Kispiox River Steelhead: Summary of Current Data and Status Review, 1997

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SUMMARY

This report summarizes the status, and current data available on the Kispiox River steelhead (*Oncorhynchus mykiss*) population. Kispiox steelhead spend on average 2 years at sea after smolting, and return to the Skeena River through D.F.O. Canada Statistical Area 4 during mid August to early September. Males average 86.1 cm in fork length and 7.37 kg in weight, while females average 79.0 cm and 5.64 kg in weight. Overwintering, spawning, and juvenile rearing locations are also mapped. Total angler effort for steelhead, total catch of steelhead, and catch per unit effort trends on the Kispiox River are summarized from the Steelhead Harvest Analysis database and from the Angling Guide Management System database. Management and future study recommendations are made to help in further study programs in the watershed.

ACKNOWLEDGEMENTS

I thank Dana Atagi, Chuck Parken, Mark Beere, and Joe DeGisi for helpful advice with this project. Funding for this work was provided by the Forest Renewal BC operational inventory program (Skeena Bulkley Region).

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1.0 INTRODUCTION

Of all steelhead (*Oncorhynchus mykiss*) populations in the Skeena River system, Kispiox River fish are world renowned for their large average size (Combs 1991). Steelhead that return to the Kispiox each year are among the largest steelhead in the world, and based on this fact the population should be adequately protected to ensure the persistence and survival of these unique fish. The purpose of this report is to provide a summary of the data currently available on Kispiox River steelhead, and to provide recommendations for future work to fill in the gaps in terms of life-history and fisheries management considerations. This review covers the following topics of the life-history of this population of steelhead:

1) Freshwater and ocean life-history review;
2) Identification and mapping of juvenile rearing areas, adult overwintering areas, and spawning site locations;
3) Review of past enhancement attempts;
4) Review of adult assessments;
5) Review of adult run timing;
6) Review of catch, angler effort, and catch per unit effort information;
7) Review of angling guide activity;
8) Review of creel survey information;
9) Review of current angling regulations;
10) Description of recreational fisheries;
11) Review of First Nations uses and harvests;
12) Review of minimum escapement requirements;
13) Summary of current stock status.

This population of steelhead should be closely monitored to minimize habitat impacts, and ensure there are no abundance declines. This is based on the ease of angler access, the proximity of the river to First Nations harvest locations, the fact that the Kispiox River is a target destination for anglers and focus of a high amount of angler effort, and forestry concerns in the watershed. The main objective of this report is to also provide recommendations for management and future study of the population, and these recommendations are dealt with in the conclusions and recommendations section at the end of this report.

2.0 STUDY AREA

The site description of the Kispiox River has been fully documented in other studies (e.g., Whately 1977) and this short summary is based on those studies. The Kispiox River flows into the Skeena River, 16 kilometers north of the town of Hazelton (Figure 1). The watershed drains an area of approximately 2,100 km^2, and the mainstem river is 140 kilometers long. The waters of the Kispiox arise from glaciers in the Skeena Mountains, but is also fed by many small lakes and bogs. Whately (1977) suggests that these water bodies moderate flows and provide high quality water to the system. The watershed is located in a transition zone between the coastal and interior biogeoclimatic zones, and is found in both the Interior Cedar-Hemlock and Coastal Western Hemlock biogeoclimatic zones (Meidinger and Pojar 1991).

Other fish species that are found in the system include pink salmon (*Oncorhynchus gorbuscha*), chum salmon (*O. keta*), coho salmon (*O. kisutch*), chinook salmon (*O. tshawytscha*), sockeye salmon (*O. nerka*), mountain whitefish (*Prosopium williamsoni*), bull trout (*Salvelinus confluentus*), Dolly Varden (*S. malma*), longnose sucker (*Catostomus catostomus*), cutthroat trout (*O. clarki*), northern squawfish (*Ptychocheilus oregonensis*), rainbow trout, and sculpins (*Cottus* spp.).

The Kispiox River has many tributaries including the Date Creek, Murder Creek, Cullon Creek, Ironside Creek, the Sweetin River, and the Nangeese River within the watershed, as well as many small lakes (Figure 2). Many of these small tributaries are important for spawning and rearing of different fish species including steelhead, and may buffer water flows and moderate temperatures.

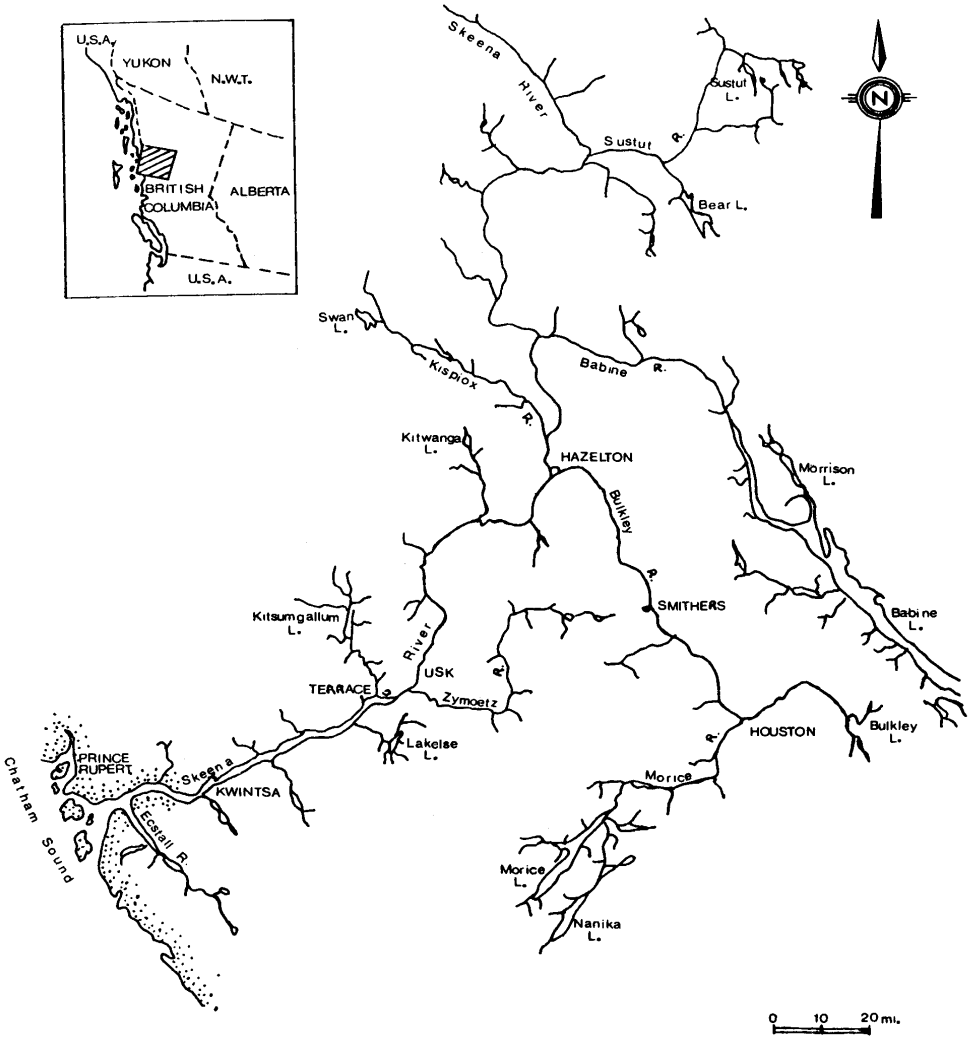


Figure 1. Location of the Kispiox River watershed in the Skeena River in northcentral British Columbia (adapted from Whately 1977).

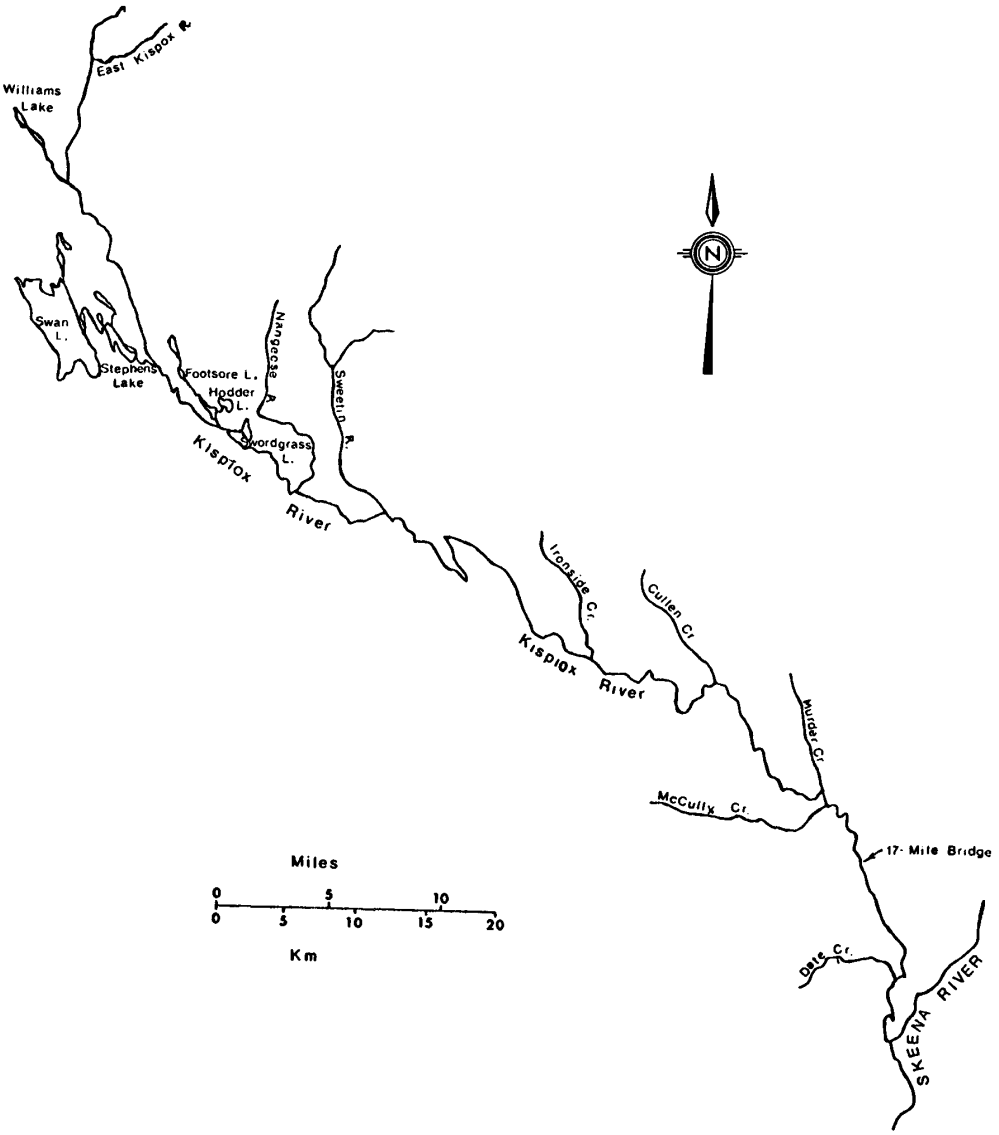


Figure 2. Map of the Kispiox River showing major tributaries (adapted from Lough 1980).

3.0 MATERIALS AND METHODS

3.1 Data Collection and Review

For this review, data were collected and reviewed from a number of sources to fully compile information available on the biology of this population of steelhead. These sources included:

1) Ministry of Environment, Lands, and Parks (M.E.L.P.) stream files (Smithers, B.C.);
2) FISS/SISS database;
3) Cataloged reports in the M.E.L.P. library (Smithers, B.C.);
4) Steelhead Floy tag (TAGS) database;
5) Angling guide management (AGMS) database;
6) Watershed Restoration Program reports;
7) Forest Renewal BC stream inventory reports;
8) Reports submitted under fish collection permit;
9) Steelhead harvest analysis (SHA) database;
10) Forest industry licensee(s);
11) Fisheries Improvement and Assessment Unit stream inventory reports;
12) Creel survey reports;
13) Primary literature sources;
14) M.E.L.P. fish scale archive data;
15) Personal communications with people that have worked in the Kispiox River watershed.

3.2 Data Entry

Data were entered that were collected from M.E.L.P. aged scale information from sampled steelhead, and the entered data were used to calculate average lengths, weights, and ocean and freshwater residency periods where possible (the entered scale age data is found in Appendix I).

3.3 Database Searches

Supplied databases from M.E.L.P. were searched to collect information on steelhead movements and run timing, as well as information regarding angling activity from both the Steelhead Harvest Analysis (SHA) database and the Angling Guide (AGMS) database.

4.0 RESULTS AND DISCUSSION

4.1 Ocean Life-History (as determined by scale aging)

On average steelhead of the Kispiox River spend two years in the ocean before returning to spawn in their natal stream (Table 1). There was no apparent difference in the number of years that males and females spent in saltwater prior to returning to spawn, and the range in the number of years that steelhead spend in the ocean is from one to four years (Table 1). Jack males were also present in small numbers.

Table 1. Number of years that adult Kispiox River steelhead (*Oncorhynchus mykiss*) remain in the ocean after migrating to sea as smolts prior to their first spawning (as determined from scale aging done by M.E.L.P.).

	Mean (years)	**S.E.**	**Median (years)**	**Range (years)**	**N**
All Individuals	2.15	0.02	2	1-4	549
Females	2.04	0.02	2	1-4	320
Males	2.30	0.05	2	1-4	227

4.2 Migration Timing through Fisheries and Oceans Canada Statistical Area 4 and into the Lower Skeena River

There are a number of studies that focused on estimating the run timing of Kispiox River steelhead using a variety of techniques including radio telemetry and scale analysis. Kispiox River steelhead begin their upstream migration through the lower Skeena River later than the early run stocks of the Morice and Sustut rivers. Migrations likely begin early in August, and peak around mid to late August (Table 2). Cox-Rogers (1985) found from an analysis of the growth patterns of steelhead scales, that in 1984 and 1985 the bulk of the catch of Kispiox River steelhead caught incidentally in the commercial fishery occurred between July 20th to August 12th in both years, prior to entry into freshwater. These fish were predominantly harvested later in the commercial fishing season, and accounted for a large portion of the total catch of steelhead harvested incidentally during the commercial fishery (Ward *et al.* 1993).

Table 2. Migration timing of Kispiox River steelhead (*Oncorhynchus mykiss*) through D.F.O. Canada Statistical Area 4 and into the lower Skeena River at Tyee.

Year	Timing	Method	Reference
1980	mid August to early September	Radio Telemetry	Lough 1980
1984, 1985	mid to late August	Scale Analysis	Cox-Rogers 1985, 1986
1991	Mid Aug. (peak Aug. 13)	Back Calculation from Tag Information	Ward *et al.* 1993
1994	prior to Aug. 15	Radio Telemetry	Koski *et al.* 1995
1987-1991	peak Aug. 15-17	Floy tag recaptures	Spence and Hooton 1992
1988-1996	July 25 to Sept. 4 (peak mid Aug.)	TAGS Database	This report (see Appendix II)

4.3 Harvest Rates of Kispiox River Steelhead in Area 4

Kispiox River steelhead are harvested incidentally in commercial fisheries in Area 4, and perhaps the best estimates of commercial harvest rates are those predicted by Ward *et al.* (1993) based on model simulations. Predicted harvest rates for the period of 1986 to 1991 ranged from 31% (1989) to 52% (1988), with a mean (± S.E.) predicted annual harvest rate from 1986 to 1991 being 41.2% (± 3.5%). These rates suggest that each year during commercial fisheries a high percentage of the returning steelhead stock is harvested incidentally by the commercial fishery.

4.4 Upstream Migration Rates

The best data available on upstream migration rates of steelhead bound for the Kispiox River is from studies undertaken in 1994 and 1995. In 1994, radio tagged Kispiox steelhead traveled on average (±S.E.) 7.1 (±0.77) km per day (Koski *et al.* 1995), while in 1995 radio tagged Kispiox steelhead traveled on average 4.8 (±1.51) km per day (Alexander *et al.* 1996). When data on migration movements of Kispiox steelhead are compared to other stocks of steelhead in the upper Skeena River, it is suggestive that

upstream movements are slower for Kispiox fish, possibly due to the decreased distance these fish must travel to their spawning areas.

4.5 Minimum Escapement Levels

In 1992, Tautz *et al.* (1992) produced a model that predicted adult production of steelhead at carrying capacity, and the number of spawners at maximum sustainable yield (MSY) in rivers throughout the Skeena River watershed. This model was based on the total area and total useable area of streams containing steelhead for the summer low-flow period, and estimated stream width, as well as known population dynamics parameters for one B.C. steelhead population (Keogh River on Vancouver Island). For the Kispiox River the predicted adult production at carrying capacity (K) was estimated at 6852 individuals, while the number of spawners at maximum sustainable yield (MSY) was estimated at 1754 individuals.

4.6 Escapement Information

Prior to 1994 and 1995, there have been no studies that have directly estimated the escapement of adult steelhead to the Kispiox River. Based on smolt yield at carrying capacity, Stuart (1981) estimated adult escapement between 1,711 and 2,811 individuals. In 1994 it was estimated that 4027 steelhead returned (Koski *et al*. 1995), and in 1995 it was estimated that 2514 steelhead returned (Alexander *et al*. 1996). These estimates are below the predicted adult production at carrying capacity, but above the number of spawners required at maximum sustainable yield predicted by Tautz *et al*. (1992); however, these estimates are likely biased due to low tag numbers, minimal recaptures, and thus underestimate steelhead escapement. Close regulation of the steelhead fishery (Native fishery and incidental captures in the commercial fishery) in this system would also prevent escapement levels being so low that a conservation concern would be a factor due to low escapement.

4.7 Sex Ratio

There have been no studies where the direct enumeration of steelhead migrating into the Kispiox River has been undertaken, so a direct estimate of the sex ratio of steelhead can

not be made. Based on the steelhead captured for aging, I calculated the sex ratio of fish sampled each year to roughly estimate a sex ratio. This calculation assumes that the catchability of males and females is equal. Based on the samples for scale aging the sex ratio is approximately 1:1 (1.41 females to males), and is similar to the 1.25:1 ratio calculated in 1975 (Whately 1977), and the 1:1 ratio calculated in 1969 (Pinsent 1970).

4.8 Size Distribution (Fork Length and Weight) of Mature Steelhead

Length and weight data have been collected from steelhead that were sampled for scale aging over the past 20 years. For all sampled steelhead in the Kispiox River, males were larger than females in both fork length (t-test, $P<0.001$) and weight (t-test, $P<0.001$) (Table 3). The fork length and weight frequency histograms (Figure 3a and 3b) for all steelhead sampled in the Kispiox River suggested that the distribution of fork length and weight was bimodal. This was also the case for the fork length frequency histograms for females and males (Figure 4). The weight frequency histograms for males and females were normally distributed (Figure 5).

Table 3. Summary of fork length and weight data collected from adult steelhead (*Oncorhynchus mykiss*) sampled in the Kispiox River for scale aging from 1972 to 1996.

	Fork Length (cm)				Weight (kg)			
	Mean	**S.E.**	**Range**	**N**	**Mean**	**S.E.**	**Range**	**N**
All fish	81.8	0.4	41.4-114.3	655	6.44	0.13	1.5-14.3	348
Females	79.0	0.4	41.4-104.1	394	5.64	0.13	1.8-10.9	187
Males	86.1	0.8	49.1-114.3	261	7.37	0.23	1.5-14.3	161

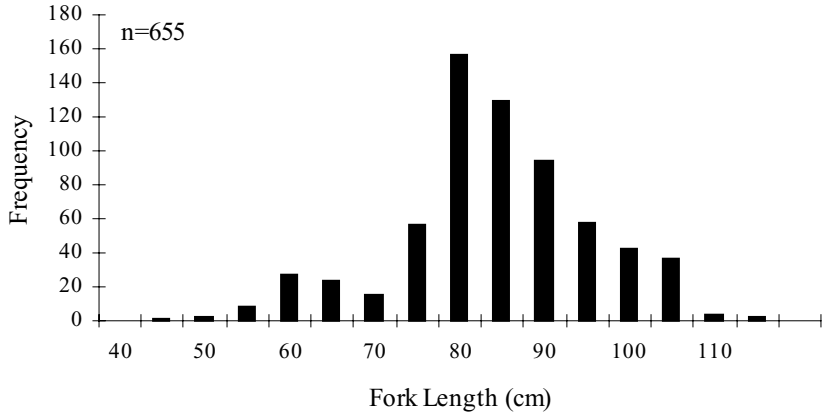


Figure 3a. Length frequency histogram of all adult steelhead (*Oncorhynchus mykiss*) sampled in the Kispiox River for scale aging from 1972 to 1996.

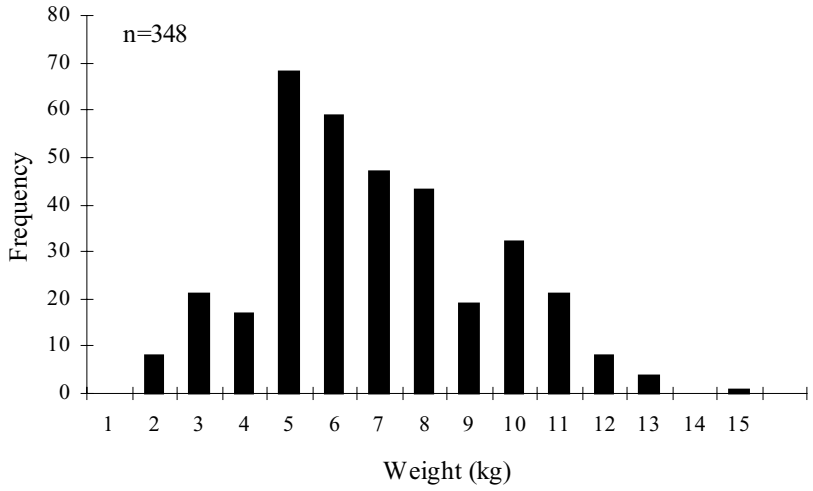


Figure 3b. Weight frequency histogram of all adult steelhead (*Oncorhynchus mykiss*) sampled in the Kispiox River for scale aging from 1972 to 1996.

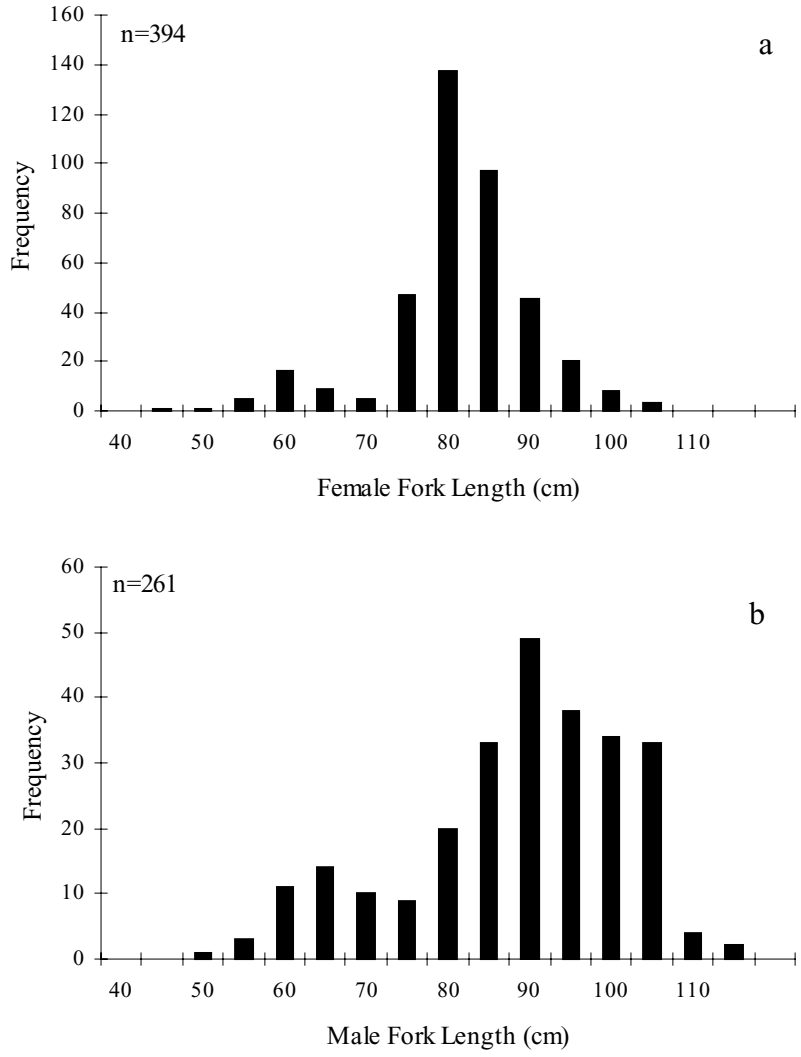


Figure 4. Length frequency histogram of adult steelhead (*Oncorhynchus mykiss*) sampled in the Kispiox River for scale aging from 1972 to 1996 (a = females, b = males).

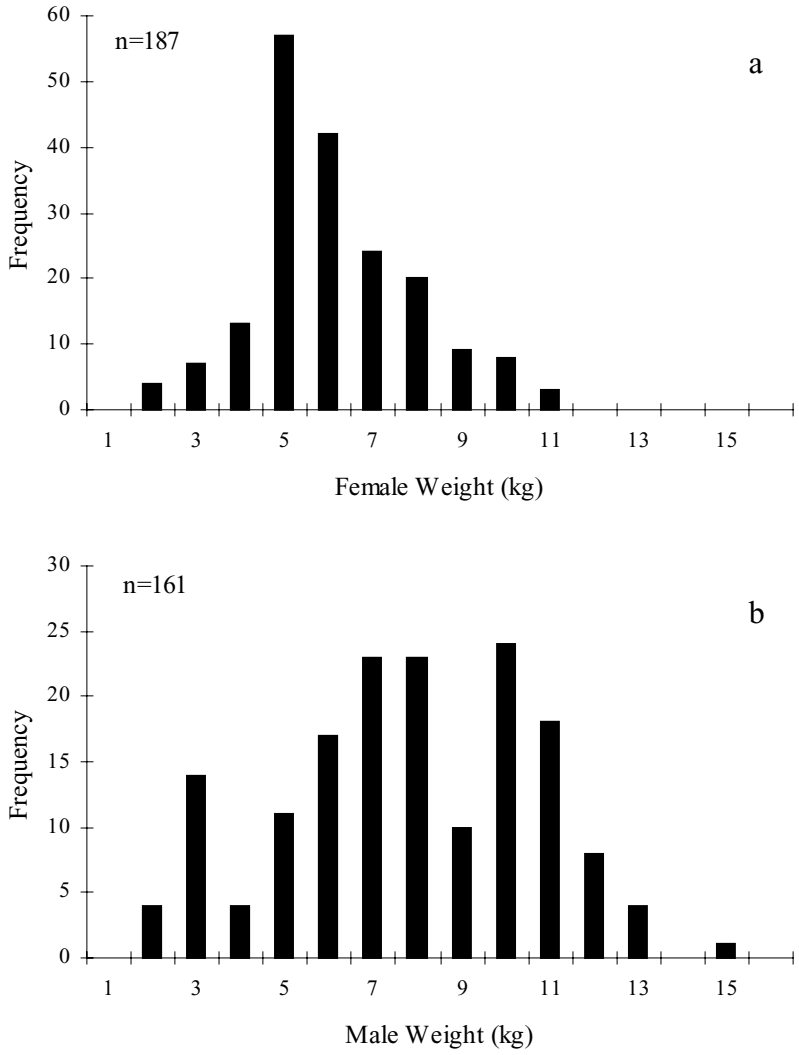


Figure 5. Weight frequency histogram of adult steelhead (*Oncorhynchus mykiss*) sampled in the Kispiox River for scale aging from 1972 to 1996 (a = females, b = males).

4.8.1 Length-Weight Relationships

For all steelhead sampled, the regression between weight and fork length (Log_{10} Weight = -3.90 + 2.43 Log_{10} Fork Length; n = 318; r^2 = 0.77) indicated positive allometric growth (e.g., slope ~3.0, as defined in Ricker 1975) (Figure 6a). For female steelhead, the regression between weight and fork length (Log_{10} Weight = -3.18 + 2.05 + Log_{10} Fork Length; n = 167; r^2 = 0.64) also indicated positive allometric growth (Figure 6b), as did the regression between weight and fork length (Log_{10} Weight = -4.28 + 2.64 Log_{10} Fork Length; n = 151; r^2 = 0.83) for males (Figure 6c).

4.9 Adult Overwintering Areas

After migrating into the Kispiox River in late summer and fall each year, steelhead overwinter in appropriate habitat (deeper water areas) prior to spawning in May and June. Within the Kispiox River watershed, there are a number of locations that steelhead have been observed to overwinter, and that might provide suitable overwintering habitat. The studies that have best identified overwintering areas used by steelhead were conducted in 1979 and 1980 through the use of radio telemetry (Lough 1980, 1983). In these studies, steelhead in the lower Kispiox River were captured and implanted with radio tags in order to track their movements after tagging. In 1979, eight steelhead were tracked through the winter period. All fish overwintered in the mainstem Kispiox River, predominantly in the lower 35 km. In 1980, 19 steelhead were tagged, and again most fish overwintered in the mainstem river below kilometer 25. Two fish also overwintered in the mainstem Skeena River, below the Kispiox confluence. Known overwintering locations are shown in Figure 7 with details found in Appendix III. Based on the life-history characteristics of other steelhead populations in the Skeena River watershed, and the type of habitat found within the Kispiox River watershed, there are also a number of other possible overwintering locations for steelhead in the system. These include some of the lakes within the watershed; however, none have yet been documented.

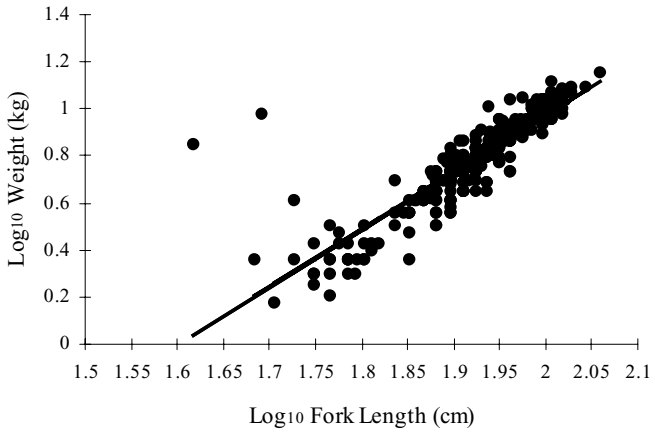


Figure 6a. Length-weight regression for steelhead (*Oncorhynchus mykiss*) in the Kispiox River.

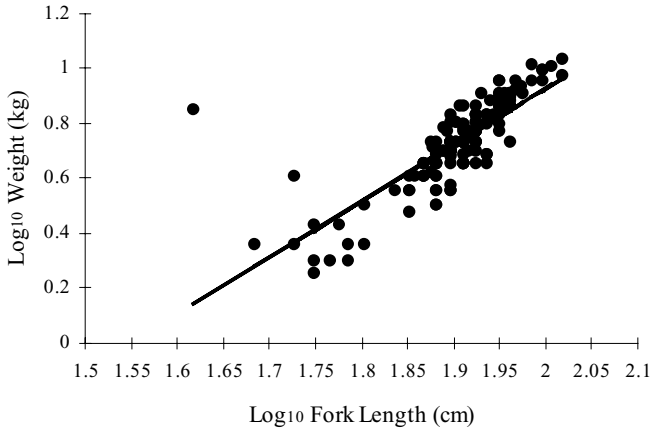


Figure 6b. Length-weight regression for female steelhead (*Oncorhynchus mykiss*) in the Kispiox River.

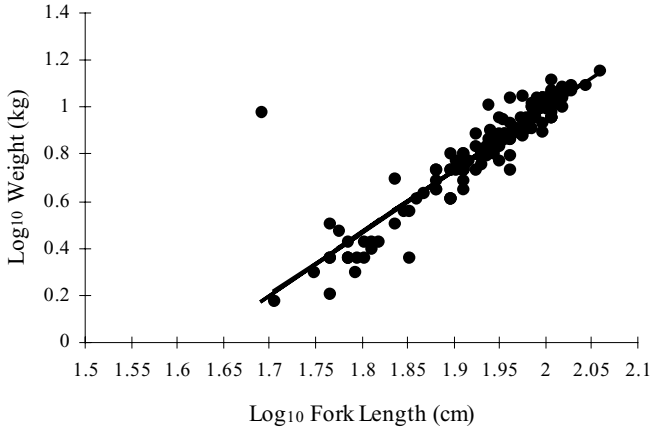
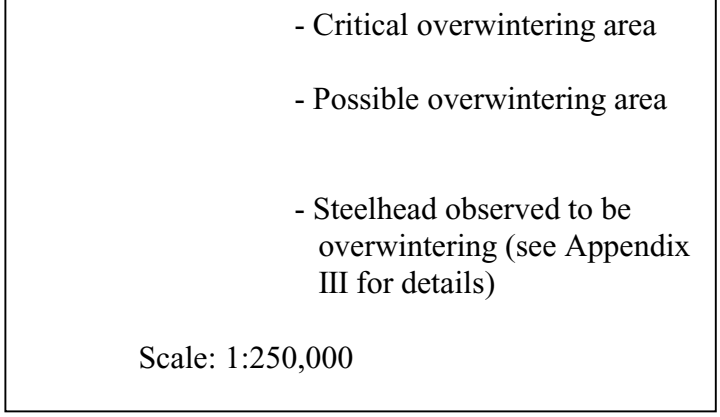


Figure 6c. Length-weight regression for male steelhead (*Oncorhynchus mykiss*) in the Kispiox River.

Figure 7. Overwintering areas for adult steelhead (*Oncorhynchus mykiss*) in the Kispiox River.



4.10 Spawning Timing

Steelhead were observed spawning in the Kispiox watershed on many occasions, and this has allowed the timing of spawning to be estimated. In 1979 and 1980, steelhead were observed spawning between mid May and early June (Lough 1980, 1983). In 1972, steelhead were observed spawning throughout the watershed on May 31st (Chudyk 1972). In 1976, spawning timing was estimated in Cullon Creek (tributary to Kispiox River) through the use of a weir (Chudyk and Whately 1977). They estimated that spawning occurred in this tributary from May 31st to June 15th.

Likely the onset of spawning in the watershed is linked with suitable water temperatures, and in the Skeena River watershed, 6°C has been suggested as the temperature when steelhead will begin to spawn (Pinsent 1971). In the Kispiox River most measured water temperatures when steelhead were observed spawning were above this suggested threshold. In spring 1972, 1976, and 1980, steelhead were observed spawning at 8.1°C , between 6°C and 10°C, and between 9°C and 11°C respectively (Chudyk 1972; Chudyk and Whately 1977; Lough 1983).

4.11 Spawning Locations

Steelhead were observed spawning in many locations in the Kispiox River watershed. Primarily, spawning occurs in tributaries and side channels of the mainstem river. Generally, steelhead spawn in areas where other salmon such as coho and chinook also spawn (Chudyk 1972). The largest observed amount of spawning occurs in Stephens Creek (a tributary to the Kispiox near Swan Lake), where there is approximately 1850 m^2 of suitable spawning habitat (Chudyk 1972). Also in the upper river, the Club Creek system is a known location of steelhead spawning (Chudyk 1972). Within the lower river, Cullon Creek has been noted to provide suitable spawning habitat (Chudyk and Whately 1977).

In 1979, five steelhead were tracked to spawning sites through the use of radio telemetry. Of these five fish, four (80%) spawned in tributaries to the Kispiox River (Lough 1980). Two fish spawned in the lower 3 km of the Nangeese River, one fish spawned in the

lower 2 km of Ironside Creek, and one steelhead spawned in lower Skunsnat Creek. It was also suspected that a steelhead spawned in lower Murder Creek. The one steelhead that spawned in the mainstem Kispiox did so at kilometer 27. These tagged fish emigrated from the Kispiox River as kelts in late May.

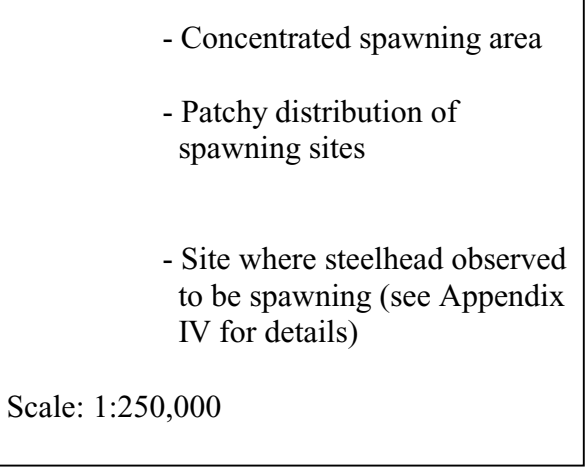
In 1980, 15 of 19 (79%) steelhead radio tagged in the mainstem Kispiox River in the fall of 1979 were tracked to their spawning locations (Lough 1983). Ten of these steelhead (52.6%) spawned in the mainstem Kispiox between kilometer 5 and 41, with a small concentration of fish between kilometer 7 and 9 (Lough 1983). Side channel areas of the mainstem river were also used for spawning. A total of 3 of the 19 (16%) steelhead left the Kispiox, with two spawning in side channels of the mainstem Skeena River, and one moving into the Shegunia River to spawn. Other spawning tributaries included lower Date Creek, lower Cullon Creek, lower Nangeese River, and the upper Sweetin River.

In general it appears that steelhead can spawn in many locations throughout the Kispiox watershed, provided there is suitable habitat. Locations of spawning sites are found in Figure 8, with summaries provided in Appendix IV.

4.12 Repeat Spawning

The incidence of repeat spawning is well documented in previous studies conducted in the Kispiox River. In a detailed study of Kispiox River steelhead during 1975 (Whately 1977), 209 steelhead scale samples were taken for age determination. Of these 209 individuals, 37 or 17.6 percent were repeat spawners. This is a high percentage when compared to other Skeena River stocks further upstream in the watershed (i.e., Sustut River = 6.2%), and may reflect a lower mortality risk associated with migration to the ocean from the Kispiox River. From the 550 scales that had readable scale ages, 11.5% were first time repeat spawners (S1+), and 0.6% were second repeat spawners (S1S1+).

Figure 8. Spawning areas for adult steelhead (*Oncorhynchus mykiss*) in the Kispiox River watershed.



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Most of the repeat spawners in the Kispiox River are females (see Appendix I), likely due to the fact that males experience a higher mortality during spawning.

4.13 Summary Data from the Steelhead Harvest Analysis

4.13.1 Period from 1968 to 1996

For the fiscal years of the period from 1968 to 1983 there was no division of steelhead anglers into resident areas from which they originated, and the total days fished and total catch are combined for B.C. residents (Skeena Region locals), B.C. residents (other than Skeena Region locals), non B.C. Canadians, and non Canadians. Based on this fact, data of total catch, total angler days, and catch per unit effort (CPUE) are summarized for all anglers for this period. From 1968 to 1985 the total catch of steelhead in the Kispiox River remained relatively stable, after which there was an increase in catch until 1989 (Table 4 and Figure 9). This jump in total catch corresponded to an increase in the number of angler days in those years. Catch per unit effort has remained stable and low (below 1.0 fish per day) during the period (Figure 10).

4.13.2 Period from 1984 to 1996

B.C. Residents (Skeena Region locals)

For the period of the fiscal years from 1984 to 1996, the number of local Skeena Region anglers fishing the river has decreased over this time period, and the total catch of steelhead by this angler group has ranged from a high of 983 steelhead in 1987 to a low of 37 steelhead in 1993 (Table 5 and Figure 11). Catch per unit effort over this period has remained stable (Figure 12).

B.C. Residents (other than Skeena Region locals)

During this period there was a decline in total catch of steelhead and total angler days for this group from 1989 to 1994 (Table 6 and Figure 13). This corresponded to a decrease in the number of anglers fishing during this period (Table 6). Catch per unit effort has remained low and stable, generally below 1.0 fish per angler day (Figure 14).

Table 4. Summary of the number of anglers, angler days, total catch of steelhead (*Oncorhynchus mykiss*), and catch per unit effort (CPUE) of anglers on the Kispiox River from steelhead harvest questionnaires returned from 1968 to 1996.

Year	Number of Anglers	Angler Days	Total Catch	CPUE (fish per angler day)
1968	920	3263	803	0.246
1969	965	3837	907	0.236
1970	1319	5349	772	0.144
1971	1490	5896	1178	0.200
1972	1080	4453	1324	0.297
1973	900	3327	1044	0.314
1974	988	3843	1264	0.329
1975	750	3312	1162	0.351
1976	848	4396	1134	0.258
1977	659	2921	679	0.232
1978	450	2078	605	0.291
1979	366	1811	659	0.364
1980	324	1765	572	0.324
1981	337	1801	959	0.532
1982	366	1800	759	0.422
1983	314	1760	608	0.345
1984	371	2071	857	0.414
1985	387	2123	1414	0.666
1986	533	2702	1946	0.720
1987	692	3438	3438	1.000
1988	802	3979	2629	0.661
1989	982	4979	2502	0.703
1990	785	3994	2126	0.532
1991	589	2752	1232	0.448
1992	311	1326	670	0.505
1993	392	1668	1276	0.765
1994	339	1444	1098	0.760
1995	580	2516	2158	0.858
1996	688	3056	2584	0.846

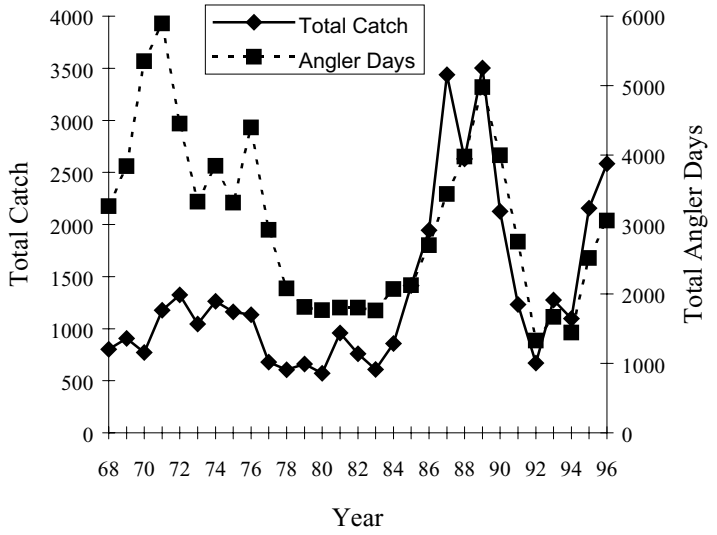


Figure 9. Summary of total catch of steelhead (*Oncorhynchus mykiss*) and total angler days for anglers on the Kispiox River from 1968 to 1996 as reported on returned steelhead harvest questionnaires.

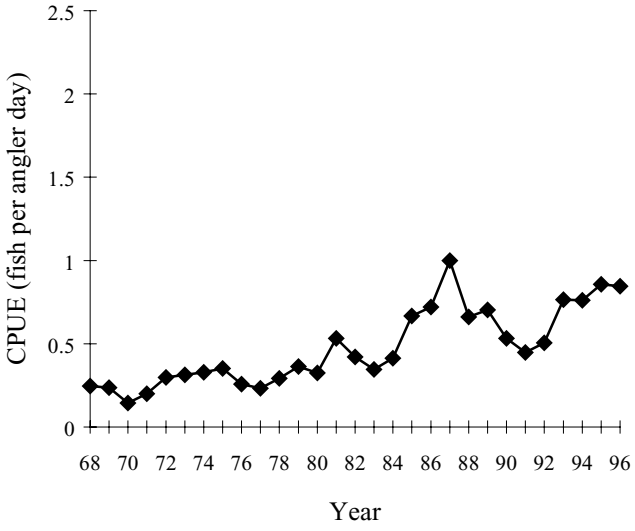


Figure 10. Summary of catch per unit effort (CPUE) of steelhead (*Oncorhynchus mykiss*) for anglers on the Kispiox River from 1968 to 1996 as estimated from data provided on returned steelhead harvest questionnaires.

Table 5. Summary of the number of anglers, angler days, total catch of steelhead (*Oncorhynchus mykiss*), and catch per unit effort (CPUE) of B.C. Resident (Skeena Region locals) anglers on the Kispiox River from 1984 to 1996 that returned the steelhead harvest questionnaires.

Year	Number of Anglers	Angler Days	Total Catch	CPUE (fish per angler day)
1984	139	587	290	0.494
1985	137	590	412	0.698
1986	161	762	651	0.854
1987	204	1120	983	0.878
1988	237	1233	848	0.688
1989	191	977	533	0.546
1990	155	642	174	0.271
1991	203	908	279	0.307
1992	110	493	216	0.438
1993	149	586	394	0.672
1994	37	89	37	0.416
1995	97	543	345	0.635
1996	85	397	434	1.093

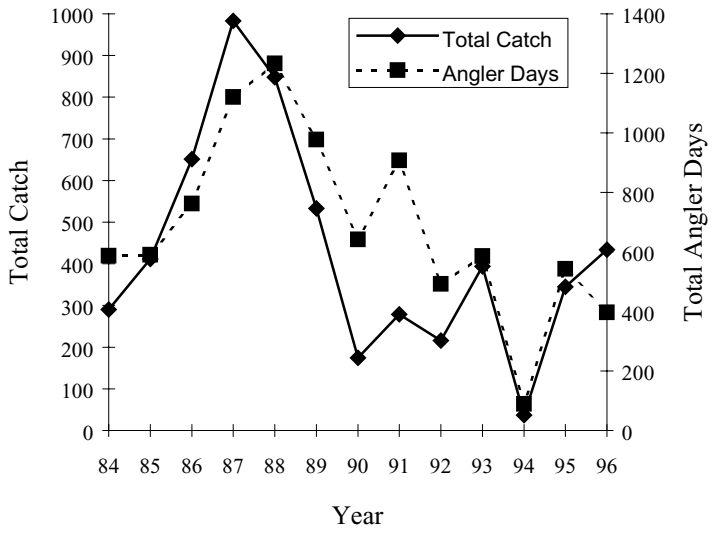


Figure 11. Summary of total catch of steelhead (*Oncorhynchus mykiss*) and total angler days for B.C. Resident (Skeena Region locals) anglers on the Kispiox River from 1984 to 1996 as reported on returned steelhead harvest questionnaires.

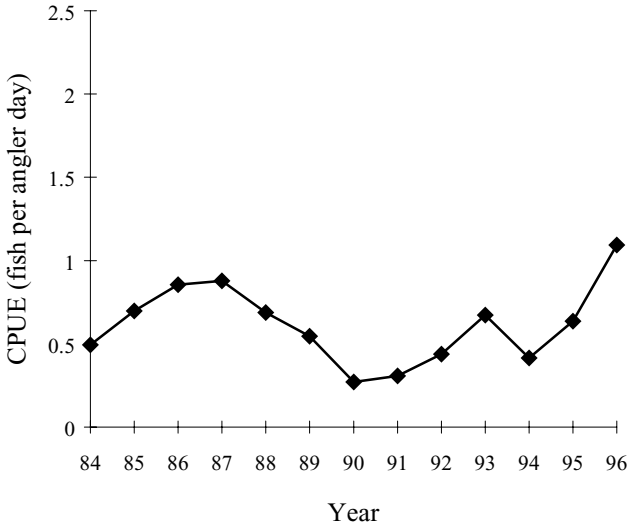


Figure 12. Summary of catch per unit effort (CPUE) of steelhead (*Oncorhynchus mykiss*) for B.C. Resident (Skeena Region locals) anglers on the Kispiox River from 1984 to 1996 as estimated from data provided on returned steelhead harvest questionnaires.

Table 6. Summary of the number of anglers, angler days, total catch of steelhead (*Oncorhynchus mykiss*), and catch per unit effort (CPUE) of B.C. Resident (other than Skeena Region locals) anglers on the Kispiox River from 1984 to 1996 that returned the steelhead harvest questionnaires.

Year	Number of Anglers	Angler Days	Total Catch	CPUE (fish per angler day)
1984	88	350	96	0.274
1985	88	595	404	0.679
1986	169	662	337	0.509
1987	179	595	657	1.104
1988	195	655	373	0.569
1989	223	692	662	0.957
1990	126	434	321	0.740
1991	122	400	179	0.448
1992	61	157	90	0.573
1993	55	153	178	1.163
1994	72	130	36	0.277
1995	157	493	407	0.826
1996	155	412	323	0.784

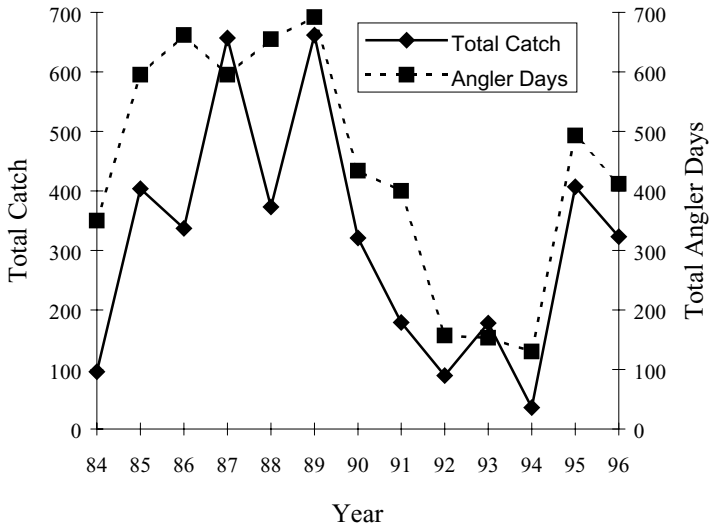


Figure 13. Summary of total catch of steelhead (*Oncorhynchus mykiss*) and total angler days for B.C. Resident (other than Skeena Region locals) anglers on the Kispiox River from 1984 to 1996 as reported on returned steelhead harvest questionnaires.

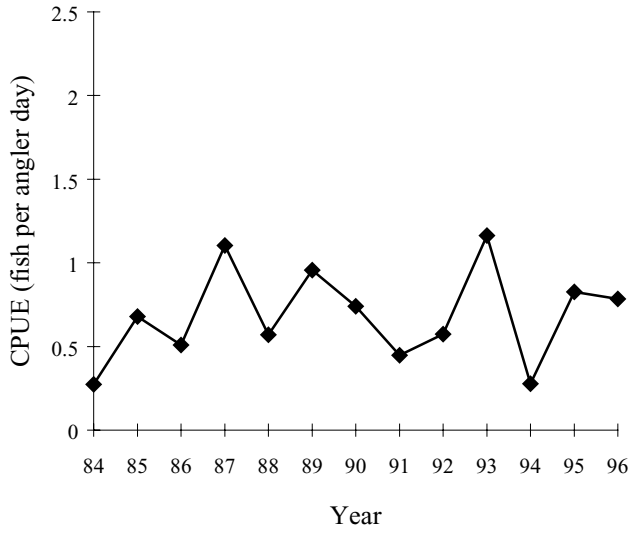


Figure 14. Summary of catch per unit effort (CPUE) of steelhead (*Oncorhynchus mykiss*) for B.C. Resident (other than Skeena Region locals) anglers on the Kispiox River from 1984 to 1996 as estimated from data provided on returned steelhead harvest questionnaires.

Non B.C. Canadians

Each year Canadian anglers other than British Columbians account for very little of the effort and total catch on the Kispiox River each year (Table 7 and Figure 15). Correspondingly their CPUE is low as well (Figure 16).

Non Canadian Anglers

Non Canadian anglers have accounted for the highest number of total angler days on the Kispiox River from 1984 to 1996, and correspondingly, the highest total catch each year (Table 8 and Figure 17). Total catch and effort increased from 1984 to 1989, and there has been a subsequent increase in the effort and catch of this angler group from 1992 (Figure 17). Catch per unit effort has remained stable over this time frame, and is generally below 1.0 fish per angler day each year (Figure 18). The slight increases in CPUE in some years is reflective of increases in catch in those years.

Table 7. Summary of the number of anglers, angler days, total catch of steelhead (*Oncorhynchus mykiss*), and catch per unit effort (CPUE) of non B.C. Canadian anglers on the Kispiox River from 1984 to 1996 that returned the steelhead harvest questionnaires.

Year	Number of Anglers	Angler Days	Total Catch	CPUE (fish per angler day)
1984	33	287	26	0.091
1985	45	169	50	0.296
1986	45	238	64	0.269
1987	78	335	155	0.463
1988	77	335	190	0.567
1989	160	823	321	0.390
1990	76	318	131	0.412
1991	32	109	44	0.404
1992				
1993	24	121	42	0.347
1994	22	120	31	0.258
1995	46	134	148	1.104
1996	46	138	128	0.928

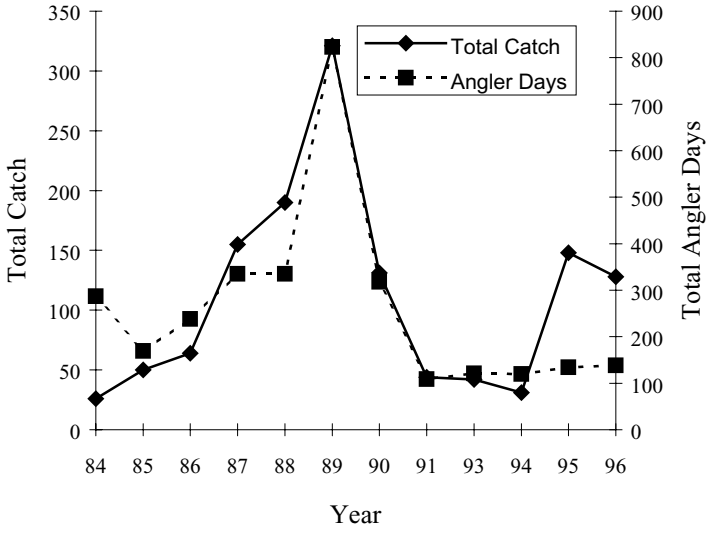


Figure 15. Summary of total catch of steelhead (*Oncorhynchus mykiss*) and total angler days for non B.C. Canadian anglers on the Kispiox River from 1984 to 1996 as reported on returned steelhead harvest questionnaires**.**

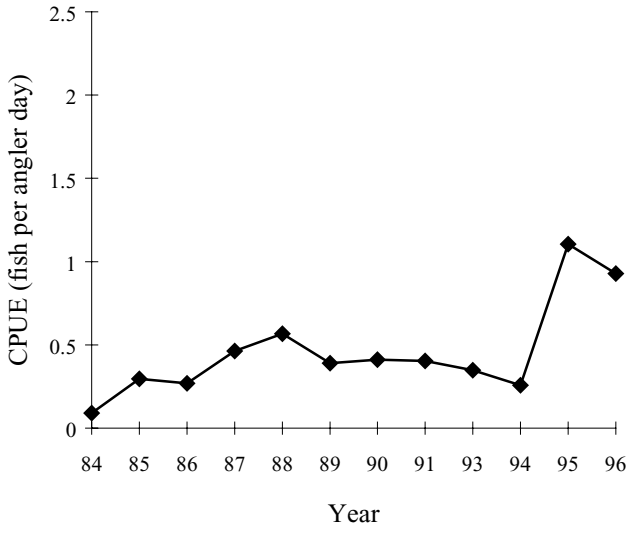


Figure 16. Summary of catch per unit effort (CPUE) of steelhead (*Oncorhynchus mykiss*) for non B.C. Canadian anglers on the Kispiox River from 1984 to 1996 as estimated from data provided on returned steelhead harvest questionnaires.

Table 8. Summary of the number of anglers, angler days, total catch of steelhead (*Oncorhynchus mykiss*), and catch per unit effort (CPUE) of non Canadian anglers on the Kispiox River from 1984 to 1996 that returned the steelhead harvest questionnaires.

Year	Number of Anglers	Angler Days	Total Catch	CPUE (fish per angler day)
1984	111	847	445	0.525
1985	117	769	548	0.713
1986	158	1040	894	0.860
1987	231	1388	1643	1.184
1988	293	1756	1215	0.692
1989	408	2487	1986	0.799
1990	428	2600	1500	0.577
1991	232	1335	730	0.547
1992	140	676	364	0.538
1993	164	808	662	0.819
1994	208	1105	994	0.900
1995	280	1346	1258	0.935
1996	402	2109	1699	0.806

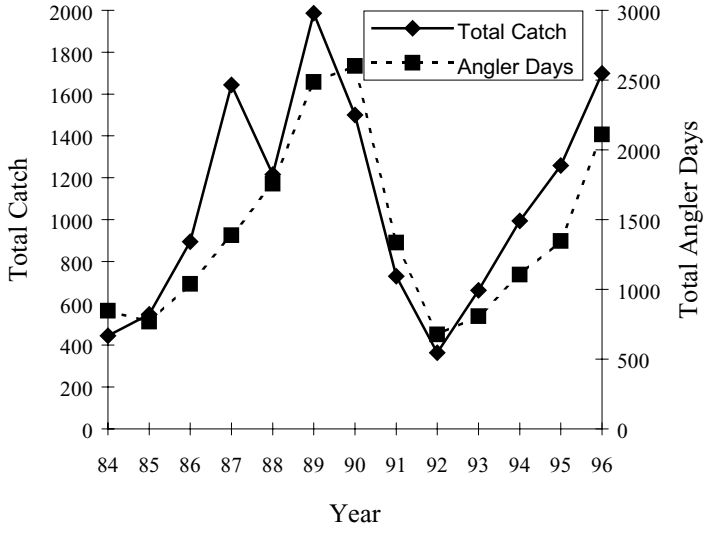


Figure 17. Summary of total catch of steelhead (*Oncorhynchus mykiss*) and total angler days for non Canadian anglers on the Kispiox River from 1984 to 1996 as reported on returned steelhead harvest questionnaires.

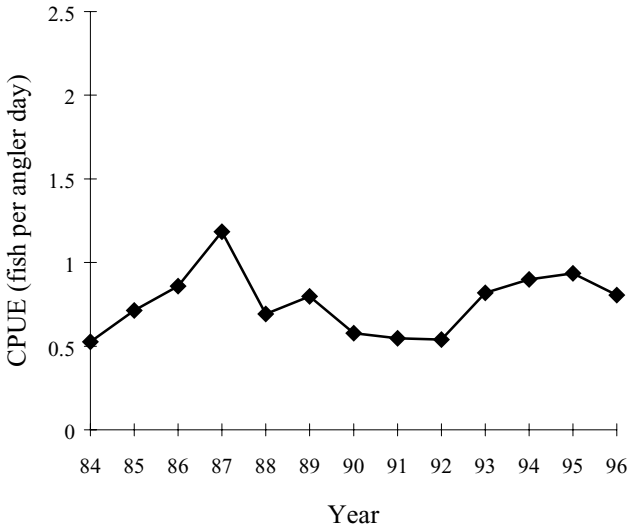


Figure 18. Summary of catch per unit effort (CPUE) of steelhead (*Oncorhynchus mykiss*) for non Canadian anglers on the Kispiox River from 1984 to 1996 as estimated from data provided on returned steelhead harvest questionnaires.

Percentage of Total Effort by Licensee by Year

For the period of the fiscal years from 1984 to 1996, the greatest amount of effort each year has been from non Canadian anglers (mean = 50.9%), and has generally been increasing from 1984 (Table 9 and Figure 19). Non B.C. Canadian anglers account for a small proportion of the total effort each year. The proportion of total effort by B.C. Skeena Region local anglers has remained relatively constant in the years that their effort was measured, and generally account for the second highest percentage of total effort on the Kispiox River each year (Table 9 and Figure 19).

Table 9. Summary of the percentage of total effort by licensee by year from 1984 to 1996 for anglers that fished for steelhead (*Oncorhynchus mykiss*) on the Kispiox River, and sent in returns to the steelhead harvest questionnaire.

Year	Non Canadian	Non B.C. Canadian	B.C. (Skeena Region)	B.C. (other than Skeena Region)
1984	40.9	13.9	28.3	16.9
1985	36.2	8.0	28.0	28.0
1986	38.5	8.8	28.2	24.5
1987	40.4	9.7	23.6	17.3
1988	44.1	8.4	31.0	16.5
1989	49.9	16.5	19.6	13.9
1990	65.1	8.0	16.1	10.9
1991	48.5	4.0	33.0	14.5
1992	51.0		37.2	11.8
1993	48.4	7.3	35.1	9.2
1994	76.5	8.3	6.2	9.0
1995	53.5	5.3	21.6	19.6
1996	69.0	4.5	13.0	13.5

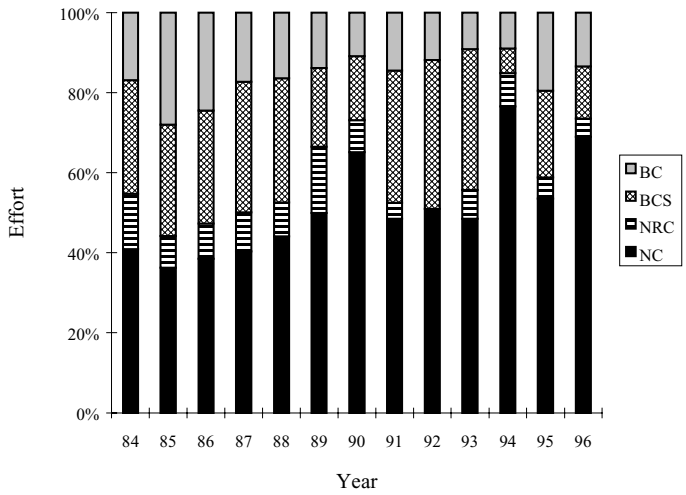


Figure 19. Summary of the percentage of total effort by licensee by year for anglers fishing for steelhead (*Oncorhynchus mykiss*) on the Kispiox River from 1984 to 1996, and returned the steelhead harvest questionnaires (BC = B.C. anglers (other than Skeena Region locals), BCS = B.C. anglers (Skeena Region locals), NRC = non B.C. Canadians, and NC = non Canadians).

4.14 First Nations Uses/Harvests

A number of Kispiox steelhead are captured incidentally in Native Fisheries in the mainstem Skeena River while they are migrating upstream to spawning areas. These fisheries target sockeye salmon that are migrating upstream early in the summer (mid July to early August), but steelhead are captured incidentally as their migration coincides with that of the sockeye (Beere 1991a, 1991b; Ward *et al*. 1993). The bulk of Native fishing effort on the mainstem Skeena River happens between Kitwanga village and Kispiox village (Lough 1988; Beere 1991a, 199b), and this location has been the focus of previous study (Figure 20).

From a study conducted in 1991, the major proportion of effort in the Skeena River Native net fishery in the area of Kispiox was from July 14th and August 10th (Beere 1991b). This effort would coincide with the beginning and early peak of the Kispiox steelhead migration. In the area near Kispiox it was estimated that 0.23 steelhead were captured per net, and a total of 168 nets were counted. In 1990 it was estimated that 1.4 steelhead were captured per net (Beere 1991a).

It has also been reported that 10% of the Kispiox steelhead run each year is harvested in First Nations fisheries (Combs 1991), although I can find no data to support this estimate directly from previous reports.

Most of the First Nations fishing effort targets mainly sockeye and chinook salmon, and there is the occasional amount of fishing that occurs in the mainstem Kispiox River using nets and angling (R. Tetreau, Fisheries Technician, Ministry of Environment, Lands, and Parks, Smithers, British Columbia, pers. comm.). These fisheries would intercept early run Kispiox steelhead, but incidental captures would likely be low due to the early timing. The Gitksan and Kispiox First Nation Band offices were not contacted for this report. Late season fisheries within the Kispiox proper harvest steelhead from both early and late run timing groups (M. Beere, Fisheries Biologist, Ministry of Environment, Lands, and Parks, Smithers, British Columbia, pers. comm.).

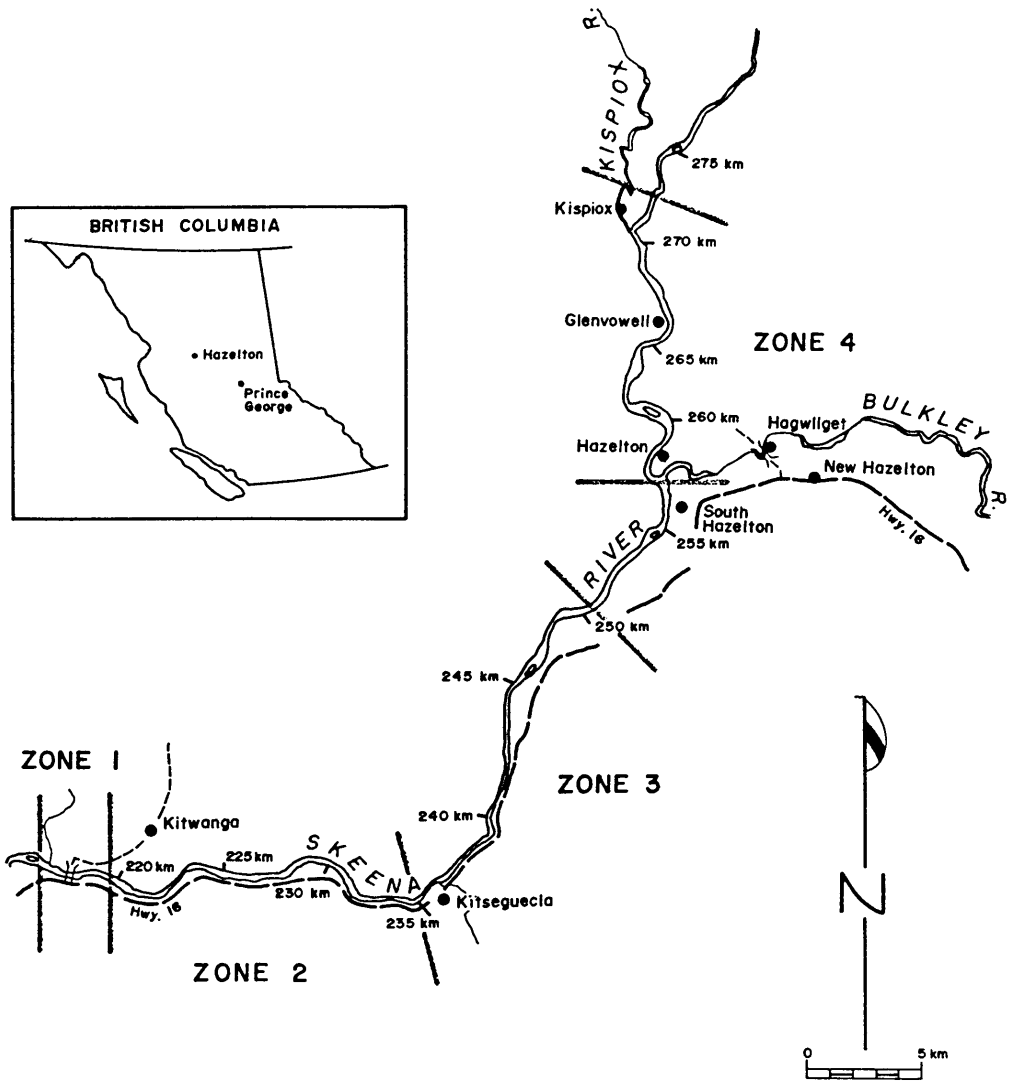


Figure 20. Location of major fishing effort by First Nations People on the Skeena River (adapted from Beere 1991a, 1991b).

4.15 Current Angling Regulations

General Skeena Region angling restrictions that apply to the Kispiox River are the use of a single hook, and no fishing from January 1st to June 15th. Anglers fishing for steelhead are also required to purchase a steelhead tag in order to allow them to fish for steelhead. Specific angling restrictions that apply to the Kispiox River are a bait ban, non-retention of steelhead, no angling from boats, no power boats, and classified water from September 1st to October 31st. The Kispiox was classified as a Class II water, but for the 1997/98 season all rivers that were classified as Class I or II are simply called classified waters as outlined in the 1997/98 B.C. Freshwater Fishing Synopsis. Previous to 1997/98 the classification required that Canadian Residents and Non Canadian anglers purchase a Class II waters license at $10 per day, while B.C. Resident anglers required no special licence to angle. It was proposed, but rescinded, for the 1998/99 season that these regulations would change so that B.C. Residents purchase a classified waters licence for all waters for $10 per year, and that Canadian Residents and Non Canadian anglers purchase a classified waters licence at $40 per day. The future of these proposed fee changes are currently under review.

4.16 Juvenile Life-History

4.16.1 Fry Length

There have been a number of studies conducted in the Kispiox River that have focused on studying juvenile steelhead. Measuring lengths and weights of fry has been a component of these studies, and these data are summarized in Table 10. Fry lengths are similar to the Sustut River.

4.16.2 Parr Length

Once steelhead fry survive their first winter in the Kispiox River they are termed parr. Parr can remain in the stream from age 1+ to 4+, so a comparison of parr length per say has to consider an age component. Mean parr length from previous studies are

summarized in Table 11.

Table 10. Summary of the mean steelhead (*Oncorhynchus mykiss*) fry fork lengths and weights in the Kispiox River from previous studies.

Year	Length (mm)	Weight (g)	Reference
1980	42.8	0.77	Stuart 1981
1981	37.8	0.55	Tredger 1983
1982	39.7	0.58	Tredger 1983
1994	42.8	1.2	Taylor 1995

Table 11. Summary of the mean steelhead (*Oncorhynchus mykiss*) parr fork lengths in the Kispiox River sampled during previous studies.

Year	Age	Fork Length (mm)	Site	Reference
1976	1+	65	Kispiox	Whately 1977
	2+	108	Kispiox	Whately 1977
	3+	145	Kispiox	Whately 1977
	4+	251	Kispiox	Whately 1977
1980	1+	87.2	Kispiox	Stuart 1981
	2+	132.2	Kispiox	Stuart 1981
	3+	169	Kispiox	Stuart 1981
	4+			
1983	1+	80	Kispiox	Tredger 1984
	2+	114	Kispiox	Tredger 1984
	3+	142	Kispiox	Tredger 1984
	4+			

4.16.3 Smolt Length

The best estimates of smolt length are from 1976. Whately (1977) back calculated average smolt lengths from adult scales. The back calculated average smolt lengths for

twelve steelhead age groups ranged from 118 mm to 254 mm. Size at smolting did not vary in relation to length of adult ocean residency.

4.16.4 Stream Rearing Life-History (as determined by scale aging)

From scales collected from upstream migrating adult steelhead, it is possible to estimate the number of years that an individual reared in freshwater prior to entering the ocean. From scales collected from over the past 20 years, all steelhead sampled in the Kispiox River spent on average three years in the river prior to moving into the ocean (Table 12). Whately (1977) estimated that Kispiox steelhead also smolt primarily at age 3-4, so the estimates from the combined scale sample are at least similar.

Table 12. Number of years that adult steelhead (*Oncorhynchus mykiss*) of the Kispiox River resided in freshwater prior to migrating to sea (as determined by scale aging).

Mean (years)	S.E.	Median (years)	Range (years)
3.40	0.02	3	1-6

4.16.5 Juvenile Density Estimates

In the Kispiox River there have been a number of studies that have estimated fry and parr densities at sites in both the mainstem Kispiox River and tributaries to the Kispiox River. I have summarized these density estimates for mainstem and tributary sites for both fry and parr where repetitive samples have been made over the years. Fry densities are generally lower in the mainstem sites (Table 13) than in tributary sites (Table 14). This is likely due to the fact that steelhead utilize the tributaries for spawning to a high degree (see previous sections). It might also be explained due to the fact that sampling these tributary sections may be more accurate due to the ability to entirely block off the entire channel, and have a higher capture efficiency for the juvenile fish. In the tributaries that were sampled repetitively each year, Cullon Creek has the highest fry densities in most

years (5 times as dense as other monitored sites). This may indicate that Cullon Creek is a major spawning site for steelhead and should be protected appropriately.

Parr densities in mainstem sites (Table 15) are generally similar to parr densities in tributary sites (Table 16), possibly indicating that most of the Kispiox system is suitable for parr rearing.

Both fry and par densities are similar or higher in the Kispiox River than in the Sustut and Bear rivers. This might suggest that the Kispiox River is a more productive system than the Sustut River.

Table 13. Average steelhead (*Oncorhynchus mykiss*) fry densities in the mainstem Kispiox River.

Year	Mean ($fry \cdot m^{-2}$)	N	Reference
1980	0.21	4	Stuart 1981
1981	0.58	4	Tredger 1983
1982	0.19	5	Tredger 1983
1983	0.71	4	Tredger 1985
1986	1.12	5	Tredger 1987

Table 14. Average steelhead (*Oncorhynchus mykiss*) fry densities in tributaries to the Kispiox River.

Year	Site	Mean (fry·m^{-2})	N	Reference
1980	Cullon Creek	1.92	3	Stuart 1981
	Ironside Creek	0	1	
	Date Creek	0.02	1	
	McCully Creek	0.06	2	
	Nangeese River	0.06	2	
1981	Cullon Creek	0.52	2	Tredger 1983
	Ironside Creek	0.15	1	
	Date Creek	0	1	
	McCully Creek	0.83	1	
	Nangeese River	0.30	1	
1982	Cullon Creek	2.15	3	Tredger 1983
	Ironside Creek	0	1	
	Date Creek	0	1	
	McCully Creek	0.05	2	
	Nangeese River	0.02	2	
1983	Cullon Creek	0.45	3	Tredger 1983
	Ironside Creek	0.34	1	
	Date Creek	0.03	1	
	McCully Creek	0.61	2	
	Nangeese River	0.05	2	
1986	Cullon Creek	3.11	3	Tredger 1987
	Ironside Creek			
	Date Creek	0	1	
	McCully Creek	0.07	2	
	Nangeese River	0	1	

Table 15. Average steelhead (*Oncorhynchus mykiss*) parr densities in the mainstem Kispiox River.

Year	Mean (parr·m^{-2})	N	Reference
1980	0.07 (age 1+)	4	Stuart 1981
	0.02 (age 2+)	4	
1981	0.04 (age 1+)	4	Tredger 1983
	0.004 (age 2+)	4	
1982	0.12 (age 1+)	5	Tredger 1983
	0 (age 2+)	5	
1983	0.09 (age 1+)	4	Tredger 1985
	0.003 (age 2+)	4	

Table 16. Average steelhead (*Oncorhynchus mykiss*) parr densities in tributaries to the Kispiox River.

Year	Site	Mean (parr·m^{-2})	N	Reference
1980	Cullon Creek	0.07 (age 1+), 0 (age 2+)	3	Stuart 1981
	Ironside Creek	0 (age 1+), 0 (age 2+)	1	
	Date Creek	0.04 (age 1+), 0.02 (age 2+)	1	
	McCully Creek	0.07 (age 1+), 0 (age 2+)	2	
	Nangeese River	0.012 (age 1+), 0 (age 2+)	2	
1981	Cullon Creek	0.85 (age 1+), 0.09 (age 2+)	2	Tredger 1983
	Ironside Creek	0 (age 1+), 0 (age 2+)	1	
	Date Creek	0.03 (age 1+), 0.02 (age 2+)	1	
	McCully Creek	0.05 (age 1+), 0.01 (age 2+)	1	
	Nangeese River	0.02 (age 1+), 0 (age 2+)	1	
1982	Cullon Creek	0.57 (age 1+), 0.10 (age 2+)	3	Tredger 1983
	Ironside Creek	0.12 (age 1+), 0 (age 2+)	1	
	Date Creek	0.02 (age 1+), 0.03 (age 2+)	1	
	McCully Creek	0.09 (age 1+), 0.05 (age 2+)	2	
	Nangeese River	0.03 (age 1+), 0 (age 2+)	2	
1983	Cullon Creek	0.04 (age 1+), 0.02 (age 2+)	3	Tredger 1983
	Ironside Creek	0 (age 1+), 0.02 (age 2+)	1	
	Date Creek	0.01 (age 1+), 0.05 (age 2+)	1	
	McCully Creek	0.03 (age 1+), 0.05 (age 2+)	2	
	Nangeese River	0.01 (age 1+), 0.02 (age 2+)	2	

4.16.6 Estimated Survival Rates

From 1980 to 1986, juvenile surveys were carried out in the Kispiox River to estimate the size of the fry and parr populations (age 1+ and 2+) each year. From these estimates it is possible to calculate the survival rates of steelhead from age 0+ (fry) to age 1+ (parr), and from age 1+ (parr) to age 2+ (parr). Fry survival ranged from 12 % to 48% (mean = 27.6%), while yearling survival ranged from 6% to 61% (mean = 29.7%) (Table 17).

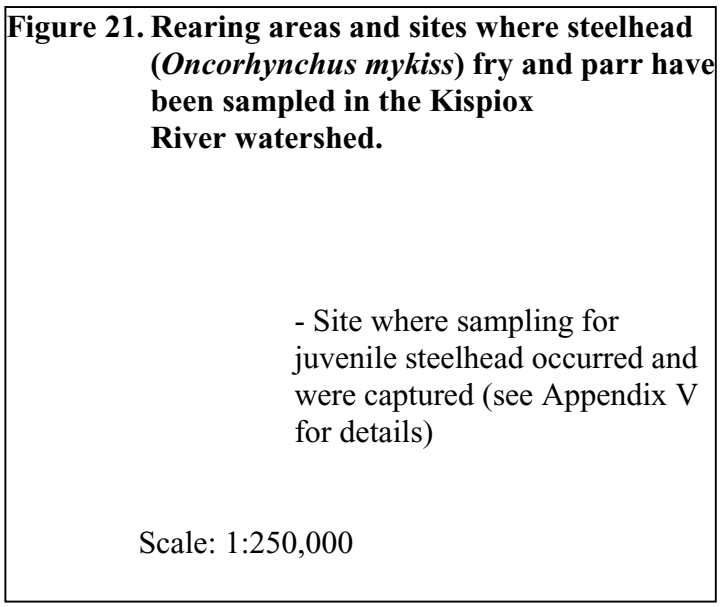
Table 17. Survival of steelhead (*Oncorhynchus mykiss*) fry and parr from 1980 to 1986 as estimated from repetitive population sampling (Tredger 1987).

Year	Fry (Age 0+) Survival (%)	Yearling (Age 1+) Survival (%)
1980	23	40
1981	48	61
1982	29	11
1983	25	30
1984	19	6
1985	12	30

4.17 Juvenile Rearing Areas

In the early to late 1980s the Kispiox River, and a number of tributaries, were the focus of a number of detailed studies to monitor the fry and parr populations (e.g., Stuart 1981; Tredger 1983, 1985, 1987). These studies repetitively sampled fry and parr in different years. The best way to identify suitable fry and parr rearing areas is to summarize where steelhead fry have been sampled, and the densities at those locations (Figure 21 and Appendix V). Both fry and parr are distributed throughout much of the system, suggesting that the entire system has at least some capacity to provide suitable fry and parr rearing habitat.

Figure 21. Rearing areas and sites where steelhead (*Oncorhynchus mykiss*) fry and parr have been sampled in the Kispiox River watershed.



4.18 Angling Guide Data

There are currently two licenced guides that operate on the Kispiox River, and an additional licenced guide that has not operated since 1993. Of the two active guides, between 3-5 assistant guides are affiliated with each guide (Tallman 1997). In total these three guides have a combined 393 issued quota angler days, that they are able to use to guide anglers for steelhead between September 1 and October 31 each year (Table 18). The two active guides have a combined total quota of 353 guided angler days (193 days for one guide and 160 days for the other guide). A number of other guides also had quota angling days between 1990 and 1993, and their data is also reported in Table 18. These guides may also operate out of this classified period, but must report those angler days as well.

The angling guide database contains data on the number of angler days guided and total catch of steelhead for angling guides from the 1990/1991 season to the 1995/1996 season. Currently, licenced guides on the Kispiox River have not used their allocated quota days in most years (Table 18). This is partly due to the unstable nature of the watershed, and the fact that water conditions in the Kispiox can deteriorate rapidly for fishing to be productive.

Table 18. Number of quota angler days allocated and fished, total catch of steelhead (*Oncorhynchus mykiss*) for those angler days, and catch per unit effort (CPUE) for guides on the Kispiox River from the 1990/91 season to the 1995/96 season.

Season	Quota Angler Days Allocated	Quota Angler Days Used	Total Catch of Steelhead	CPUE
1990/91	463	220	90	0.409
1991/92	463	216	102	0.472
1992/93	463	125	156	1.248
1993/94	473	254	271	1.066
1994/95	473	193	181	0.938
1995/96	393	333	250	0.751
1996/97	393			

4.19 Creel Survey Information

Based on the large amount of angling effort that the Kispiox River receives, and the fact that the system is an international destination for anglers, there have been many creel surveys carried out on the river to assess angler demographics and economics. Initially these studies were useful in determining where the majority of the anglers originated from, and the amount of effort these anglers accounted for. In 1969, an initial creel survey determined that the majority of effort and catch on the Kispiox River was accounted for by anglers from the United States (Pinsent 1970). Based on this observation it was initially suggested in 1970 that fees in the Kispiox River should be increased for foreign anglers. This study also determined that the bulk of fishing effort was between early and late October. Another interesting point to note from this study was the length of time that anglers put into fishing each day. Compared to the Suskwa, Morice, and Bulkley rivers, the amount of time that anglers on average spent fishing

during a day on the Kispiox was roughly twice that of the other systems (approximately 5 hours to 10 hours). This might suggest that in actual fact true angler effort (in hours) on this system is a lot greater than other systems with the use of angler days and not hours as the measure of effort. It may be worth considering the measure of effort to conform between systems. I would suggest that hours are used as the measure of effort, and that catch be converted to catch per hour.

In 1974, another preliminary creel survey was undertaken in the Kispiox River (Remington *et al.* 1974). This survey again found that the majority of the anglers were not residents of Canada, and were primarily of U.S. origin. These American anglers accounted for a large proportion of the total catch, and had a very high CPUE. It is also interesting to note that at this time the majority of the fisherman fished with lures (70%) as opposed to flies (30%), and that non-resident anglers didn't oppose a proposed increase in licence fees for non-residents, special designation of the river, and more restrictive regulations.

In the highly detailed creel survey of 1975, Whately (1977) found that the number of non-resident anglers far out-numbered other angler groups. Local residents comprised a minimal proportion of the anglers fishing the system, and correspondingly effort. These non-resident anglers also accounted for the greatest amount of effort, and had the highest success on the Kispiox. The primary method of angling was lure (76%) fishing as opposed to flies (24%). In 1975, Whately also found that 17.6% of the fish were repeat spawners, and based on this data and the high rate of release of steelhead at this time, suggested that the Kispiox population was not being over harvested. From scales sampled during this survey, a high percentage of the steelhead spent 3 years in the ocean, which would account for the large average size.

In 1989, a detailed creel survey analysis carried on the Kispiox River identified that in September and October steelhead anglers fished an estimated 3605 days, capturing an estimated 1384 steelhead (Lewynsky and Olmsted 1990). Of all interviewed anglers, 8% used the services of a guide. Catch success was highest between mid and late October, possibly suggesting that this was when the peak in steelhead in migration was occurring.

The Kispiox differed from the Bulkley River and Skeena River in that the majority of the anglers were non-residents, and the average length of a trip (in number of days) to fish was longest on the Kispiox River. One interesting point to note is that in this study most interviewed non-guided anglers on the Kispiox used flies (80%) as opposed to lures (20%), which was a reversal from previous years. All interviewed guided anglers used flies.

The most recent creel survey was carried out in the fall of 1996 from September 15th to October 31st (Tallman 1997). The purpose of this survey was to estimate catch and angler effort, quantify angler demographics and characteristics, investigate guiding activities, and measure angler compliance with licencing requirements for the fishery. During this period an estimated (±S.E.) 7107 (1175) angler hours were expended fishing for steelhead. In this same time frame an estimated (±S.E.) 637 (177) steelhead were caught. All steelhead caught by interviewed anglers were released. Fifteen percent of the interviewed anglers were guided.

In 1996, 62% of those anglers interviewed were of foreign residence. Of those anglers of Canadian residence, 92% were from British Columbia. Fly fishing was the method used predominantly by anglers (80%). In terms of regulations, compliance of interviewed anglers with required regulations was fairly high (above 90% in most cases). With regard to having a basic licence, a required steelhead stamp, and a classified waters licence, compliance was 98.4%, 95.3% and 90.8% respectively.

4.20 Angling Use Plan

The Kispiox River is one of the steelhead systems in the Skeena Region that has had a draft angling use plan developed for the steelhead fishery. This plan was put forth to attempt to sustain quality angling opportunities and experiences for British Columbia residents while maintaining business opportunities for commercial users (guides). Over time the number of local British Columbians that fish the Kispiox has declined (Anonymous 1997), and to attempt to improve opportunities for residents during preferred times (peak in the steelhead run), the proposed regulation changes for the river

would include limiting the number of non-resident anglers for each week of the fishing season. Licences for non-residents would be allocated in eight day blocks on a lottery basis. This would also limit illegal guiding activity. These proposed changes would allow quality fishing opportunities to exist for both resident and non-resident anglers, and likely make everybody's time on the river more pleasurable.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

5.1.1 Life History

The Kispiox River steelhead population, as well as the Babine River and Suskwa River populations, are unique from the other stocks due to the large average size of the returning fish. For this reason alone, the population requires close monitoring to ensure that escapement levels do not drop to the point where there might be a conservation concern. Escapement levels in the Kispiox River have not been measured directly, but given the large estimated population size (Tautz *et al.* 1992), and continued high catches by anglers fishing each year, it does not appear that the population is decreasing. This may be attributed to imposing catch and release regulations. Habitat use by adult steelhead for overwintering and spawning are fairly specific in the Kispiox River. Certain areas and streams are also key for juvenile rearing, specifically with regard to parr rearing. Appropriate habitat protection for these areas should be put in place to ensure that these habitats are not negatively impacted.

5.1.2 Habitat Concerns

The main concern to fish habitat within the Kispiox River watershed is forest harvest, and approximately 20% of the operable forest in the Lower Kispiox Planning Area has been harvested in the past 20 years (B.C. Forest Service, Kispiox Forest District, Hazelton, information on file). Impacts associated with forest harvest and road building can lead to an increase in sediment promotion into streams, and the deleterious effects of sediment on fish are well known. It is particularly important to minimize sedimentation while eggs are incubating in the gravel environment within streams. It appears that in the Kispiox River watershed these types of practices may be occurring, and that fish habitat is being impacted in tributary streams (M. Beere, Fisheries Biologist, Ministry of Environment, Lands, and Parks, Smithers, B.C., pers. comm.). Forest harvest can also lead to the removal of riparian vegetation, a decline in the stability of the river discharge, and limit large woody debris promotion into streams.

A number of sites on the mainstem Kispiox River and tributaries to the watershed have been identified as providing critical habitat for rearing and spawning. Impacts to these sites should be limited. In particular Cullon Creek had the highest densities of fry and parr steelhead from the data that was summarized from previous studies. This suggests that this system should have limited, if any, development. Currently some of the upper Kispiox River watershed is protected or proposed to be protected within the Swan Lake Provincial Park (DeGisi 1997).

There is also currently a Kispiox Watershed Restoration Project underway that has identified four sub-basins (the Nangeese River, Cullon/Murder/Ironside creeks, Clifford/Corral creeks, and Steep Canyon/Brownpaint creeks) as high priority for Watershed Restoration Program activities (D. Fillier, Habitat Protection Officer, Ministry of Environment, Lands, and Parks, Kispiox District, B.C., pers. comm.). The Sweetin River, McCully Creek, and Date Creek sub-basins were identified as moderate priority for this work. Given that high priority watersheds are usually impacted by previous forestry activity, and contain important fish species, habitat prescriptions in these areas are likely warranted. Some of these systems have also been identified as important steelhead spawning and rearing streams, so instream habitat work will likely benefit steelhead. Road deactivation, placement of instream structures, stabilization of slumps, and riparian treatments are all projects that should possibly be undertaken in this watershed, but detailed Level 1 and 2 Fish Habitat Assessment are needed to identify locations and prescriptions for these type of habitat programs.

In the lower part of the watershed land development and agriculture have also had some impacts on the Kispiox River, but the extent is unknown (D. Atagi, Fisheries Biologist, Ministry of Environment, Lands, and Parks, Smithers, B.C., pers. comm.).

5.1.3 Steelhead Harvest (First Nations)

The question as to the extent of steelhead harvest by First Nations people might be addressed by setting up a steelhead catch monitoring program with First Nations Bands

involved in incidental harvest of steelhead while fishing for sockeye and chinook salmon. This would serve to benefit both the Provincial Fisheries Branch and First Nations people by providing information needed for management of the population, and giving the Aboriginal fishers a better understanding of possible conservation concerns and a improved sense of stewardship for the resource.

5.1.4 Current Research Program

The program of research in the Kispiox River over the past 5 years has mainly focused on creel surveys of anglers. The main purpose of these surveys has been to estimate fishing effort by Non-Canadian and B.C. anglers in an attempt to determine trends in effort, catch and guiding activity. Non-Canadians expend the greatest amount of effort on the river each year, and accordingly also catch the greatest number of fish. Proposed future regulations on the river should restore some of the quality angling opportunities in this system, and reduce the amount of illegal guiding activity that is currently ongoing.

5.2 Recommendations

There are a number of possible recommendations for the population that could be addressed and implemented.

1. Another study conducted while steelhead are spawning would further identify which locations are used for spawning, and determine if there have been any changes from previous data in the locations used. It has been a considerable number of years since the last spawning site surveys were undertaken through the use of radio telemetry, and such a program would be of benefit. A more detailed study might also allow population size to be estimated.

2. First Nations Groups that have individuals that utilize the Kispiox River for harvest of salmonids should be contacted in an attempt to set up a steelhead catch monitoring program to estimate the number of steelhead harvested incidentally. This could be carried out by the First Nations Groups, M.E.L.P., and D.F.O.

3. Proposed regulations changes with regard to the limiting of effort should be adopted in the Kispiox River in order to restore quality angling opportunities, and reduce illegal guiding.

4. Future developments in the watershed should be monitored to ensure critical habitat is maintained, particularly in Cullon Creek and other small tributaries.

5. Habitat enhancement work should continue in the watershed where limitations are identified to fish populations and their habitat.

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Appendix I. Biological data of adult steelhead (*Oncorhynchus mykiss*) sampled in the Kispiox River for scale aging.

Appendix II. Summary of adult steelhead (*Oncorhynchus mykiss*) tagged in D.F.O. Statistical Area 4 and the lower Skeena River and recovered in the Kispiox River as found in the Steelhead Floy Tag database.

Appendix III. Summary of locations where adult steelhead (*Oncorhynchus mykiss*) were observed to overwinter in the Kispiox River.

Appendix IV. Summary of locations where adult steelhead (*Oncorhynchus mykiss*) were observed to spawn in the Kispiox River.

Appendix V. Summary of sites where steelhead (*Oncorhynchus mykiss*) fry and parr were sampled in the Kispiox River watershed in 1980 (Stuart 1981).