited	5	3.68%
FFF	Federation of Fly Fishers	4	2.94%
FFOAA	Fly Fitters Outfitting association of Alberta	1	0.74%
FOAM	FOAM Outfitters	1	0.74%
FVAS	Fraser Valley Angling Society	1	0.74%
HBFFA	Heg Brown Fly Fishing association	1	0.74%
HFRF	Henry's Fork River Foundation	1	0.74%
HHF	Harry Hawthorn Foundation	1	0.74%
HSFUSA	Henry Sports Foundation USA	1	0.74%
HWGS	Houston Wild Game Society	2	1.47%
IEFFC	Inland Empire Fly Fishing Club	2	1.47%
KFG	Kamloops Fish and Game	1	0.74%
MCP	Mosa Club Pievepelago	1	0.74%
NCSA	Northcoast Steelhead Alliance	2	1.47%
OFAH	Ontario Federation of Anglers and Hunters	2	1.47%
OFF	Oslo Fly Fishers	1	0.74%
OFFC	Osprey Fly Fishers Club	3	2.21%
PBA	Power Boat Association	1	0.74%
PFF	Peninsula Fly Fishers	3	2.21%
PFFC	Penticton Fly Fishers Club	1	0.74%
QUAL	Qual aunlimited	1	0.74%
RCNA	RCN Angler Association	1	0.74%
RGC	Rod and Gun Club	3	2.21%
RI	Rotary International	1	0.74%
SA	St. Alliances	1	0.74%
SBFFC	Stream Bourne Fly Fishing Club	2	1.47%
SBSAA	Spences Bridge Steelhead Advocate Association	1	0.74%
SC	Sierra Club	1	0.74%
SCI	Safari Club International	1	0.74%
SRGC	Squamish Rod and Gun Club	1	0.74%
SSC	Southeast Steelhead Conservation	1	0.74%
SSE	Sooke Salmon Enhancement	1	0.74%
TFUS	Trout Fitters US	1	0.74%
TUC	Trout Unlimited Canada	25	18.38%
VFFC	Vernon Fly Fishers Club	1	0.74%
VFG	Vernon Fish and Game	1	0.74%
WFFC	Westcoast Fly Fishers Club	2	1.47%
WhFFC	Whistler Fly Fishing Club	1	0.74%

Appendix 3. A summary of weather and water conditions during the classified water period

Survey Date	Morning Reach	Afternoon Reach	Day Type	Start Time	Time Stop	Weather	Water Temp	Secchi Depth (m)	Stream Gauge Height (cm)	Water Level
2004/09/01	3	4	Weekday	11:30	15:00	Overcast /showers	14	2	0.58	Low
2004/09/02	4	3	Weekday	8:45	17:40	Partly Cloudy	14	1.5	0.56	Low
2004/09/03	1	4	Weekday	8:45	17:30	Partly Cloudy	15	1.5	0.56	Dropping
2004/09/05	3	3	Weekend	8:45	18:30	Partly Cloudy / showers	13.5	1.5	0.585	Rising
2004/09/07	2	3	Weekday	9:40	13:30	Overcast /showers	13	2.5	0.57	Low
2004/09/08	3	4	Weekday	8:45	17:00	Overcast /showers	13	1.5	0.62	Rising
2004/09/10	3	2	Weekday	8:46	16:40	Overcast	11	1.5	0.68	Rising
2004/09/11	3	1	Weekend	8:30	15:35	Partly Cloudy / showers	11	1	0.77	Rising
2004/09/12	2	1	Weekend	7:45	15:30	Partly Cloudy	10	0.5	0.86	Rising
2004/09/15	2	4	Weekday	8:45	18:00	Partly Cloudy /showers	11	1.5	0.82	Dropping
2004/09/16	4	4	Weekday	7:45	18:00	Partly Cloudy	11	2	0.8	Dropping
2004/09/17	1	1	Weekday	8:00	15:30	Rain	11	1.5	0.78	Rising
2004/09/18	4	3	Weekend	8:45	16:45	Overcast / flurries	10	2	0.83	Dropping
2004/09/19	3	2	Weekend	8:00	16:30	Partly Cloudy	10	2	0.8	Dropping
2004/09/20	4		Weekday	8:00	15:30	Partly Cloudy	9	2	0.78	Dropping
2004/09/22	3	2	Weekday	8:30	16:30	Partly Cloudy	10	1.5	0.84	Rising
2004/09/23	1	2	Weekday	8:00	16:30	Partly Cloudy	9	1.5	0.83	Dropping
2004/09/24	4	4	Weekday	7:30	17:00	Sunny/clear	10	1.5	0.82	Dropping
2004/09/26	1	4	Weekend	8:30	18:55	Sunny/clear	9	2	0.79	Dropping
2004/09/27	3	1	Weekday	7:45	16:30	Partly Cloudy	9	2	0.77	Dropping
2004/09/28	2	1	Weekday	9:00	19:23	Sunny/clear	9	2	0.75	Dropping
2004/09/29	4	3	Weekday	8:00	15:30	Sunny/clear	8	2	0.73	Dropping
2004/10/02		5	Weekend	8:00	20:15	Sunny/clear	11	2.5	0.66	Dropping
2004/10/04	5	3	Weekday	8:45	17:30	Overcast	10	2.5	0.6	Dropping
2004/10/06	2	3	Weekday	8:45	18:30	Partly Cloudy	9	2.5	0.6	Dropping
2004/10/07	3	2	Weekday	7:45	17:30	Partly Cloudy	8	2	0.6	Steady
2004/10/10	5	1	Weekend	18:45	17:15	Overcast /showers	10	2	0.6	Steady
2004/10/11	1	4	Weekday	8:00	17:00	Partly Cloudy /showers	9	1.5	0.65	Rising
2004/10/13	4	2	Weekday	8:00	17:00	Partly Cloudy /showers	10	0.5	0.96	Rising
2004/10/14	1	3	Weekday	8:00	15:00	Partly Cloudy	10	0.1	1.04	Rising
2004/10/15	3	1	Weekday	8:00	16:00	Partly Cloudy /showers	9	0.5	1.65	Steady
2004/10/16	5	4	Weekend	7:30	15:30	Partly Cloudy	9	2	1.5	Rising
2004/10/17	3	3	Weekend	8:30	16:30	Overcast / flurries	8	0.5	1.2	Steady
2004/10/18	3	3	Weekday	8:00	15:30	Overcast /flurries	6	1	1.2	Steady
2004/10/19	4	4	Weekday	8:00	14:30	Partly Cloudy	6	2	0.98	Dropping
2004/10/22	1	3	Weekday	9:00	18:00	Partly Cloudy	5	1.5	0.86	Dropping
2004/10/23	5	5	Weekend	8:00	17:30	Partly Cloudy	8	2	0.83	Dropping
2004/10/26	3	2	Weekday	8:00	16:00	Partly Cloudy	6	2	0.74	Dropping
2004/10/28	2	5	Weekday	9:00	17:30	Partly Cloudy	5	1.5	0.7	Dropping
2004/10/29	2	1	Weekday	8:00	16:00	Partly Cloudy	5	2	0.68	Dropping
2004/10/30	3	2	Weekend	9:00	15:00	Partly Cloudy	4.5	2	0.65	Dropping
2004/10/31	1	5	Weekend	8:00	17:00	Partly Cloudy	4	2	0.62	Dropping
2004/11/01	5	3	Weekday	8:00	17:00	Partly Cloudy	6	2	0.6	Dropping
2004/11/02	3	1	Weekday	8:00	14:30	Partly Cloudy	4.5	2	0.58	Dropping
2004/11/04	5	5	Weekday	8:00	16:00	Partly Cloudy	6	1.5	0.58	Dropping
2004/11/06	0	5	Weekend	8:00	16:30	Partly Cloudy	5	1.5	1.2	Dropping
2004/11/07	1	0	Weekend	8:00	14:30	Snow	3	0.5	1.1	Dropping



Appendix 4. The method of grouping 'quality characteristics' mentioned by Morice River anglers

Category	Quality Characteristics
Beauty/Scenery/Aesthetic Attributes	Beautiful scenery
	Clean camp ground
	High quality environment
	Pleasant surroundings
	Scenery
Catch and Release/Fly Fishing	Catch and release
	Dry fly
	Dry fly activity
	Good fly fishing
	No gear fishing
	Selection of fly
Don't change a thing	Don't change a thing
Don't know	don't know
Friends/Social/Hospitality/Politeness	Educate-politeness
	Type of polite people
Good Accessibility/Shuttles	Access
	Accessible river
	easy access to river
	Shuttles
Good/Great Guiding	Good Guiding
	Great guiding
	Having a guide
High Abundance/Lots of Fish	50 steelhead per day
	catching fish
	catching steelhead
	Fish
	Lots of fish
	Love steelhead and Chinook
	Numbers of fish
	Rising fish
Low angling pressure	low angling pressure
Miscellaneous	Bymac services
	Guardians on the river
	High experience
Motorized boats permitted	Use of jet boats permitted
No motorized boats	No river boats
River size/River Attributes/River Flow	Great beautiful river
	Beautiful river
	Care of the river
	Classic ST water
	Nice drifts
Solitude/Peaceful	peaceful setting
Solitude/Peaceful	Solitude
	Un-crowded
Weather/Water level/Water clarity	Beautiful colour quality
	Cloud cover
	Good water
	Good weather
	Low water
	Morice always clean
	Nice weather
	Sunny
	Water clarity
	Water consistently clear
	Water quality
Wild/Native Fish	Beauty of fish
	catching wild steelhead
	Wild Steelhead
Wilderness/Wildlife	No Farms
	Wilderness
	Wildlife

Appendix 5. A summary of time spent interviewing

Appendix 5. A summary of time spent interviewing.

Date	week code	Morning Reach	Afternoon Reach	Day Type	Start Time	Time Stop	Weather	Secchi Depth (m)	Stream Gauge Height (cm)	Water Level	Reach	Anglers Observed	Anglers Interviewed	Time Entered	Time Exited
2004/08/31	01		1	Weekday	13:45	16:00	Partly Cloudy	2		Low	1	4	3	13:45	16:00
2004/09/01	01	3	4	Weekday	11:30	15:00	Overcast and showers	2	0.58	Low	3	0	0	11:30	12:45
2004/09/01	01	3	4	Weekday	11:30	15:00	Overcast and showers	2	0.58	Low	3	0	0	14:15	15:00
2004/09/01	01	3	4	Weekday	11:30	15:00	Overcast and showers	2	0.58	Low	4	0	0	12:45	14:15
2004/09/02	01	4	3	Weekday	8:45	17:40	Partly Cloudy	1.5	56	Low	3	0	0	13:45	15:20
2004/09/02	01	4	3	Weekday	8:45	17:40	Partly Cloudy	1.5	56	Low	4	4	4	11:55	13:44
2004/09/03	01	1	4	Weekday	8:45	17:30	Partly Cloudy	1.5	56	Dropping	1	3	3	9:30	11:40
2004/09/03	01	1	4	Weekday	8:45	17:30	Partly Cloudy	1.5	56	Dropping	4	0	0	13:30	16:00
2004/09/05	01	3	3	Weekend	8:45	18:30	Partly Cloudy and showers	1.5	58.5	Rising	3	0	0	9:30	11:30
2004/09/05	01	3	3	Weekend	8:45	18:30	Partly Cloudy and showers	1.5	58.5	Rising	3	6	6	11:30	14:45
2004/09/07	02	2	3	Weekday	9:40	13:30	Overcast and showers	2.5	57	Low	2	0	0	9:59	11:00
2004/09/07	02	2	3	Weekday	9:40	13:30	Overcast and showers	2.5	57	Low	3	4	3	11:00	13:30
2004/09/08	02	3	4	Weekday	8:45	17:00	Overcast and showers	1.5	62	Rising	3	4	4	9:28	11:04
2004/09/08	02	3	4	Weekday	8:45	17:00	Overcast and showers	1.5	62	Rising	4	4	4	12:25	14:30

Appendix 5. A summary of time spent interviewing.

Date	week code	Morning Reach	Afternoon Reach	Day Type	Start Time	Time Stop	Weather	Secchi Depth (m)	Stream Gauge Height (cm)	Water Level	Reach	Anglers Observed	Anglers Interviewed	Time Entered	Time Exited
2004/09/10	02	3	2	Weekday	8:46	16:40	Overcast	1.5	68	Rising	2	2	2	12:39	14:15
2004/09/10	02	3	2	Weekday	8:46	16:40	Overcast	1.5	68	Rising	3	0	0	9:30	11:51
2004/09/11	02	3	1	Weekend	8:30	15:35	Partly Cloudy and showers	1	77	Rising	1	8	6	13:15	15:35
2004/09/11	02	3	1	Weekend	8:30	15:35	Partly Cloudy and showers	1	77	Rising	3	2	2	9:10	11:40
2004/09/12	02	2	1	Weekend	7:45	15:30	Partly Cloudy	0.5	86	Rising	1	9	8	10:30	13:20
2004/09/12	02	2	1	Weekend	7:45	15:30	Partly Cloudy	0.5	86	Rising	2	2	2	8:45	10:23
2004/09/15	03	2	4	Weekday	8:45	18:00	Partly Cloudy and showers	1.5	82	Dropping	2	4	4	10:00	11:45
2004/09/15	03	2	4	Weekday	8:45	18:00	Partly Cloudy and showers	1.5	82	Dropping	4	8	8	13:10	15:50
2004/09/16	03	4	4	Weekday	7:45	18:00	Partly Cloudy	2	80	Dropping	4	5	5	10:26	12:25
2004/09/16	03	4	4	Weekday	7:45	18:00	Partly Cloudy	2	80	Dropping	4	6	5	13:20	16:10
2004/09/17	03	1	1	Weekday	8:00	15:30	Rain	1.5	78	Rising	1	2	2	12:20	14:30
2004/09/17	03	1	1	Weekday	8:00	15:30	Rain	1.5	78	Rising	1	8	8	8:00	10:40
2004/09/18	03	4	3	Weekend	8:45	16:45	Overcast with flurries	2	83	Dropping	3	4	0	13:00	14:30
2004/09/18	03	4	3	Weekend	8:45	16:45	Overcast with flurries	2	83	Dropping	4	1	1	10:40	12:20
2004/09/19	03	3	2	Weekend	8:00	16:30	Partly Cloudy	2	80	Dropping	2	13	9	10:25	13:50

Appendix 5. A summary of time spent interviewing.

Date	week code	Morning Reach	Afternoon Reach	Day Type	Start Time	Time Stop	Weather	Secchi Depth (m)	Stream Gauge Height (cm)	Water Level	Reach	Anglers Observed	Anglers Interviewed	Time Entered	Time Exited
2004/09/19	03	3	2	Weekend	8:00	16:30	Partly Cloudy	2	80	Dropping	3	1	1	8:34	10:25
2004/09/20	04	4		Weekday	8:00	15:30	Partly Cloudy	2	78	Dropping	4	10	10	8:45	13:00
2004/09/22	04	3	2	Weekday	8:30	16:30	Partly Cloudy	1.5	84	Rising	2	4	4	12:30	14:00
2004/09/22	04	3	2	Weekday	8:30	16:30	Partly Cloudy	1.5	84	Rising	3	3	3	10:00	11:52
2004/09/23	04	1	2	Weekday	8:00	16:30	Partly Cloudy	1.5	83	Dropping	1	11	9	8:00	11:20
2004/09/23	04	1	2	Weekday	8:00	16:30	Partly Cloudy	1.5	83	Dropping	2	8	8	12:30	15:08
2004/09/24	04	4	4	Weekday	7:30	17:00	Sunny/clear	1.5	82	Dropping	4	11	11	11:40	14:50
2004/09/24	04	4	4	Weekday	7:30	17:00	Sunny/clear	1.5	82	Dropping	4	13	13	8:25	11:00
2004/09/26	04	1	4	Weekend	8:30	18:55	Sunny/clear	2	79	Dropping	1	15	13	9:50	12:42
2004/09/26	04	1	4	Weekend	8:30	18:55	Sunny/clear	2	79	Dropping	4	9	9	14:10	16:40
2004/09/27	05	3	1	Weekday	7:45	16:30	Partly Cloudy	2	77	Dropping	1	13	13	11:15	15:10
2004/09/27	05	3	1	Weekday	7:45	16:30	Partly Cloudy	2	77	Dropping	3	0	0	8:35	10:10
2004/09/28	05	2	1	Weekday	9:00	19:23	Sunny/clear	2	75	Dropping	1	10	10	15:13	19:23
2004/09/28	05	2	1	Weekday	9:00	19:23	Sunny/clear	2	75	Dropping	2	18	18	9:55	14:00
2004/09/29	05	4	3	Weekday	8:00	15:30	Sunny/clear	2	73	Dropping	3	3	3	12:15	13:55

Appendix 5. A summary of time spent interviewing.

Date	week code	Morning Reach	Afternoon Reach	Day Type	Start Time	Time Stop	Weather	Secchi Depth (m)	Stream Gauge Height (cm)	Water Level	Reach	Anglers Observed	Anglers Interviewed	Time Entered	Time Exited
2004/09/29	05	4	3	Weekday	8:00	15:30	Sunny/clear	2	73	Dropping	4	9	8	8:50	11:07
2004/10/01	05	0	1	Weekday	17:30	19:30	Sunny/clear		66	Dropping	1	10	10	17:30	19:30
2004/10/02	05		5	Weekend	8:00	20:15	Sunny/clear	2.5	66	Dropping	5	16	16	14:25	18:35
2004/10/04	06	5	3	Weekday	8:45	17:30	Overcast	2.5	60	Dropping	3	6	5	13:46	16:00
2004/10/04	06	5	3	Weekday	8:45	17:30	Overcast	2.5	60	Dropping	5	3	3	10:40	12:32
2004/10/06	06	2	3	Weekday	8:45	18:30	Partly Cloudy	2.5	60	Dropping	2	9	7	8:45	12:27
2004/10/06	06	2	3	Weekday	8:45	18:30	Partly Cloudy	2.5	60	Dropping	3	23	23	13:00	16:30
2004/10/07	06	3	2	Weekday	7:45	17:30	Partly Cloudy	2	60	Steady	2	12	12	12:30	14:30
2004/10/07	06	3	2	Weekday	7:45	17:30	Partly Cloudy	2	60	Steady	3	11	11	8:40	11:00
2004/10/10	06	5	1	Weekend	18:45	17:15	Overcast and showers	2	60	Steady	1	5	5	14:10	16:00
2004/10/10	06	5	1	Weekend	18:45	17:15	Overcast and showers	2	60	Steady	5	15	13	10:12	12:40
2004/10/11	07	1	4	Weekday	8:00	17:00	Partly Cloudy and showers	1.5	65	Rising	1	4	2	8:00	9:41
2004/10/11	07	1	4	Weekday	8:00	17:00	Partly Cloudy and showers	1.5	65	Rising	4	13	12	10:40	13:27
2004/10/13	07	4	2	Weekday	8:00	17:00	Partly Cloudy and showers	0.5	96	Rising	2	0	0	14:00	15:00

Appendix 5. A summary of time spent interviewing.

Date	week code	Morning Reach	Afternoon Reach	Day Type	Start Time	Time Stop	Weather	Secchi Depth (m)	Stream Gauge Height (cm)	Water Level	Reach	Anglers Observed	Anglers Interviewed	Time Entered	Time Exited
2004/10/13	07	4	2	Weekday	8:00	17:00	Partly Cloudy and showers	0.5	96	Rising	4	10	7	10:00	12:45
2004/10/14	07	1	3	Weekday	8:00	15:00	Partly Cloudy	0.1	1.04	Rising	1	3	0	8:00	10:00
2004/10/14	07	1	3	Weekday	8:00	15:00	Partly Cloudy	0.1	1.04	Rising	3	1	1	10:45	13:00
2004/10/15	07	3	1	Weekday	8:00	16:00	Partly Cloudy and showers	0.5	1.65	Steady	1	6	4	11:00	12:30
2004/10/15	07	3	1	Weekday	8:00	16:00	Partly Cloudy and showers	0.5	1.65	Steady	3	0	0	8:30	10:10
2004/10/16	07	5	4	Weekend	7:30	15:30	Partly Cloudy	2	1.5	Rising	4	3	3	10:34	12:18
2004/10/16	07	5	4	Weekend	7:30	15:30	Partly Cloudy	2	1.5	Rising	5	14	14	9:00	13:15
2004/10/17	07	3	3	Weekend	8:30	16:30	Overcast with flurries	0.5	1.2	Steady	3	0	0	9:45	11:01
2004/10/17	07	3	3	Weekend	8:30	16:30	Overcast with flurries	0.5	1.2	Steady	5	8	8	12:15	14:20
2004/10/18	08	3	3	Weekday	8:00	15:30	Overcast with flurries	1	1.2	Steady	3	2	2	8:46	9:46
2004/10/18	08	3	3	Weekday	8:00	15:30	Overcast with flurries	1	1.2	Steady	3	2	2	11:30	13:00
2004/10/19	08	4	4	Weekday	8:00	14:30	Partly Cloudy	2	0.98	Dropping	4	0	0	8:35	10:25
2004/10/19	08	4	4	Weekday	8:00	14:30	Partly Cloudy	2	0.98	Dropping	4	0	0	11:20	13:00
2004/10/22	08	1	3	Weekday	9:00	18:00	Partly Cloudy	1.5	86	Dropping	1	11	11	10:50	13:22

Appendix 5. A summary of time spent interviewing.

Date	week code	Morning Reach	Afternoon Reach	Day Type	Start Time	Time Stop	Weather	Secchi Depth (m)	Stream Gauge Height (cm)	Water Level	Reach	Anglers Observed	Anglers Interviewed	Time Entered	Time Exited
2004/10/22	08	1	3	Weekday	9:00	18:00	Partly Cloudy	1.5	86	Dropping	3	2	2	14:30	16:00
2004/10/23	08	5	5	Weekend	8:00	17:30	Partly Cloudy	2	83	Dropping	5	9	6	9:37	11:53
2004/10/23	08	5	5	Weekend	8:00	17:30	Partly Cloudy	2	83	Dropping	5	9	7	12:50	15:05
2004/10/24	08	3	2	Weekend	8:00	12:30	Partly Cloudy		80	Dropping	1	1	1	11:50	12:00
2004/10/26	09	3	2	Weekday	8:00	16:00	Partly Cloudy	2	74	Dropping	2	2	2	12:20	14:10
2004/10/26	09	3	2	Weekday	8:00	16:00	Partly Cloudy	2	74	Dropping	3	5	3	9:40	11:30
2004/10/28	09	2	5	Weekday	9:00	17:30	Partly Cloudy	1.5	70	Dropping	2	5	5	9:43	12:00
2004/10/28	09	2	5	Weekday	9:00	17:30	Partly Cloudy	1.5	70	Dropping	5	0	0	13:28	15:15
2004/10/29	09	2	1	Weekday	8:00	16:00	Partly Cloudy	2	68	Dropping	1	11	10	10:55	13:40
2004/10/29	09	2	1	Weekday	8:00	16:00	Partly Cloudy	2	68	Dropping	2	2	0	8:32	10:05
2004/10/30	09	3	2	Weekend	9:00	15:00	Partly Cloudy	2	65	Dropping	2	8	8	11:26	13:45
2004/10/30	09	3	2	Weekend	9:00	15:00	Partly Cloudy	2	65	Dropping	3	0	0	9:00	10:40
2004/10/31	09	1	5	Weekend	8:00	17:00	Partly Cloudy	2	62	Dropping	1	7	7	8:00	10:45
2004/10/31	09	1	5	Weekend	8:00	17:00	Partly Cloudy	2	62	Dropping	5	0	0	12:30	14:04
2004/11/01	10	5	3	Weekday	8:00	17:00	Partly Cloudy	2	60	Dropping	3	3	3	12:50	14:40

Appendix 5. A summary of time spent interviewing.

Date	week code	Morning Reach	Afternoon Reach	Day Type	Start Time	Time Stop	Weather	Secchi Depth (m)	Stream Gauge Height (cm)	Water Level	Reach	Anglers Observed	Anglers Interviewed	Time Entered	Time Exited
2004/11/01	10	5	3	Weekday	8:00	17:00	Partly Cloudy	2	60	Dropping	5	0	0	10:00	11:30
2004/11/02	10	3	1	Weekday	8:00	14:30	Partly Cloudy	2	58	Dropping	1	6	6	10:52	13:44
2004/11/02	10	3	1	Weekday	8:00	14:30	Partly Cloudy	2	58	Dropping	3	0	0	8:30	10:03
2004/11/04	10	5	5	Weekday	8:00	16:00	Partly Cloudy	1.5	58	Dropping	5	0	0	12:15	14:00
2004/11/06	10	0	5	Weekend	8:00	16:30	Partly Cloudy	1.5	120	Dropping	5	4	4	11:18	14:13
2004/11/07	10	1	0	Weekend	8:00	14:30	Snow	0.5	110	Dropping	1	0	0	9:30	11:15

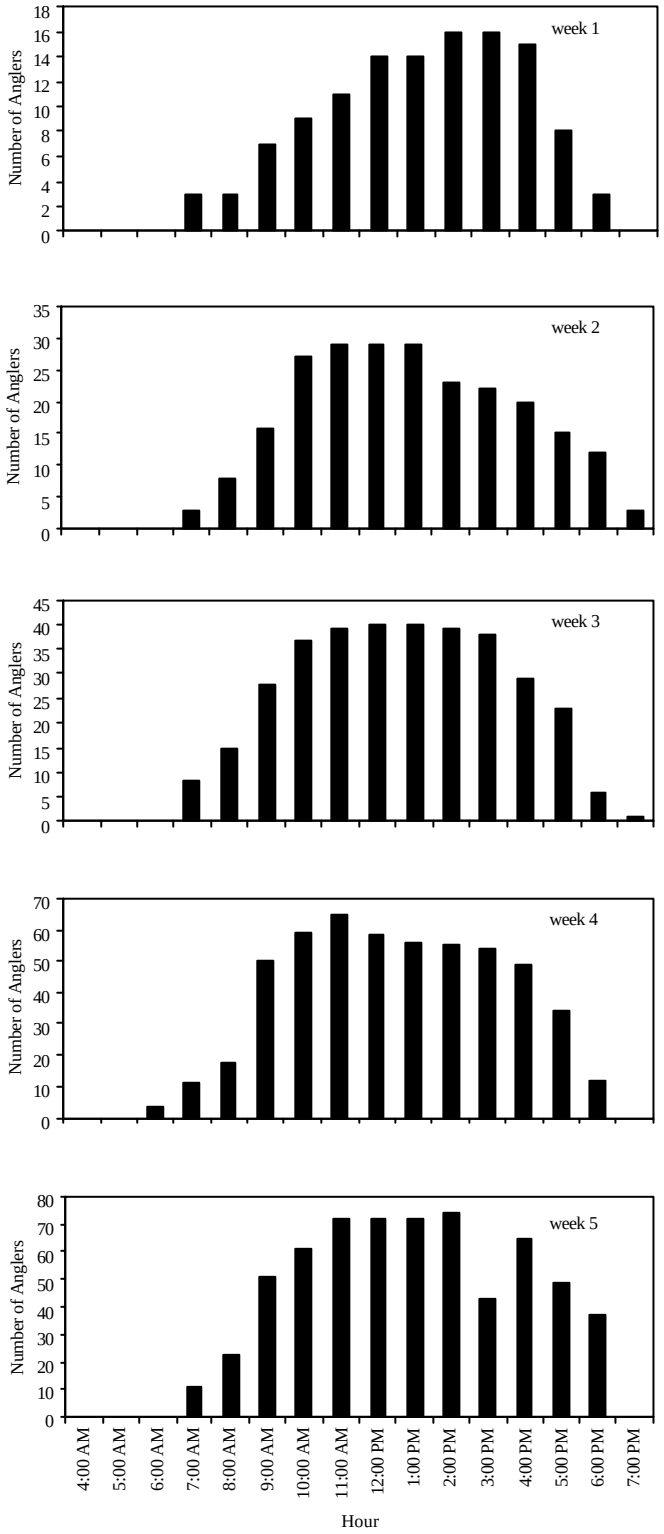
Appendix 6. A summary of the flight data

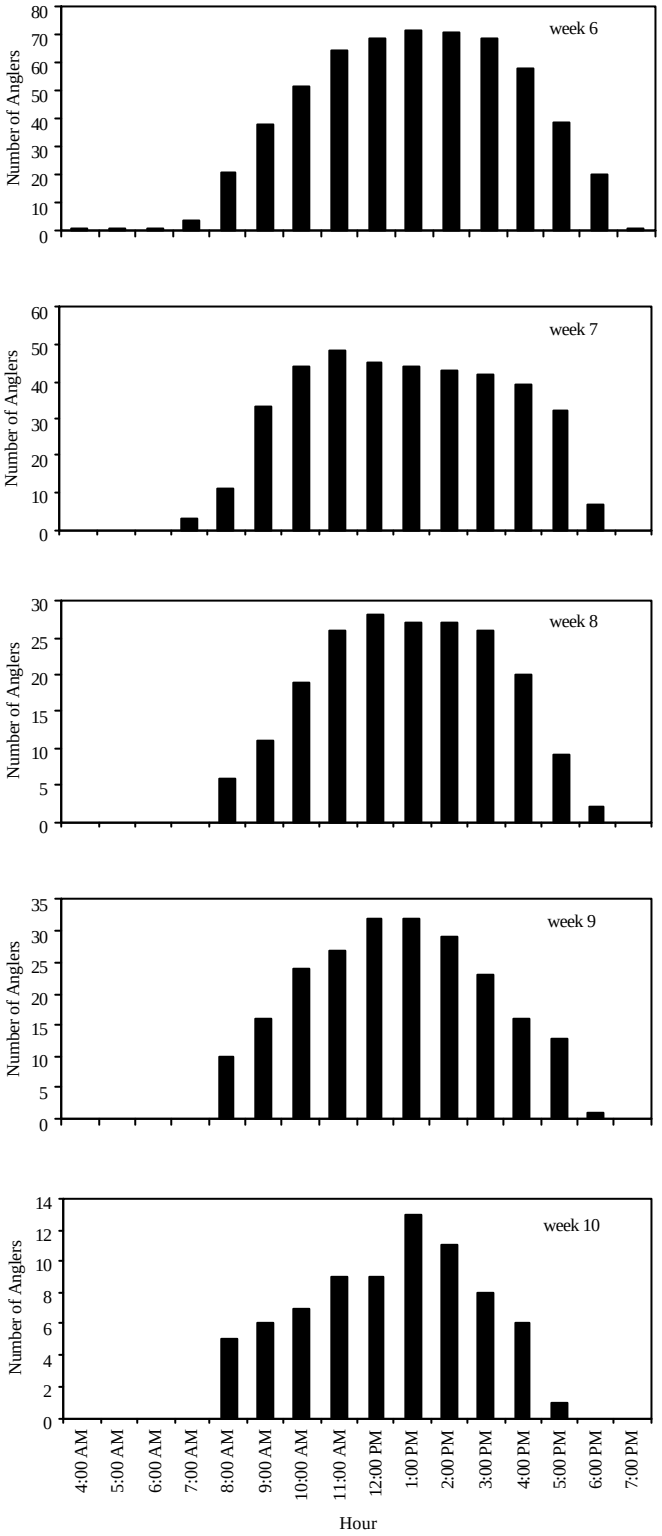
	Flight Date	03-Sep	05-Sep	08-Sep	12-Sep	17-Sep	18-Sep	23-Sep	26-Sep	01-Oct	02-Oct	07-Oct	11-Oct	15-Oct
	Flight #	1	2	3	4	5	6	7	8	9	10	11	12	13
	Flight Duration	0.9	1.1	1	1.1	1.1	1	1.1	1	cancelled	1	0.9	1	1.2
	Weather	part.cloud	part. Cloud	overcast	part. Cloud	overcast, rain	overcast	part. Cloud	sun	boat not	sun	partial cloud/100%	overcast	partial cloud/100%
	Water level	low	low	rising	rising	rising	rising	rising		working	dropping	dropping	rising	high
	Water Clarity	clear	clear	clear	turbid	turbid	turbid	turbid	clear		clear	clear	turbid	turbid
	Start Time	12:53:00 PM	12:30:00 PM	12:36:00 PM	12:19:00 PM	12:33:00 PM	12:45:00 PM	12:50:00 PM	1:12:00 PM		12:31:00 PM	13:13:00 PM	12:44:00 PM	13:17:00 PM
Section I	Anglers	5	11	6	13	4	9	9	11		13	25	7	4
Forks -	Fly	3	7	1	2	3	6	2	10		10	9	5	1
Knapper Creek	Gear	2	4	1	2	0	0	0	0		0	0	2	3
	Jet Boats	2	3	2	4	1	4	6	5		4	5	2	1
	Drift Boats	0	2	0	1	0	1	0	0		4	9	2	0
	Guided	0	0	3	0	4	2	0	0		3	3	0	0
Section II	Anglers	0	5	0	4	0	4	8	14		8	6	3	0
Knapper Creek -	Fly	0	2	0	0	0	3	4	7		3	6	3	0
Owen Canyon	Gear	0	3	0	0	0	0	1	3		2	0	0	0
	Jet Boats	0	1	0	1	0	2	1	1		4	0	0	0
	Drift Boats	0	0	0	0	0	0	2	6		0	5	2	0
	Guided	0	0	0	0	0	0	3	0		0	0	0	0
Section III	Anglers	1	5	2	6	0	0	15	9		8	7	9	3
Owen Canyon -	Fly	0	5	0	5	0	0	11	6		8	4	9	3
Lamprey Creek	Gear	0	0	0	1	0	0	1	0		0	0	0	0
	Jet Boats	1	2	1	2	0	0	2	1		1	2	3	1
	Drift Boats	0	0	0	0	0	0	3	2		0	2	2	0
	Guided	0	3	2	3	0	0	3	5		0	4	0	3
Section IV	Anglers	0	4	4	0	1	1	10	10		4	7	9	5
Lamprey Creek -	Fly	0	0	4	0	0	0	10	8		0	5	7	5
Gosnell Creek	Gear	0	0	0	0	0	0	0	0		0	0	0	0
	Jet Boats	0	1	1	0	0	0	1	2		3	1	2	0
	Drift Boats	0	0	0	0	1	1	3	2		0	3	3	0
	Guided	0	4	4	0	0	0	4	4		0	4	6	0
Section V	Anglers		0	0	0	0	0	0	0		12	0	2	12
Gosnell Creek	Fly		0	0	0	0	0	0	0		2	0	2	12
Morice Lake	Gear		0	0	0	0	0	0	0		0	0	0	0
	Jet Boats		0	0	0	0	0	0	0		5	0	2	1
	Drift Boats		0	0	0	0	0	0	0		0	0	0	3
	Guided		0	0	0	0	0	0	0		0	0	0	0
Total	Anglers	**6**	**25**	**12**	**23**	**5**	**14**	**42**	**44**		**45**	**45**	**30**	**24**
	Fly	**3**	**14**	**5**	**7**	**3**	**9**	**27**	**31**		**23**	**24**	**26**	**21**
	Gear	**2**	**7**	**1**	**3**	**0**	**0**	**2**	**3**		**2**	**0**	**2**	**3**
	Jet Boats	**3**	**7**	**4**	**7**	**1**	**6**	**10**	**9**		**17**	**8**	**9**	**3**
	Drift Boats	**0**	**2**	**0**	**1**	**1**	**2**	**8**	**10**		**4**	**19**	**9**	**3**
	Guided	**0**	**7**	**9**	**3**	**4**	**2**	**10**	**9**		**3**	**11**	**6**	**3**

Guided includes the guide

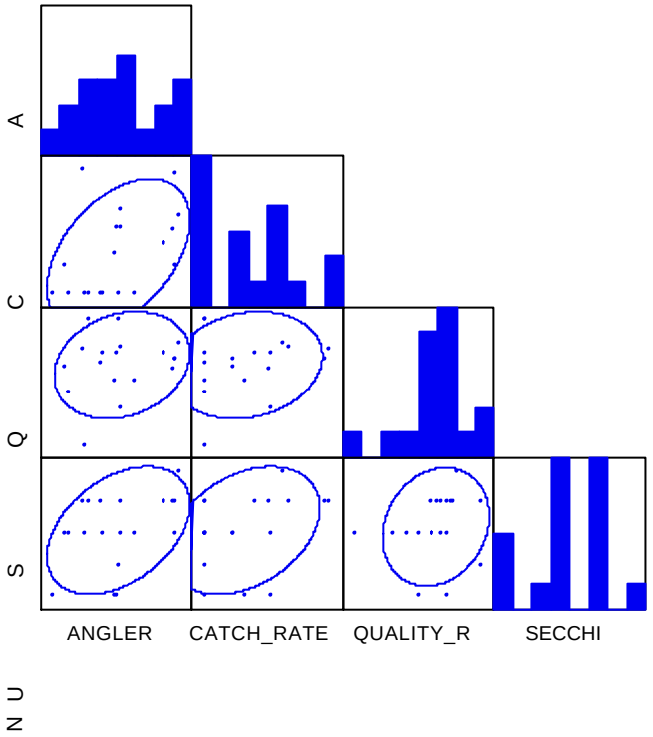
	Flight Date	16-Oct	18-Oct	23-Oct	28-Oct	31-Oct	01-Nov	07-Nov	Totals
	Flight #	14	15	16	17	18	19	20	
	Flight Duration	1.2	1	1.2	1.1	1	1	1	
	Weather	partial cloud	overcast	showers	partial cloud	partial cloud	100% overcast,	100% overcast,	
	Water level	dropping	dropping	dropping	dropping	dropping	dropping	rising	
	Water Clarity	turbid	turbid	clear	clear	clear	clear	turbid	
	Start Time	12:25:00 PM	13:00:00 PM	13:24:00 PM	12:27:00 PM	12:35:00 PM	12:32:00 PM	12:38:00 PM	
Section I	Anglers	7	9	7	4	3	6	1	154
Forks -	Fly	3	8	6	3	2	0	1	82
Knapper Creek	Gear	3	0	0	0	0	3	0	20
	Jet Boats	1	0	2	3	1	0	0	46
	Drift Boats	0	5	0	0	0	1	0	25
	Guided	0	0	3	0	0	0	0	18
Section II	Anglers	4	5	2	1	5	0	0	69
Knapper Creek -	Fly	4	5	2	0	4	0	0	43
Owen Canyon	Gear	0	0	0	0	0	0	0	9
	Jet Boats	0	0	0	1	0	0	0	11
	Drift Boats	2	2	2	0	2	0	0	23
	Guided	0	0	0	0	0	0	0	3
Section III	Anglers	2	0	0	10	6	3	0	86
Owen Canyon -	Fly	2	0	0	8	3	3	0	67
Lamprey Creek	Gear	0	0	0	0	0	0	0	2
	Jet Boats	1	0	0	1	1	0	0	19
	Drift Boats	0	0	0	3	2	1	0	15
	Guided	0	0	0	4	0	0	0	27
Section IV	Anglers	16	8	8	4	3	1	0	95
Lamprey Creek -	Fly	15	7	3	4	3	1	0	72
Gosnell Creek	Gear	0	0	0	0	0	0	0	0
	Jet Boats	3	1	2	1	0	0	0	18
	Drift Boats	0	2	1	0	1	0	0	17
	Guided	7	2	3	4	0	0	0	42
Section V	Anglers	11	3	7	0	0	2	0	49
Gosnell Creek	Fly	8	0	7	0	0	0	0	31
Morice Lake	Gear	0	0	0	0	0	0	0	0
	Jet Boats	4	1	3	0	0	1	0	17
	Drift Boats	1	0	0	0	0	0	0	4
	Guided	0	0	0	0	0	0	0	0
Total	Anglers	40	25	24	19	17	12	1	453
	Fly	32	20	18	15	12	4	1	295
	Gear	3	0	0	0	0	3	0	31
	Jet Boats	9	2	7	6	2	1	0	111
	Drift Boats	3	9	3	3	5	2	0	84
	Guided	7	2	6	8	0	0	0	90

Appendix 7. Weekly summaries of the number of anglers that fished during each one hour time block.




week 6
Number of Anglers
0
10
20
30
40
50
60
70
80
week 7
Number of Anglers
0
10
20
30
40
50
60
week 8
Number of Anglers
0
5
10
15
20
25
30
week 9
Number of Anglers
0
5
10
15
20
25
30
35
week 10
Number of Anglers
0
2
4
6
8
10
12
14
4:00 AM
5:00 AM
6:00 AM
7:00 AM
8:00 AM
9:00 AM
10:00 AM
11:00 AM
12:00 PM
1:00 PM
2:00 PM
3:00 PM
4:00 PM
5:00 PM
6:00 PM
7:00 PM
Hour

Appendix 8. Correlation matrix for key angling variables (aerial counts, catch rate, quality rating and secchi depth).



Correlation matrix for key angling variables (n=18)

Pearson correlation coefficients for key angling variables

	Adjusted Angler count	Catch	Quality Rating
Catch	0.401		
Quality Rating	0.212	0.162	
Secchi Depth	0.285	0.289	0.182