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FISH POPULATION MONITORING IN FOXY AND BUCK CREEKS SEPTEMBER 1991

Prepared by

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for

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SUMMARY

Sampling at fish index sites was conducted at five locations in Foxy and Buck creeks for Equity Silver Mines Ltd. during September 1991. This is the sixth year of population estimates in Foxy Creek and the fourth year in Buck Creek.

The fish sampling data collected to date indicates that lower Foxy Creek continues to provide a very productive juvenile rainbow trout rearing environment. Fish populations remained high in 1991, with rainbow fry numbers at their highest levels recorded to date. Total parr production estimates in the study sections have remained at relatively constant levels despite fluctuations in fry numbers. Habitat changes at the lower sample site may account for the most significant differences over the years - and the loss of deep pool habitat with debris cover may account for the reduction in older parr in this site. Both fry and parr fork lengths were near the average for previous years. Longnose dace consituted over 10% of the population estimates in lower Foxy Creek for the second year reflecting a significant increase in numbers over earlier years.

Density and biomass estimates at the site located downstream of Bessemer Creek but above Goosly Lake remain at low levels relative to the upstream site reflecting generally poor quality rainbow trout rearing habitat. However, estimates for the past two years indicate rainbow numbers have increased over years previous to this and are judged to be substantially higher than the early 1980's when it was difficult to obtain an adequate sample for metal analyses of fish tissue. Rainbow fry were again present in this section, but in very low numbers. Rainbow fry numbers at the site upstream of Bessemer Creek were the highest recorded to date. These fry were small, possibly reflecting the high densities present in 1991. Rainbow parr numbers at the site have remained at a very steady level throughout the five years of population estimates at this site. Habitat conditions have remained stable, fry recruitment is adequate, and the site productivity appears to reflect the amount of suitable parr habitat available at this location.

Steelhead fry population estimates at a site in lower Buck Creek were above the average of the previous four years while parr numbers were down slightly. Parr numbers and steelhead biomass at this site have stayed within a narrow range, but comparisons to sampling conducted in the area prior to 1987 suggest that the site is capable of producing higher steelhead parr densities. Similarly, fry densities during some years have been much higher than during the past five years. The lower fry numbers presumably reflect poorer recruitment due to low numbers of spawners. The test fishery index on the lower Skeena provides an indication of the strength of the following year's fry recruitment based on the last five years of estimates.

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1.0 INTRODUCTION

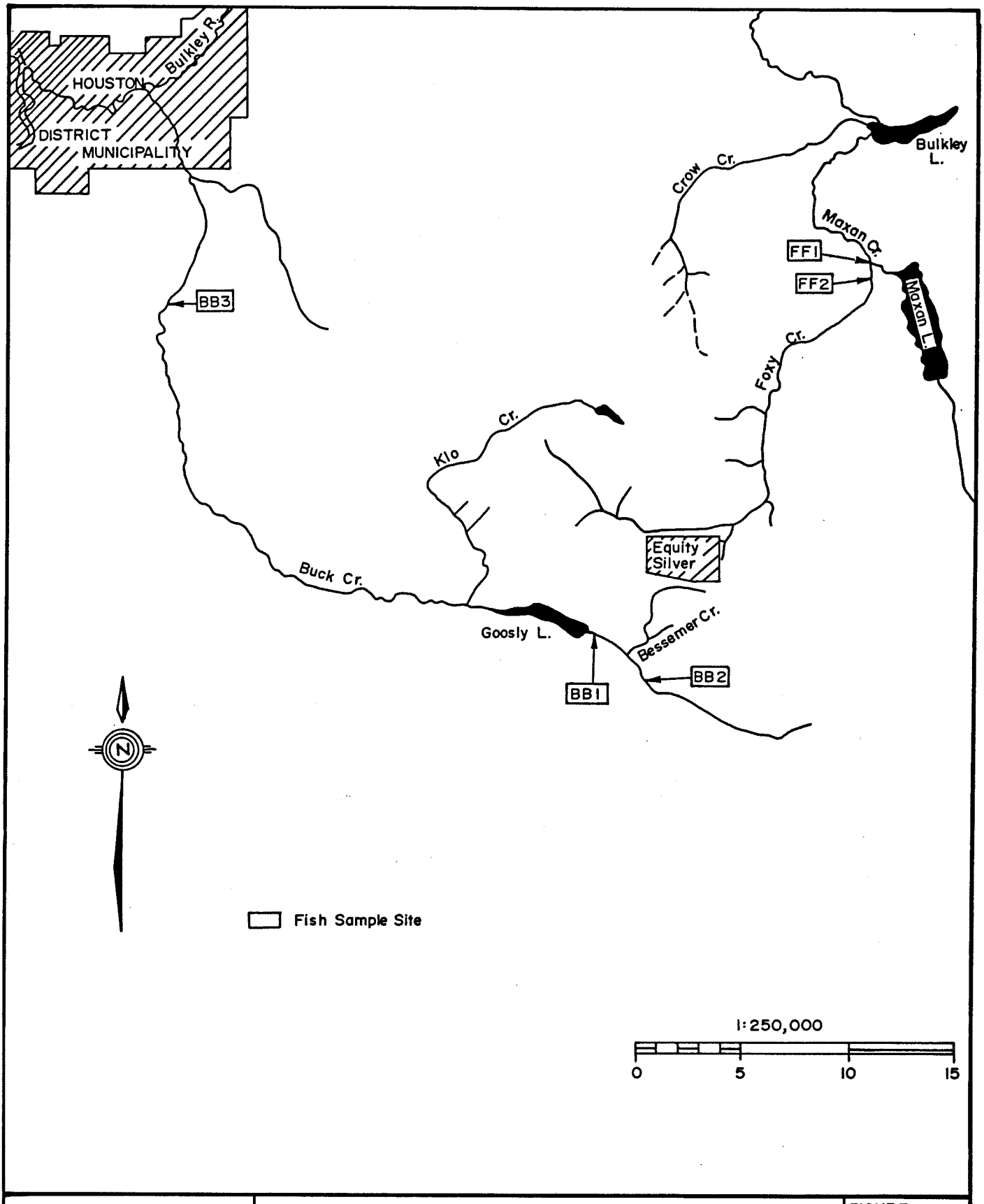
Field studies assessing fish populations were undertaken in Foxy and Buck creeks, two small streams located in north central British Columbia near Houston (Figure 1). These studies were conducted during early September 1991 for Equity Silver Mines Ltd. This work was undertaken as part of a monitoring program of fish populations in the vicinity of the mine operation and was done in conjunction with an ongoing program to collect fish for analyses of metal content in tissues.

The 1991 studies represent the sixth year of detailed fish population assessments in Foxy Creek. Previous sampling was conducted in Foxy Creek during 1984 and from 1987 to 1990 (summarized in Bustard 1990). These previous studies have demonstrated that high numbers of juvenile rainbow trout (Oncorhynchus mykiss), and limited numbers of chinook salmon (Oncorhynchus tshawytscha), Dolly Varden char (Salvelinus malma), longnose dace (Rhinichthys cataractae), mountain whitefish (Prosopium williamsoni), prickly sculpins (Cottus asper), and longnose suckers (Catostomus catostomus) are present in Foxy Creek during some years. Rainbow trout are present in a canyon section 10 to 12 km upstream from Maxan Creek, but are most numerous in the lower 3 km gravel fan section of the creek (Bustard 1984).

Based on the low number of trout older than age 1+ sampled during the late summer period at locations in lower Foxy Creek, it is probable that most rainbow trout remain in the stream for two and sometimes three winters. These fish then move downstream, presumably as flows decline during the early summer. It is assumed that juvenile rainbow trout in Foxy Creek are the progeny of resident rainbow trout (possibly from Maxan Lake) and are not steelhead trout (Oncorhynchus mykiss), although this has not been verified. The presence of juvenile chinook salmon in lower Foxy Creek during some years indicates that steelhead would have no difficulty gaining access to lower Foxy Creek during the spring high-flow period.

The Department of Fisheries and Oceans planted 15,000 hatchery-raised coho salmon (Oncorhynchus kisutch) fry in the lower 1 km of Foxy Creek in July 1990. Juvenile coho from this outplanting comprised 15% of the total catch at the two lower Foxy Creek sample sites during September 1990. Despite these additions, rainbow trout fry densities and total rainbow biomass remained high in 1990, while yearling densities were below average. No coho outplantings were conducted during 1991.

The 1991 studies represent the fifth year that fish population monitoring has been conducted in Buck Creek for Equity Silver Mines Ltd. Fish sampling in lower Buck Creek had been undertaken at a number of sites between 1981 and 1986 as part of a steelhead stock



DAVID BUSTARD & ASSOCIATES	Location of Fish Sample Sites	FIGURE 1

monitoring program by the Ministry of Environment (summarized in Tredger 1987). Approximately 30 km of Buck Creek is accessible to steelhead trout. The lower end of Buck Creek also receives limited use by chinook and coho salmon. As well longnose dace, longnose suckers, and mountain whitefish are present in the lower creek. Fish population estimates were conducted for the first time in 1987 at two fish sample sites in Buck Creek upstream of Goosly Lake (Figure 1). These sites had previously been fish collection areas for subsequent tissue metal analyses. Rainbow trout, longnose suckers, prickly sculpins, and redside shiners (Richardsonius balteatus) are present in upper Buck Creek (summarized in Bustard 1990). Juvenile rainbow trout in this section are presumed to be the progeny of Goosly Lake fish. No resident adults are present in the sample sites during the fall period.

2.0 METHODS

Field studies were conducted by a crew of two from August 30 to September 6, 1991 - a similar time period to all other years of sampling. Access to four of the five sites sampled was by vehicle. Site BB1 in Buck Creek just upstream of Goosly Lake, was accessed by boat.

The detailed fish sample site on lower Foxy Creek (Site FF1 in Figure 1) was re-located into its former channel in 1990 and remained at this location in 1991. Foxy Creek had shifted course in this section of the fan and had cut a new channel 50 m south of the original channel that was left dry in 1989. The location of Site FF2 remained unchanged from the previous three years. Site BB1 on Buck Creek below Bessemer Creek was re-located approximately 50 m upstream of the site sampled during previous years due to a beaver dam at the old location. Site BB2 has remained unchanged 1.5 km upstream, above the Bessemer Creek confluence with Buck Creek. The lowest site on Buck Creek corresponds to Site 3 of the Ministry of Environment steelhead index sites (Tredger 1987).

The sample sites were blocked with stopnets at their upstream and downstream ends and sampled using a gas-powered Coffelt electroshocker. Fish captured were anaesthetized, measured to the nearest millimeter and returned to the stream at the end of the sampling. At least 50 rainbow fry were measured at each site when available. This is an increase from 30 fry measurements taken in previous years. The two-step removal method (Seber and LeCren 1967) was used to estimate fish populations.

Sample site areas were calculated from measurements of length and a series of width measurements made at 5-m intervals along the site. As well, water depths (maximum and mean), water temperature, substrate and cover characteristics were recorded at the sites.

Ten 20-gram samples of rainbow trout were retained at all of the sites except Site FF1 for tissue analyses of heavy metals. Scales for aging were removed from these fish. Weights were collected from these rainbow as well as from a sample of rainbow fry and other species captured in order to calculate biomass at the sites. Measurements were made to the nearest 0.1 g using a portable Sartorius electronic balance.

Each sample collected for metal analyses was placed in a separate bag, frozen and shipped to ASL Laboratories. The length, weight and age characteristics of these fish are presented in Appendix 1. The results of the heavy metal analyses were returned directly to Equity Silver Mines Ltd. and are not presented in this report.

3.0 RESULTS AND DISCUSSION

3.1 Foxy Creek

A total of 530 m^2 and 104 m of stream length in Foxy Creek was sampled (Table 1). The total length of stream sampled has been similar for all years of sampling. The area sampled varies annually and the smaller area sampled in 1991 reflects the low streamflow conditions present during the sample period. The two sample sites combined comprise nearly 3.5% of the total habitat in the main fish-producing section of Foxy Creek. The thick algal mat covering the streambed in lower Foxy Creek was again present in 1991, although levels were judged to be less at the lower site (FF1) than in 1990.

The sample site at FF1 is less complex with little debris or deep pool habitat compared to the earlier years of the study. In 1984 the site was described as having debris cover throughout, with pools up to 1 m in depth. In 1991, debris cover was estimated at 15% of the site, with a 50 cm maximum depth for the pools. Habitat conditions at Site FF2 were unchanged from previous years.

A total of 1768 fish were captured at the two sites in 1991, well above the average of 1200 fish (Table 1). The detailed catch results for each site are presented in Appendix 2. The catch was again dominated by rainbow trout (87.2%). A significant difference from 1990 is the nearly complete absence of coho in the sample. No hatchery outplantings were conducted in 1991, and four coho yearlings from the previous year were all that remained. Chinook juveniles were not present in the 1991 sample. Longnose dace again comprised a significant portion of the catch (11.2%). There has been an increase in longnose dace numbers present at the Foxy Creek sites since 1990.

Table 1. Catch Composition of Foxy Creek Fish Sample Sites (Combined) from 1984 to 1991.

SPECIES	1984 (%)	1987 (%)	1988 (%)	1989 (%)	1990 (%)	1991 (%)	MEAN 84-90 (%)
RAINBOW FRY	799 (57.2)	660 (72.7)	768 (66.3)	546 (62.8)	929 (55.8)	1194 (67.5)	740 (61.7)
RAINBOW PARR	593 (42.4)	202 (22.2)	319 (27.5)	315 (36.2)	246 (14.8)	349 (19.7)	335 (27.9)
CHINOOK	4 (0.3)	0	0	2 (0.2)	29 (1.7)	0	7 (0.6)
COHO	0	0	0	0	249 (15.0)	4 (0.2)	50 (4.2)
DACE	2 (0.1)	36 (4.0)	49 (4.2)	6 (0.7)	205 (12.3)	198 (11.2)	60 (5.0)
WHITEFISH	0	6 (0.7)	16 (1.4)	1 (0.1)	2 (0.1)	22 (1.2)	5 (0.4)
SCULPINS	0	4 (0.4)	3 (0.3)	0	2 (0.1)	0	2 (0.2)
SUCKERS	0	0	4 (0.3)	0	3 (0.2)	1 (0.1)	1 (0.1)
TOTAL	1398	908	1159	870	1665	1768	1200
AREA (m^2)	624	531	659	678	523	530	603
LENGTH (m)	104	104	103	103	104	104	104

Total numbers of rainbow trout fry in 1991 were the highest on record for the two sites combined. The population estimates for the sites (including 95% confidence intervals for the estimates) are shown in Figure 2 with more detailed information in Appendix 3. Density estimates combined for the two sites are presented in Figure 3, while a breakdown comparing the two sites is presented in Table 2. Fry numbers have increased substantially in the lower Foxy sample sites, with the largest increase over previous years occurring at Site FF1. This may reflect an increased stability at this site in the past two summers after the creek has been re-established in the main channel. Rainbow trout fry densities have been more stable at Site FF2 (Table 2).

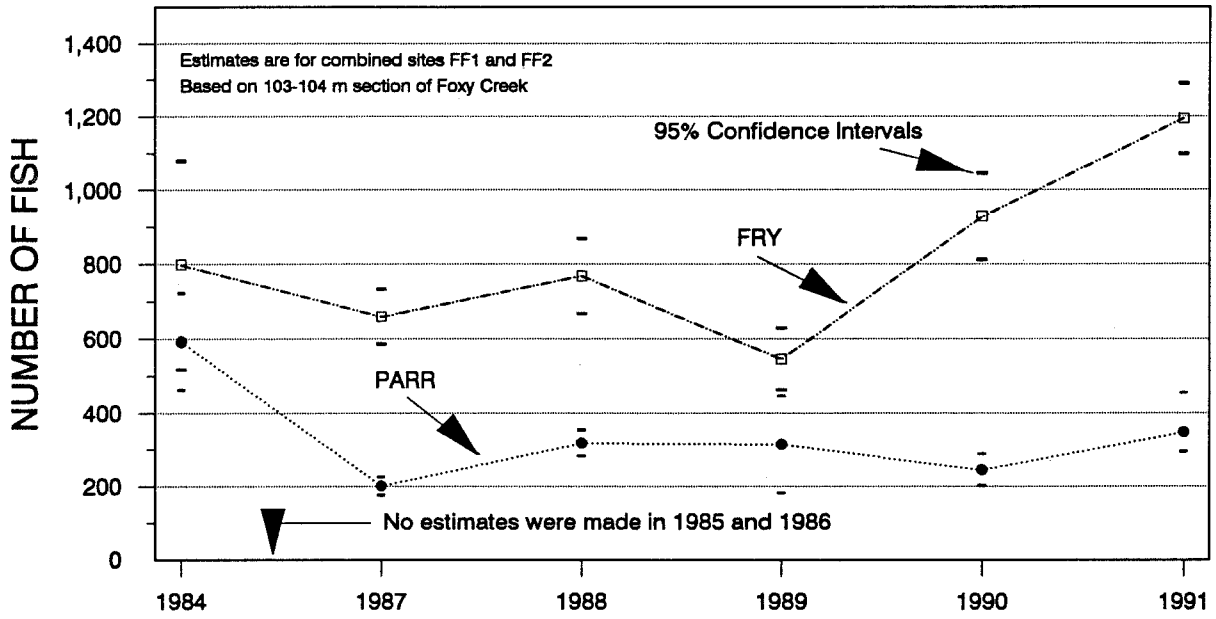


Figure 2. Foxy Creek rainbow trout population estimates for the period 1984 to 1991.

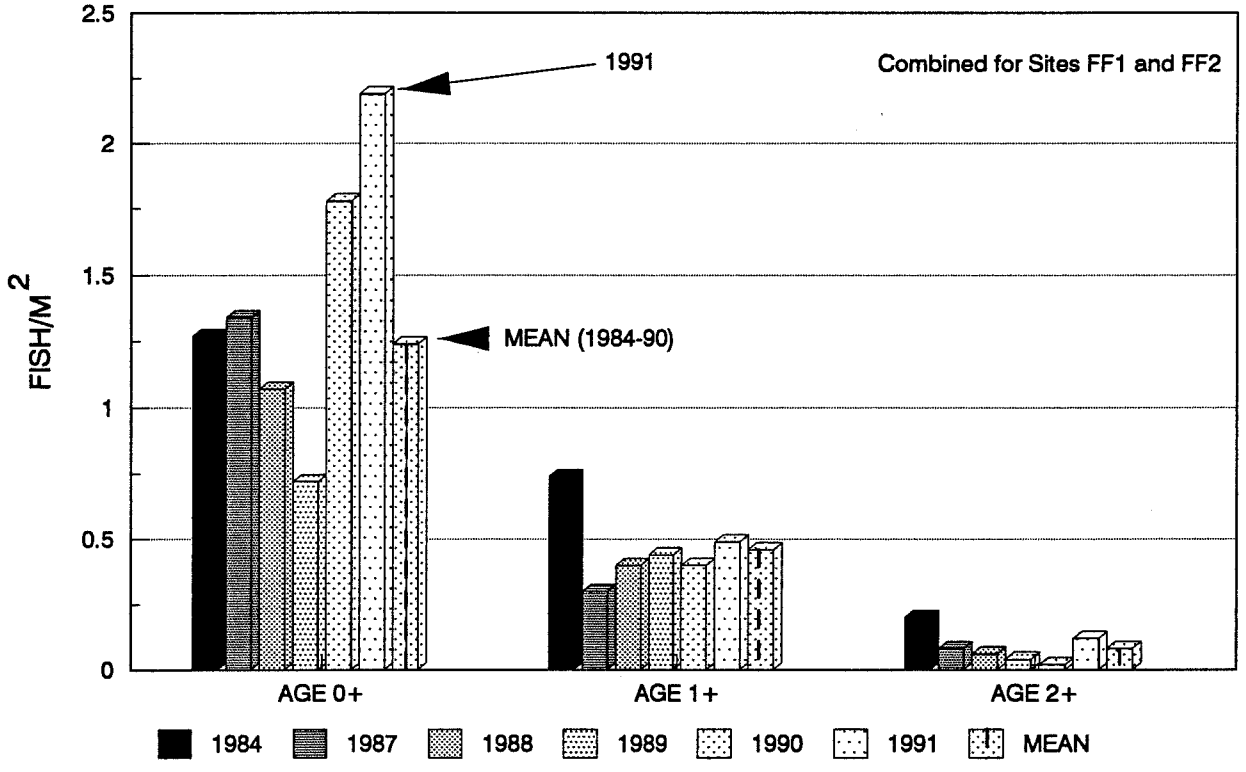


Figure 3. Rainbow trout density estimates in Foxy Creek from 1984 to 1991.

Table 2. Summary of Rainbow Trout Density Estimates in Foxy Creek from 1984 to 1991.

SAMPLE SITE	YEAR	DENSITY (fish/m^2) 0+	1+	≥2+
FF1	1984	0.88	0.63	0.21
	1987	0.66	0.30	0.09
	1988	0.32	0.26	0.05
	1989	0.34	0.55	0.04
	1990	1.81	0.18	0.01
	(1984-90)	**0.73**	**0.38**	**0.08**
	1991	**1.87**	**0.37**	**0.01**
FF2	1984	1.66	0.86	0.20
	1987	2.03	0.30	0.06
	1988	1.82	0.55	0.07
	1989	1.10	0.34	0.04
	1990	1.75	0.63	0.03
	(1984-90)	**1.67**	**0.54**	**0.08**
	1991	**2.51**	**0.62**	**0.22**
MEAN	1984	1.27	0.74	0.20
	1987	1.34	0.30	0.08
	1988	1.07	0.40	0.06
	1989	0.72	0.44	0.04
	1990	1.78	0.40	0.02
	(1984-90)	**1.24**	**0.46**	**0.08**
	1991	**2.19**	**0.49**	**0.12**

Rainbow parr numbers in lower Foxy Creek were slightly above the average for the previous years (Table 1 and Figure 2). Total parr estimates for the two sites combined have been very steady since 1987, ranging from 202 to 349 fish annually at the sites. Similarly, when expressed as density of parr, the 1991 results were slightly above average (Figure 3 and Table 2). As in past years, rainbow parr densities were considerably higher at Site FF2 than at FF1. Site FF2 has more deep pool habitat with complex debris cover, and this may help to account for these higher parr densities. In particular age 2+ fish would tend to use deeper water areas.

Table 3 shows the estimated survival of age 0+ rainbow fry to age 1+ parr the subsequent September. Survival ranged from 30% to 43% with the best survival occurring during years of lowest fry numbers. The data suggests that lower Foxy Creek is adequately seeded with fry and that age 1+ production has been very steady from year-to-year despite fluctuations in fry abundance.

Biomass estimates for rainbow trout in the two Foxy Creek sites are summarized in Table 4 with more detailed information provided in Appendix 4 Table 1. The 1991 biomass estimates exceed all years except the first year of survey in 1984. The increase between 1990 and 1991 is largely a result of increased age 1+ parr production at Site FF1 (Appendix 4 Table 1). The biggest difference between 1991 biomass estimates and 1984 estimates is the reduced parr production at Site FF1 compared to the earliest year of survey, particularly age 2+ fish. Age 2+ rainbow production at this site exceeded 4.3 g/m^2 in 1984 compared to 0.1 g/m^2 in 1991.

Table 3. Survival of Age 0+ Rainbow to Age 1+ Based on Combined Estimates for Sites FF1 and FF2.

YEAR	AGE 0+	AGE 1+[1]	SURVIVAL (%)
1987	660	279	42.3
1988	768	286	37.2
1989	546	234	42.9
1990	929	277	29.8

[1] Based on following year estimates.

Table 4. Summary of Biomass Estimates of Rainbow Trout for the Foxy Creek Sites Combined from 1984 to 1991.		
YEAR	BIOMASS ESTIMATES	
	GRAMS/M^2	GRAMS FROM 2 SITES
1984	9.6	5977
1987	3.3	1758
1988	3.3	2283
1989	2.5	1700
1990	4.4	2445
1991	**5.5**	**3186**

Rainbow fry and age 1+ parr mean fork lengths were near the average for the previous four years (Table 5 and Figure 4). Unlike 1990, no differences were noted in rainbow fry fork lengths between Site FF1 (37.2 mm) and FF2 (37.0 mm). The 5 mm difference noted between mean fry lengths at these sites in 1990 was reflected in smaller age 1+ parr at Site FF1 in 1991. Extensive channel disturbance at Site FF1 in 1989 and 1990 may have reduced invertebrate production resulting in small fish sizes at this site in 1990 (Bustard 1990).

Table 5. Summary of Rainbow Trout Age 0+ and Age 1+ Fork Lengths (mm) Combined for the Two Foxy Creek Sites.		
YEAR	FORK LENGTHS	
	AGE 0+	AGE 1+
1984	34.3	77.6
1987	38.8	81.0
1988	39.2	79.8
1989	37.7	72.7
1990	38.0	75.0
(1984-90)	37.6	77.2
1991	37.1	77.2

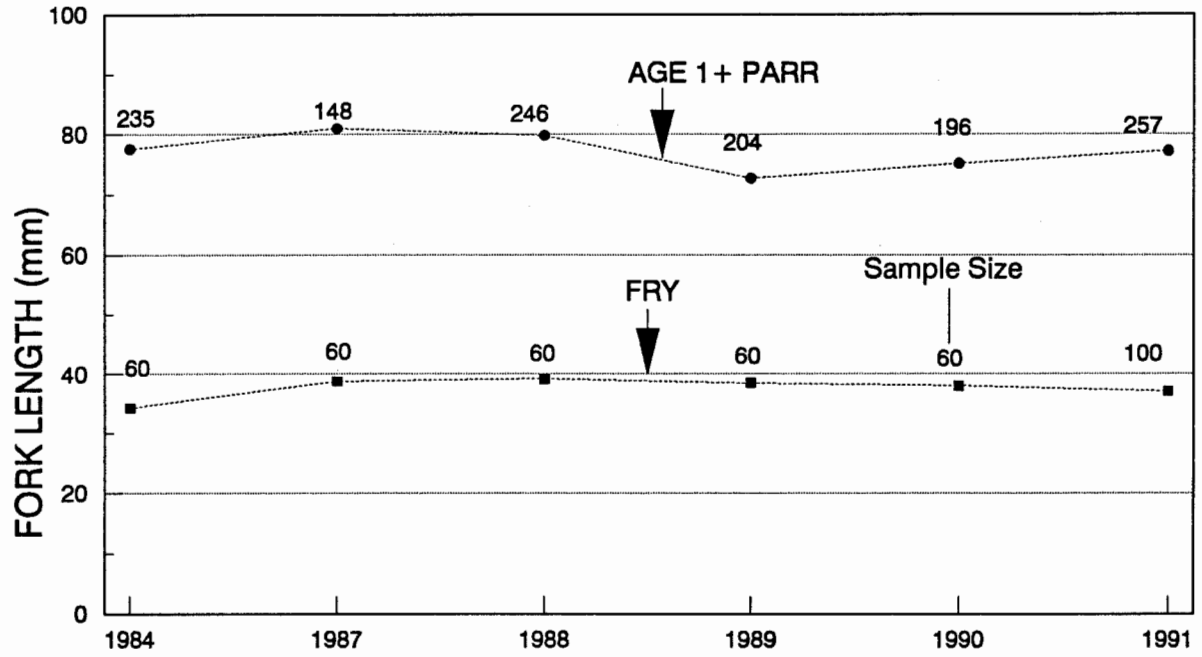


Figure 4. Mean fork lengths (mm) of Foxy Creek Rainbow Trout from 1984 to 1991.

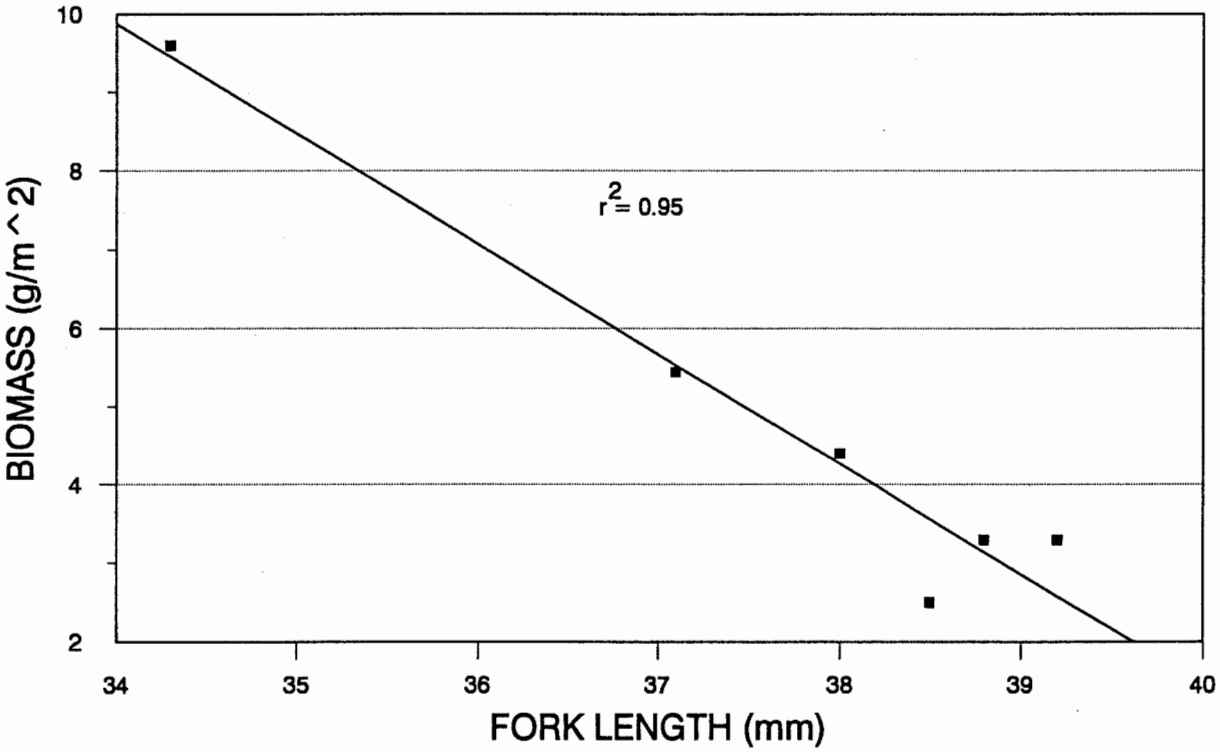


Figure 5. Mean Fork Length of Age 0+ Rainbow Trout in Foxy Creek Versus Total Biomass of Rainbow Trout in the Two Sample Sites.

It is interesting to note the relationship between rainbow fry fork lengths and rainbow trout biomass (Figure 5). During years of high biomass such as 1984, rainbow fry tended to be small, while during those years of low biomass, fry sizes tended to be larger. These results suggest that the sites are at carrying capacity during years of higher biomass.

Table 6 compares the density and biomass of rainbow fry and parr in Foxy Creek based on the six years of measurements to density and biomass information collected in the best similar-sized rainbow tributaries to Babine and Francois lakes. The fry and parr densities and biomass estimates from Foxy Creek in 1991 are at the upper end of those reported from these other very productive systems. The six-year average for fry densities in Foxy Creek is in the mid-range of the levels reported for these systems while the estimates of parr and biomass are in the mid to upper end of the range.

Table 6. Rainbow Trout Density and Biomass Estimates in Foxy Creek Compared to Best Adjacent Rainbow Trout Streams.

SYSTEM	FRY DENSITIES ($fish/m^2$)	PARR DENSITIES ($fish/m^2$)	BIOMASS (g/m^2)
DUNCAN*	1.96	0.40	6.0
MORRISON TRIB*	1.47	0.67	5.1
NITHI**	2.41	0.37	5.8
RAMSAY**	1.34	0.12	3.1
UNCHA**	0.92	0.03	2.2
FOXY (1984-91)	**1.40**	**0.55**	**4.8**
FOXY 1991	**2.19**	**0.61**	**5.5**

* From Bustard (1989)
**From Bustard (1987)

The fish sampling data collected to date indicates that lower Foxy Creek continues to provide a very productive juvenile rainbow trout rearing environment. Fish populations remain high, and data suggests at carrying capacity during some years. Total parr production estimates in the study sections have remained at constant levels despite fluctuations in fry numbers. Habitat changes at the lower sample site may account for the most

significant differences in biomass production in the study area - and habitat instability including loss of deep pool habitat at Site FF1 may help explain the drop in age 2+ fish numbers at this site.

3.2 Upper Buck Creek

A total of 787 m^2 of Buck Creek upstream of Goosly Lake comprising 143 m of stream margin was sampled in 1991 (Tables 7a and 7b). The lower site (BB1) was moved upstream approximately 50 m from the area sampled in previous years due to a new beaver dam at the old location. This is the first free-flowing section of stream upstream of Goosly Lake.

Habitat characteristics in the upper site (BB2) remained unchanged from previous years. The site is comprised of excellent spawning gravels and a good diversity of pool and riffle habitat with abundant debris and bank cover. The total area and length of stream margin remained unchanged from previous years. Suspected old spawning redds were observed in the middle of the study section during the surveys. An extensive network of beaver dams including

Table 7a. Catch Composition of Buck Creek Fish Sample Site BB1 from 1987 to 1991.

SPECIES	1987 (%)	1988 (%)	1989 (%)	1990 (%)	1991 (%)	MEAN 87-90 (%)
RAINBOW FRY	1 (1.3)	0	21 (26.6)	5 (4.2)	2 (2.4)	6 (7.2)
RAINBOW PARR	37 (48.7)	29 (56.9)	24 (30.4)	86 (72.3)	57 (67.9)	44 (54.7)
WHITEFISH	13 (17.1)	0	8 (10.1)	8 (6.7)	0	7 (9.0)
SCULPINS	25 (32.9)	22 (43.1)	25 (31.6)	20 (16.8)	24 (28.6)	23 (28.6)
SUCKERS	0	0	1 (1.3)	0	1 (1.2)	0
TOTAL	76	51	79	119	84	80
AREA (m^2)	409	394	406	476	445	421
LENGTH (m)	66	63	65	71	65	66

Table 7b. Catch Composition of Buck Creek Fish Sample Site BB2 from 1987 to 1991.

SPECIES	1987 (%)	1988 (%)	1989 (%)	1990 (%)	1991 (%)	MEAN 87-90 (%)
RAINBOW FRY	190 (66.2)	130 (61.0)	213 (69.2)	188 (61.4)	599 (84.5)	180 (64.7)
RAINBOW PARR	97 (33.8)	83 (39.0)	95 (30.8)	118 (38.6)	110 (15.5)	98 (35.3)
TOTAL	287	213	308	306	709	279
AREA (m^2)	319	359	343	340	342	341
LENGTH (m)	76	77	78	78	78	77

a large dam at the road culvert located approximately 1 km upstream of the lake restricts access from Goosly Lake during most periods of the year. However, rainbow trout spawners are able to reach the study area during high flow periods in the spring.

Nearly all of the 793 fish captured in upper Buck Creek were rainbow trout (97%). The remainder of the catch was comprised of prickly sculpins (3%) and a single longnose sucker (Tables 7a and 7b). As in past years, rainbow trout were the only fish species present in the upper site. Detailed catch results are presented in Appendix 2.

Only 2 rainbow fry were captured in the deep low gradient habitat at Site BB1. Age 1+ parr densities were slightly above average while age 2+ fish were more abundant than during past years (Table 8 and Figure 6). Both density and biomass estimates (Table 10) at this lower site indicate that rainbow production in the site has improved from 1990 onward.

Sampling results at Site BB2 indicate a sharp increase in rainbow fry numbers (Table 7b). An estimated 599 fry were present at this site, more than three times the average from the previous four years. An estimated 110 rainbow parr were present in Site BB2. This is very close to the average for past years. The estimated fry and parr populations (including 95% confidence intervals) are shown in Figure 7. Nearly all parr captured at this site are age 1+, similar to past years (Table 8).

Table 8. Summary of Rainbow Trout Density Estimates in Upper Buck Creek from 1987 to 1991.				
SAMPLE SITE	YEAR	DENSITY (fish/m^2) 0+	1+	≥2+
BB1	1987	0.00	0.07	0.02
	1988	0.00	0.06	0.01
	1989	0.05	0.04	0.02
	1990	0.01	0.16	0.02
	(1987-90)	**0.02**	**0.08**	**0.02**
	1991	**<0.01**	**0.09**	**0.04**
BB2	1987	0.59	0.27	0.03
	1988	0.36	0.23	0.00
	1989	0.62	0.27	0.01
	1990	0.55	0.34	0.01
	(1987-90)	**0.53**	**0.28**	**0.01**
	1991	**1.75**	**0.32**	**0.01**

Table 9. Survival of Age 0+ Rainbow to Age 1+ Based on Estimates for Site BB2.			
YEAR	AGE 0+	AGE 1+[2]	SURVIVAL (%)
1987	190	83	43.7
1988	130	92	70.8
1989	213	115	54.0
1990	188	108	57.4

[2] Based on following year estimates.

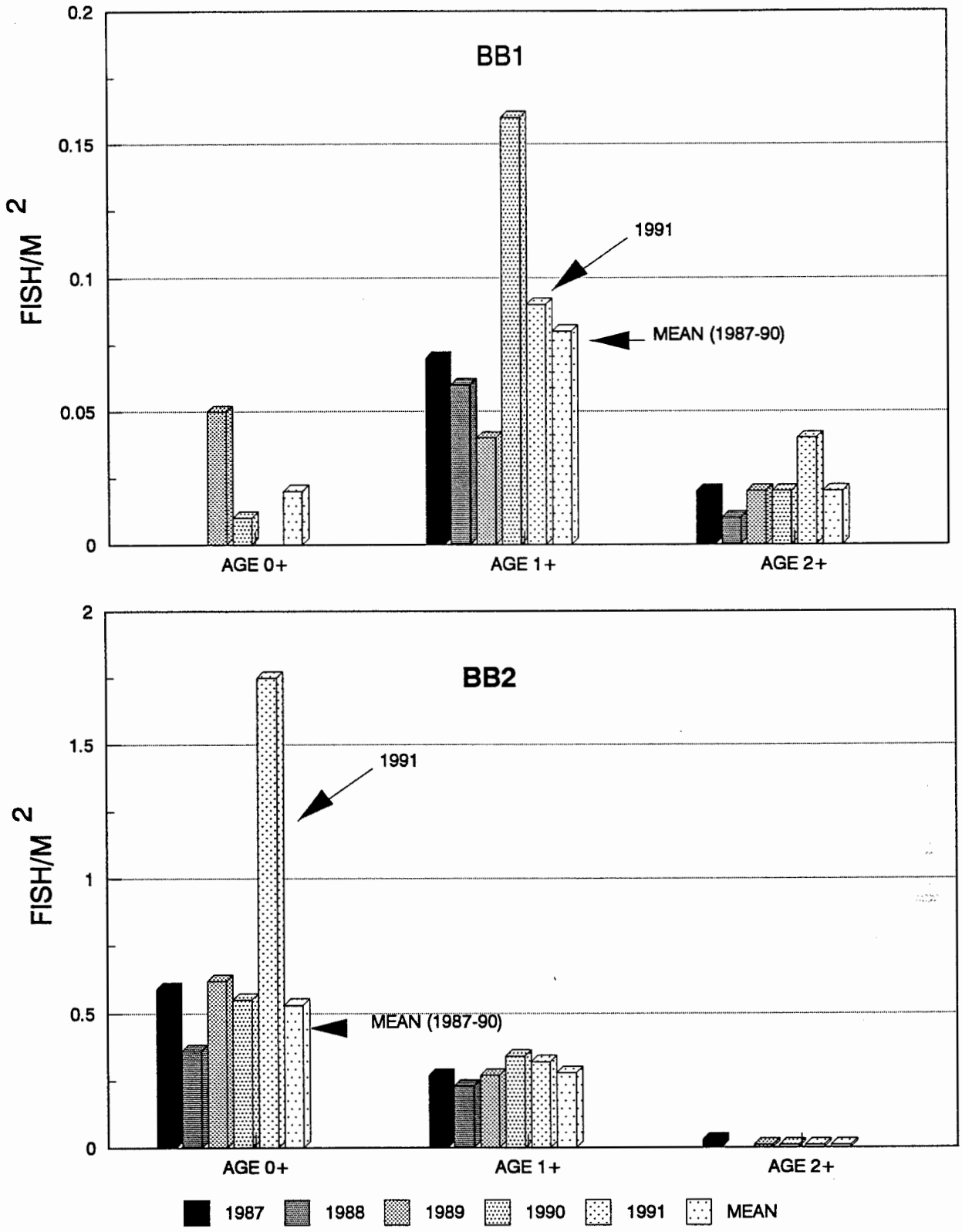


Figure 6. Rainbow trout density estimates in upper Buck Creek from 1987 to 1991.

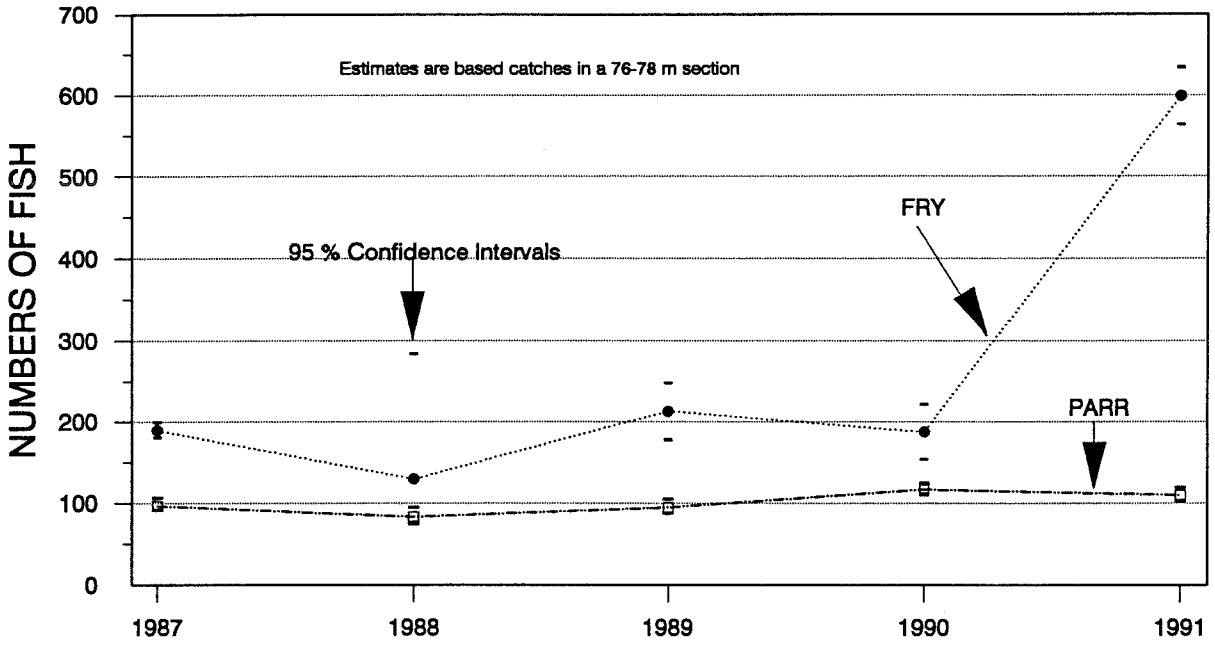


Figure 7. Juvenile rainbow population estimates in upper Buck Creek (Site BB2) from 1987 to 1991.

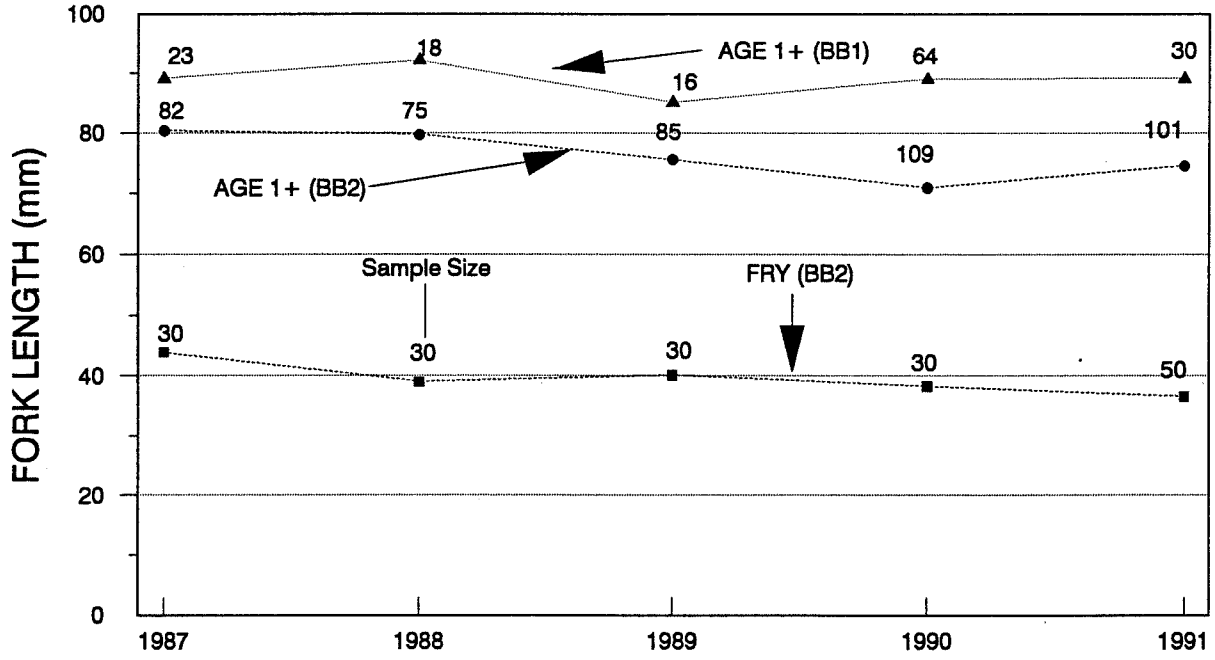


Figure 8. Mean fork lengths (mm) of upper Buck Creek rainbow trout from 1987 to 1991.

Parr estimates at this site have remained within a narrow range between 83 and 118 fish during the past five years. Similarly, densities have consistently been near 0.3 parr/m^2 at this site. Estimated survival from age 0+ fry to age 1+ fish the following September has ranged from 44% to 70% (Table 9) with the best survival occurring during years of poor fry recruitment.

Biomass estimates at Sites BB2 (2.4 g/m^2) were slightly lower than 1990 reflecting small reduction in age 1+ parr numbers at this site (Table 10). These estimates are in the lower end of the estimates provided for other productive rainbow trout rearing streams in the general vicinity of Buck Creek (Table 6).

Table 10. Summary of Biomass Estimates of Rainbow Trout for the Upper Buck Creek Sites from 1987 to 1991.

YEAR	GRAMS/M^2		TOTAL GRAMS FROM SITE	
	BB1	BB2	BB1	BB2
1987	0.77	2.35	315	750
1988	0.70	1.32	276	474
1989	0.51	1.58	207	542
1990	1.49	2.61	708	888
1991	**1.22**	**2.42**	**543**	**827**

Rainbow fry fork lengths at Site BB2 were below the average of the previous four years, possibly reflecting the very high densities (1.75 fry/m^2) present in the site in 1991 (Figure 8 and Table 11). Age 1+ parr at this site were smaller than average but larger than in 1990 (Table 11). Parr sizes at Site BB2 are considerably smaller than at the downstream site (BB1), reflecting totally different habitat conditions at the upper site.

In summary, density and biomass estimates at the sample site below Bessemer Creek (BB1) remain at low levels relative to the upper site. However, estimates from the past two years indicate rainbow parr numbers have increased over years previous to this and are judged to be substantially higher than during the early 1980's when it was difficult to obtain an adequate sample for fish tissue analysis. Rainbow fry numbers at the site upstream of Bessemer Creek (BB2) were the highest recorded to date. Rainbow parr numbers at the site have remained at a very steady level throughout

the five years of population estimates at this site. Habitat conditions have remained stable, fry recruitment is adequate, and the site productivity appears to reflect the amount of suitable parr habitat.

Table 11. Summary of Rainbow Trout Age 0+ and Age 1+ Fork Lengths for the Two Upper Buck Creek Sample Sites.

YEAR	AGE 0+		AGE 1+	
	BB1	BB2	BB1	BB2
1987	*	43.9	89.1	80.4
1988	*	39.0	92.2	79.7
1989	44.1	40.1	85.1	75.6
1990	*	38.3	89.0	71.0
(1987-90)	44.1	40.3	88.8	76.7
1991	*	**36.6**	**89.1**	**74.6**

* Inadequate sample size (<15 measurements)

3.3 Lower Buck Creek

Sample Site BB3 in lower Buck Creek was 390 m^2 and comprised 43 m of stream margin (Table 12). Streamflow conditions during sampling at this location were low, similar to 1990.

Longnose dace were again the predominant fish species present at this site comprising 56% of the total 505 fish estimated in the sample site. This represents a minimum estimate for dace since a poor decline in fish numbers was obtained in the sample. The 1991 dace estimates simply represent a combination of the first and second pass of fish caught at the site (Appendix 2). Rainbow trout (assumed to be the progeny of steelhead trout) comprised approximately 41% of the total sample. A small number of longnose suckers (2.6%) and mountain whitefish (0.2%) were also present in the sample site.

Total steelhead fry numbers (175) were higher than the average since 1987 (113) while steelhead parr numbers (34) were the lowest recorded at this site (Table 12). Nearly half of the steelhead parr captured in 1991 were older parr (age 2+ and two age 3+ fish). The lower densities of age 1+ fish at this site may reflect the

Table 12. Catch Composition of Lower Buck Creek Fish Sample Site BB3 from 1987 to 1991.

SPECIES	1987 (%)	1988 (%)	1989 (%)	1990 (%)	1991 (%)	MEAN 87-90 (%)
STEELHEAD FRY	217 (39.7)	66 (28.6)	109 (40.1)	58 (14.7)	175 (34.7)	113 (31.1)
STEELHEAD PARR	49 (9.0)	39 (16.9)	67 (24.6)	40 (10.1)	34 (6.7)	49 (13.5)
LONGNOSE DACE	279 (51.0)	108 (46.8)	89 (32.7)	282 (71.4)	282 (55.8)	190 (52.5)
WHITEFISH	2 (0.4)	15 (6.5)	3 (1.1)	7 (1.8)	1 (0.2)	7 (1.9)
SUCKERS	0	3 (1.3)	4 (1.5)	8 (2.0)	13 (2.6)	4 (1.0)
TOTAL	547	231	272	395	505	361
AREA (m^2)	413	416	458	399	390	422
LENGTH (m)	44	43	43	43	43	43

higher abundance of larger parr at this site in 1991 (Table 13 and Figure 10). Total parr estimates within the site have ranged from 34 to 67 fish during the past five years (average of 46 fish), despite a nearly four-fold difference in fry estimates at the site over this time period.

Table 13. Summary of Steelhead Trout Density Estimates in Lower Buck Creek from 1987 to 1991.

SAMPLE SITE	YEAR	DENSITY (fish/m^2) 0+	1+	≥2+
BB3	1987	0.53	0.08	0.04
	1988	0.16	0.07	0.02
	1989	0.24	0.12	0.03
	1990	0.14	0.05	0.04
	(1987-90)	**0.27**	**0.08**	**0.03**
	1991	**0.45**	**0.05**	**0.04**

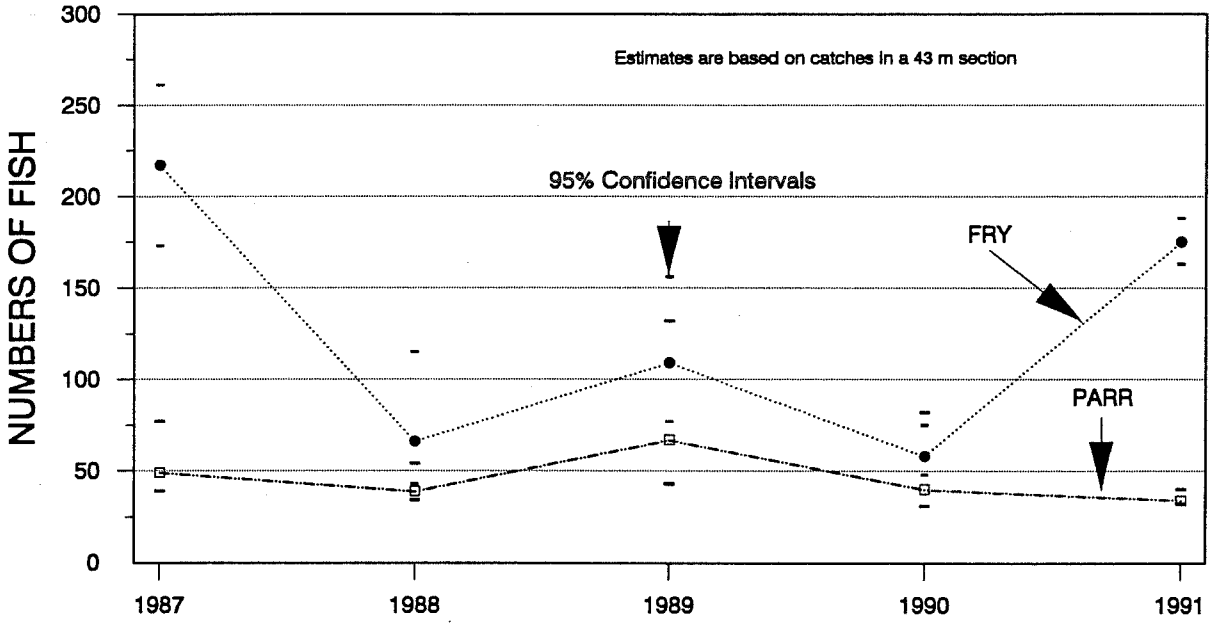


Figure 9. Juvenile steelhead population estimates in lower Buck Creek (Site BB3) from 1987-1991.

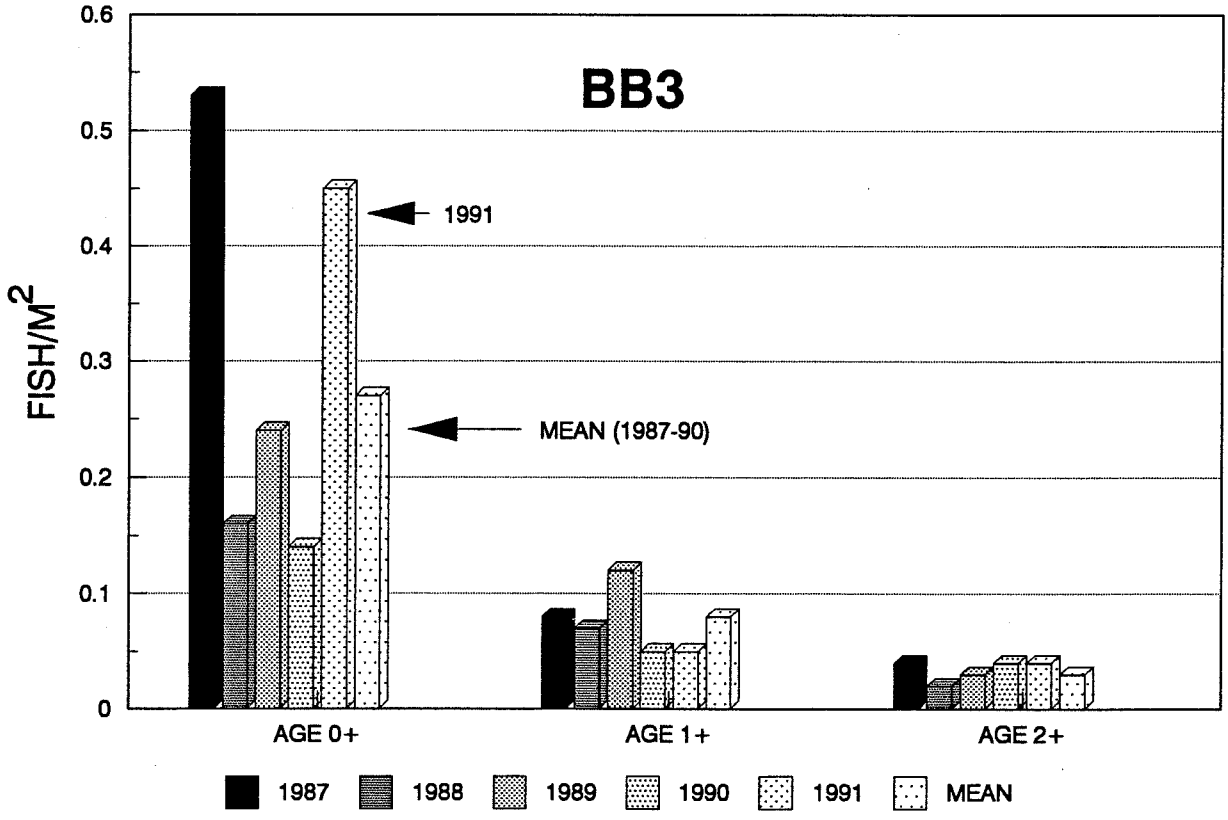


Figure 10. Steelhead trout density estimates in lower Buck Creek from 1987 to 1991.

The estimated survival from age 0+ fry to age 1+ parr the next September based on population estimates within the sample site range from 13% to over 80% (Table 14). The poorest estimated survival occurred during the year of highest fry recruitment while the highest estimated survival occurred during a year when confidence in the fry estimates was poor.

Table 14. Survival of Age 0+ Steelhead to Age 1+ Based on Estimates for Site BB3.

YEAR	AGE 0+	AGE 1+[3]	SURVIVAL (%)
1987	217	29	13.4
1988	66	55	83.3
1989	109	22	20.2
1990	58	18	31.0

Density estimates of steelhead parr have been near 0.1 fish/m^2 for the past 5 years. Tredger (1987) reported densities of between 0.3 and 0.4 parr/m^2 at a sample site located in Buck Creek at Site BB3 during 1985 and 1986. However, these estimates were based on a small number of fish in a short stream section (eg., sample site was approximately 10 m long in 1986 compared to 43 m since 1987). Similarly, fry densities as high as 1.85 fry/m^2 have been reported for this section of Buck Creek (Tredger 1987) suggesting that densities of 0.3 fry/m^2 typical of the past five years are low relative to densities that have occurred during some years.

Figure 12 shows the number of steelhead trout fry versus the previous year's adult steelhead test fishery index on the lower Skeena River (data on file, Ministry of Environment, Smithers). The data suggests that for those years when the test fishery index was high, steelhead fry numbers were also relatively high the following year (r^2=0.44). The 1991 test fishery index for steelhead (39.6) is lower than the lowest levels shown in Figure 12, suggesting that fry recruitment to Buck Creek may be quite poor in 1992. It should be noted that the Skeena test fishery is generally finished by the end of August and the index relects the early portion of the steelhead run, but does not reflect the strength of the run entering the Skeena in September.

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[3] Based on following year estimates.

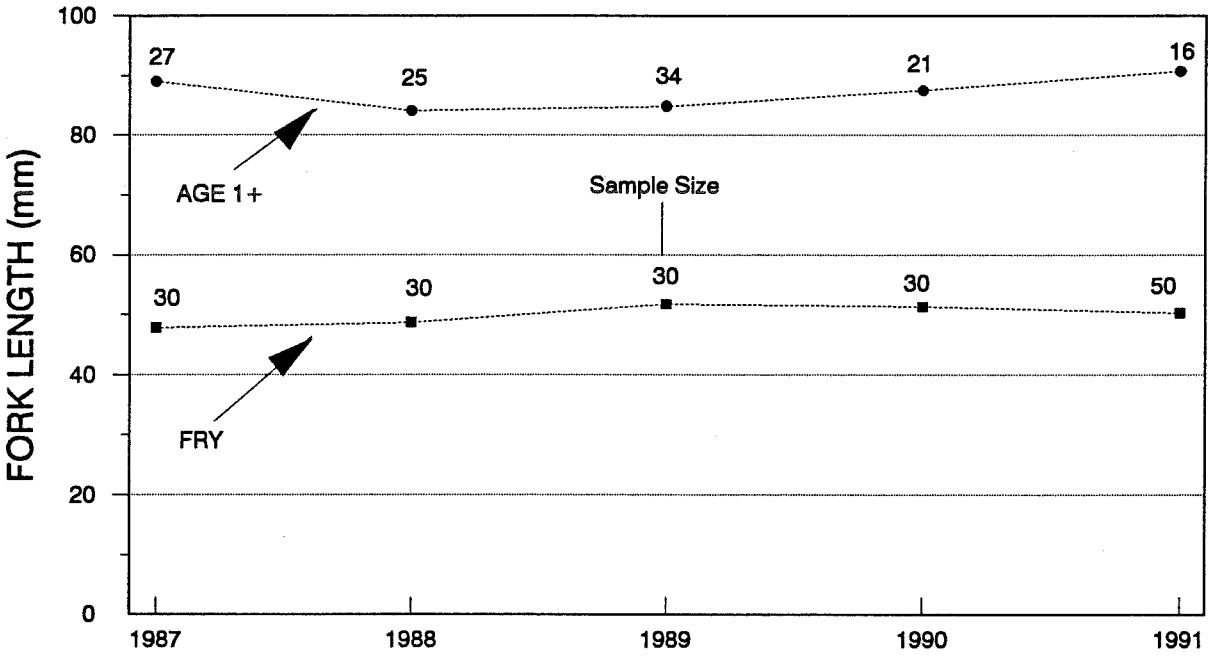

Figure 11. Mean fork lengths (mm) of lower Buck Creek rainbow (steelhead) trout from 1987 to 1991.

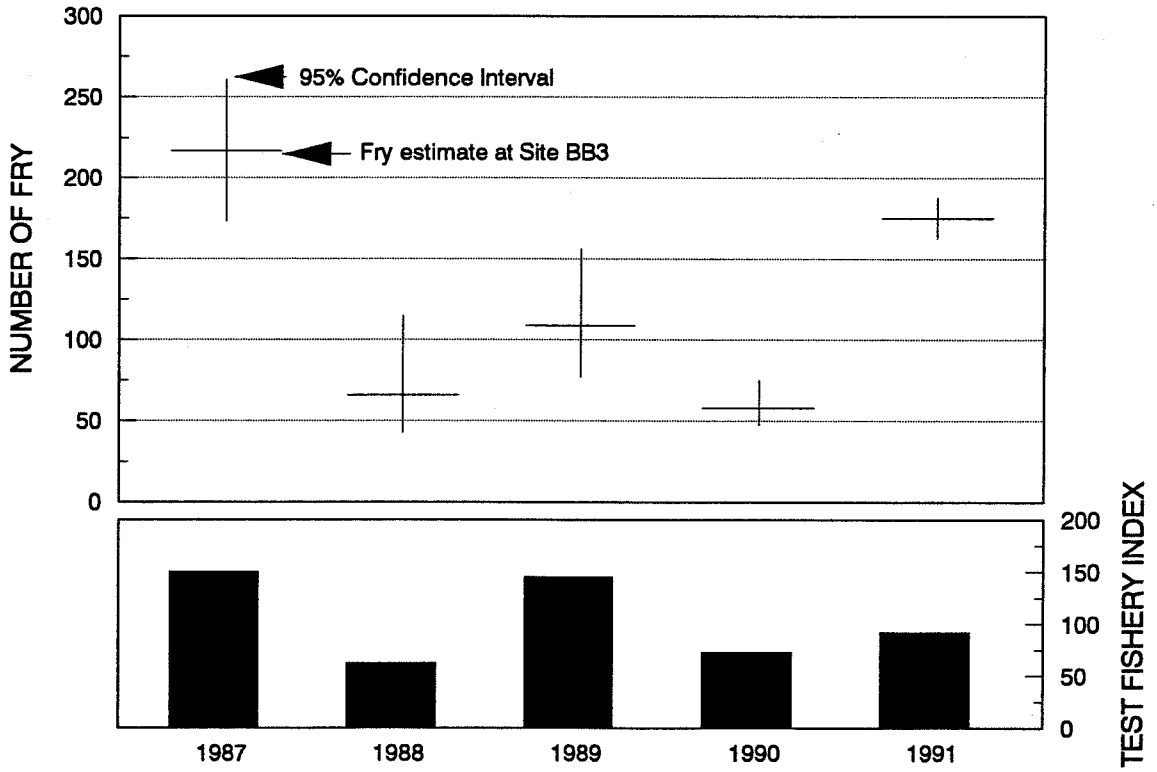

Figure 12. Steelhead fry numbers in lower Buck Creek versus the previous year's test fishery index.

Steelhead trout biomass estimates at Site BB3 have ranged from 1-2 grams/m^2 during the past five years. Even though the number of steelhead parr was down in 1991, the biomass of rainbow trout at the site was up (Table 15), reflecting a high proportion of age 2+ fish (Figure 10) and larger age 1+ parr in 1991 (Table 16).

It is interesting to note that longnose dace biomass at this site exceeded 2.0 grams/m^2 in 1991 (Appendix 2). Dace biomass estimates have ranged from 1.0 g/m^2 in 1988 to 4.7 g/m^2 in 1989. It is not known what influence the presence of large numbers of longnose dace in this site have on the abundance and growth of juvenile steelhead trout. The larger dace tend to occupy similar sections of the stream as steelhead parr. Studies by Reeves et al. (1987) demonstrated that in warm-water habitats, steelhead trout production was decreased by more than 50% due to the presence of redside shiners. Water temperatures in this section of Buck Creek may rise to levels that give the longnose dace a competitive feeding advantage since the dace tend to be more active and respond more quickly to food than trout in warm water.

Table 15. Summary of Biomass Estimates for Steelhead Trout in Lower Buck Creek (Site BB3) from 1987 to 1991.

YEAR	GRAMS/M^2	TOTAL GRAMS FROM SITE
1987	2.01	830
1988	1.06	441
1989	1.51	692
1990	1.74	694
1991	**1.81**	**706**

Steelhead trout fry sizes were slightly above the average for the previous four years (Table 16 and Figure 11), while age 1+ parr were the largest recorded to date. It should be noted that the 1991 sample size of age 1+ fish was small (16 fish).

Table 17 compares steelhead fry and age 1+ parr densities in the lower Buck Creek site to densities in the main steelhead tributaries of the Morice River. Steelhead fry and parr densities are in the mid-range of estimates for these other systems. Fry densities in the 0.5 fry/m^2 range should be adequate to maximize smolt production in Buck Creek based on the results of fry stocking density assessments elsewhere (Hume and Parkinson 1987).

Table 16. Summary of Steelhead Trout Age 0+ and Age 1+ Fork Lengths for Lower Buck Creek.

	FORK LENGTHS (mm)	
YEAR	**AGE 0+**	**AGE 1+**
1987	47.8	89.0
1988	48.7	84.1
1989	51.7	84.9
1990	51.3	87.5
(1987-90)	49.9	86.4
1991	**50.3**	**90.7**

Table 17. Steelhead Fry and Parr Densities in Site BB3 in Lower Buck Creek Compared to Other Nearby Productive Steelhead Rearing Streams During 1991[4].

SYSTEM	FRY/M^2	PARR/M^2
OWEN CREEK (3 sites)	1.21	0.12
LAMPREY CREEK (3 sites)	1.04	0.06
SHEA CREEK (2 sites)	0.48	0.11
THAUTIL RIVER (4 sites)	0.20	0.09
BUCK CREEK (Site BB3)	**0.45**	**0.09**

In summary, steelhead fry numbers were above the average of the previous four years at Site BB3 while parr numbers were down slightly. Parr numbers and steelhead biomass at this site have stayed within a narrow range, but comparisons to sampling conducted in the area prior to 1987 suggest that the site is capable of producing higher steelhead parr densities. Similarly, fry densities during some years have been much higher than during the past five years. The lower fry numbers presumably reflect poorer recruitment due to low numbers of spawners. The test fishery index on the lower Skeena provides an indication of the strength of the following year's fry recruitment based on the last five years of estimates.

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[4]Preliminary data from juvenile steelhead index surveys (Bustard in prep.)

4.0 LITERATURE CITED

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Appendix 1: Detailed Information Describing Rainbow Trout Collected for Analyses of Tissue.

TABLE 1. Foxy Creek Rainbow Trout Samples Collected for Metal Analyses of Tissue, September 3, 1991.

SAMPLE #	LENGTH (mm)	AGE	WEIGHT (gm)	TOTAL WEIGHT
1	118	2+	17.5	17.5
2	132	2+	27.6	27.6
3	129	2+	21.4	21.4
4	131	2+	27.4	27.4
5	105	2+	16.4	16.4
6	109	2+	13.0	
	94	1+	8.7	21.7
7	159	3+	47.0	47.0
8a	107	2+	14.7	
8b	108	2+	12.6	27.3
9	112	2+	13.0	
	97	1+	9.4	22.4
10a	105	2+	11.9	
10b	80	1+	6.2	18.1

COMMENT: These samples were captured by electrofishing (250 v). Sample location was site FF2.

TABLE 2. Buck Creek Above Bessemer Creek Rainbow Trout Samples Collected for Metal Analyses, September 5, 1991.

SAMPLE #	LENGTH (mm)	AGE	WEIGHT (gm)	TOTAL WEIGHT
1a	106	2+	12.3	
1b	75	1+	4.1	16.4
2a	97	2+	8.9	
2b	85	1+	7.2	16.1
3a	82	1+	6.2	
3b	87	1+	6.5	
3c	77		4.5	17.2
4a	85		6.1	
4b	88		7.5	
4c	70		3.7	17.3
5a	83		6.6	
5b	89	1+	7.5	
5c	72		4.6	18.7
6a	82		6.1	
6b	82		5.5	
6c	79		5.9	17.5
7a	87		7.3	
7b	81		6.3	
7c	78		5.3	18.9
8a	82		6.5	
8b	83		5.7	
8c	76		4.7	16.9
9a	82		5.2	
9b	86		7.5	
9c	81		5.5	18.2
10a	81		5.3	
10b	79		5.3	
10c	73		4.9	
10d	66		2.9	18.4

COMMENT: These samples were captured by electrofishing at a site located approximately 1.2 km above Bessemer confluence.

TABLE 3. Buck Creek Below Bessemer Creek Rainbow Trout Samples Collected for Metal Analyses of Tissues, September 6, 1991.

SAMPLE #	LENGTH (mm)	AGE	WEIGHT (gm)	TOTAL WEIGHT
1a	91	1+	8.9	
1b	88	1+	7.3	16.2
2a	88		7.9	
2b	92	1+	9.0	16.9
3a	113	2+	14.7	
3b	90	1+	8.3	23.0
4a	102	2+	12.4	
4b	93	1+	8.6	21.0
5a	112	2+	14.4	
5b	92	1+	8.7	23.1
6a	102	2+	12.6	
6b	88	1+	8.2	20.8
7a	98	2+	10.4	
7b	81	1+	6.6	17.0
8a	90	1+	8.9	
8b	92	1+	9.7	18.6
9a	106	2+	13.8	
9b	95	1+	9.6	23.4
10a	95		9.6	
10b	104	2+	12.6	22.2

COMMENT: These samples were captured by electrofishing at a site located approximately 300 m upstream of Goosly Lake.

TABLE 4. Buck Creek Below Goosly Lake Rainbow Trout (Steelhead) Sample Collected for Metal Analyses, August 30, 1991.

SAMPLE #	LENGTH (mm)	AGE	WEIGHT (gm)	TOTAL WEIGHT
1a	109	2+	12.0	
1b	81	1+	7.0	19.0
2	153	3+	39.7	39.7
3a	113	2+	14.0	
3b	75	1+	7.0	21.0
4a	118	2+	16.6	16.6
5a	103	1+	12.3	
5b	92	1+	9.9	22.2
6a	108	2+	12.0	
6b	96	1+	9.4	21.4
7a	113	2+	15.4	
7b	86	1+	7.6	23.0
8a	109	2+	13.5	
8b	92	1+	8.8	22.3
9a	99	2+	11.3	
9b	97	1+	9.3	20.6
10a	100	1+	10.5	
10b	103	1+	12.0	22.5

COMMENT:These samples were captured by electrofishing at a site located approximately 200 m downstream of the 1st bridge crossing on Buck Flats

Appendix 2: Site Descriptions and Detailed Results of Fish Sampling in Foxy and Buck Creeks, September 1991.

SITE DESCRIPTIONS - SITE FF1 DATE- SEPT 4/91 TEMP. 14.0 C @1100 hr. SLOPE- 1.0%
Same site as last year.
Some debris is accumulating just above the site - may move into site by next year.
Alage not as thick as last year.
Site starts approximately 10 m upstream from former bridge site.

POPULATION ESTIMATES:

SPECIES	AGE	PASS 1	PASS 2	U1&U2	NUMBER	S.E.	MORTS	N-CORR	N/M*M	N/LIN-M
Rainbow	0+	247	97	344	406.7	19.7	0	407	1.874	8.13
Rainbow	1+	68	11	79	81.1	2.0	0	81	0.374	1.62
Rainbow	2+	1	1	2	2.0	NA	0	2	0.009	0.04
Chinook	0+	0	0	0	0.0	NA	0	0	0.000	0.00
Coho	1+	4	0	4	4.0	0.0	0	4	0.018	0.08
LN Dace	all	28	14	42	56.0	13.0	0	56	0.258	1.12
LN Sucker	all	1	0	1	1.0	0.0	0	1	0.005	0.02
P Sculpin	1+	0	0	0	0.0	NA	0	0	0.000	0.00
M Whitefish	0+	4	1	5	5.3	1.0	0	5	0.025	0.11
M Whitefish	1+	0	0	0	0.0	0.0	0	0	0.000	0.00
Lamprey		15	4							
TOTAL								556	2.563	11.124

LENGTH/WEIGHT DATA:

SPECIES	AGE	FL-RANGE (mm)	MEAN FL (mm)	MEAN WEIGHT (g)	BIOMASS (g/m*m)
Rainbow	0+	27-55	37.2	0.530	0.99
Rainbow	1+	60-88	74.7	4.480	1.67
Rainbow	2+	110-118	114.0	16.390	0.15
Chinook	0+	0	0.0	0.000	0.00
Coho	1+	92-102	97.5	10.140	0.19
LN Dace	all	41-83	58.6	2.270	0.59
LN Sucker	all	112	112.0	16.740	0.08
P Sculpin	1+	0	0.0	0.000	0.00
M Whitefish	0+	70-85	74.0	3.880	0.10
M Whitefish	1+	0	0.0	0.000	0.00
TOTAL					3.76

SITE MEASUREMENTS:

LOCATION (m)	WIDTH (m)	MEAN DEPTH(cm)	MAXIMUM DEPTH(cm)	BANK COVER	DEBRIS COVER	D50/D90 (cm)
0	4.0	10	50	Present	Present	6/30
5	4.2					
10	3.8					
15	4.1		Estimate flow at 3-5 cfs			
20	4.1		Entire reach is on creek fan.			
	5.3		Photo 19			
	2.0					
	9.0					
	4.4					
	4.3					

AREA (M*M) 217.0 MARGIN (M) 50.0

SITE DESCRIPTIONS - SITE FF2 DATE-SEPT 3/91 TEMP. 12.0 C @1830 hr Slope 1.5 %
This site is approximately 1 km upstream of Maxan at water sample site.
Same site as 1988-90.
Very similar to 1990 sampling conditions including heavy algal mat.
Half of the site has a small sidechannel along the left side. This channel is nearly dry.

POPULATION ESTIMATES:

SPECIES	AGE	PASS 1	PASS 2	U1&U2	NUMBER	S.E.	MORTS	N-CORR	N/M*M	N/LIN-M
Rainbow	0+	485	186	671	786.7	26.1	0	787	2.512	14.57
Rainbow	1+	137	41	178	195.5	8.1	0	196	0.624	3.62
Rainbow	2+	22	15	37	69.1	41.0	0	69	0.221	1.28
Rainbow	3+	1	0	1	1.0	0.0	0	1	0.003	0.02
Chinook	0+	0	0	0	0.0	NA	0	0	0.000	0.00
Coho	0+	0	0	0	0.0	NA	0	0	0.000	0.00
LN Dace	all	77	65	142	142.0	NA	0	142	0.453	2.63
LN Sucker	all	0	0	0	0.0	NA	0	0	0.000	0.00
P Sculpin	1+	0	0	0	0.0	0.0	0	0	0.000	0.00
M Whitefish	0+	3	14	17	17.0	NA	0	17	0.054	0.31
M Whitefish	1+	0	0	0	0.0	0.0	0	0	0.000	0.00
Lamprey		2	1							
TOTAL								1211	3.868	22.433

LENGTH/WEIGHT DATA:

SPECIES	AGE	FL-RANGE (mm)	MEAN FL (mm)	MEAN WEIGHT (g)	BIOMASS (g/m*m)
Rainbow	0+	26-55	37.0	0.52	1.31
Rainbow	1+	63-97	79.6	5.45	3.40
Rainbow	2+	99-138	111.5	15.30	3.38
Rainbow	3+	159	159	45.41	0.14
Chinook	0+	0	0.0	0.00	0.00
Coho	0+	0	0.0	0.00	0.00
LN Dace	all	42-93	63.1	2.79	1.26
LN Sucker	all	0	0.0	0.00	0.00
P Sculpin	1+	0	0.0	0.00	0.00
M Whitefish	0+	70-88	74.6	3.96	0.21
M Whitefish	1+	0	0.0	0.00	0.00
Lamprey					
TOTAL					9.71

SITE MEASUREMENTS:

LOCATION (m)	WIDTH (m)	MEAN DEPTH(cm)	MAXIMUM DEPTH(cm)	BANK COVER	DEBRIS COVER	D50/D90 (cm)
0	5.8	10	90		Present	15/40
5	6.3		This site is 30% pool and 70% riffle.			
10	6.0		Good cover in cobble and debris. Entire bottom covered with thick algal mat.			
15	5.6		Estimate flow of 5 cfs			
20	4.5					
	4.3					
	4.9					
	9.6					
	9.0 Plus others					
	5.8					

AREA (M*M) 313.2 MARGIN (M) 54.0

SITE DESCRIPTIONS - SITE BB1 DATE-SEPT 6/91 TEMP. 12 C SLOPE- 0.2%
This site on Buck Creek is located 350 m upstream of Goosly Lake.
This is the first section of the creek upstream of the lake with flowing riffles.
Estimate this site is 95% pool and 5% riffle.
This site was moved upstream approx 50 m as old site was dammed by beavers.
The site is 5 m shorter due to deep pool at the top end.
POPULATION ESTIMATES:

SPECIES	AGE	PASS 1	PASS 2	U1&U2	NUMBER	S.E.	MORTS	N-CORR	N/M*M	N/LIN-M
Rainbow	0+	2	0	2	2.0	0.0	0	2	0.004	0.03
Rainbow	1+	20	10	30	40.0	11.0	0	40	0.090	0.62
Rainbow	2+	10	4	14	16.7	4.2	0	17	0.037	0.26
LN Dace	0+	0	0	0	0.0	0.0	0	0	0.000	0.00
LN Dace	1+	0	0	0	0.0	0.0	0	0	0.000	0.00
LN Sucker	0+	0	0	0	0.0	0.0	0	0	0.000	0.00
LN Sucker	1+	1	0	1	1.0	0.0	0	1	0.002	0.02
P Sculpin	1+	11	6	17	24.2	10.9	0	24	0.054	0.37
M Whitefish	0+	0	0	0	0.0	0.0	0	0	0.000	0.00
M Whitefish	1+	0	0	0	0.0	0.0	0	0	0.000	0.00
Lamprey										
TOTAL								84	0.188	1.29

LENGTH/WEIGHT DATA:

SPECIES	AGE	FL-RANGE (mm)	MEAN FL (mm)	MEAN WEIGHT (g)	BIOMASS (g/m*m)
Rainbow	0+	46	46.0	0.97	0.00
Rainbow	1+	77-97	89.1	8.56	0.77
Rainbow	2+	98-113	103.5	12.10	0.45
LN Dace	0+	0	0.0	0.00	0.00
LN Dace	1+	0	0.0	0.00	0.00
LN Sucker	0+	0	0.0	0.00	0.00
LN Sucker	1+	67	67.0	4.11	0.01
P Sculpin	1+	59-111	90.5	10.49	0.57
M Whitefish	0+	0	0.0	0.00	0.00
M Whitefish	1+	0	0.0	0.00	0.00
TOTAL				0.00	1.806

SITE MEASUREMENTS:

LOCATION (m)	WIDTH (m)	MEAN DEPTH(cm)	MAXIMUM DEPTH(cm)	BANK COVER	DEBRIS COVER	D50/D90 (cm)
0	5.0	60	100	Present	Present	Silt/2
5	5.6					
10	8.6		Debris and log cover throughout			
15	5.8		Free-flowing section.			
20	9.1		Estimate 1-2 cfs.			
	7.7					
	7.5					
	6.3					
	4.1 (and others)					
	6.9					
AREA (M*M)	445.3	MARGIN (M)	65.0			

SITE DESCRIPTIONS - SITE BB2 DATE-SEPT 5/91 TEMP. 12 C 1600 SLOPE- 0.7%
This site on Buck Creek is located approximately 1 km upstream of the road crossing above Goosly Lake.
This section of the creek has good spawning potential in gravel riffles.
Estimate this site is 80% pool and 20% riffle.
Virtually unchanged channel since last year.

POPULATION ESTIMATES:

SPECIES	AGE	PASS 1	PASS 2	U1&U2	NUMBER	S.E.	MORTS	N-CORR	N/M*M	N/LIN-M
Rainbow	0+	403	132	535	599.3	16.8	0	599	1.754	7.68
Rainbow	1+	81	20	101	107.6	4.4	0	108	0.315	1.38
Rainbow	2+	2	0	2	2.0	0.0	0	2	0.006	0.03
LN Dace	0+	0	0	0	0.0	0.0	0	0	0.000	0.00
LN Dace	1+	0	0	0	0.0	0.0	0	0	0.000	0.00
LN Sucker	0+	0	0	0	0.0	0.0	0	0	0.000	0.00
LN Sucker	1+	0	0	0	0.0	0.0	0	0	0.000	0.00
P Sculpin	1+	0	0	0	0.0	0.0	0	0	0.000	0.00
M Whitefish	0+	0	0	0	0.0	0.0	0	0	0.000	0.00
M Whitefish	1+	0	0	0	0.0	0.0	0	0	0.000	0.00
TOTAL								709	2.075	9.088

LENGTH/WEIGHT DATA:

SPECIES	AGE	FL-RANGE (mm)	MEAN FL (mm)	MEAN WEIGHT (g)	BIOMASS (g/m*m)
Rainbow	0+	30-47	36.6	0.53	0.93
Rainbow	1+	59-87	74.6	4.53	1.43
Rainbow	2+	96-106	101.3	10.82	0.06
LN Dace	0+	0	0.0	0.00	0.00
LN Dace	1+	0	0.0	0.00	0.00
LN Sucker	0+	0	0.0	0.00	0.00
LN Sucker	1+	0	0.0	0.00	0.00
P Sculpin	1+	0	0.0	0.00	0.00
M Whitefish	0+	0	0.0	0.00	0.00
M Whitefish	1+	0	0.0	0.00	0.00
TOTAL					2.42

SITE MEASUREMENTS:

LOCATION (m)	WIDTH (m)	MEAN DEPTH(cm)	MAXIMUM DEPTH(cm)	BANK COVER	DEBRIS COVER	D50/D90 (cm)
0	5.3	20	100			3/7
5	3.9		Spawning gravel throughout. Appears to be old redds in site.			
10	4.9		Lots of debris and overhanging banks			
15	4.6		Bank instability below road.			
20	4.4		Flows are low - estimate 1-2 cfs.			
	3.9					
	2.3					
	6.1					
	5.4 (plus others)					
	4.4					
AREA (M*M)	341.6	MARGIN (M)	78.0			

SITE DESCRIPTIONS - SITE BB3 DATE- AUG 30/91 TEMP. 13.5 C @ 1600 hr SLOPE- 1.5%
This site is located on Buck Creek 150 m downstream of the 1st bridge crossing on Buck Flats Rd.
The site was identical to 1989-90 site.
Estimate site is 80 % riffle and 20 % glide.

POPULATION ESTIMATES:

SPECIES	AGE	PASS 1	PASS 2	U1&U2	NUMBER	S.E.	MORTS	N-CORR	N/M*M	N/LIN-M
Rainbow	0+	129	34	163	175.2	6.2	0	175	0.449	4.07
Rainbow	1+	12	4	16	18.0	3.0	0	18	0.046	0.42
Rainbow	2+	14	0	14	14.0	0.0	0	14	0.036	0.33
Rainbow	3+	2	0	2	2.0	0.0	0	2	0.005	0.05
LN Dace	all	152	130	282	282.0	NA	0	282	0.723	6.56
LN Sucker	0+	0	0	0	0.0	0.0	0	0	0.000	0.00
LN Sucker	1+	7	6	13	13.0	NA	0	13	0.033	0.30
P Sculpin	1+	0	0	0	0.0	0.0	0	0	0.000	0.00
M Whitefish	0+	0	0	0	0.0	NA	0	0	0.000	0.00
M Whitefish	1+	1	0	1	1.0	0.0	0	1	0.003	0.02
Lamprey		0	0							
TOTAL								505	1.295	11.75

LENGTH/WEIGHT DATA:

SPECIES	AGE	FL-RANGE (mm)	MEAN FL (mm)	MEAN WEIGHT (g)	BIOMASS (g/m*m)
Rainbow	0+	37-60	50.3	1.55	0.70
Rainbow	1+	75-98	90.7	8.82	0.41
Rainbow	2+	99-122	109.1	13.82	0.50
Rainbow	3+	153	153	39.70	0.20
LN Dace	all	33-102	62.1	2.82	2.04
LN Sucker	0+	0	0.0	0.00	0.00
LN Sucker	1+	82-169	120.4	20.39	0.68
P Sculpin	1+	0	0.0	0.00	0.00
M Whitefish	0+	0	0.0	0.00	0.00
M Whitefish	1+	128	128.0	20.90	0.05
TOTAL					4.573

SITE MEASUREMENTS:

LOCATION (m)	WIDTH (m)	MEAN DEPTH(cm)	MAXIMUM DEPTH(cm)	BANK COVER	DEBRIS COVER	D50/D90 (cm)
0	10.6	15	70			20/35
5	10.6					
10	9.8					
15	8.7					
20	9.2					
	9.1					
	7.7					
	6.9					
	9.1					

Mainly cobble cover
Limited debris.
Marked at top and bottom with orange ribbon.
Unstable banks at high flows
Gravel bar development and debris downstream
Estimate 20 cfs flow.
Dace difficult to recover in cobble.
Fry - good habitat potential in shallows along left side.
Parr - moderate potential - too shallow in a lot of the site.

AREA (M*M) 390.2 MARGIN (M) 43.0

Appendix 3: Rainbow Trout Population Estimates for Sample Sites in Foxy and Buck Creeks from 1984 to 1991.

APPENDIX 3 TABLE 1
RAINBOW POPULATION ESTIMATES FOR BUCK CREEK SAMPLE SITE BB1

FILE = BB1TIME

AGE 0+

YEAR	ESTIMATE	SE	+95 % CI	-95% CI	MEAN FL
1987	1	0	1	1	SAMPLE SIZE
1988	0	0	0	0	TOO SMALL
1989	21				
1990	5	1.5	8	4	
1991	2	0			

AGE 1+

YEAR	ESTIMATE	SE	+95 % CI	-95% CI	MEAN FL
1987	28	6.6	42	23	89.1
1988	24	8.5	42	18	92.2
1989	16	0.8	18	16	85.1
1990	76	8.4	94	64	89.0
1991	40	11	63	30	89.1

AGE 2+

YEAR	ESTIMATE	SE	+95 % CI	-95% CI	MEAN FL
1987	9	0.5	10	9	102.6
1988	5	1.0	7	5	117.2
1989	8	0.0	8	8	102.1
1990	8	4.9	18	6	114.0
1991	17	4.2	26	14	103.5

COMBINED

YEAR	ESTIMATE	SE	+95 % CI	-95% CI	MEAN FL
1987	37		52	32	
1988	29		49	23	
1989	24		26	24	
1990	84		112	70	
1991	57		89	44	

APPENDIX 3 TABLE 2
RAINBOW TROUT POPULATION ESTIMATES FOR BUCK CREEK SITE BB2
FILE = BB2TIME
SITE BB2

AGE 0+

YEAR	ESTIMATE	SE	+95 % CI	-95% CI	MEAN FL
1987	190	4.7	200	181	43.9
1988	130	73.7	284	75	39.0
1989	213	16.8	248	178	40.1
1990	188	16.4	222	154	38.3
1991	599	16.8	634	564	36.6

AGE 1+

YEAR	ESTIMATE	SE	+95 % CI	-95% CI	MEAN FL
1987	87	4.7	97	82	80.4
1988	83	5.8	95	75	79.7
1989	92	4.6	102	85	75.6
1990	115	3.9	123	109	71.0
1991	108	4.4	117	101	74.6

AGE 2+

YEAR	ESTIMATE	SE	+95 % CI	-95% CI	MEAN FL
1987	10	0.0	10	10	116.8
1988	0	0.0	0	0	
1989	3	0.0	3	3	104.3
1990	2	0.0	2	2	116.5
1991	2	0.0	2	2	101.3

COMBINED

YEAR	ESTIMATE	+95 % CI	-95% CI
1987	97	107	92
1988	83	95	75
1989	95	105	88
1990	117	125	111
1991	110	119	103

APPENDIX 3 TABLE 3
RAINBOW POPULATION ESTIMATES FOR BUCK CREEK SAMPLE SITE BB3
FILE = BB3TIME
SITE BB3

AGE 0+

YEAR	ESTIMATE	SE	+95 % CI	-95% CI	MEAN FL
1987	217	20.8	261	173	47.8
1988	66	23.4	115	43	48.7
1989	109	22.4	156	77	51.7
1990	58	8.2	75	48	51.3
1991	175	6.2	188	163	50.3

AGE 1+

YEAR	ESTIMATE	SE	+95 % CI	-95% CI	MEAN FL
1987	33	6.5	47	27	89.0
1988	29	5.2	40	25	84.1
1989	55	24.9	107	34	84.9
1990	22	1.1	24	21	87.5
1991	18	3	24	16	90.7

AGE 2+

YEAR	ESTIMATE	SE	+95 % CI	-95% CI	MEAN FL
1987	16	6.9	30	12	106.0
1988	10	1.7	14	9	120.5
1989	12	6.0	25	9	112.1
1990	18	19.0	58	10	118.7
1991	16	0.0	16	16	109.1

COMBINED

YEAR	ESTIMATE	+95 % CI	-95% CI
1987	49	77	39
1988	39	54	34
1989	67	132	43
1990	40	82	31
1991	34	40	32

APPENDIX 3 TABLE 4
RAINBOW POPULATION ESTIMATES FOR FOXY CREEK SAMPLE SITES
FILE = FF1TIME
SITE FF1

AGE 0+

YEAR	ESTIMATE	SE	+95 % CI	-95% CI	MEAN FL
1984	269	63.1	401	137	33.9
1987	201	10.3	223	179	40.2
1988	92	3.5	99	85	40.5
1989	90	4.2	99	81	38.4
1990	384	10.8	407	361	35.9
1991	407	19.7	448	366	37.2

AGE 1+

YEAR	ESTIMATE	SE	+95 % CI	-95% CI	MEAN FL
1984	193	36.8	270	116	77.2
1987	93	3	99	87	79.6
1988	75	2.7	81	69	79.5
1989	145	47.6	245	45	70.5
1990	38	1.8	42	34	71.3
1991	81	2	85	77	74.7

AGE 2+

YEAR	ESTIMATE	SE	+95 % CI	-95% CI	MEAN FL
1984	64	11	87	41	120.5
1987	28	2	32	24	115.9
1988	14	0.9	16	12	118.3
1989	11	1.4	14	8	119.0
1990	2	0	2	2	106.5
1991	2	0	2	2	114.0

APPENDIX 3 TABLE 5
RAINBOW TROUT POPULATION ESTIMATES FOR FOXY CREEK SAMPLE SITES
FILE = FF2TIME
SITE FF2

AGE 0+

YEAR	ESTIMATE	SE	+95 % CI	-95% CI	MEAN FL
1984	530	70.5	678	382	34.7
1987	459	24.4	510	408	37.4
1988	676	44.7	770	582	38.0
1989	456	35.3	530	382	38.6
1990	545	44.8	639	451	40.1
1991	787	26.1	842	732	37.0

AGE 1+

YEAR	ESTIMATE	SE	+95 % CI	-95% CI	MEAN FL
1984	273	10.1	294	252	78.0
1987	67	6	80	54	82.3
1988	204	13.1	231	177	80
1989	141	10.8	164	118	74.9
1990	196	16.9	231	161	78.7
1991	196	8.1	213	179	79.6

AGE 2+

YEAR	ESTIMATE	SE	+95 % CI	-95% CI	MEAN FL
1984	63	4.4	72	54	119.5
1987	14	0.9	16	12	106.6
1988	26	0.2	26	26	109.9
1989	18	3.0	24	12	111.4
1990	10	1.7	14	6	118.9
1991	69	41.0	155	37	111.5

Appendix 4: Biomass Estimates for Rainbow Trout from Foxy and Buck Creeks from 1984 to 1991.

APPENDIX 4 TABLE 1. Biomass Summary of Rainbow Trout in Foxy Creek.
FILE = BIOMASS

SITE	YEAR	GRAMS/M*M 0+	1+	2+	TOTAL
FF1	1984	0.54	3.82	4.37	8.73
	1987	0.41	1.40	1.47	3.28
	1988	0.17	1.24	0.86	2.27
	1989	0.16	1.75	0.69	2.60
	1990	1.71	0.77	0.12	2.60
	1991	0.99	1.67	0.15	2.81
	MEAN	0.66	1.78	1.28	3.72
FF2	1984	1.08	5.30	4.01	10.39
	1987	0.93	1.60	0.82	3.35
	1988	0.79	2.65	0.95	4.39
	1989	0.52	1.33	0.60	2.45
	1990	2.05	3.50	0.54	6.09
	1991	1.31	3.40	3.52	8.23
	MEAN	1.11	2.96	1.74	5.82
MEAN	1984	0.81	4.56	4.19	9.56
	1987	0.67	1.50	1.15	3.32
	1988	0.48	1.95	0.91	3.33
	1989	0.34	1.54	0.65	2.53
	1990	1.88	2.14	0.33	4.35
	1991	1.15	2.54	1.84	5.52
	MEAN	0.89	2.37	1.51	4.77

SITE	YEAR	TOTAL GRAMS FROM SITE 0+	1+	2+	TOTAL
FF1	1984	164.7	1165.1	1332.9	2662.7
	1987	125.1	427.0	448.4	1000.4
	1988	48.7	355.5	246.6	650.8
	1989	42.3	463.1	182.6	688.0
	1990	362.5	163.2	25.4	551.2
	1991	214.8	362.4	32.6	609.8
	MEAN	159.7	489.4	378.1	1027.1
FF2	1984	344.5	1690.7	1279.2	3314.4
	1987	210.5	362.1	185.6	758.1
	1988	293.9	985.8	353.4	1633.1
	1989	215.0	549.8	248.0	1012.8
	1990	637.6	1088.5	167.9	1894.0
	1991	410.0	1064.2	1101.8	2576.0
	MEAN	351.9	956.9	556.0	1864.7
MEAN	1984	254.6	1427.9	1306.0	2988.5
	1987	167.8	394.5	317.0	879.3
	1988	171.3	670.7	300.0	1141.9
	1989	128.7	506.4	215.3	850.4
	1990	500.0	625.9	96.7	1222.6
	1991	312.4	713.3	567.2	1592.9
	MEAN	255.8	723.1	467.0	1445.9

APPENDIX 4 TABLE 2. Biomass Summary of Rainbow Trout in Buck Creek.
FILE = BIOMASS1

SITE	YEAR	GRAMS/M*M 0+	1+	2+	TOTAL
BB1	1987	0.00	0.52	0.25	0.77
	1988	0.00	0.48	0.22	0.70
	1989	0.05	0.25	0.21	0.51
	1990	0.02	1.22	0.25	1.49
	1991	0.00	0.77	0.45	1.22
	MEAN	0.01	0.65	0.28	0.94
BB2	1987	0.50	1.38	0.47	2.35
	1988	0.22	1.10	0.00	1.32
	1989	0.41	1.08	0.09	1.58
	1990	0.77	1.70	0.14	2.61
	1991	0.93	1.43	0.06	2.42
	MEAN	0.57	1.34	0.15	2.06
BB3	1987	0.56	0.84	0.61	2.01
	1988	0.20	0.44	0.42	1.06
	1989	0.36	0.77	0.38	1.51
	1990	0.32	0.50	0.92	1.74
	1991	0.70	0.41	0.70	1.81
	MEAN	0.43	0.59	0.61	1.63

SITE	YEAR	TOTAL GRAMS FROM SITE 0+	1+	2+	TOTAL
BB1	1987	0.0	212.8	102.3	315.1
	1988	0.0	189.0	86.6	275.7
	1989	20.3	101.6	85.3	207.2
	1990	9.5	580.1	118.9	708.5
	1991	0.0	342.9	200.4	543.3
	MEAN	6.0	285.3	118.7	409.9
BB2	1987	159.6	440.5	150.0	750.1
	1988	78.9	394.7	0.0	473.6
	1989	140.7	370.7	30.9	542.3
	1990	261.9	578.2	47.6	887.7
	1991	317.7	488.5	20.5	826.7
	MEAN	126.4	401.9	60.3	663.4
BB3	1987	231.1	346.7	251.7	829.5
	1988	83.1	182.9	174.6	440.6
	1989	164.9	352.7	174.0	691.6
	1990	127.6	199.4	366.9	693.9
	1991	273.1	160.0	273.1	706.3
	MEAN	176.0	248.3	248.1	672.4