SITE C CLEAN ENERGY PROJECT
FISHERIES STUDIES

2010 DINOSAUR RESERVOIR SAMPLING AND LITERATURE REVIEW

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EXECUTIVE SUMMARY

Dinosaur Reservoir was impounded by the Peace Canyon Dam in 1979 and occupies the former Peace River Canyon immediately downstream of the WAC Bennett Dam. The 20.5 km long reservoir is a narrow, steep-sided waterbody with limited littoral habitat and little accessible tributary habitat. Productivity is extreme low and driven largely by inputs from Williston Reservoir.

Twenty species of fish have been identified in Dinosaur Reservoir since its formation including rainbow trout (*Oncorhynchus mykiss*), bull trout (*Salvelinus confluentus*), lake trout (*S. malma*), Arctic grayling (*Thymallus arcticus*), kokanee (*O. nerka*) mountain whitefish (*Prosopium williamsoni*), pygmy whitefish (*P. coulteri*), lake whitefish (*Coregonus clupeaformis*), burbot (*Lota lota*), longnose sucker (*Catostomus catostomus*), white sucker (*C. commersoni*), largescale sucker (*C. macrocheilus*), northern pikeminnow (*Ptychocheilus oregonensis*), peamouth (*Mylocheilus caurinus*), redside shiner (*Richardsonius balteatus*), slimy sculpin (Cottus cognatus), prickly sculpin (*C. asper*), spoonhead sculpin (*C. ricei*) and longnose dace (*Rhinichthys cataractae*). Fish species composition in the reservoir has changed in response to environmental and operational conditions and, to a lesser extent, fisheries management activities.

The primary objectives of the current study were to:

1. Conduct a fish sampling program modelled after standard lake survey procedures for British Columbia with the intent of determining the current fish species composition of Dinosaur Reservoir, and
2. Conduct a review of available existing literature relevant to fish populations in Dinosaur Reservoir.

Sampling of reservoir fish populations was conducted between August 19 and 27, 2010. Sampling methods included gill netting, beach seining, minnow trapping, backpack electro-fishing, boat electro-fishing, and angling.

A total of 562 fish representing 12 species were sampled in the reservoir and its tributaries. Listed in order of abundance, sport-fish species included rainbow trout, mountain whitefish, kokanee, lake whitefish, lake trout and bull trout. Non-sport species included prickly sculpin, slimy sculpin, longnose sucker, white sucker, peamouth, and redside shiner.

Existing historical information on fish populations in Dinosaur Reservoir were reviewed. These data originate from 3 primary sources: the 1983-1986 evaluation of the Peace Canyon Hatchery and rainbow trout stocking program, enhancement and monitoring activities conducted by the Peace-Williston Fish and Wildlife Compensation Program since its establishment in 1989, and more recent sampling and habitat assessment conducted pursuant to the BC Hydro Water Use Planning Process.

Comparison of historical and 2010 sampling results suggest that kokanee and lake trout population levels have increased while Arctic grayling, lake whitefish and bull trout numbers have declined.

ACKNOWLEDGEMENTS

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1 INTRODUCTION

Two hydro-electric facilities currently exist on the British Columbian portion of the Peace River: the WAC Bennett Dam and the Peace Canyon Dam. Construction of the 183 m high WAC Bennett Dam was completed in 1967 and the resulting impoundment, Williston Reservoir, reached full storage level (FSL) in 1972 (Hirst 1991). The smaller Peace Canyon Dam, located 21 km downstream, was completed in 1979. Dinosaur Reservoir, the impoundment created behind the Peace Canyon Dam, reached FSL the same year and now occupies the former Peace River Canyon, which formed the divide between the upper and lower Peace River watersheds.

In the 32 years since the creation of Dinosaur Reservoir, fish populations have undergone changes in response to a wide variety of factors, including conversion of the lower portion of the reservoir to a lentic environment, recruitment by entrainment from Williston Reservoir upstream, absence of recruitment from the Peace River downstream, entrainment losses through the Peace Canyon Dam, hatchery augmentation, other management and enhancement activities conducted by the Provincial fisheries management program and the Peace-Williston Fish and Wildlife Compensation Program, and the ongoing influences of the operational regimes at both hydroelectric facilities.

Diversified Environmental Services (DES) was sub-contracted by Mainstream Aquatics Ltd. (Mainstream), who was under contract to BC Hydro (BCH), to conduct fish sampling in Dinosaur Reservoir in August and September 2010 and undertake a review of historical information relevant to fish populations.

The primary objectives of these activities were to:

1. Determine the current status of fish populations in Dinosaur Reservoir through a program of fish sampling modelled after standard lake inventory procedures for British Columbia,
2. Conduct a review of available literature pertaining to Dinosaur Reservoir fish populations for comparison to current fish species composition and relative abundance information.

2 PROJECT AREA

Dinosaur Reservoir lies approximately 6 km west of Hudson's Hope, British Columbia (Fig. 1). This 20.5 km long, run-of-the-river reservoir occupies the former Peace River canyon between the Peace Canyon and WAC Bennett dams. Surface area of the reservoir is approximately 805 ha and the mean and maximum depths are 53.2 m and 200 m, respectively (Hammond 1984).

Operation of the Peace Canyon Dam is largely dictated by operations at the much larger WAC Bennett Dam located immediately upstream. As a run-of-the-river reservoir, the water level of Dinosaur Reservoir remains relatively constant. Although daily water levels may fluctuate up to 2 m under normal operations, no seasonal fluctuations occur. The entire reservoir volume (215.86 million m^3) is exchanged in approximately 3 days (Hammond 1984). The bathymetry of the reservoir is extremely steep, owing to the geology of the original canyon, and littoral zones are largely absent. Productivity of the reservoir is thought to be controlled by limnological conditions in the much larger Williston Reservoir (Hammond 1984).

A diverse assemblage of fish species has been documented in Dinosaur Reservoir since its creation (Table 1). Sport-fish species include rainbow trout (*Oncorhynchus mykiss*), bull trout (*Salvelinus confluentus*), lake trout (*S. malma*), Arctic grayling (*Thymallus arcticus*), kokanee (*O. nerka*) mountain whitefish (*Prosopium williamsoni*), lake whitefish (*Coregonus clupeaformis*), and burbot (*Lota lota*) (Hammond, 1984, 1987). Non-sport species include longnose sucker (*Catostomus catostomus*), white sucker (*C. commersoni*), largescale sucker (*C. macrocheilus*), pygmy whitefish (*P. coulteri*), northern pikeminnow (*Ptychocheilus oregonensis*), peamouth (*Mylocheilus caurinus*), redside shiner (*Richardsonius balteatus*), slimy sculpin (Cottus cognatus), prickly sculpin (*C. asper*), spoonhead sculpin (*C. ricei*) and longnose dace (*Rhinichthys cataractae*) (Hammond, 1984, 1987).

Tributary stream habitat directly accessible to reservoir fish populations is extremely limited. The majority of tributaries are ephemeral and lack sufficient discharge to support fish throughout most of the year. Gradient barriers and impassable waterfalls are common in the watershed, which further limits the availability of fish habitat in streams with perennial discharge. Only 5 tributaries are known to support fish, namely Gething, Johnson, Mogul, Moosebar and Starfish creeks. Access beyond the lowermost reach of all 5 of these streams is precluded by impassable falls.

The only public access to the reservoir is located at the downstream end, approximately 1 km upstream of the Peace Canyon Dam. Ground access to the upper end of the reservoir via the WAC Bennett Dam tailrace is restricted to BC Hydro employees and maintenance contractors. Public water access and angling is not permitted in the Peace Canyon Dam forebay (downstream of the anti-vortex dike) or between the WAC Bennett Dam and a sport-fishing boundary established 100 m downstream of the Gething Creek confluence.

3 METHODS

3.1 Fish Sampling

Fish sampling was conducted in accordance with methodologies outlined in *Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Standards and Procedures, Version 1.1 (RIC April 1998, Errata March 1999); Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Data Forms and User Notes, Version 1.1 (RIC April 1998, Errata March 1999);* and *Fish Collection Methods and Standards, Version 4.0 (RIC Jan 1997, Errata #1 March 1999).*

Sampling was distributed throughout the reservoir and accessible tributary reaches with the intent of sampling a full range of available habitats. Fish sampling was conducted in the reservoir using gill nets, beach seines, minnow traps, boat electro-fisher, and angling. Inlet tributaries having sufficient surface flow at the time of the survey were sampled using a backpack electro-fisher.

The location of sample sites was recorded as Universal Transverse Mercator (UTM NAD83) coordinates obtained by a hand-held GPS unit. Sample sites were photographed and notes regarding environmental conditions, including sampling depth, water clarity, temperature, substrate type, and presence of emergent or submergent aquatic vegetation were recorded.

Two 91.4 m x 2.4 m, 6-panel experimental sinking and floating standard experimental gill nets (RIC 1997) were used to sample a range of habitats within the reservoir and to maximize fish sample sizes. Gill nets were typically set perpendicular to shore in areas adjacent to deeper portions of the reservoir, as well as in infrequent shallow littoral habitats. Notes describing soak time, water depth at the distal end of the gill net, and the position of the lead line in relation to the reservoir bottom were recorded at each site.

Beach seine sites were sampled by using a 5 m long x 1.2 m high beach seine constructed of 6 mm knotless mesh. Three hauls were made at each site; fish from all 3 hauls were combined in a pooled sample. Criteria used to select sites for beach seining included appropriate water depth, shelter from rough open water conditions, absence of debris capable of snagging the lead line, and the presence of aquatic vegetation assumed to provide higher suitability for cyprinids, cottids, suckers, and juvenile sport-fish. A larger 15 m x 2 m seine with 25 mm knotted mesh was used to capture adult sport-fish in Gething Creek.

Six galvanized 6 mm wire mesh Gee-type minnow traps were used to sample littoral areas in an attempt to capture cyprinids, cottids, and juvenile suckers and sport-fish. Two traps, baited with canned sardines, were set overnight at each site. Minnow trapping sites were selected using the same general criteria as beach seine sites.

All backpack electro-fishing was conducted using a Coffelt Mark 10 gas-generator, backpack electro-fisher. Pulse frequency and output voltage were typically set at 60 hertz and 250-300 volts, with adjustments made for water depth, conductivity, and length of fish anticipated. All available habitats were sampled at each site. All backpack electro-fishing was conducted in a single pass with no enclosure nets. Sample sites typically ranged in length from 50 to 300 m.

A boat electro-fisher was used to capture fish in nearshore habitats along segments of the reservoir shoreline and the margins of the WAC Bennett Dam tailrace. Boat electro-fishing sampling protocol followed that described by Mainstream and Gazey (2010) with some minor exceptions. Electro-fisher settings were typically maintained at an amperage output of 5.5 to 6.5 amps, pulsed DC current of 354 volts, and a frequency of 60 Hz in order to target any fish encountered. At sites where water current was present, as in the WAC Bennett Dam tailrace, the sampling procedure involved drifting downstream at idle along the channel margin, while outputting a continuous electrical field. Despite the limitations of electro-fishing in deeper water, boat electro-fishing could not be restricted to nearshore areas ≤ 2.0 m deep due to the steep shoreline topography of the reservoir at most sites. Where backwater areas roughly two boat-lengths or greater were encountered, the boat was manoeuvred into the backwater at its downstream end and the channel margin in the backwater area was sampled in an upstream direction. In large, shallow nearshore areas where little or no current was present, the boat was manoeuvred in a series of transects across the shallows in order to maximize the area sampled. Immobilized fish were retrieved by two netters positioned at the bow of the boat.

With the exception of the afternoon of August 21, 2010 when angling was used to specifically target lake trout in the WAC Bennett Dam tailrace, angling effort was limited to short periods of free time associated with other capture methods. Individual fish data and capture location were collected for fish captured by angling, however, no sampling effort information was recorded.

All fish captured were enumerated, identified to species, and measured for fork length (mm). Additional information collected included weight (g), and sex and maturity, if discernable. Aging structures were collected for most sport-fish captured and included scales from rainbow trout, mountain whitefish, lake whitefish, and kokanee, and pectoral fin-ray sections from bull trout and lake trout. Scales were collected from a sub-sample of the rainbow trout captured in tributary backpack electro-fishing sites.

Scale and fin ray samples were stored in paper envelopes. Scales samples were processed and analyzed by DES staff while fin rays were processed and analyzed by Mainstream staff. Individual scales were mounted between glass slides and viewed on a Bell & Howell SR-IV microfiche reader; each projected scale image was then photographed and stored digitally. Fin rays were fixed in epoxy, sectioned with a jeweller's saw, and mounted on a slide for viewing under a dissecting microscope. Fin rays were read by an experienced reader and checked randomly by a second reader. Samples are archived.

3.2 Literature Review

Information relevant to the Dinosaur Reservoir and its tributaries was collected primarily from online sources including:

- Ecological Reports Catalogue (EcoCat),
- Fisheries Information Data Queries (FDIQ) search tool,
- HabitatWizard search tool,
- Peace/Williston Fish and Wildlife Compensation Program (PWFWCP) online reports,
- BC Hydro Water Use Planning Process online reports repository, and
- BC Hydro's Planning and Regulatory Section – Site C reports online report repository.

Additional sources included the reports library located at the Fort St. John Ministry of Forests, Lands and Natural Resource Operations office.

Information used for this review is contained primarily in reports produced after the creation of Dinosaur Reservoir. Between 1983 and 1987, the BC Ministry of Environment conducted evaluations of the Peace Canyon hatchery program, which included fish population assessments (Hammond 1984, 1986a, 1987a, 1987b) and angler creel surveys (Hammond 1985, 1986a, 1986b, 1987a, 1988). This information was reviewed and summarized in Pattenden and Ash (1993a, 1993b). Since the inception of the Peace/Williston Fish and Wildlife Compensation Program (PWFWCP) in 1989, the PWFWCP has continued fish population assessments, angler creel surveys, and various enhancement projects in the Dinosaur Reservoir and Williston Reservoir watersheds. Activities carried out by the PWFWCP are summarized in detail within the PWFWCP report series accessible online at http://www.bchydro.com/pwcp.

A portion of the PWFWCP report series has been reviewed and summarized for other purposes. LeRuez (2009), on behalf of BC Hydro's Peace Water Use Plan initiative, summarized reports pertaining to Dinosaur Reservoir as part of a project to develop recommendations for improving access and enhancing habitat on Dinosaur Reservoir tributaries. AMEC (2008) reviewed and summarized fisheries and aquatic literature for the Peace River on behalf of BC Hydro's proposed Site C Project. Although this review focused primarily on studies completed for the Site C project over the past 30 years, a portion of the documents reviewed related directly to Dinosaur Reservoir.

4 RESULTS

This section presents results of fish sampling conducted on Dinosaur Reservoir between August 19 and 27, 2010. Sample site descriptions, locations, and catch and effort results are summarized in Appendices I to VI, Figures 2 and 3 and, Tables 2 to 7, respectively, for all gill netting, minnow trapping, beach seining, backpack electro-fishing, boat electro-fishing, and angling. Individual fish data are found in Appendix VII. The important features of sampling results relative to the findings of the literature review are presented in Section 5.

Floating and sinking experimental gill nets were set at 12 locations throughout the reservoir (Fig. 2) for a total of 33.98 net hours of effort. Gill net catch and effort are summarized in Table 2 and Appendix I). A total of 174 fish representing 7 fish species were captured by gill net. Mountain whitefish were most abundant and accounted for 40.7% of the catch. Rainbow trout, kokanee, and lake whitefish accounted for 25.0, 18.0 and 15.7%, respectively. Only one lake trout, one bull trout and one longnose sucker were captured during gill netting, with each accounting for 0.6% of the overall gill net catch. Mean catch per unit effort (CPUE) for mountain whitefish in all sets combined was 2.06 fish/net hour (range 0-12.38; Table 2). Rainbow trout were the next most frequently captured species at 1.26 fish/net hour (range 0-5.98), followed by kokanee and lake whitefish at 0.91 fish/net hour (range 0-3.60) and 0.79 fish/hr/net (range 0-6.86), respectively. Mean CPUE for all species and sites combined was 5.12 fish/net hour.

Pairs of minnow traps were fished at 9 sites along the length of the reservoir between August 18 and 20, 2010 (Fig. 2). Minnow trap catch and effort are summarized in Table 3 and Appendix II). Minnow trap success was relatively poor with only 7 of the 18 traps catching 9 prickly sculpin, 1 slimy sculpin and 1 peamouth. Mean CUE for minnow traps was 0.03 ± 0.01 fish/hr.

Beach seining was used at only 3 sites to sample relatively rare, shallow littoral habitats within the reservoir (Fig. 2, Appendix III) and at two sites to collect adult bull trout in Gething Creek. The results of seining are summarized in Table 4. Beach seining along shallow reservoir shoreline habitats produced 29 prickly sculpin, 3 slimy sculpin, 2 juvenile longnose sucker, and a single redside shiner. All but one prickly sculpin and one slimy sculpin were collected at the beach seine site located at public boat launch (BS01). No fish were captured at the shallow alluvial delta at the mouth of Johnson Creek; however, large schools of longnose sucker young-of-the-year (YOY), approximately 25 mm in length and a single adult bull trout approximately 650 mm in length, were observed at this location (BS03).

Seining in Gething Creek was conducted on August 20, 21 and 27, 2010. Three adult bull trout in spawning condition were captured in a pool immediately upstream of the reservoir on August 20 and 21; although no seining or snorkel count was conducted further upstream at the Gething Falls plunge pool on August 20-21, one 3-year old sub-adult bull trout was angled. On August 27, 8 mature bull trout were captured by seining at the Gething Falls plunge pool and 3 additional adult bull trout were observed during a snorkel count for a total of 11 spawning adults. Several hundred adult kokanee in spawning condition were observed in pools in Gething Creek between the confluence and the Gething Falls plunge pool on August 27. Approximately 300 kokanee were incidentally captured during bull trout seining efforts at the falls; a sub-sample of 33 were measured.

Backpack electro-fishing was conducted in the lower reach of 3 tributaries, including Johnson Creek, Moosebar Creek, and Gething Creek (Fig. 2, Appendix IV). No other tributaries contained sufficient surface flow to support fish at the time of the survey (i.e., Mogul Creek and Starfish Creek). Catch and density estimates for each tributary site are summarized in Table 5. YOY rainbow trout, YOY and juvenile longnose sucker, prickly sculpin, and slimy sculpin were collected in Johnson Creek (Appendix VII). In Gething Creek, YOY rainbow trout and high densities of prickly and slimy sculpin were captured. Four yearling rainbow trout and 4 prickly sculpin were sampled in Moosebar Creek. Juvenile rainbow trout catch rates in Johnson, Gething and Moosebar creeks were 0.05, 0.02 and 0.08 fish/m^2, respectively.

Boat electro-fishing was conducted at 11 sites throughout the reservoir totalling 9,807 linear metres (Fig. 3, Appendix V). Catch results are summarized in Table 6. Seven fish species were captured by boat electro-fishing. Mountain whitefish were most commonly captured representing 59.2% of the catch, followed by kokanee (18.4%) and rainbow trout (14.3%). Only one bull trout, one lake whitefish, one longnose sucker, and one white sucker were captured by boat electro-fisher. Mean CPUE for mountain whitefish was 4.58 fish/km, while CPUE for rainbow trout and kokanee was 0.53 fish/km) and 1.34 fish/km, respectively. Mean CPUE for all species combined for all sites was 5.0 fish/km. Fish densities encountered during boat electro-fishing were generally higher in the lower half of the reservoir, with 4 of the 5 most productive sites (ES01, ES02, ES10, and ES11) located between the Peace Canyon Dam and Johnson Creek Inlet (Fig. 3).

Angling was conducted at 6 sites throughout Dinosaur Reservoir (Appendix VI) with a total of 40 fish captured (Table 7). Lake trout and rainbow trout accounted for 50% (20) and 40% (16) of the angling catch, respectively, followed by bull trout and kokanee at 5% (2) each. All lake trout and the majority of rainbow trout were angled in the WAC Bennett Dam tailrace between the outflow manifolds and mouth of Gething Creek (ANG303 and ANG04). Both bull trout captured by angling were also caught in the upper portion of the study area, one in the WAC Bennett Dam tailrace and one in Gething Creek (Table 7). Angling effort was largely directed at the WAC Bennett Dam tailrace in order to maximize lake trout sample size; this species was previously known to concentrate in the area of the WAC Bennett Dam spillway plunge pool (Euchner 2006).

The number of sport-fish species capture within each age class, and their respective minimum, maximum, and mean fork lengths ± standard error (S.E.) is summarized in Table 8. The length-weight relationship and mean length at age ± S.E. for rainbow trout are plotted in Fig. 4 and 5. Ages were determined for 95 rainbow trout (Table 8). Age 2 and 3 rainbow trout were most frequently captured, each accounting for 28% of the sample (Fig. 6 and 7). YOY and yearling rainbow trout were captured exclusively in tributary habitats. Older rainbow trout (age 5 and 6) were captured infrequently and accounted 5% of the aged sample.

The length-weight relationship and mean length at age ± S.E. for mountain whitefish are plotted in Fig. 8 and 9. Ages were determined for 78 mountain whitefish and ranged from 1 to 15 years (Table 8). Age 4, 5 and 6 mountain whitefish were most frequently captured, each accounting for 18, 13 and 9% of the sampled fish, respectively (Table 8). Yearling mountain whitefish were captured by gill net and boat electro-fisher and accounted for 12% of the aged sample.

The length-weight relationship and mean length at age ± S.E. for lake whitefish are plotted in Fig. 10 and 11. Ages were determined for 28 lake whitefish which ranged from 1 to 9 years (Table 8). Yearling and 5-year-old lake whitefish were most frequently captured, each accounting for 25% of the sample (Table 8). The absence of the 2 and 3-year-old age classes may be a result of low overall sample size.

The length-weight relationship and mean length at age ± S.E. for 34 kokanee captured by gill netting and boat electro-fishing in the reservoir and tailrace are plotted in Fig. 12 and 13. Ages ranged from 1 to 3 years (Table 8); no YOY or kokanee exceeding 3 years of age were captured. Age 2 and 3 kokanee dominated the sample, accounting for 35% and 53%, respectively (Table 8). Prior to August 23, 2010, when boat electro-fishing was conducted, schools of adult kokanee were observed in the WAC Bennett Dam tailrace. These fish were not visually observed in the tailrace on August 23, and on August 27, several hundred adult kokanee were present in nearby Gething Creek. A sub-sample of 33 mature kokanee captured during bull trout seining in Gething Creek on August 27 were measured but not aged. The mean fork length of the Gething Creek sub-sample was 222 mm, which corresponds to the mean fork length of 221 mm calculated for the 3-year-old reservoir/tailrace sample.

The length-weight relationship and mean length at age ± S.E. for lake trout are plotted in Fig. 14 and 15. Aging structures were analyzed from 19 lake trout ranging in age from 4 to 10 years (Table 8). Five-year-old lake trout were most frequently captured, accounting for 32% of the sample (Table 8), with the remainder of the relatively small sample scattered throughout the 4 year and 6 to 10 year age classes. With the exception of one lake trout gill netted in the Johnson Creek bay (GN07), all were captured by angling in the WAC Bennett Dam tailrace (Appendix VII).

A total of 15 bull trout were captured, including 12 from Gething Creek and 3 from the reservoir (1 each by angling, gill netting and boat electro-fishing; Appendix VII). Sample size was too small to allow analysis of length-weight relationship; the mean length at age ± S.E. for 12 bull trout for which age was determined appears in Fig. 16. Ages ranged from 3 to 10 years with the oldest age class reaching 835 mm in length (Table 8).

A total of 33 longnose sucker were captured by all methods in the reservoir and tributaries; length distribution is plotted in Fig. 17. Twenty-eight of 33 were captured by backpack electro-fishing in lower Johnson Creek; the majority of these were YOY and yearling juveniles. Of the 5 suckers sampled in the reservoir, 4 were juveniles captured by beach seine (2), gill net (1) and boat electro-fisher (1), and only one was an adult (400 mm) captured by boat-electro-fisher (Appendix VII).

The length distribution of 87 prickly sculpin and 55 slimy sculpin captured in the reservoir and tributaries is plotted in Fig. 18. Prickly sculpin ranged in size from 30 mm to 110 mm with fish 50-70 mm being most common (Fig. 18, Appendix VII). Slimy sculpin ranged in size from 23 mm to 96 mm. Although slimy sculpin were slightly less common, their mean length was slightly higher with most fish measuring 60-80 mm. The proportion of slimy and prickly sculpin captured at stream sites versus reservoir sites is plotted in Fig. 19. While slimy and prickly sculpin are captured in roughly the same frequency in tributaries, sculpin captured at reservoir sites were almost exclusively prickly sculpin.

5 DISCUSSION

5.1 Physical Environment and Factors Influencing Fish Production and Distribution

Understanding the dynamics of the physical environment within Dinosaur Reservoir and the limitations it places on fish production is essential to understanding fish population dynamics in the reservoir. This section summarizes these factors in a general sense and is followed by a detailed discussion of individual fish species.

Limnological characteristics including temperature and dissolved oxygen have been described by Hammond (1984) and more recently by Golder Associates Ltd. (Golder 2009). In addition, as part of BC Hydro's Water Use Planning initiatives, water temperature in the WAC Bennett Dam tailrace and at the Peace Canyon Dam forebay (surface and 10 m depth) has been recorded since 2009 (Euchner 2010). Although some thermal stratification has been observed in Dinosaur Reservoir during seasonal peaks in ambient temperature, particularly during mid-summer, thermocline development appears limited by high exchange rates (DES 2011). The temperature of water entering Dinosaur Reservoir from the WAC Bennett Dam also varies as a result of operational adjustments in penstock withdrawal elevation from Williston Reservoir, particularly during periods of seasonal temperature stratification (Hammond 1984, Euchner 2010, DES 2011).

Similar trends in dissolved oxygen have been noted, with measured levels near or at complete saturation throughout the water column (Hammond 1984, Golder 2009). Higher dissolved oxygen levels were documented in early summer with subsequent declines in July and August corresponding to seasonally higher water temperatures and reduced oxygen solubility (Golder 2009).

Total gas pressure (TGP) in the reservoir environment has been monitored on a number of occasions, usually in response to spill events from the WAC Bennett Dam. Under normal operating conditions TGP throughout the reservoir has been reported as normal and within acceptable ranges (i.e. ≤ 110%), with only slightly elevated levels recorded in the WAC Bennett Dam tailrace (Golder 2009). Slightly elevated values appeared to dissipate relatively quickly with distance downstream under normal operating regimes. During spill events in 1996 and 2002, TGP levels well in excess of 110% were observed, with peak values of 129% measured at the WAC Bennett Dam tailrace in 1996 (Wilby 1997) and 125.2% in 2002 in the vicinity of the Johnson Creek forebay (AMEC 2008). During long-term, continuous spill events from the WAC Bennett Dam, elevated TGP was measured throughout the length of Dinosaur Reservoir (Wilby 1997, AMEC 2008).

Monitoring of nutrient parameters including total dissolved solids (TDS), total nitrogen, nitrate and nitrite, total phosphorous and phosphate, and Chlorophyll *a* has been conducted by Hammond (1984) and Golder (2009). In addition, between 1999 and 2000 the PWFWCP conducted intensive limnological studies of Williston Reservoir (Stockner *et al* 2001). In general, the productive capacity of Dinosaur Reservoir, and Williston Reservoir from which it originates, is described as ultra-oligotrophic. Since Williston Reservoir reached FSL in 1972 and Dinosaur Reservoir in 1979, overall productivity has declined (Stockner *et al* 2001).

Barriers to fish movement documented within the Dinosaur Reservoir drainage area are plotted in Fig. 20. Impassable barriers were first documented during early investigations by Ash (1978) prior to the advent of GPS and creation of the reservoir. Early descriptions make reference to a 6 m high falls located 600 m upstream on Gething Creek and a 5 m falls located 500 m upstream on Johnson Creek. Although mapped, no coordinates were provided and location descriptions were qualitative and relative to confluences prior to impoundment. The Johnson Creek barrier described by Ash is assumed to have been inundated by impoundment. The lowermost impassable barrier on Gething Creek consists of a 6.0 m waterfall located approximately 1,000 m upstream of the confluence with the reservoir (UTM 10.547201.6206510), while the current lowermost Johnson Creek barrier consists of a 6.4 m waterfall located approximately 920 m upstream of the reservoir (UTM 10.553438.6199361). Additional multiple barriers occur further upstream on both tributaries. The accessible length of lotic habitat in each stream varies with fluctuations in the operational level of the reservoir. In addition, sediment deposition and streambed aggrading at stream mouths has resulted in the downstream migration of stream/reservoir interfaces since impoundment. This is particularly evident at Johnson Creek, where the reservoir confluence has migrated approximately 300 m downstream since 1983 (B. Culling, pers. obs).

The quality of available tributary habitat in Gething and Johnson Creeks was summarized by Pattenden and Ash (1993b) and is generally considered moderate to low. Lower reaches of both tributaries are confined in canyon terrain. Stream substrates are comprised largely of angular colluvial material that has originated from slumping canyon walls. Spawning gravels are highly compacted and limited in availability, particularly in Gething Creek. Areas of bank slumping and erosion, that contribute to sediment load and turbidity exist in the upper Johnson Creek watershed (Pattenden and Ash 1993b). Occasional periods of heavy rain or accelerated snow melt result in periodic debris torrents, particularly in Johnson Creek (Hammond 1984, R. Pattenden Pers. Comm. 2011). Extensive forestry development has occurred in the upper watersheds of both tributaries. Deep pool habitat is limited, with the most significant features being the plunge pools below each of the impassable falls. Beaver activity is common in lower Johnson Creek (Euchner 2006). During the 2010 field survey, a low beaver dam spanned the width of the channel of Johnson Creek approximately 100 m upstream of the reservoir.

Tributary habitat limitations have also been examined recently by LeRuez (2009) as part of BC Hydro's Water Use Planning initiative. In an inventory of tributary habitats and examination of the feasibility of improving access for fish or enhancing tributary habitat, LeRuez examined 48 mapped drainages; only 7 were determined to possess accessible fish habitat. The remainder were seasonal or ephemeral drainages, or possessed impassable barriers at their mouths (LeRuez 2009). Enhancement opportunities considered included barrier removal, habitat complexing in stream channels, creating new stream habitat, diverting non fish-bearing streams in order to augment flow to existing tributaries, habitat complexing in the reservoir and diverting non reservoir tributaries into the reservoir. In general, accessible stream habitats were determined to be already functioning as fish habitat and the potential benefits of enhancing existing conditions were considered to carry a high level of uncertainty. As determined in previous assessments (Pattenden and Ash 1993a), the best option for enhancement was determined to be the diversion of Portage and Bullrun creeks into an artificial channel entering the reservoir; both streams presently enter the Peace River immediately downstream of the Peace Canyon Dam (LeRuez 2009).

5.2 Fish Resources

Fish species historically reported in the Dinosaur Reservoir and its tributaries are listed in Table 1. Species present in the reservoir between 1983 and 1987, shortly after its creation, are described by Hammond (1984, 1985, 1986a, 1987a, 1987b, 1988). This work consisted of a 4-year evaluation of the Dinosaur Reservoir stocking program, which involved the production and release of approximately 50,000 yearling rainbow trout annually from the Peace Canyon Hatchery located at the Peace Canyon Dam. Sampling for the 1983-1986 evaluation program involved gill netting and angling in the reservoir, backpack electro-fishing and seining in tributaries, and angler creel surveys. During the evaluation, emphasis was placed primarily on the sampling of sport-fish species, particularly rainbow trout. Information recorded for non-sport species and non-target sport-fish species was often limited to records of species collected, whether they occurred in the reservoir or in tributaries, and qualitative comments about relative densities encountered while sampling target sport-fish. Such comments were generally restricted to lake whitefish, mountain whitefish, kokanee and longnose sucker.

Because of the extensive use of angling and the emphasis on target species during the 1983-1986 evaluation, rainbow trout were the most frequently captured sport-fish, followed by bull trout. During Year 1 of evaluation (1983) rainbow trout accounted for 88% of sampled fish while bull trout accounted for most of the balance of sport-fish (Hammond 1984). Similar proportions were observed in subsequent years of the evaluation (Hammond 1986a, 1987a). Gill netting results and general observation suggested that lake whitefish were the most common and widely distributed salmonid in the reservoir (Hammond 1984), while mountain whitefish were considered uncommon and referred to as a remnant population believed to be distributed primarily in the WAC Bennett Dam tailrace and at the mouths of Gething and Johnson creeks. During Year 4 of the evaluation, it was noted that lake whitefish and mountain whitefish were captured with decreased frequency, while kokanee appeared more common (Hammond 1987a). Lake trout were captured very infrequently, with only 1 recorded angling capture between 1983 and 1986. Arctic grayling, which were abundant prior to impoundment, became increasingly rare after 1983 and by 1986, were believed to be absent from the reservoir (Hammond 1987a).

Between 1983 and 1986, longnose sucker and northern pikeminnow were reported as common in the tailrace area and at the mouths of Gething and Johnson creeks (Hammond 1984, 1986a, 1987a). No records of numbers of other species such as redside shiners or peamouth were documented other than a reference to a "large spawning run of peamouth" in Johnson Creek (Hammond 1987a). "Sizeable populations" of slimy and spoonhead sculpin were reported in Johnson Creek in 1983, while no sculpin were collected in Gething Creek (Hammond 1984). After 1983, only slimy and prickly sculpin have been reported, suggesting that prickly sculpin may have been initially misidentified as spoonhead sculpin during Year 1 of the evaluation. Hammond (1986a) speculated that fish distribution in the reservoir was not homogenous and that most fish were concentrated in the WAC Bennett Dam tailrace possibly due to factors such as food availability, water temperatures and currents, spawning activities, and the fact that the WAC Bennett Dam poses a limit to upstream movement.

Since its inception in 1989, the PWFWCP has conducted additional fish sampling in the reservoir and tributaries in conjunction with periodic monitoring of fisheries enhancement projects. Between 2001 and 2006, the PWFWCP conducted sampling within shallow shoreline areas throughout the reservoir (Fig. 21) in order to assess fish use in the vicinity of shoreline debris structures installed as rearing cover in 2002 and 2003 (Blackman *et al* 2004, Murphy and Blackman 2004, Murphy *et al* 2004, Blackman 2005, Blackman and Cowie 2005, Blackman 2006). With the exception of daytime boat electro-fishing in 2001 (Murphy *et al* 2004) and sampling by trap nets and angling in 2004 (Blackman and Cowie 2005), sampling was conducted by boat electro-fishing at night. The relative proportion of each species captured during each assessment year between 2001 and 2006 are plotted in Fig. 22 and compared to 2010 results. It should be noted that for comparability to 2010 results, only data from the early July sampling session is included in years where multiple sampling events occurred (i.e. 2001 and 2002). The 2010 data included in Fig. 22 include all gill netting, minnow trapping, angling, and daytime boat electro-fishing conducted in the reservoir.

Rainbow trout and mountain whitefish were encountered most frequently during all sampling events between 2001 and 2010 (Blackman *et al* 2004, Murphy and Blackman 2004, Murphy *et al* 2004, Blackman 2005, Blackman and Cowie 2005, Blackman 2006). Longnose sucker and peamouth appeared to be moderately abundant in the reservoir during the 2001 to 2006 sampling, although neither species was encountered in abundance in 2010. Although inconsistencies in sampling methods and localized effort preclude a valid, direct comparison between data from 2001 to 2006 and the 2010 data, an increase in kokanee numbers may be most notable.

Hydroacoustic surveys were conducted in Dinosaur Reservoir by Sebastien *et al* (2004) and Scholten *et al* (2005) in June 2003 and August 2004 in an attempt to assess potential impacts from occasional spill events. In 2003, 8 transects were surveyed longitudinally during complete darkness. Five transect were located between the Peace Canyon Dam and Johnson Creek and 3 were located the "canyon" between the WAC Bennett Dam and the Johnson Creek forebay. In 2004, an additional transect was added to the lower section in the vicinity of the Johnson Creek Forebay. Based on the lack of distinct echo traces or fish targets on all transects, fish densities in Dinosaur Reservoir were described as very low in both years (Sebastien *et al* 2004, 2005). In 2003, the distribution of echo traces led researchers to speculate that 3 distinct biological zones existed in the reservoir. The highest density of fish was estimated to be 90-150 fish/ha in the central portion of the reservoir, in the vicinity of the Johnson Creek forebay, while fish density in the upper or canyon section and in the lower section ranged from 5-27 fish/ha (Sebastian *et al* 2004). Echo traces of fish located in the canyon and sections of the reservoir were found primarily close to the bottom, while fish in the central portion of the reservoir appeared to be distributed more widely through the water column. Based on this pattern, and an analysis of netting samples and hydroacoustic surveys of Williston Reservoir (Pillipow and Langston 2002, Sebastian *et al* 2003, Sebastian *et al* 2004), it was suggested that a species composition dominated by kokanee and lake whitefish may exist in the central portion of the reservoir (Sebastian *et al* 2004). Approximately 95% of fish observed were estimated to be less than 30 cm in length (Sebastian *et al* 2004). The remaining 5% were observed close to bottom along submerged shelves in the central section (former riparian flat adjacent to Johnson Creek) and in the canyon section.

Similar patterns in fish density and distribution were observed during hydroacoustic surveys conducted in 2004 (Scholten *et al* 2005), with fish density in the central section estimated 20-100 fish/ha. Higher densities of fish were also detected in the vicinity of the anti-vortex dike and the upper portion of the canyon section near Mogul Creek (Scholten *et al* 2005). As in 2003, approximately 95% of observed fish were less than 30 cm in length and the remaining 5% were believed to be larger fish associated with shelf habitat in the central section and the upper portion of the canyon section (Scholten *et al* 2005).

Estimated total population size was 36,000 (16,000–57,000) fish in 2003 (Sebastien *et al* 2004) and 23,400 (3,000-49,000) in 2004 (Scholten *et al* 2005). Limited sample sizes and low densities of fish did not allow for more accurate estimates.

Rainbow Trout

Rainbow trout are the most frequently captured sport-fish in Dinosaur Reservoir and have also been the most intensively examined and managed species in the reservoir. Both rainbow trout and Arctic grayling were abundant throughout the Peace River Canyon prior to construction of the Peace Canyon Dam (B. Culling, pers.obs.). Since impoundment, the rainbow trout population has been augmented through the release of hatchery stock. A complete history of rainbow trout stocking in Dinosaur Reservoir is presented in Table 9. Stocking history of the reservoir has been reviewed and summarized in various forms including Pattenden and Ash (1993b) and Langston and Murphy (2008). With the exception of 1998, rainbow trout were stocked annually between 1982 and 2003. During the first 8 years, BC Environment and BC Hydro jointly operated the Peace Canyon Hatchery, located at the Peace Canyon Dam, as an interim measure to augment fish populations potentially impacted by dam construction and reservoir impoundment. Using brood stock from Johnson Creek and Blackwater Creek, on the Parsnip Reach of Williston Reservoir, the Peace Canyon Hatchery produced between 16,000 to 73,000 rainbow trout fingerlings annually. During this period rainbow trout were released in late April to early May at various locations including the WAC Bennett Tailrace, Gething and Johnson creeks, and the public boat launch near the Peace Canyon Dam (Pattenden and Ash 1993b).

The Peace Canyon Hatchery was closed in 1989 and fish stocked from 1990 to 2003 were produced elsewhere in the provincial hatchery system using brood from a variety of sources. The decision to close the pilot hatchery was made due to high unit cost relative to its success and the difficulty in obtaining sufficient local brood stock during the later years of operation (Hammond 1987b, Pattenden and Ash 1993b). Between 1990 and 1997, all rainbow trout released were domestic diploid. Beginning in 1999, stocking densities were reduced and experimental releases were conducted, including approximately 12,500 to 14,650 fingerling triploid and triploid all-female rainbow trout in 1999 and 2000, and 5,000 catchable sized triploid and triploid all-female rainbow trout from 2001 to 2003 (Langston and Murphy 2008).

Stocking success in the reservoir has been monitored periodically either by direct sampling or through angler creel surveys. Survival of stocked rainbow trout has been very low despite attempts to establish fish throughout the reservoir and encourage longer residency. Fish released in the WAC Bennett tailrace traveled downstream through the reservoir quickly, with some taking up temporary residence in lower Gething, Mogul, Moosebar, Johnson and Starfish creeks (Hammond 1984, 1985, 1986a, 1987a). Limited tributary and shallow littoral refuge habitat are cited as the main factors limiting survival of juvenile rainbow trout in the reservoir. Significant entrainment of stocked fish through the Peace Canyon Dam has been documented and cited as a major factor limiting augmentation efforts (Hammond 1984, 1985, 1986a, 1986b, 1987a).

Between 1983 and 1986, rainbow trout sampled in Dinosaur Reservoir ranged from 1 to 6 years of age, with ages 2, 3, and, 4 dominating the age structure (Pattenden and Ash 1993). Rainbow trout sampled during the hatchery evaluation rarely exceeded 370 mm fork length (1993b). Rainbow trout sampled during the 1999, 2000, 2003, and 2005 sampling and summer creel surveys also ranged in age from 1 to 6 years, with age classes 3, 4, and 5 dominant (Joslin 2001a, 2001b, Cowie 2004, Blackman 2005, 2006, Stiemer 2006). While some rainbow trout exceed 400 mm fork length during this period, the majority ranged from 300-350 mm. The slightly higher occurrence of larger, older fish may be a result of more selective angler retention or an indication of an ageing population resulting from reduced stocking densities and decreased competition. In recent years, very large rainbow trout weighing several kilograms have been captured in Dinosaur Reservoir, however little is known about these fish. It has been speculated that they may be the progeny of Gerrard stock introduced into the Nation Lakes in the Parsnip Reach of Williston Reservoir in 1989-1991.

Rainbow trout in Dinosaur Reservoir spawn primarily in Johnson Creek and to a lesser extent in Gething Creek (Pattenden and Ash 1993b). Fish fences operated in 1983, 1984 and 1986, combined with electro-fishing, documented a small spawning run of rainbow trout using Johnson Creek. In 1983 and 1984, the estimated spawning run size was roughly 90-100 fish (Hammond 1984, 1986a). Peak spawning in Johnson Creek occurred in late May when water temperatures reached 7-10 °C (Hammond 1984). In 1986, only four mature rainbow trout were captured in a fish fence operated between June 3 and 13 (Hammond 1986a). Electro-fishing upstream of the fence failed to locate additional spawners. The reduced number of adult fish in Johnson Creek in 1986 was attributed to a significant flood event in the summer of 1983 (Hammond 1986a).

In 1983, Gething Creek was electro-fished five times between May 21 and June 10, from its confluence to Gething Creek falls (Hammond 1984). Approximately 30 mature rainbow trout were captured during this period. Peak spawning run timing for Gething Creek was estimated to occur during the first week of June, approximately one week later than Johnson Creek (Hammond 1984). No subsequent evaluation of spawning run size is documented for Gething Creek. The capture of YOY and yearling rainbow trout in Gething Creek during backpack electro-fishing in August 2010, suggests current spawning activity.

In 2006, the PWFWCP operated the Johnson Creek fish fence from June 1 to 20. Results from 2006 were similar to those of Hammond 22 years earlier. During its operation, an estimated 203 rainbow trout ascended Johnson Creek of which 38 were classified as adult spawners (Newsholme and Euchner 2006). A total of 240 rainbow trout were captured in the downstream trap, including 46 classified as adult spawners.

Rainbow trout movement into and out of Johnson Creek was ongoing when the fence was removed and the number of spawning rainbow trout was likely higher than that documented. The operation of the trap also coincided with spawning for a large number of longnose sucker and peamouth (Newsholme and Euchner 2006).

Attempts to diversify shoreline habitat and increase available rearing cover has had limited success. Brush piles established in the Johnson Creek forebay by the PWFWCP were submerged in lake sediments after only two years (Blackman 2001). Monitoring of shoreline debris structures installed in 2002 and 2003 indicate that use by rainbow trout has increased in enhanced areas versus control sites (Blackman and Cowie 2005). Presumably this equates to a net gain in usable habitat and thus an increase in reservoir-resident rainbow trout. Shoreline enhancement in the form of aquatic vegetation transplants have been considered and a small test plot was established in the Johnson Creek forebay in 1999 (AIM 2000). Frequent reservoir drawdown and exposure of the planted cuttings and sedimentation from Johnson Creek were identified as factors limiting the success of this project (AIM 2000). Some remnants of the original test plot were observed during the August 2010.

The release of fingerling rainbow trout into the WAC Bennett tailrace appeared to subject stocked fish to considerable predation by native bull trout and lake trout. During the release of hatchery stock in the tailrace it was common to observe large bull trout swirling at the surface as they pursued newly released rainbows (B. Culling, T. Euchner, pers. obs).

Between 1985 and 1987, angler catch rates for rainbow trout were consistently low at less than 0.4 fish/hr (Hammond 1985, 1986a, 1986b, 1987a, 1987b, 1988, Pattenden and Ash 1993a). Catches of hatchery versus wild rainbow trout fluctuated annually due to changes in stocking rate, recruitment from tributary spawning, entrainment from Williston Reservoir, and the skewing affect of rainbow trout size restrictions placed on anglers. In most years, hatchery and wild fish were captured in equal proportions (Pattenden and Ash 1993a). In the first several years after the newly-impounded reservoir was opened to fishing, angler effort declined annually while catch rates remained roughly the same. Angler discontent with the quality of the fishery was cited as the primary reason for the decline in effort (Pattenden and Ash 1993a).

Rainbow trout accounted for approximately 95% of angler-caught sport-fish between 1985 and 1987. Bull trout, kokanee, lake whitefish and mountain whitefish made up the remainder. Arctic grayling, which were frequently caught by anglers prior to impoundment of the canyon, disappeared from the creel sample by 1987. Lake trout were caught very infrequently during the same period.

Similar observations of rainbow trout catch, effort and angler satisfaction were reported during subsequent creel surveys conducted by the PWFWCP in 1999, 2000, 2003, and 2005 (Joslin 2001a, 2001b, Cowie 2004, Stiemer 2006). Rainbow trout accounted for the majority of fish caught, ranging from 45 to 88% of the catch. Catch rates in 1999, 2000 and 2005 were estimated at 0.25, 0.31 and 0.65 fish/hr, respectively (Joslin 2001a, 2001b, Stiemer 2006). The remainder of the catch was comprised of lake trout, bull trout and whitefish. As in earlier surveys, the hatchery contribution to the harvest was relatively low.

Between 1982 and 1985, fingerling rainbow trout produced at the Peace Canyon Hatchery were also released upstream of the impassable falls on Gething Creek and Johnson Creek. Recipient waters in these upper drainages included Gething, Dowling Gaylard, Johnson and Burnt Trail creeks (Table 9) (Langston and Murphy 2008). Rainbow trout stocking has also been conducted in Wright Lake, which forms the headwaters of Gething Creek and in Pete Lake located at the headwaters of Burnt Trail Creek. Prior to stocking, Wright Lake supported a native, resident, dwarf population longnose suckers (McLean and Jesson 1990). The potential for escapement downstream from both waterbodies has been confirmed (Zemlak 1999, 2010, Zemlak and Cowie 2005, 2006, Langston 2008). Through a combination of ongoing escapement and naturalization, upstream-resident rainbow trout are now widely distributed throughout the upper Gething Creek and Johnson Creek watersheds (Fig. 23). No assessments of these resident rainbow trout populations, other than reconnaissance inventories conducted by Canfor in the Johnson and Gaylard Creek drainages (ARL 1999a, 1999b) and PWFWCP sampling for bull trout in Gething and Gaylard creeks (Harvey 1995, Langston and Zemlak 1998a, Langston 2008) have occurred since their introduction.

Bull Trout

Bull trout in Dinosaur Reservoir are members of a remnant fluvial population trapped between the WAC Bennett and Peace Canyon dams (Hammond 1987a, Langston 2008). The extent to which the population may be supplemented by entrainment from Williston Reservoir or reduced by entrainment through the Peace Canyon Dam is unknown. With the exception of the Gething Creek spawning component of the population, the life history of this species within Dinosaur Reservoir is not well understood. Adult and sub-adult bull trout are captured throughout the reservoir in very low densities. Sampling during the Peace Canyon Hatchery evaluation, indicated that the highest densities of bull trout occurred in the tailrace upstream of Gething Creek and that these fish tended to be large adults ranging in size from 425-770 mm fork length (Hammond 1984, 1986a, 1987a). Smaller sub-adult bull trout have been captured, in low densities, along shallow shoreline areas of the reservoir (Blackman *et al* 2004, Murphy and Blackman 2004, Murphy *et al* 2004, Blackman 2005, Blackman and Cowie 2005, Blackman 2006). Mean size of bull trout captured in nearshore areas excluding the tailrace, range from 177-413 mm fork length (Blackman *et al* 2004, Murphy and Blackman 2004, Murphy *et al* 2004). During the same sampling events, the proportion of bull trout in the catch ranged from 2.8-10%. Bull trout appear to contribute minimally to the Dinosaur Reservoir sport fishery. During creel surveys conducted between 1985 and 1987, and 1999 to 2005, anglers reported catching few bull trout. In most survey years, only one to two bull trout were reportedly captured by anglers in total (Hammond 1985, 1986a, 1987a, 1987a, 1988, Joslin 2001a&b, Cowie 2004, Stiemer 2006). The WAC Bennett Dam tailrace, where adult bull trout densities appears highest, is closed to recreational angling.

Spawning habitat for this population is limited to the lower several hundred metres of Gething Creek. Between the 1983-1986 Peace Canyon Hatchery evaluation, portions of lower Gething Creek, including the plunge pool below Gething Falls, were electrofished and seined periodically in late August to mid-September in order to assess the spawning run size of this population. Sampling was conducted between August 27 and September 20. Between 18 and 40 mature, adult bull trout were captured during these sampling events (Hammond 1984, 1986a, 1987a). Fork lengths of the fish collected ranged from

423 to 767 mm (Hammond 1984, 1986a). Up to 30% of the fish captured were recaptures from the previous year (Hammond 1986a). Actual redd building has been observed infrequently and the exact timing of spawning is uncertain. Seven pairs of adult spawners were observed downstream of the falls pool on September 27, 1984 (Hammond 1986a).

Annual recruitment of bull trout from lower Gething Creek is assumed to be low due to the low spawner numbers and limited availability of high quality spawning and juvenile rearing habitat. Repeated sampling of Gething Creek in May to July 1983 to 1986 resulted in the capture of very few YOY or yearling bull trout (Hammond 1984, 1986a, 1987a). The only notable occurrence of juvenile bull trout was in 1986 when higher than usual densities on yearlings were encountered in the main reservoir (Hammond 1987a).

Monitoring of the Gething Creek bull trout spawning population has been conducted periodically by the PWFWCP since 1987. Between 1993 and 2002 the PWFWCP embarked on a project intended to establish an upstream-resident bull trout population in upper Gething and Gaylard creeks and augment reservoir recruitment. Adult bull trout in spawning condition were captured below the Gething Creek falls and translocated by helicopter above impassable barriers to selected reaches of upper Gething Creek in 1993, 1997 and 1999 and Gaylard Creek in 1994 (Langston and Zemlak 1998a, Newsholme 1999, Langston 2008). After spawning, spent bull trout were recaptured in a downstream trap and moved by truck back to Dinosaur Reservoir.

A total of 63 bull trout were translocated, including 12 in 1993, 16 in 1994, 14 in 1997, and 21 in 1999 (Langston 2008). During the 1999 operation, 45 adult bull trout were captured in a fish fence while ascending lower Gething Creek between August 27 and September 14. An inspection of the Gething Creek falls pool prior to fence installation on August 26, 1999, revealed that 17 bull trout had already entered Gething Creek (Newsholme 1999). Bull trout sampled during the translocation efforts ranged in age from 3 to 12 years based on analysis of fin ray sections. Mean fork length and weight were 633 mm and 2,800 g respectively (Langston 2008).

The capture of juvenile bull trout in the upper Gething Creek drainage, including Wright Lake, between 1994 and 2002 indicated successful spawning by the translocated adults, however, subsequent sampling in 2005 and 2008 suggests that a viable self-sustaining population may not have established itself (Langston 2008). The distribution of bull trout occurrences, including translocation sites, is plotted in Fig. 24.

Bull trout do not appear to spawn in Johnson Creek. Repeated sampling of Johnson Creek between 1983 and 1986 failed to locate either YOY or adult bull trout (Hammond 1984, 1986a, 1987a). Occasional feeding forays by yearling to three-year-old sub-adults into Johnson Creek were noted.

Kokanee

Kokanee in Williston and Dinosaur reservoirs originate from two possible sources: native populations in headwater lakes in both the Finlay and Parsnip drainages (Langston and Zemlak 1998b) and introduction of fry to tributaries of Williston Reservoir by PWFWCP.

Very low numbers of kokanee were reported in the Peace River prior to the construction of the Peace Canyon Dam in 1979 and in Dinosaur Reservoir in the years immediately following impoundment (Hammond 1984, 1986a, 1987a).

Between 1990 and 1998, more than 3.3 million kokanee fry were planted in tributaries to Williston Reservoir, including Dunlevy Creek, Carbon Creek, Manson River, and Davis River in an attempt to establish self-sustaining spawning populations (Langston and Zemlak 1998b, BC Environment 2011). Subsequent aerial surveys conducted by the PWFWCP have confirmed significant spawning runs of kokanee in several Williston Reservoir tributaries and reservoir sampling between 1994 and 2000 indicates that kokanee abundance in the Williston Reservoir has increased dramatically (Langston 1998b, Pillipow and Langston 2002, Sebastian *et al* 2003). It is assumed that entrainment of kokanee through the WAC Bennett Dam into Dinosaur Reservoir has increased with the expanded Williston population.

During the 1983-1986 Peace Canyon Hatchery evaluation, kokanee comprised less than 0.3% of the Dinosaur Reservoir fish sample and were not reported in tributaries to the reservoir (Hammond 1986a). In 1999, a fish fence installed on Gething Creek from August 25 to September 20 intercepted small numbers of ripe kokanee ascending the stream. During kokanee spawner surveys conducted by PWFWCP on October 3 and 4, 2007, schools of mature kokanee and redds were observed in both Gething and Johnson creeks (A. Langston Pers. Comm. 2011). Most recently, several hundred mature kokanee were observed in Gething Creek on August 27, 2010.

Hydroacoustic surveys of the Dinosaur Reservoir conducted in 2003 and 2004 identified significant numbers of fish suspected to be kokanee occupying pelagic habitat in the central section of the reservoir (Sebastian *et al* 2004, Scholten *et al* 2005). During the August 2001 sampling, kokanee accounted for approximately 13% of the overall catch.

Kokanee in the Dinosaur Reservoir appear to have undergone a size shift since becoming common. Average fork length of 3-year-old kokanee sampled between 1983 and 1987 ranged from 283 to 324 mm while 4-year-old kokanee, which were less common, ranged from 292 to 350 mm fork length (Hammond 1986a, 1987a, 1988). Mean fork length of 3-year-old kokanee sampled in 2010 was 221 mm and 4-year-old fish were not encountered. This is likely a consequence of the Williston kokanee stocking program undertaken from 1990 to 1998, which may have resulted in the prevalence of the smaller introduced Hill Creek strain as opposed to the larger native Finlay and Parsnip strain (Langston and Zemlak 1998b).

Lake Trout

Lake trout were recorded rarely in the Peace River mainstem prior to construction of the Peace Canyon Dam and creation of the Dinosaur Reservoir (Hammond 1984). Until the late 1990's, their increasing presence in the reservoir had gone relatively undetected. Lake trout were infrequently encountered during sampling for the Peace Canyon hatchery evaluation, with only 1 fish captured between 1983 and 1986 (Hammond 1984, 1986a, 1987a). None were reported by anglers participating in creel surveys conducted from 1984 to 1988 (Pattenden and Ash 1993a).

More recent inventory work and creel surveys and numerous anecdotal reports indicate that lake trout have increased in abundance in Dinosaur Reservoir. In creel surveys conducted by the PWFWCP in 1999, 2000, and 2005, lake trout accounted for 3.5%, 4.5%, and 28.0% of the angler catch, respectively (Joslin 2001a, 2001b, Cowie 2004, Stiemer 2006). In addition to increasing abundance, several other factors may have contributed to the dramatic increase in angler harvest between 2000 and 2005. These include preference of anglers for larger fish species, a growing knowledge that large lake trout were available in Dinosaur Reservoir, and the use of angling techniques that specifically target lake trout. Although lake trout are now distributed throughout the reservoir, they appear concentrated upstream of the Johnson Creek forebay and in particular, in the tailrace of the WAC Bennett Dam.

YOY and yearling lake trout ranging in length from 80 to 185 mm were captured by boat-electro-fishing in 2002 and 2003 suggesting lake trout may spawn in the reservoir (Blackman *et al* 2004; Murphy *et al* 2004). In 2003, the PWFWCP initiated a lake trout telemetry project to determine if lake trout spawning occurred in Dinosaur Reservoir and if so, identify potential spawning sites. From May to October 2003 and 2004, nine lake trout implanted with ultra-sonic radio transmitters were tracked in the reservoir (Euchner 2006). All but one lake trout, which travelled downstream as far as Starfish Creek, stayed in the upper nine kilometres of the reservoir, spending the majority of their time in the WAC Bennett Dam tailrace and canyon section above Moosebar Creek. Increased movement was noted during September-October, which was believed to coincide with spawning activity. Fall activity appeared to focus on 3 sites, including the Gething Creek delta, the scour hole below the WAC Bennett Dam spillway, and a submerged rock ledge near the outlet of the decommissioned diversion tunnels. No spawning activity was confirmed although night monitoring in early October 2004 confirmed the presence of groups of lake trout in the vicinity of radio-tagged individuals at these sites (Euchner 2006).

During the course of transmitter implanting activities, 77 lake trout, ranging in length from 330 to 745 mm and aged from 6 to 26 years, were captured by angling. All were captured upstream of the sport-fishing boundary located near the mouth of Gething Creek. Modal size of the angled sample was 385 mm and the most commonly encountered age class was 7 years (Euchner 2006).

During the period in which lake trout have become common in Dinosaur Reservoir, anglers in Williston Reservoir have also seen increased success rates for this species, with some fish reportedly reaching 13 kg (~30 lb) (G. Gieger pers. comm.). It is unknown to what degree entrainment through the WAC Bennett Dam accounts for Dinosaur Reservoir recruitment.

Whitefish

Relatively little information is available for lake or mountain whitefish in Dinosaur Reservoir. During the 1983-1986 Peace Canyon Hatchery evaluation both fish were regarded as non-target species and not sampled or enumerated as part of the fishery assessment program. It was noted in 1983 and 1984 however, that lake whitefish were considered the most abundant salmonid in the reservoir, especially in the WAC Bennett Dam tailrace (Hammond 1984, 1986a) and by 1986, the species was observed with less frequency (Hammond 1987a).

Lake whitefish have not contributed significantly to the sport fishery in Dinosaur Reservoir. During creel surveys conducted between 1984 and 1988, catches of lake whitefish were reported infrequently (Hammond 1984, 1985a, 1986a, 1987a, 1988, Pattenden and Ash 1993a). The majority of lake whitefish reported by anglers were observed floating on the surface of the reservoir during the operation of the WAC Bennett Dam spillway (Hammond 1984). No lake whitefish have been reported in creel surveys conducted by the PWFWCP (Joslin 2001a&b, Cowie 2004, Steiner 2005).

During PWFWCP assessments of enhancement structures from 2001 to 2006, lake whitefish accounted for less than 5% of the catch at most sites (Blackman *et al* 2004, Murphy and Blackman 2004, Murphy *et al* 2004, Blackman 2005, Blackman and Cowie 2005, Blackman 2006).

No direct evidence of lake whitefish spawning has been documented in Dinosaur Reservoir, although Blackman observed high densities of lake whitefish in the tailrace in mid-October 2002 and speculated that this may have been a spawning aggregation (Murphy *et al* 2004). It is likely that the population is partially maintained by recruitment from Williston Reservoir, as this species appears particularly susceptible to entrainment. During the 1996 spill, lake whitefish made up 94% of approximately 4,500 dead or injured fish enumerated during spillway mortality surveys conducted on Dinosaur Reservoir over a 39 day period Reservoir (BC Environment 1996).

Even less is known of mountain whitefish populations in Dinosaur Reservoir. During the 1983-1986 Peace Canyon Hatchery evaluation they were believed to be less abundant than lake whitefish (Hammond 1984, 1986a, 1987a). During creel surveys between 1984 and 1988, mountain whitefish have accounted for less than 10% of the catch (Hammond 1984, 1986a, 1987a, 1988, Pattenden and Ash 1993a). In more recent creel surveys conducted by PWFWCP, mountain whitefish were reported with less frequency (< 5 fish sampled per survey; Blackman *et al* 2004, Murphy and Blackman 2004, Murphy *et al* 2004, Blackman 2005, Blackman and Cowie 2005, Blackman 2006).

More recently, mountain whitefish appeared to be the second most abundant species, after rainbow trout, during sampling of near-shore reservoir habitats for PWFWCP enhancement structure monitoring between 2001 to 2006 (Blackman *et al* 2004, Murphy and Blackman 2004, Murphy *et al* 2004, Blackman 2005, Blackman and Cowie 2005, Blackman 2006). Mountain whitefish were the most numerous species captured during gill netting and boat electro-fishing in 2010.

Non-sport and Other Species

Longnose sucker appear to be the most abundant non-sport species in Dinosaur Reservoir. During early assessments, Hammond (1984. 1986a, 1987a) noted that longnose sucker were commonly captured in the WAC Bennett Dam tailrace area and in the vicinity of Gething and Johnson creeks using a variety of capture methods including gill nets, electrofishing and fish fences. Large numbers of mature longnose sucker were observed ascending Johnson Creek during operation of the 1986 Johnson Creek fish fence (Hammond 1987a). In 2006, more than 3,000 adult longnose sucker passed through the Johnson Creek fish fence (Newsholme and Euchner 2006) and while some longnose sucker were known to have ascended Johnson Creek before installation of the fence, several thousands more were still staged below the fence when it was removed. The mean fork length of longnose sucker processed Johnson Creek fish fence in 2006 was 359 mm (Newsholme and Euchner 2006). The unusually low occurrence of adult longnose sucker in the 2010 sample could not be explained.

The distribution and relative density of largescale and white sucker in Dinosaur Reservoir is unknown. Both species were sampled by Hammond (1984, 1986a, 1987a) between 1983 and 1986 and both were recorded infrequently during monitoring activities conducted by the PWFWCP (Blackman *et al* 2004, Murphy and Blackman 2004, Murphy *et al* 2004, Blackman 2005, Blackman and Cowie 2005, Blackman 2006). Only 6 adult largescale suckers passed through the Johnson Creek fish fence in 2006 (Newsholme and Euchner 2006).

The presence of Peamouth was noted throughout the reservoir during the 1983-1986 Peace Canyon Hatchery evaluation and Hammond (1987a) makes reference to a large spawning run peamouth that ascended Johnson creek to spawn during the operation of the Johnson Creek fish fence in 1986. Peamouth were commonly captured in the reservoir during PWFWCP sampling between 2001 and 2006 (Fig. 22) (Blackman *et al* 2004, Murphy and Blackman 2004, Murphy *et al* 2004, Blackman 2005, Blackman and Cowie 2005, Blackman 2006). More than 9,800 peamouth passed though the Johnson Creek fish fence between June 1 and 20, 2006 and schools numbering in the thousands were observed staging on the mud flats located downstream of the fence (Newsholme and Euchner 2006). The relative abundance of peamouth in the reservoir, based on the results of the 2010 sampling, may be under-estimated.

Redside shiners were recorded during the 1983-1986 Peace Canyon Hatchery evaluation (Hammond 1984, 1986a, 1987a) and during subsequent monitoring by the PWFWCP (Blackman *et al* 2004, Murphy and Blackman 2004, Murphy *et al* 2004, Blackman 2005, Blackman and Cowie 2005, Blackman 2006). Adult and juvenile redside shiner were recorded ascending and descending Johnson Creek during the operation of the 2006 Johnson Creek fish fence (Newsholme and Euchner 2006). No evidence linking this moving to spawning activity was noted. Only a single redside shiner was sampled in 2010 suggesting that their density in Dinosaur Reservoir may be relatively low.

Additional species documented infrequently include burbot, northern pikeminnow, longnose dace, lake chub, and pygmy whitefish. Burbot, northern pikeminnow and longnose dace were sampled during the 1983-1986 Peace Canyon Hatchery evaluation (Hammond 1984, 1986a, 1987a) and have been encountered infrequently since. Their rare appearance suggests they may be present in very low densities and that their presence in Dinosaur Reservoir may be largely dependent on entrainment from Williston Reservoir.

Lake chub and pygmy whitefish, which are known to occur in Williston Reservoir, are sampled least frequently in Dinosaur Reservoir. Records for these species appear limited to mortalities recovered during the 1996 spill event (BC Environment 1996). Both species are encountered downstream in the Peace River (P&E 2002) indicating a continuous distribution throughout the mainstem Peace River. Neither species however, appears to have become established in the Dinosaur Reservoir.

REFERENCES CITED

AIM Ecological Consultants Ltd. 2000. Dinosaur Lake aquatic plant enhancement potential. Peace/Williston Fish and Wildlife Compensation Program Report No. 259. 26pp plus appendices.

AMEC Earth and Environmental. 2008. Peace River fisheries and aquatic resources literature summary. Prepared for BC Hydro, Vancouver, BC. AMEC File No. VE51567. 72pp.

ARL (Aquatic Resources Ltd.). 1999a. 1998 Reconnaissance (1:20,000) fish and fish habitat inventory of Stott and upper Gaylard creeks, Gething Landscape Unit. Prepared for Canadian Forest Products Ltd. (Chetwynd Division).

ARL (Aquatic Resources Ltd.). 1999b. 1998 Reconnaissance (1:20,000) fish and fish habitat inventory of Johnson and other tributaries to Dinosaur Reservoir, Johnson Landscape Unit. Prepared for Canadian Forest Products Ltd. (Chetwynd Division).

Ash, G. 1976. Site One development fisheries study: Phase III. Renewable Resources Consulting Services Ltd. Prepared for BC Hydro and Power Authority, Vancouver, BC. Peace Fisheries Report No. PFI-005C, FISS Ref. NO. 700-092.

Ballard, S., and J. M. Shrimpton. 2009. Summary report of Arctic grayling management and conservation 2009: A synopsis of the information available on Arctic grayling in the Omineca region of northern British Columbia and identification of additional information needs. Prepared for Peace/Williston Fish and Wildlife Compensation Program. PWFWCP Report No. 337. 76pp.

BC Environment. 1996. Ministry of Environment, Lands and Parks 1996 spill monitoring file data. Fisheries Section office, Fort St. John, BC.

BC Environment. 2011. Ministry of Environment release records database – accessed January 17, 2011. http://a100.gov.bc.ca/pub/fidq/stockingQuery.do.

Blackman, B. G. 2001. Peace Williston Fish and Wildlife Compensation Program summary of fisheries activities 1988 – 1997. Peace/Williston Fish and Wildlife Compensation Program Report No. 260. 36pp plus appendices.

Blackman, B. G. 2005. Dinosaur Reservoir fish abundance assessment. Unpublished report of 2005 field season - fish data for BC Ministry of Environment fish collection permit no. FJ05-12384.

Blackman, B. G. 2006. Dinosaur Reservoir fish abundance assessment. Unpublished report of 2006 field season - fish data for BC Ministry of Environment fish collection permit no. PG/FJ06-21570.

Blackman, B. G., and D. M. Cowie. 2005. 2004 assessment of habitat improvements in Dinosaur Reservoir. Peace/Williston Fish and Wildlife Compensation Program Report No. 299. 9pp.

Blackman, B. G., E. B Murphy, and D. Cowie. 2004. 2003 Dinosaur Reservoir littoral fish population and habitat enhancement assessments. Peace/Williston Fish and Wildlife Compensation Program Report No. 298. 13pp plus appendices.

Conservation Data Centre (CDC). 2011. BC Species and Ecosystems Explorer. Accessed December 3, 2010. http://a100.gov.bc.ca/pub/eswp/.

Cowie, D. M. 2004. Dinosaur Reservoir and Peace River volunteer creel summary 2003. Peace/Williston Fish and Wildlife Compensation Program Report No. 292. 8pp.

DES (Diversified Environmental Services). 2011. Peace River Water Use Plan Peace River baseline TGP/temperature - Year 2 monitoring program - interim report December 2009 to December 2010. Prepared for BC Hydro, Hudson's Hope, BC.

Euchner, T. 2006. Identification of potential lake trout spawning areas in the Dinosaur Reservoir, 2003 – 2004. Prepared for Peace/Williston Fish and Wildlife Compensation Program, Prince George, BC by Diversified Environmental Services, Fort St. John, BC. PWFWCP Report No. 310. 32pp plus appendices.

Euchner, T. 2010. Peace River Water Use Plan Implementation Program – Peace River Baseline TGP/Temp – GMSWorks-2 – Year 1 monitoring program interim report. April 2010. Prepared for BC Hydro, Hudson Hope, BC. 36pp.

Golder Associates Ltd. 2009. Baseline data collection: Peace River watershed water quality and Dinosaur Lake limnology sampling – 2008. Prepared for BC Hydro, Vancouver, BC. 87pp.

Hammond, R. J. 1984. Evaluation of Dinosaur Lake stocking program (1983 – Year 1). Prepared for Ministry of Environment, Fort St. John, BC. 30pp plus appendices. PFI – 005I, FISS Ref. No. 701-077.

Hammond, R. J. 1985. Dinosaur Lake summer creel census, 1985. Prepared for Ministry of Environment, Fort St. John, BC. PFI – 005J, FISS. Ref. No. 701-079. 20pp.

Hammond, R. J. 1986a. Evaluation of Dinosaur Lake stocking program (1984 – Year 2). Prepared for Ministry of Environment, Fort St. John, BC. PFI – 005K, FISS Ref. No. 701-089. 86pp.

Hammond, R. J. 1986b. Peace River summer creel census, 1985: Report No. PCE 05. Prepared for Ministry of Environment, Fort St. John, BC. PFI – 028A, FISS. Ref. No. 701-086. 20pp.

Hammond, R. J. 1987a. Evaluation of Dinosaur Lake stocking program (1986- Year 4): Report No. PCE .13. Prepared for Ministry of Environment, Fort St. John, BC. PFI – 005L, FISS Ref. No. 701-090. 60pp.

Hammond, R. J. 1987b. Evaluation of Dinosaur Lake stocking program summary report. Report No. PCE. 15. Prepared for Ministry of Environment, Fort St. John, BC. PFI – 005M, FISS Ref. No. 701-095. 11pp.

Hammond, R. J. 1988. Dinosaur Lake summer creel survey, 1987. Report No. PCE. 17. Prepared for Ministry of Environment, Fort St. John, BC. PFI – 005N, FISS Ref. No. 701-096. 21pp.

Harvey, K. 1995. Peace Fisheries – field report – Gething and Gaylard creeks. Unpublished field report. Fort St. John Fisheries Section stream files. FISS Ref. No. HQ2430.

Hirst, S.M. 1991. Impacts of the operation of existing hydroelectric developments on fishery resources in British Columbia. Volume II. Inland Fisheries. Can. Manuscr. Rep. Fish. Aquat. Sci. 2093: 331pp.

Joslin, J. 2001a. 1999 Dinosaur Reservoir creel survey report. Peace/Williston Fish and Wildlife Compensation Program Report No. 238. 19pp plus appendices.

Joslin, J. 2001b. 2000 Dinosaur Reservoir creel survey report. Peace/Williston Fish and Wildlife Compensation Program Report No. 257. 22pp plus appendices.

Langston, A. R. 2008. Gething Creek bull trout translocation project, 1993 to 2005. Peace/Williston Fish and Wildlife Compensation Program Report No. 333. 24pp. plus appendices.

Langston, A. R., and E. B. Murphy. 2008. The history of fish introductions (to 2005) in the Peace/Williston Fish and Wildlife Compensation Program Area. Peace/ Williston Fish and Wildlife Compensation Program Report No. 325. 59pp.

Langston, A. R., and R. J. Zemlak. 1998a. A reconnaissance survey of Gaylard Creek and bull trout habitat suitability, 1994. Peace/Williston Fish and Wildlife Compensation Program Report No. 140. 16pp plus appendices. PFI-234.

Langston, A. R., and R. J. Zemlak. 1998b. Williston Reservoir stocked kokanee spawning assessment, 1994. Peace/Williston Fish and Wildlife Compensation Program Report No. 176. PFI-233. 13 pp plus appendices.

Langston, A. R. 2010. Williston Reservoir tributaries aerial kokanee counts. Unpublished report of 2009 aerial survey data - fish data submission for BC Ministry of Environment fish collection permit no. PG09-52821.

LeRuez, M. 2009. Peace Project Water Use Plan: Dinosaur Tributary Inventory and Feasibility GMSWORKS #9. Recommendations for improving access or enhancing habitat on Dinosaur Reservoir tributaries study period: June 2009 to November 2009. Prepared by Triton Environmental Consultants Ltd., Prince George, BC for BC Hydro, Hudson Hope, BC. 25pp plus appendices.

Mainstream Aquatics Ltd., and W. J. Gazey Research. 2010. Peace River community indexing program – 2009 studies. Prepared for B.C. Hydro, Hudson Hope, BC. Report No. 08011F. 93pp plus appendices.

McLean, A. R., and D. A. Jesson. 1990. A reconnaissance survey of Wright Lake, 1990. Peace/Williston Fish and Wildlife Compensation Program Report No. 102. FISS Ref. No. 701-351. 33pp.

McPhail, J. D. 2007. The freshwater fishes of British Columbia. University of Alberta Press. Edmonton, AB. 620pp.

Murphy, E. B., and B. G. Blackman. 2004. Dinosaur Reservoir fish collection summary 2001. Peace/Williston Fish and Wildlife Compensation Program Report No.287. 12pp.

Murphy, E. B., B. G. Blackman, D. M. Cowie, and N. Baccante. 2004. Dinosaur Reservoir 2002 fish collection summary. Peace/Williston Fish and Wildlife Compensation Program Report No.297. 19pp plus appendices.

Newsholme, K. 1999. Gething Creek bull trout transplant 1999. Prepared by Diversified Environmental Services for Peace/Williston Fish and Wildlife Compensation Program. 7pp.

Newsholme, K., and T. Euchner. 2006. Fish counting fence operation on Johnson Creek, 2006. Prepared for Peace/Williston Fish and Wildlife Compensation Program, Prince George, BC by Diversified Environmental Services, Fort St. John, BC. Peace/Williston Fish and Wildlife Compensation Program Report No. 308. 15pp plus appendices.

P & E Environmental Consultants Ltd. 2002. Peace River community indexing program – Phase I studies. Prepared for B.C. Hydro Power Supply Environmental Services. FISS Ref. No. HQ2462. 220pp. including appendices.

Pattenden, R., and G. Ash. 1993a. Dinosaur Lake summer creel surveys: results of the 1988 program and a five year review (1984 – 1988). Peace/Williston Fish and Wildlife Compensation Program Report No. 73. 26pp plus appendices.

Pattenden, R., and G. Ash. 1993b. Fisheries enhancement options for Dinosaur Lake, a review. Peace/Williston Fish and Wildlife Compensation Program. PWFWCP Report No. 72. 38pp plus appendices.

Pillipow, R. A., and A. R. Langston. 2002. Williston Reservoir fish assessments 2000, pelagic netting summary. Peace/Williston Fish and Wildlife Compensation Program Report No. 261. 12pp plus appendices.

RIC (Resources Inventory Committee). 1997. Fish collection methods and standards, version 4.0 (Jan 1997). B.C. Ministry of Fisheries, Fisheries Inventory Section, Victoria, BC.

RIC (Resources Inventory Committee). 1999. Fish collection methods and standards, version 4.0 (Errata #1 March 1999). B.C. Ministry of Fisheries, Fisheries Inventory Section, Victoria, BC.

RIC (Resources Inventory Committee). 1998. Reconnaissance (1:20,000) fish and fish habitat inventory: data forms and user notes, version 1.1 (April 1998). B.C. Ministry of Fisheries, Fisheries Inventory Section, Victoria, BC. 38p.

RIC (Resources Inventory Committee). 1998. Reconnaissance (1:20,000) fish and fish habitat inventory: standards and procedures, version 1.1 (April 1998). B.C. Ministry of Fisheries, Fisheries Inventory Section, Victoria, BC.

RIC (Resources Inventory Committee). 1999. Reconnaissance (1:20,000) fish and fish habitat inventory: data forms and user notes, version 1.1 (Errata March 1999). B.C. Ministry of Fisheries, Fisheries Inventory Section, Victoria, BC.

RIC (Resources Inventory Committee). 1999. Reconnaissance (1:20,000) fish and fish habitat inventory: standards and procedures, Version 1.1 (Errata March 1999). B.C. Ministry of Fisheries, Fisheries Inventory Section, Victoria, BC.

Scholten, G., D. Sebastian, and P. Woodruff. 2005. Dinosaur Reservoir baseline hydroacoustic survey – August 2004. Prepared by BC Ministry of Water, Land and Air Protection for BC Hydro, Hudson Hope, BC. Stock Management Report No. 28. 36pp.

Sebastian, D.C., G.H. Scholten, and P.E. Woodruff. 2003. Williston Reservoir fish assessment: results of hydroacoustic, trawl and gill net surveys in August 2000. Peace/ Williston Fish and Wildlife Compensation Program Report No. 274. 34pp plus appendices.

Sebastian, D., G. Scholten, and P. Woodruff. 2004. Dinosaur Reservoir baseline hydroacoustic survey – June 2003. Prepared by BC Ministry of Water, Land and Air Protection for BC Hydro, Hudson Hope, BC. Stock Management Report No. 25. 22pp.

Stiemer, R. 2006. 2005 Dinosaur Reservoir creel survey report. Peace/Williston Fish and Wildlife Compensation Program Report No. 306. 14pp plus appendices.

Stockner, J. G., A. R. Langston, and G. A. Wilson. 2001. The limnology of Williston Reservoir. Peace/Williston Fish and Wildlife Compensation Program Report No. 242. 51pp plus appendices.

Wilby, K. 1997. 1996 Spillway discharge environmental monitoring overview – Peace River Generating Facilities - Final Report. Strategic Fisheries Report No. SFP96-PR-04. Peace Fisheries Report No. PFI-219. 56pp plus appendices.

Zemlak, R. J. 1999. Fish stocking assessment of Wright Lake, 1998. Peace/Williston Fish and Wildlife Compensation Program Report No. 198. 26pp.

Zemlak, R. J., and D. M. Cowie. 2005. Recreational fishery stock assessment of Pete Lake, 2003. Peace/Williston Fish and Wildlife Compensation Program Report No. 301. 24pp.

Zemlak, R. J., and D. M. Cowie. 2006. Recreational fishery stock assessment of Wright Lake, 2004. Peace/Williston Fish and Wildlife Compensation Program Report No. 312. 24pp.

Zemlak, R. J. 2010. Recreational fishery stock assessment of Wright Lake, 2008. Peace/Williston Fish and Wildlife Compensation Program Report No. 338. 14pp.

PERSONAL COMMUNICATIONS

Culling, Brad. 2011. Diversified Environmental Services, Fort St. John, BC - fisheries consultant with prior involvement with 1983 to 1986 Peace Canyon hatchery evaluation.

Gieger, Gerry. 2011. Fort St. John, BC resident and Williston Reservoir lake trout angling enthusiast.

Langston, Arne. 2011. Peace-Williston Fish and Wildlife Compensation Program - program fisheries biologist.

Pattenden, Rick. 2011. Mainstream Aquatics, Edmonton Alberta – fisheries consultant.

Table 1. Documented fish species in Williston Reservoir, Dinosaur Reservoir and major tributaries, and the Peace River mainstem within British Columbia.

Common and Scientific Fish Names		Species Code	Williston – Upper Peace (documented in reservoir)	Dinosaur Reservoir	Dinosaur Reservoir Tributaries						Peace River (confirmed presence in Peace mainstem)
					Gething	Gaylard	Mogul	Moosebar	Johnson	Starfish	
Lake whitefish	*Coregonus clupeaformis*	LW	✓	✓	✓						✓
Mountain whitefish	*Prosopium williamsoni*	MW	✓	✓	✓				✓		✓
Pygmy whitefish	*P. coulteri*	PW	✓	✓							✓
Arctic grayling	*Thymallus arcticus*	GR	✓1	✓3	✓3						✓
Lake trout	*Salvelinus namaycush*	LT	✓	✓							✓
Bull trout	*S. confluentus*	BT	✓	✓	✓7	✓7			✓		✓
Brook trout	*S. fontinalis*	EB									I-2
Rainbow trout	*Oncorhynchus mykiss*	RB	✓	✓	✓7	✓7	✓	✓	✓7	✓	✓
Kokanee	*O. nerka*	KO	✓	✓	✓						✓
Northern pike	*Esox lucius*	NP									✓
Redside shiner	*Richardsonius balteatus*	RSC	✓	✓					✓		✓
Northern pikeminnow	*Ptychocheilus oregonensis*	NSC	✓	✓					✓		✓
Yellow perch	*Perca flavescens*	YP									I
Walleye	*Sander vitreus*	WP									✓
Goldeye	*Hiodon alosoides*	GE									✓
Burbot	*Lota lota*	BB	✓	✓							✓
Peamouth	*Mylocheilus caurinus*	PMC	✓	✓							✓
Flathead chub	*Platygobio gracilus*	FHC									✓
Lake chub	*Couesius plumbeus*	LKC	✓	?4							✓
Longnose dace	*Rhinichthys cataractae*	LNC	✓	✓5	✓5						✓
Finescale dace	*Phoxinus neogaeus*	FDC									✓
Northern redbelly dace	*P. eos*	RDC									✓
Spottail shiner	*Notropis hudsonius*	STC									I
Largescale sucker	*Catostomus macrocheilus*	CSU	✓	✓							✓
White sucker	*C. commersoni*	WSU	✓	✓							✓
Longnose sucker	*C. catostomus*	LSU	✓	✓	✓					✓	✓
Trout-perch	*Percopsis omiscomaycus*	TP									✓
Brook stickleback	*Culaea inconstans*	BSB									✓
Prickly sculpin	*Cottus asper*	CAS	✓	✓	✓				✓	✓	✓
Slimy sculpin	*C. cognatus*	CCG	✓	✓	✓				✓	✓	✓
Spoonhead sculpin	*C. ricei*	CRI		✓6					✓6		✓

1 – Classified by CDC of BC as G1QS1, critically imperilled within the Williston Reservoir (Ballard and Shrimpton 2009). Rating has been subsequently downgraded to G5S4 not at risk. (CDC 2011).
2 – A single brook trout was captured 12 km downstream of the Halfway River in the Peace River mainstem in 2002 (P&E 2002).
3 – Functionally extinct from Dinosaur Reservoir, last documented record from 1988 Creel (Pattenden and Ash 1993a)
4 – Not sampled in reservoir with exception of recovered mortalities during 1996 spill. Present upstream (McPhail 2007).
5 – Not sampled since 1986? (Hammond 1987)
6 – Johnson Creek in 1983 (Hammond 1984) - possible misidentification; sculpin collected in subsequent years identified as prickly and slimy sculpin (Hammond 1987a).
7 – Present above and below impassable barriers due to introductions and transplants (Langston and Zemlak 1998a)
I – Introduced (McPhail 2007)

Table 2. Summary of gillnet catch and effort in Dinosaur Reservoir, August 18-27, 2010.

CATCH								
SITE	RB	MW	LW	KO	LT	LSU	BT	Total Fish
GN1	19	0	0	0	0	0	0	19
GN2	1	17	1	14	0	0	0	33
GN3	0	3	0	4	0	0	0	7
GN4	3	13	7	1	0	0	0	24
GN5	7	10	0	0	0	0	0	17
GN6	3	0	0	1	0	0	0	4
GN7	0	3	3	0	1	0	0	7
GN8	3	1	8	0	0	0	0	12
GN9	1	0	1	0	0	0	0	2
GN10	1	8	2	0	0	1	0	12
GN11	2	0	0	0	0	0	0	2
GN12	3	15	5	11	0	0	1	35
Total Species	43	70	27	31	1	1	1	174
Proportion of Catch (%)	25.0	40.7	15.7	18.0	0.6	0.6	0.6	100
CATCH PER HOUR								
SITE	RB	MW	LW	KO	LT	LSU	BT	Total Fish
GN1	4.94	0	0	0	0	0	0	4.94
GN2	0.26	4.37	0.26	3.60	0	0	0	8.48
GN3	0	1.24	0	1.65	0	0	0	2.89
GN4	2.86	12.38	6.67	0.95	0	0	0	22.86
GN5	5.98	8.55	0	0	0	0	0	14.53
GN6	1.00	0	0	0.33	0	0	0	1.33
GN7	0	1.03	1.03	0	0.34	0	0	2.40
GN8	2.57	0.86	6.86	0	0	0	0	10.28
GN9	0.15	0	0.15	0	0	0	0	0.30
GN10	0.88	7.06	1.77	0	0	0.88	0	10.59
GN11	0.94	0	0	0	0	0	0	0.94
GN12	0.65	3.27	1.02	2.40	0	0	0.22	7.64
Ave. Sp./Hr	1.69	3.23	1.48	0.74	0.03	0.07	0.02	
SD	2.00	4.09	2.53	1.20	0.10	0.25	0.06	
Total Sp	43	70	27	31	1	1	1	174
Total Sp/Hr	1.26	2.06	0.79	0.91	0.03	0.03	0.03	5.12

Table 3. Summary of minnow trap catch and effort in Dinosaur Reservoir, August 18-27, 2010.

Site Name	Fishing Time (hr)	Catch	Catch/Hr
MT1	22.3	1 CAS	0.05
MT2	22.3	1 CAS	0.05
MT3	22.1		0
MT4	22.1		0
MT5	22.1		0
MT6	22.1		0
MT7	24.0	1 CAS, 1 PCC	0.08
MT8	24.0		0
MT9	24.0	1 CCG, 3 CAS	0.17
MT10	24.0		0
MT11	18.8	1 CAS	0.06
MT12	18.8		0
MT13	23.5	1 CAS	0.04
MT14	23.5		0
MT15	26.5		0
MT16	26.5		0
MT17	20.7	1 CAS	0.05
MT18	20.7		0
Average Fish/Hr ± S.E.			0.03 ± 0.01

Table 4. Summary of beach seine catch in Dinosaur Reservoir, August 18-27, 2010.

Site Name	Date	Catch	Comments
BS01	21-Aug-10	28 CAS, 2 CCG, 2 LSU, 1 RSC	at boat launch
BS02	21-Aug-10	1 CAS, 1 CCG	at Pipeline bay
BS03	21-Aug-10	No fish captured	at Johnson Creek delta, 25mm sucker fry and 65 cm BT observed
GethingBT	20,21-Aug-10	3 BT adults	first pool upstream from reservoir
Gething Falls	27-Aug-10	8 BT adults captured, 11 counted by snorkelling , 300+ KO, sub-sample of 30 KO measured	plunge pool at base of 6m falls

Table 5. Summary of backpack electro-fishing catch and fish density at tributary sites in Dinosaur Reservoir, August 18-27, 2010.

			Number Captured				
Site	Name	Area (m^2)	RB	LSU	CCG	CAS	Total
EF1	Johnson	2700	44	28	17	12	101
EF2	Moosebar	50	4			4	8
EF3	Gething	840	52		34	32	118

		Catch Rate (Fish/m^2)				
Site	Name	RB	LSU	CCG	CAS	Total
EF1	Johnson	0.05	0.03	0.02	0.01	0.12
EF2	Moosebar	0.08			0.08	0.16
EF3	Gething	0.02		0.01	0.01	0.04

Table 6. Summary of boat electro-fishing catch and effort.

	Number Sampled							
SITE	BT	RB	KO	MW	LW	LSU	WSU	All Species
ES01		1	5	4		1		11
ES02			2	9			1	12
ES03								0
ES04				2				2
ES05		1						1
ES06		1	1					2
ES07	1							1
ES08				4	1			5
ES09			1					1
ES10		1		6				7
ES11		3		4				7
Total	1	7	9	29	1	1	1	49
Proportion (%)	2.0	14.3	18.4	59.2	2.0	2.0	2.0	100

	Fish Per Km							
SITE	BT	RB	KO	MW	LW	LSU	WSU	All Species
ES01		1.15	5.75	4.60		1.15		12.64
ES02			6.67	3.00			3.33	4.00
ES03								0
ES04				3.14				3.14
ES05		0.77						0.77
ES06		0.76	0.76					1.53
ES07	3.13							3.13
ES08				6.32	1.58			7.90
ES09			1.52					1.52
ES10		0.54		3.24				3.78
ES11		2.38		3.77				5.38
Ave/SP/km	0.28	0.53	1.34	4.58	0.14	0.14	0.33	
					All Species combined/km			5.00

Table 7. Summary of angling catch in Dinosaur Reservoir, August 18-27, 2010.

Site	RB	LT	BT	KO	Total
ANG01	1			1	2
ANG02	5				5
ANG03	6	7		1	14
ANG04	3	13	1		17
ANG05	1				1
Gething Falls			1		1
Total	16	20	2	2	40
Proportion (%)	40	50	5	5	

Table 8. Minimum, maximum and mean fork length by age class of rainbow trout, bull trout, lake trout, kokanee, mountain whitefish and lake whitefish, sampled from Dinosaur Reservoir and tributaries, August 18-27, 2010.

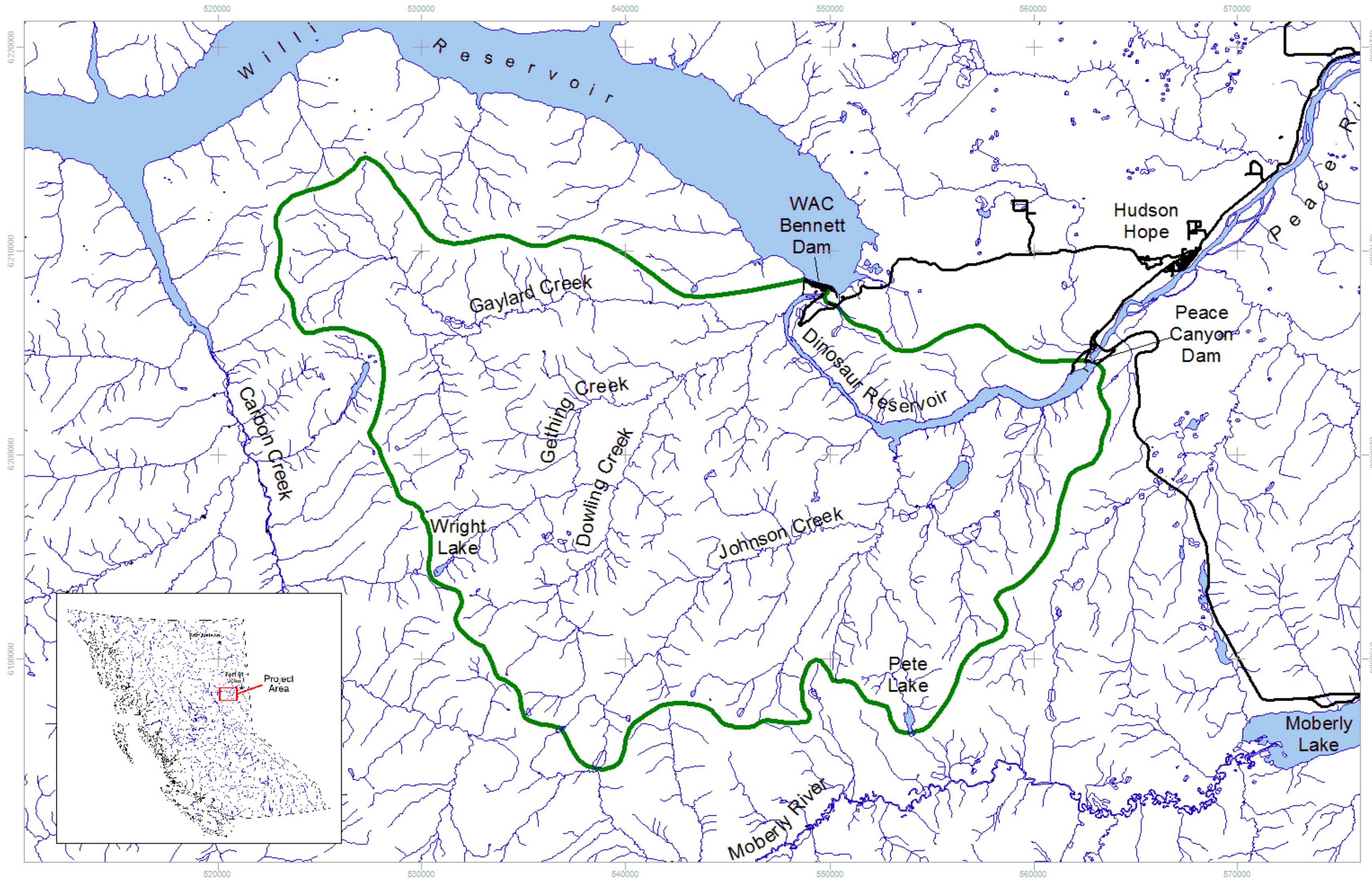
Species	Age (Yr)	n	Proportion (%)	Min. Fork Length	Max. Fork Length	Mean Fork Length	S.E.
RB	0	4	4	92	101	96	2.3
	1	20	21	130	170	153	2.9
	2	27	28	154	291	197	5.6
	3	27	28	217	322	260	4.6
	4	12	13	265	366	307	8.0
	5	2	2	334	337	336	1.5
	6	3	3	333	454	374	39.8
BT	3	2	17	285	292	289	3.5
	5	1	8	642	642	642	
	7	3	25	723	811	762	26.0
	8	2	17	761	763	762	1.0
	9	2	17	777	796	787	9.5
	10	2	17	810	835	823	7.5
LT	4	1	5	300	300	300	
	5	6	32	324	366	340	3.9
	6	4	21	322	405	359	17.1
	7	4	21	431	446	439	3.9
	9	1	5	495	495	495	
	10	3	16	444	505	558	37.4
KO	1	4	12	126	141	136	3.4
	2	12	35	185	225	210	3.3
	3	18	53	207	231	221	
MW	1	12	15	127	165	171	14.2
	2	5	6	154	234	178	14.2
	3	8	10	218	270	241	6.2
	4	18	23	243	321	273	6.2
	5	13	17	252	322	293	6.2
	6	9	12	295	323	308	2.7
	7	6	8	317	346	330	5.2
	8	3	4	357	370	362	3.9
	9	1	1	349	349	349	
	12	1	1	348	348	348	
	13	1	1	386	386	386	
	15	1	1	395	395	395	
LW	1	7	25	128	165	148	4.8
	4	4	14	279	334	300	12.9
	5	7	25	287	382	335	15.9
	6	3	11	356	420	380	20.3
	7	5	18	356	409	386	9.0
	8	1	4	371	371	371	
	9	1	4	387	387	387	

Table 9. History of fish stocking in the Dinosaur Reservoir drainage.

Name	Year	Species	Number	Stock	Comments
Burnt Trail Creek 230-809800-18900	1984	RB	6750	Dinosaur	reared and stocked by Peace Canyon Hatchery
Dinosaur Reservoir	1982	RB	14091	Dinosaur	produced by Peace Canyon Hatchery
WBID 01273UPCE	1983	RB	43704	Williston Reservoir	produced by Peace Canyon Hatchery
	1984	RB	90752	Williston Reservoir	produced by Peace Canyon Hatchery
	1985	RB	33476	Dinosaur/Williston	produced by Peace Canyon Hatchery
	1986	RB	65841	Williston Reservoir	produced by Peace Canyon Hatchery
	1987	RB	46457	Williston Reservoir	produced by Peace Canyon Hatchery
	1988	RB	73375	Dinosaur/Williston	produced by Peace Canyon Hatchery
	1989	RB	42100	Tunkwa	reared in Peace Canyon Hatchery
	1990	RB	40000	NRT Premier	
	1991	RB	40000	NRT Premier	
	1992	RB	40109	NRT Premier	
	1993	RB	40000	Tunkwa-Dragon	
	1994	RB	40000	Tunkwa	
	1995	RB	30000	NRT Genier	
	1996	RB	40000	Beaver	
	1997	RB	40000	Badger-Tunkwa	
	1999	RB	12532	Fraser Valley 3N	
	2000	RB	14640	Fraser Valley AF3N	
	2001	RB	5006	Fraser Valley AF3N	
	2002	RB	5030	Fraser Valley 3N	
	2003	RB	5030	Fraser Valley 3N	
Dowling Creek 230-815600-25300	1985	BT	430	Gething Creek	reared and stocked by Peace Canyon Hatchery
Gaylard Creek 230-815600-04500	1983	RB	3150	Modeste	reared and stocked by Peace Canyon Hatchery
	1994	BT	16	Dinosaur	Gething Creek bull trout translocation project 1993-2005, Langston 2008
Gething Creek 230-815600	1983	RB	3150	Modeste	reared and stocked by Peace Canyon Hatchery
	1993	BT	13	Dinosaur	Gething Creek bull trout translocation project 1993-2005, Langston 2008
	1997	BT	14	Dinosaur	Gething Creek bull trout translocation project 1993-2005, Langston 2008
	1999	BT	21	Dinosaur	Gething Creek bull trout translocation project 1993-2005, Langston 2008

Table 9 cont'd. History of fish stocking in the Dinosaur Reservoir drainage.

Name	Year	Species	Number	Stock	Comments
Wright Lake	1991	RB	8000	NRT Premier	
WBID 01109UPCE	1992	RB	8797	NRT Premier	
Located at	1993	RB	7500	Tunkwa-Dragon	
headwaters	1994	RB	3000	Tunkwa	
of Gething Creek	1996	RB	1500	Beaver	
	1998	RB	2000	Badger-Tunkwa	
	1999	RB	2000	Pennask-Beaver	
	2000	RB	2000	Pennask AF3N	
	2001	RB	2000	Pennask AF3N	
	2002	RB	2000	Pennask AF3N	
	2003	RB	2000	Blackwater R 3N - Dragon	
	2004	RB	2000	Blackwater R 3N - Dragon	
	2005	RB	2000	Blackwater R 3N	
	2006	RB	2000	Blackwater R 3N	
	2007	RB	2000	Blackwater R 3N - Dragon	
	2008	RB	2000	Blackwater R 3N - Dragon	
	2009	RB	2000	Blackwater R AF3N - Dragon	
	2010	RB	1000	Blackwater R AF3N - Dragon	
Johnson Creek 230-809800	1982	RB	1994	Dinosaur	reared and stocked by Peace Canyon Hatchery
	1984	RB	6750	Dinosaur	reared and stocked by Peace Canyon Hatchery
Pete Lake WBID 01142UPCE Located at	1993	RB	5000	Tunkwa	
headwaters	1994	RB	5000	Tunkwa-Genier	
of Burnt Trail Ck in	1995	RB	3350	Blackwater R 3N - Dragon	
the Johnson Ck	1996	RB	3130	Blackwater R 3N - Dragon	
watershed.	1997	RB	2500	Blackwater R AF3N - Dragon	
	1999	RB	2500	Blackwater R AF3N - Dragon	
	2000	RB	2500	Blackwater R AF3N - Dragon	
	2001	RB	2500	Blackwater R AF3N - Dragon	
	2002	RB	664	Blackwater R 3N - Dragon	
	2002	RB	839	Blackwater R AF3N - Dragon	
	2002	RB	998	Blackwater R 3N - Dragon	
	2003	RB	2500	Pennask AF3N	
	2004	RB	2500	Pennask AF3N	
	2005	RB	1500	Pennask AF3N	
	2006	RB	1500	Pennask-Beaver AF3N	
	2007	RB	1500	Pennask-Beaver AF3N	
	2008	RB	1500	Pennask-Beaver AF3N	
	2009	RB	1500	Pennask-Beaver AF3N	



BC Government Data	BC Hydro Data
- BC 1:50,000 Watershed Atlas (June 2005)	

Legend

Dinosaur Reservoir watershed boundary

5 0 5 10 Km

N

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Peace River Site C Hydro Project
Stage 2 Preliminary Reference Information

Figure 1. Location of Dinosaur Reservoir drainage in British Columbia (Scale 1:250,000).

December 2011	Drawing No. 1	Revision No. 1

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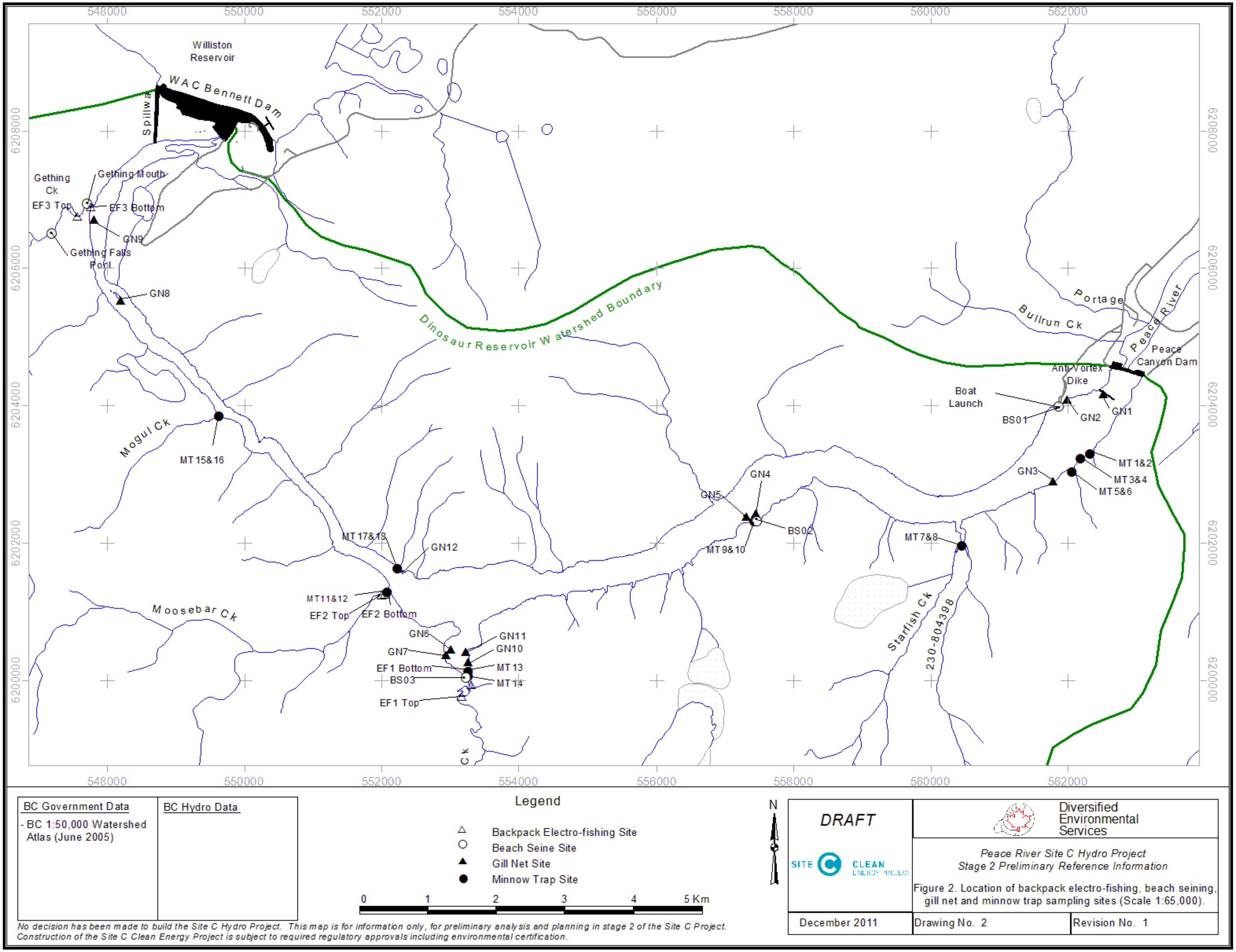
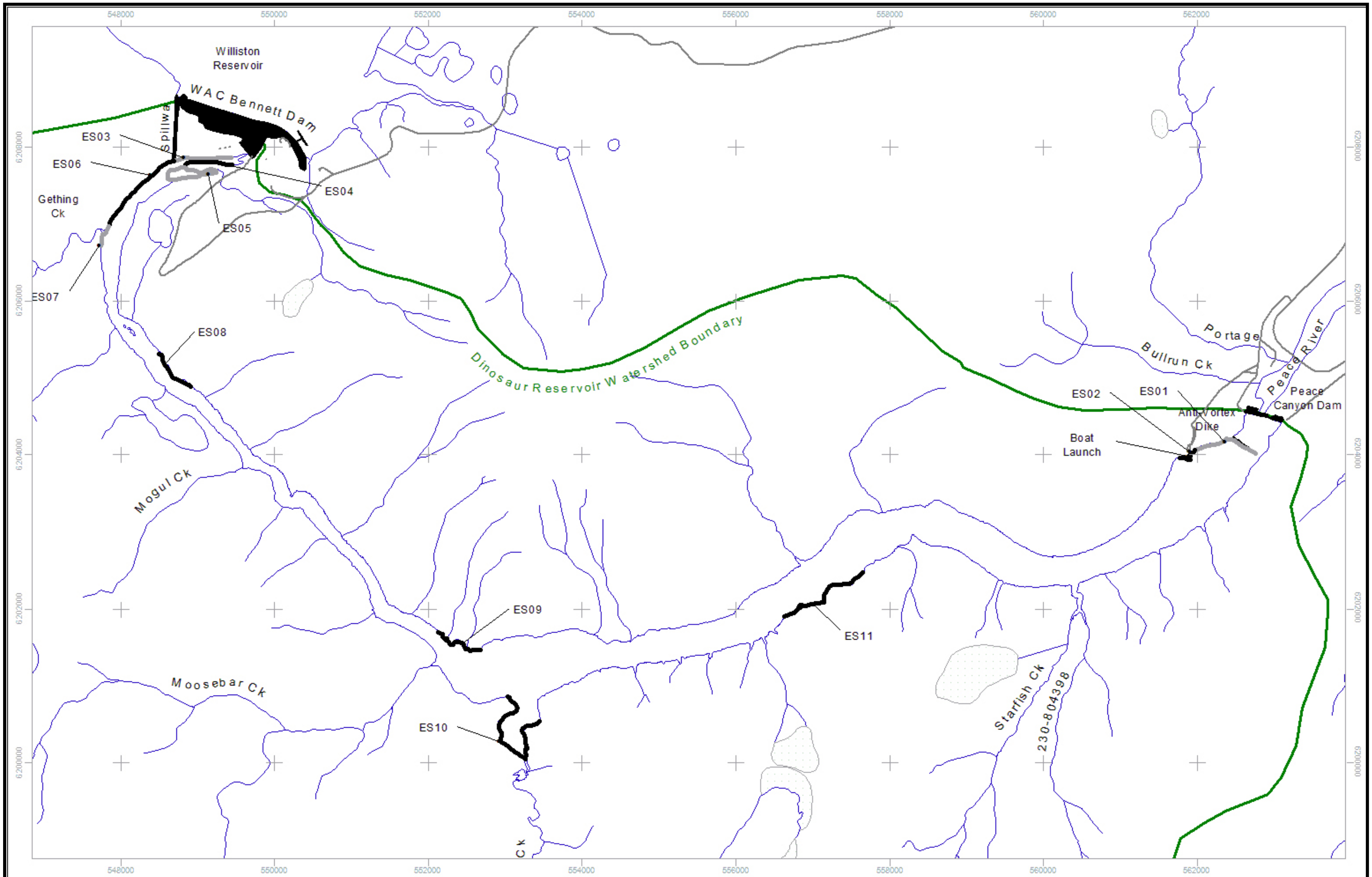


Figure 2. Location of backpack electro-fishing, beach seining, gill net and minnow trap sampling sites (Scale 1:65,000).



BC Government Data	BC Hydro Data
- BC 1:50,000 Watershed Atlas (June 2005)	

Legend

Boat Electro-fishing Sites
(shaded segment represents limits of sampling)

0 1 2 3 4 5 Km

N

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Diversified Environmental Services

Peace River Site C Hydro Project
Stage 2 Preliminary Reference Information

Figure 3. Location of boat electro-fishing sites (Scale 1:65,000).

December 2011	Drawing No. 3	Revision No. 1

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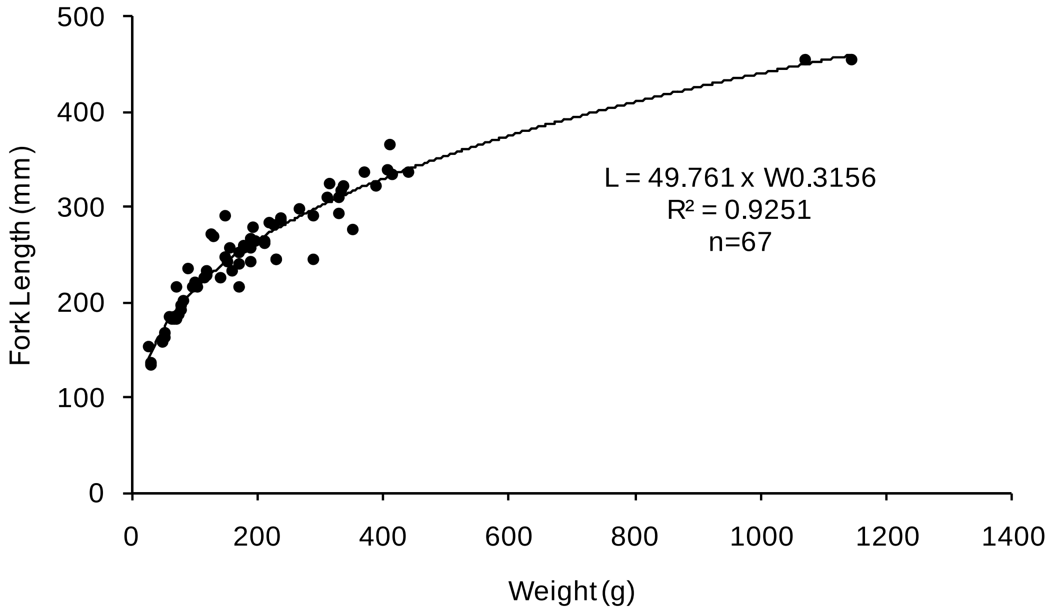


Figure 4. Length-weight relationship of sampled rainbow trout, Dinosaur Reservoir, August 18-27, 2010.

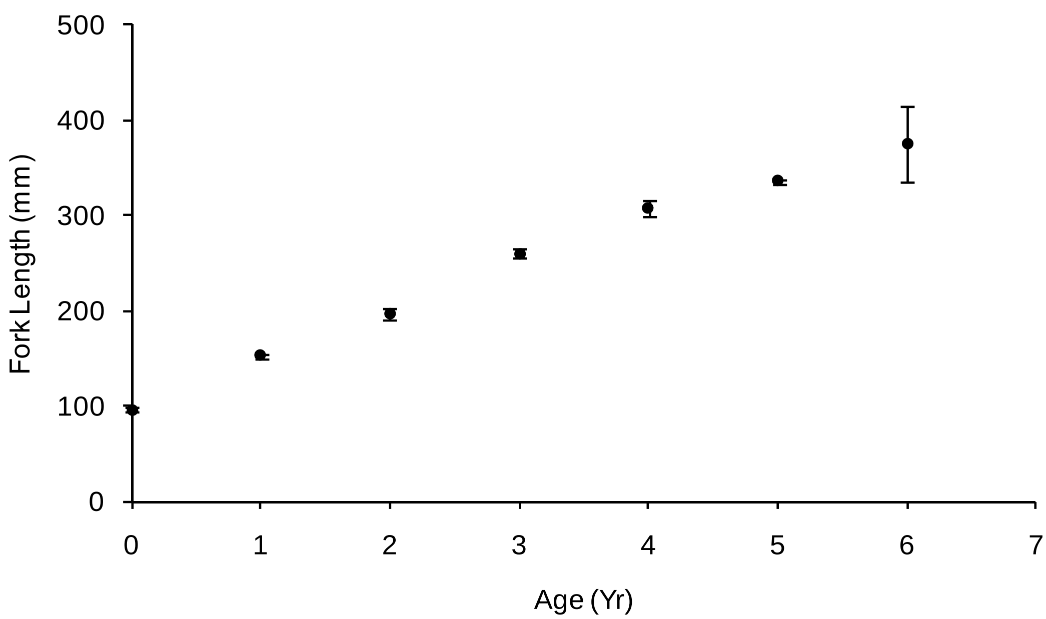


Figure 5. Length-at-age ± S.E. of sampled rainbow trout, Dinosaur Reservoir, August 18-27, 2010.

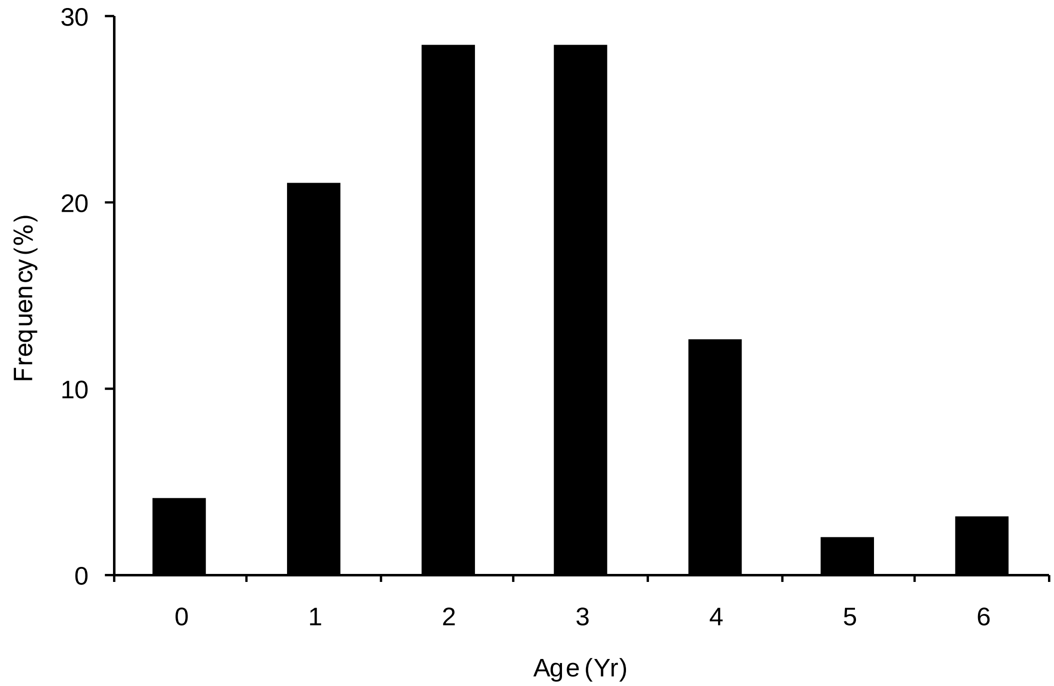


Figure 6. Age class proportions of sampled rainbow trout from all sites, Dinosaur Reservoir, August 18-27, 2010.

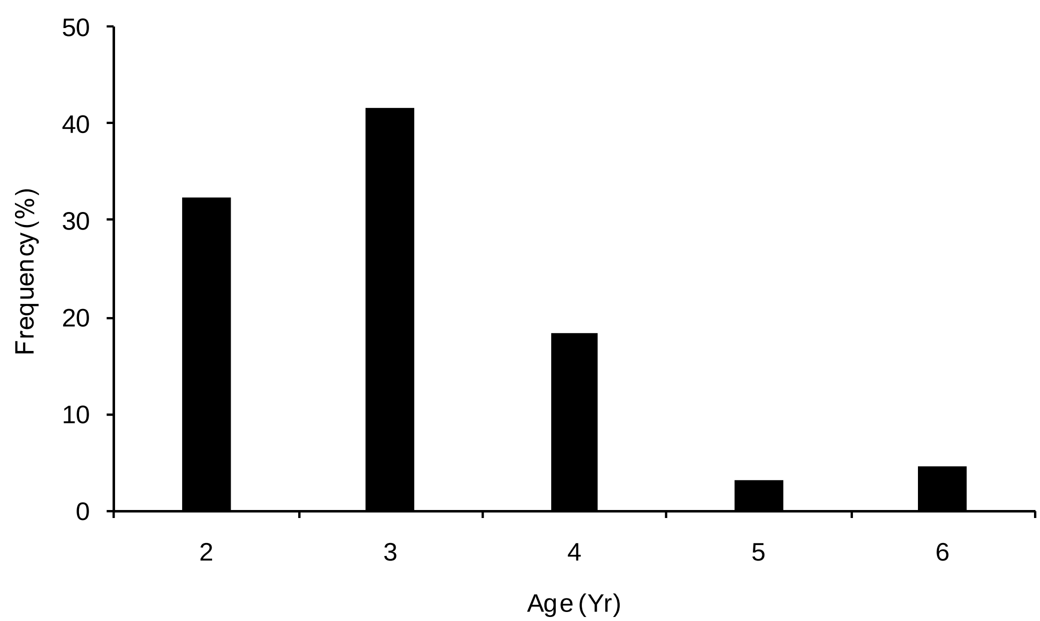


Figure 7. Age class proportions of sampled rainbow trout excluding tributary sites, Dinosaur Reservoir, August 18-27, 2010.

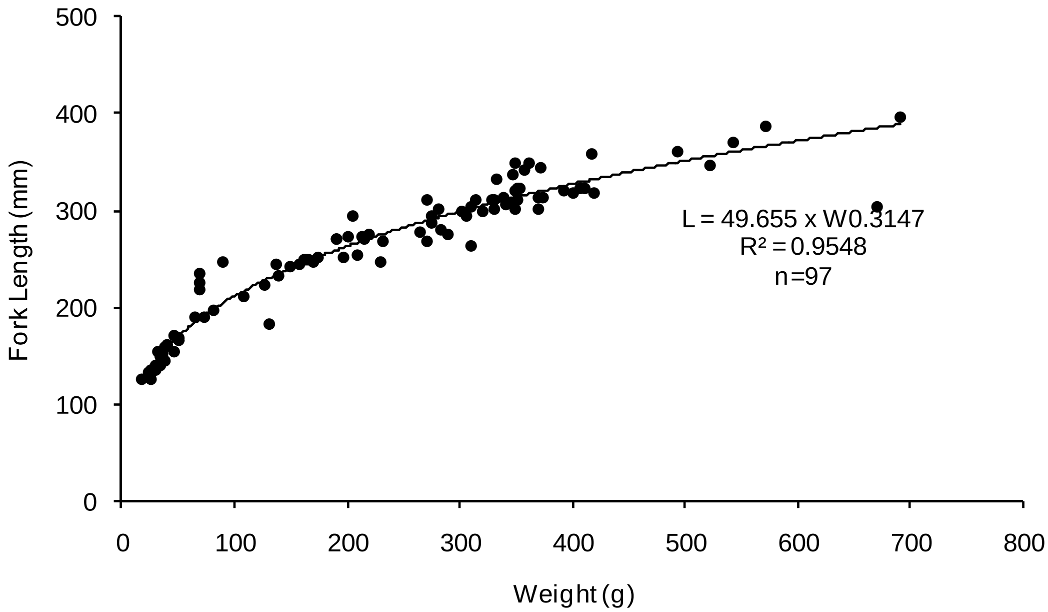


Figure 8. Length-weight relationship of sampled mountain whitefish, Dinosaur Reservoir, August 18-27, 2010.

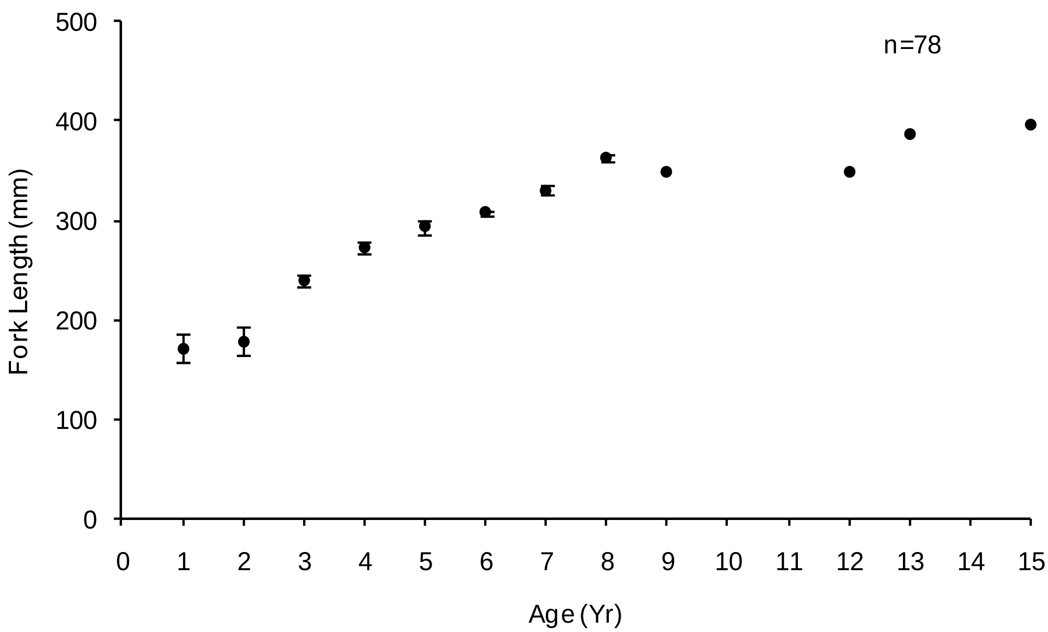


Figure 9. Length-at-age ± S.E. of sampled mountain whitefish, Dinosaur Reservoir, August 18-27, 2010.

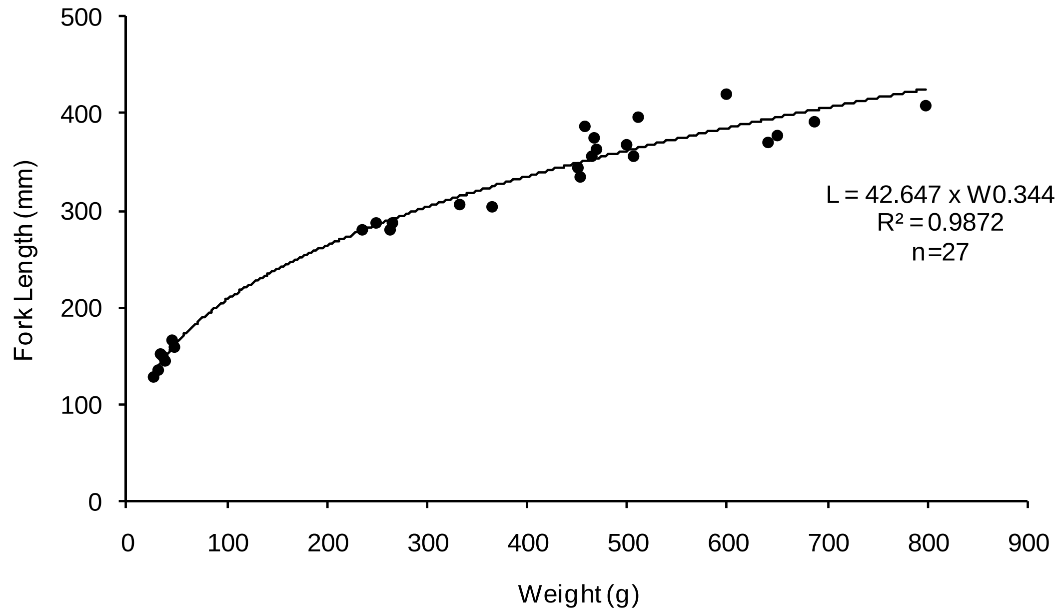


Figure 10. Length-weight relationship of sampled lake whitefish, Dinosaur Reservoir, August 18-27, 2010.

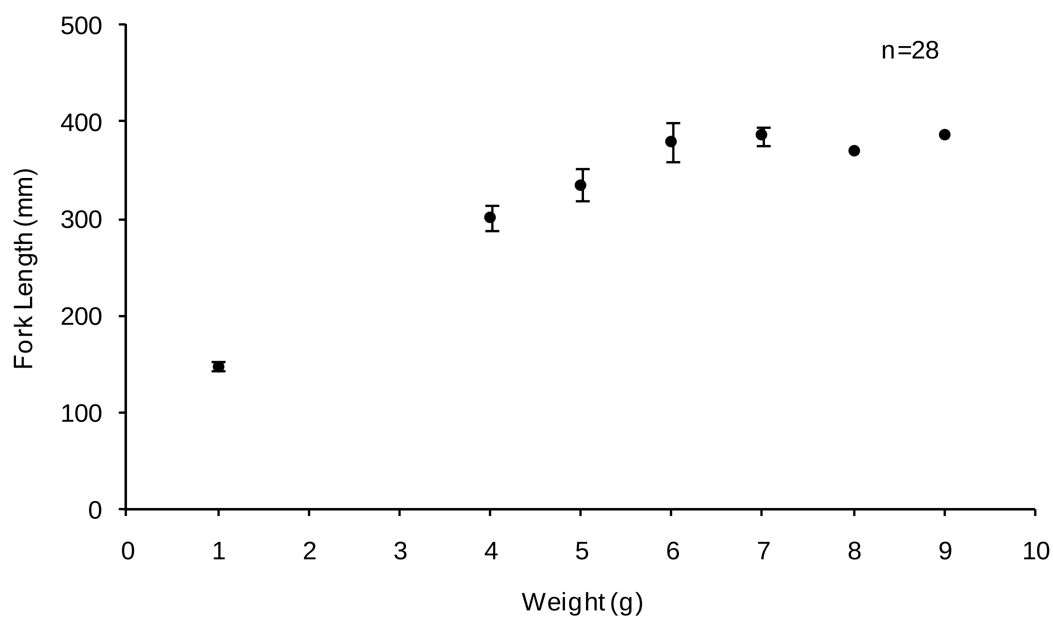


Figure 11. Length-at-age ± S.E. of sampled lake whitefish, Dinosaur Reservoir, August 18-27, 2010.

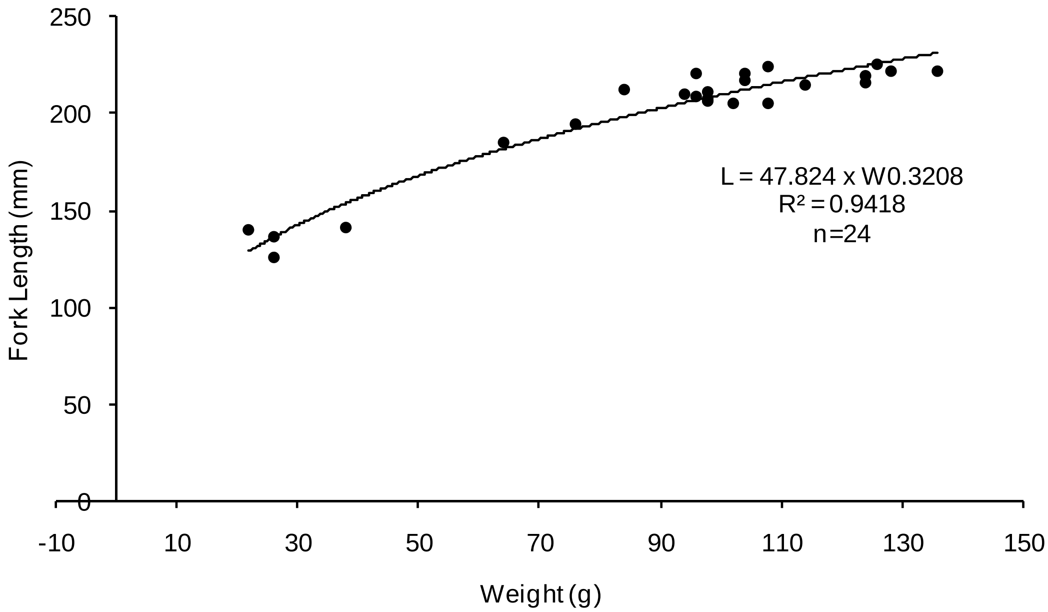


Figure 12. Length-weight relationship of sampled kokanee, Dinosaur Reservoir, August 18-27, 2010.

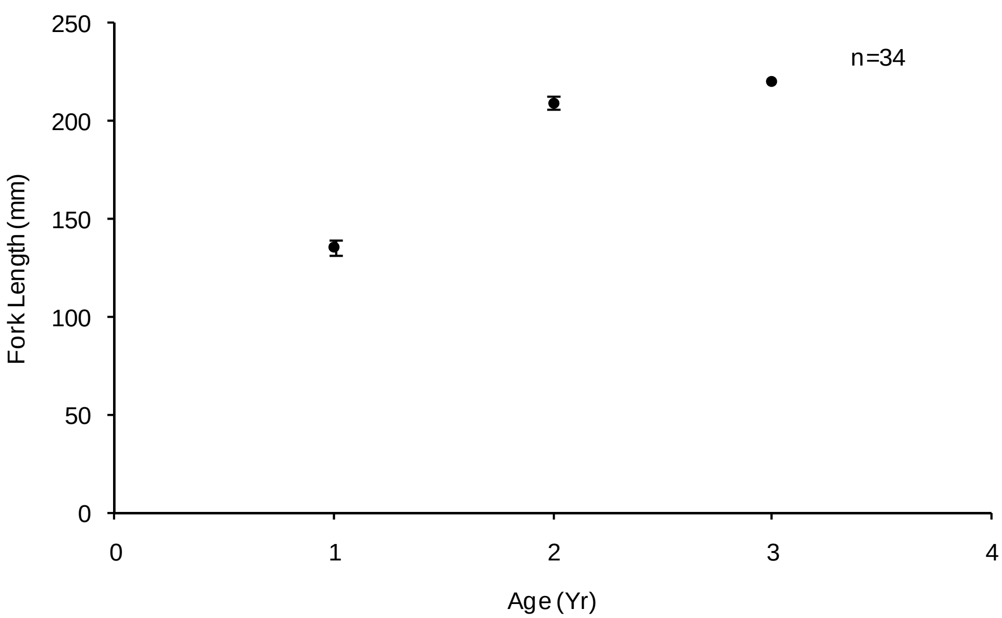


Figure 13. Length-at-age ± S.E. of sampled kokanee, Dinosaur Reservoir, August 18-27, 2010.

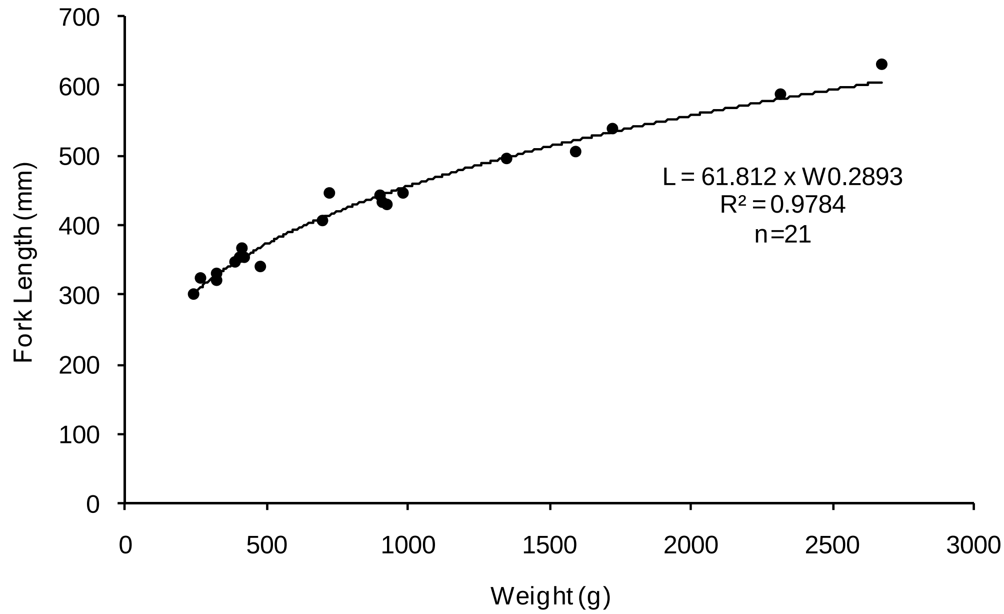


Figure 14. Length-weight relationship of sampled lake trout, Dinosaur Reservoir, August 18-27, 2010.

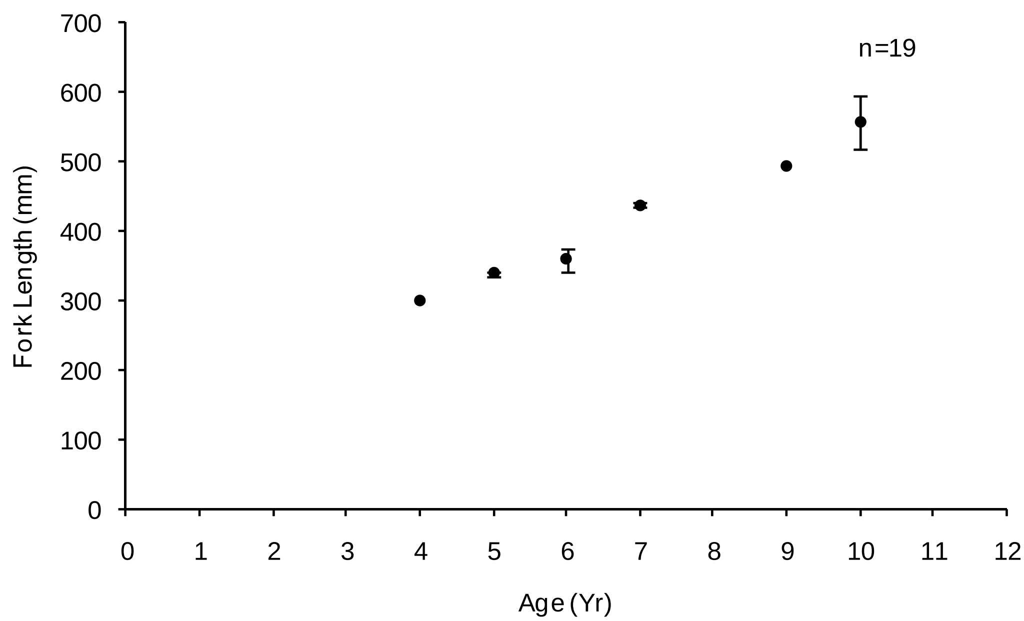


Figure 15. Length-at-age ± S.E. of sampled lake trout, Dinosaur Reservoir, August 18-27, 2010.

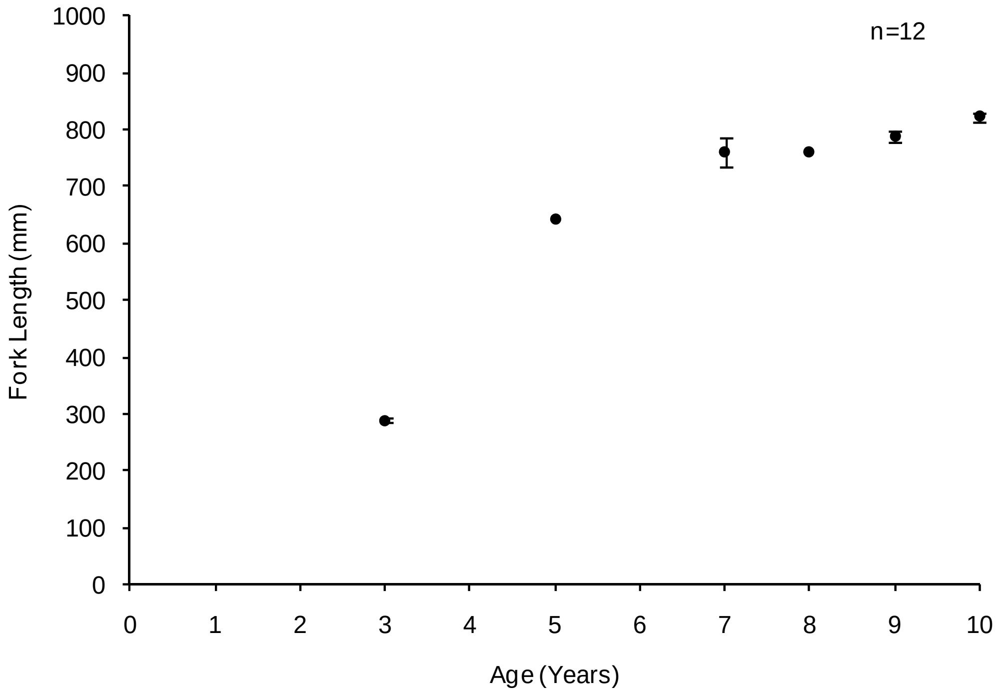


Figure 16. Length-at-age ± S.E. of sampled bull trout, Dinosaur Reservoir and tributaries, August 18-27, 2010.

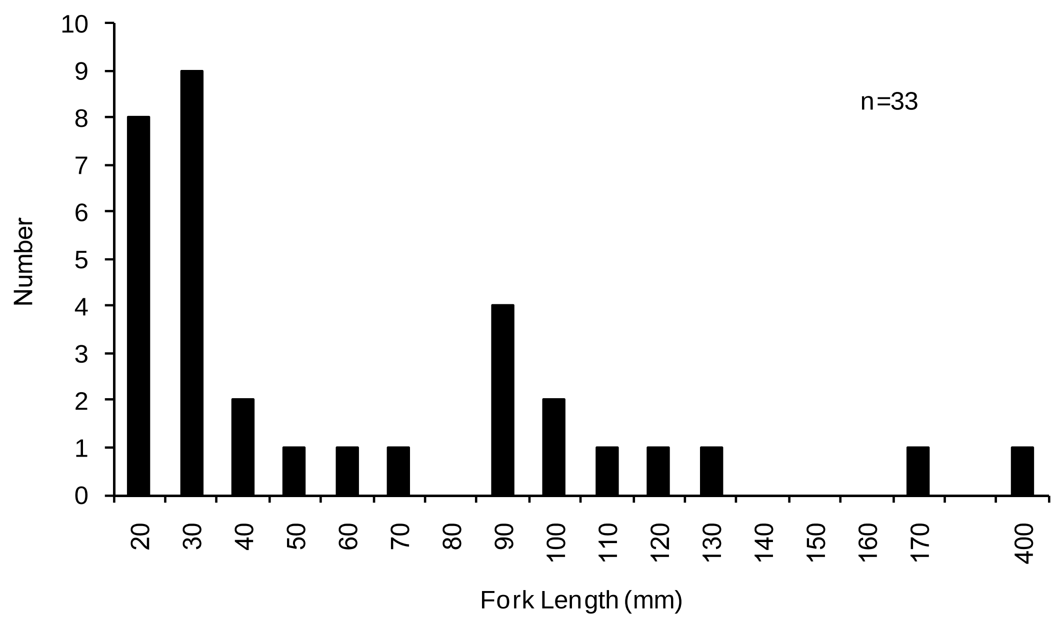


Figure 17. Length distribution of longnose sucker, Dinosaur Reservoir and tributaries, August 18-27, 2010.

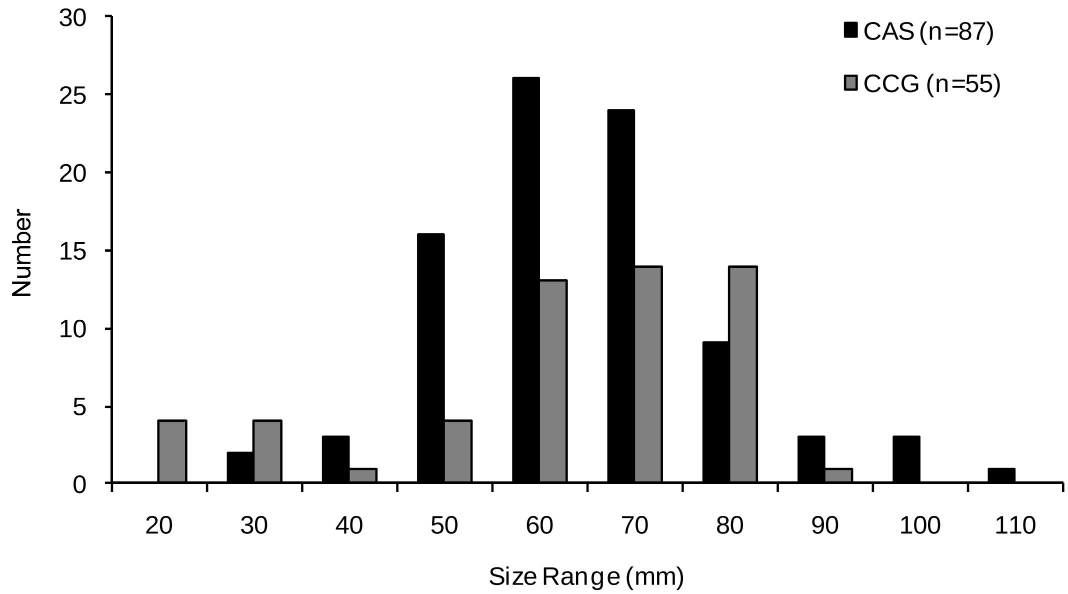


Figure 18. Length distribution of prickly and slimy sculpin from all sites combined Dinosaur Reservoir, August 18-27, 2010.

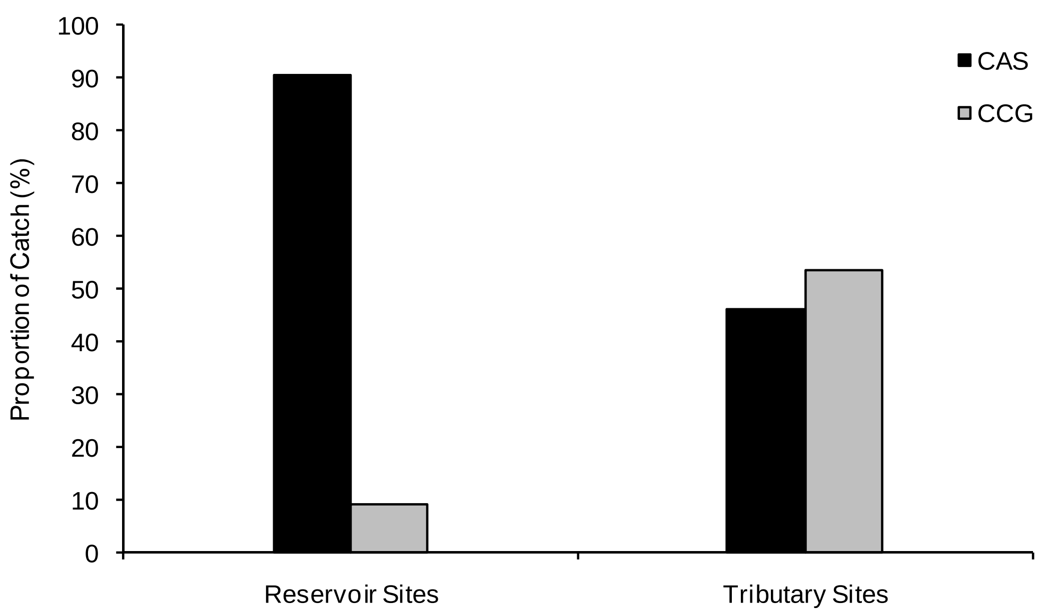
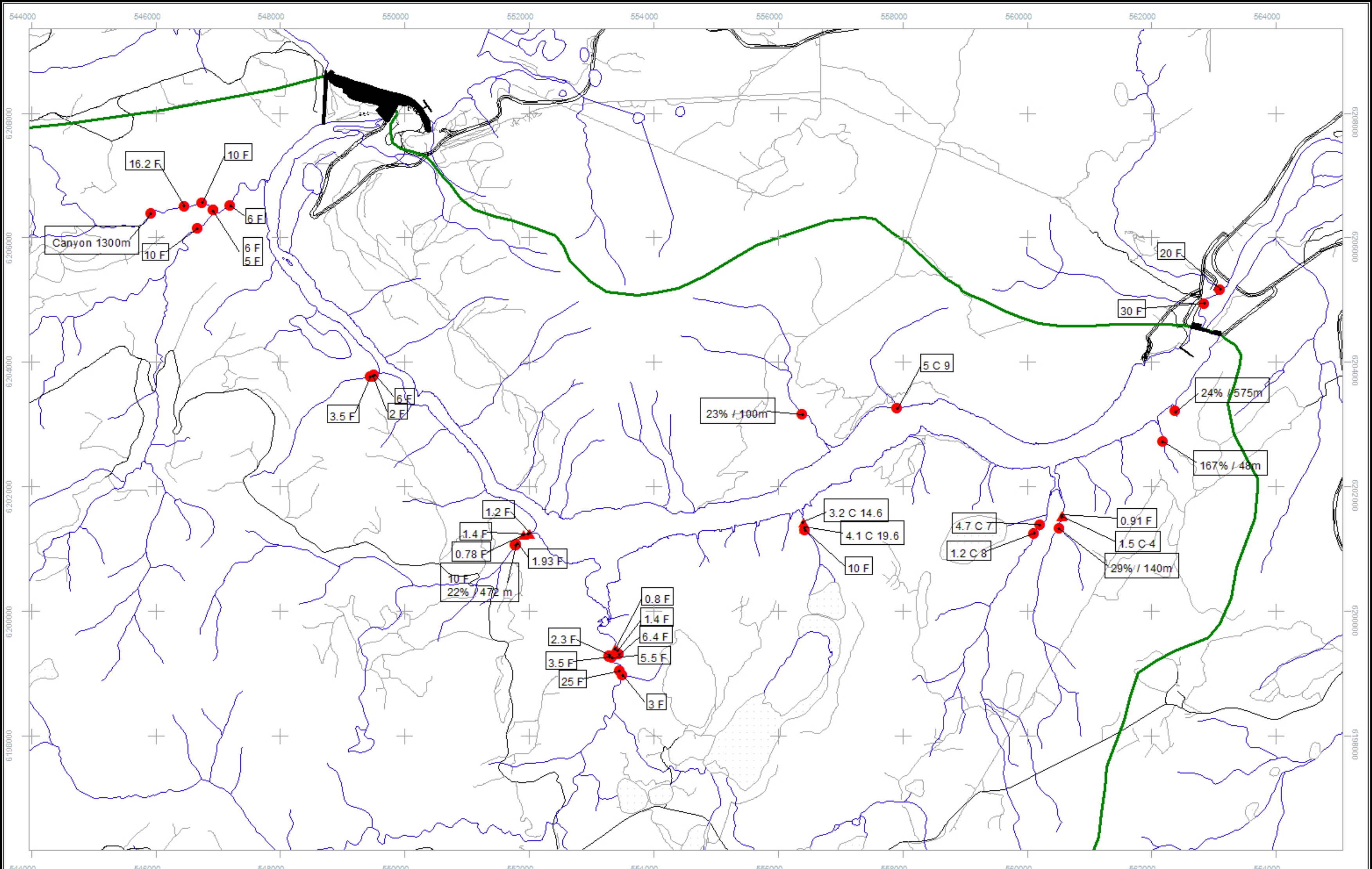


Figure 19. Proportion of prickly and slimy sculpin captured at reservoir and tributary sites, Dinosaur Reservoir, August 18-27, 2010.



BC Government Data
- BC 1:50,000 Watershed Atlas (June 2005)
- Digital Road Atlas (DRA M-PAR 2010-12-01)
- Freshwater Atlas Obstructions (2008)

BC Hydro Data
- LeRuez 2009

Legend

10 F 35% / 250 m — Definite Barrier (eg. Height, Type, Gradient, Length)

0.8 F — Partial Barrier (Height, Type)

1 0 1 2 3 4 5 Km

N

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Diversified Environmental Services

Peace River Site C Hydro Project
Stage 2 Preliminary Reference Information

Figure 20. Location of documented barriers in the Dinosaur Reservoir watershed (Scale 1:80,000).

December 2011 | Drawing No. 20 | Revision No. 1

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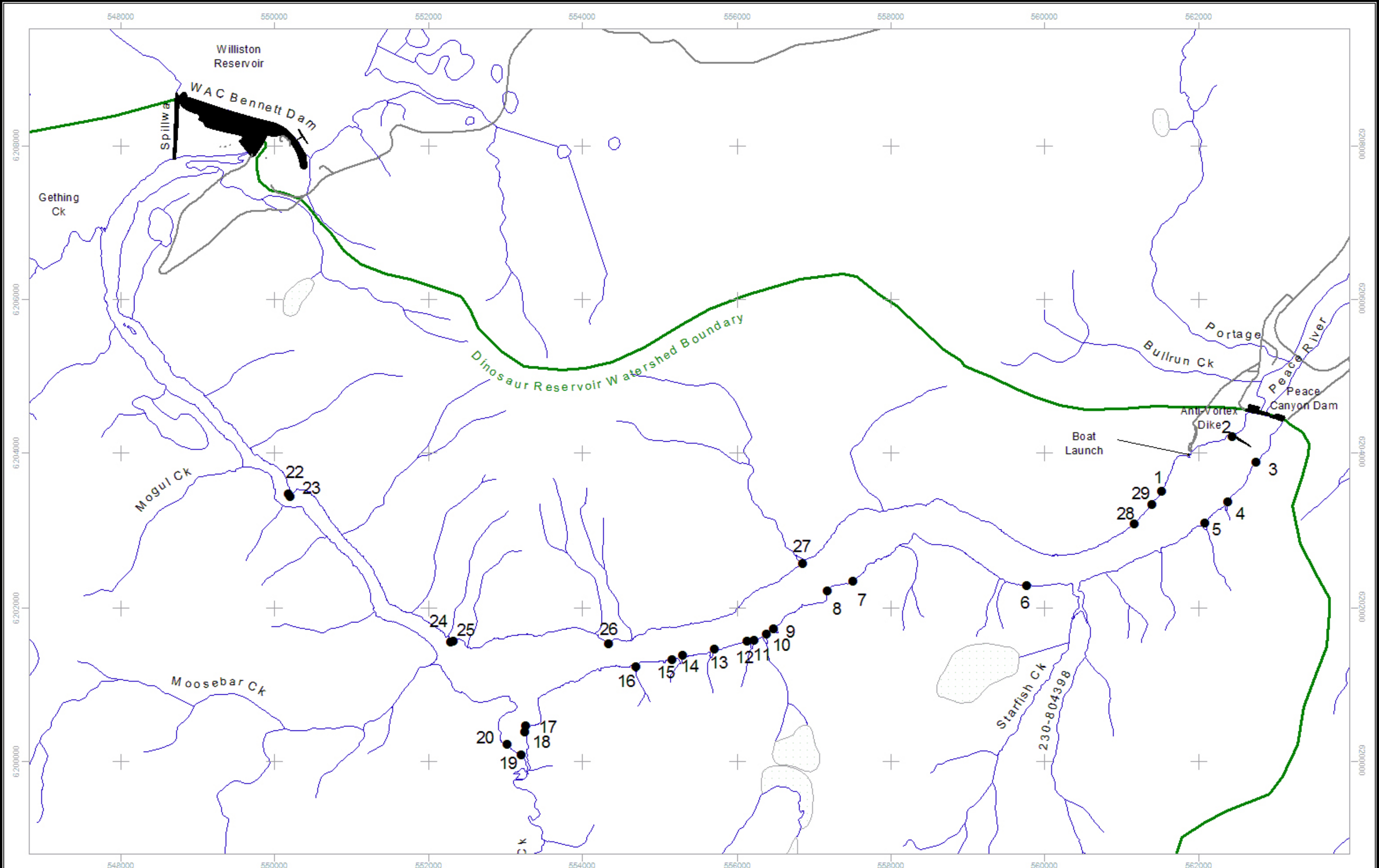

BC Government Data	BC Hydro Data
- BC 1:50,000 Watershed Atlas (June 2005)	

Legend

● PWFWCP Boat Electrofishing Site (2006)

1 0 1 2 3 4 5 Km

N

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Peace River Site C Hydro Project
Stage 2 Preliminary Reference Information

Figure 21. Location of PWFWCP littoral sampling sites (Scale 1:65,000).

December 2011	Drawing No. 21	Revision No. 1

No decision has been made to build the Site C Hydro Project. This map is for information only, for preliminary analysis and planning in stage 2 of the Site C Project. Construction of the Site C Clean Energy Project is subject to required regulatory approvals including environmental certification.

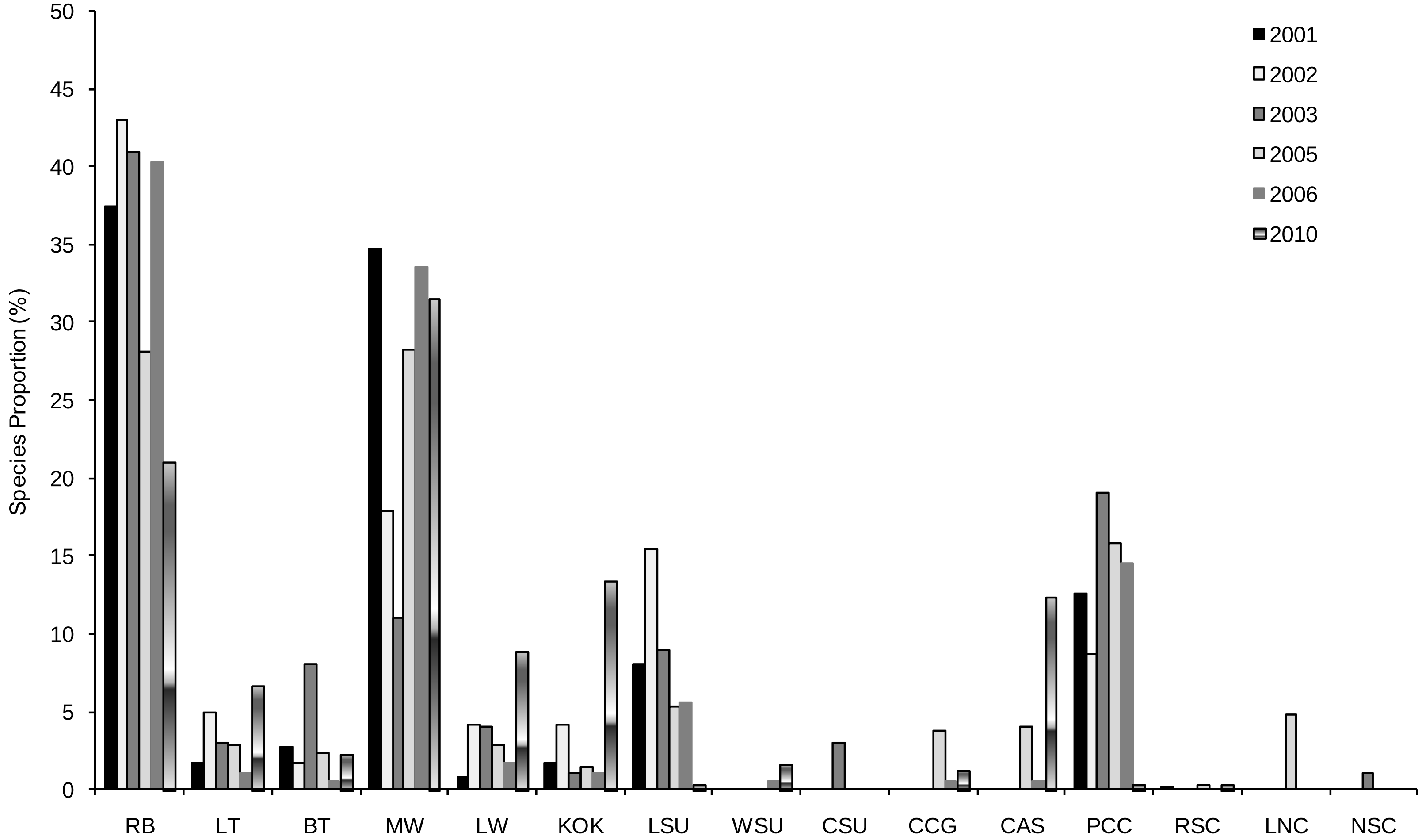
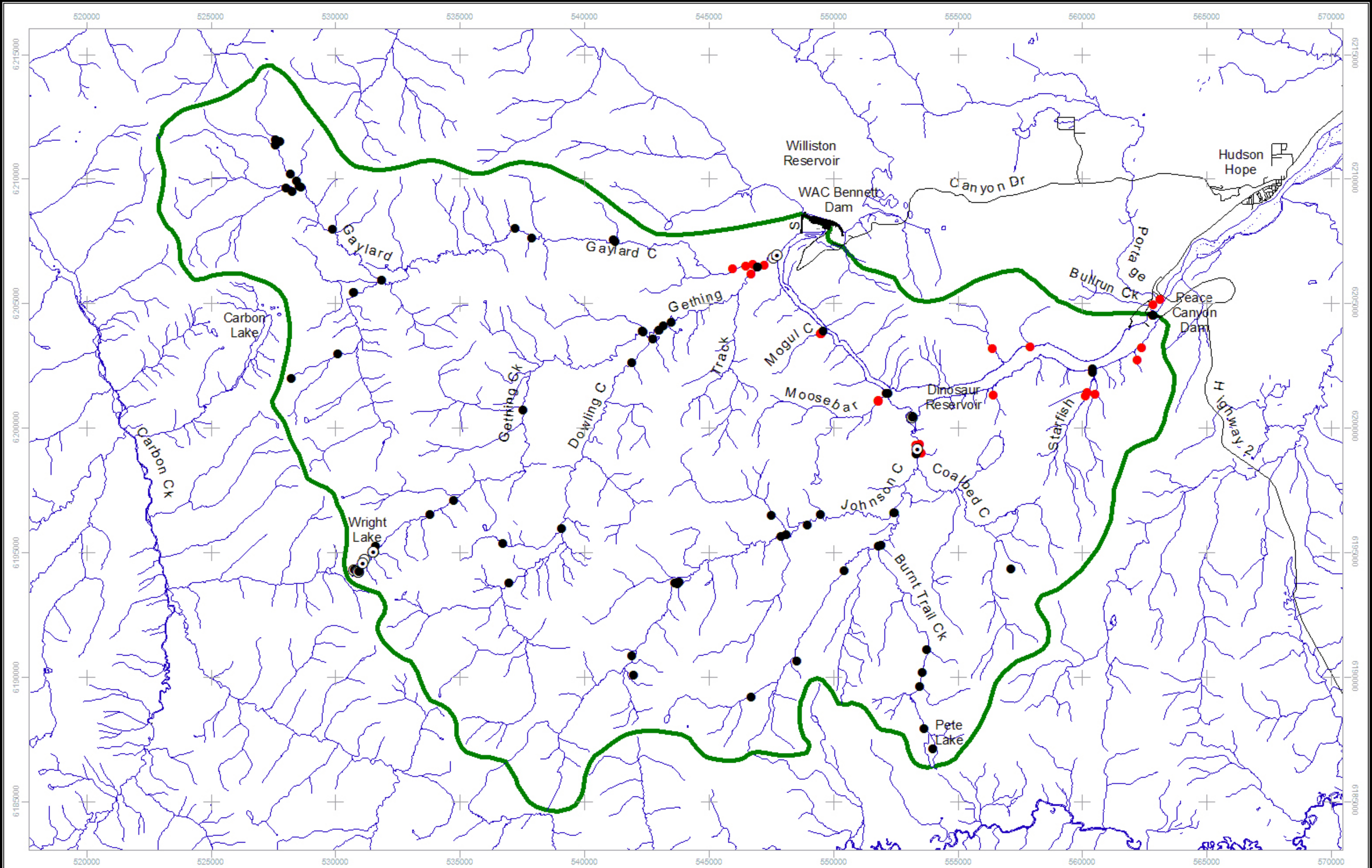


Figure 22. Comparison of species composition during Dinosaur Reservoir sampling events between 2001 and 2010.



BC Government Data	BC Hydro Data
- BC 1:50,000 Watershed Atlas (June 2005) - Digital Road Atlas (DRA M-PAR 2010-12-01) - Freshwater Atlas Obstructions (2008)	- LeRuez 2009

Legend

- Confirmed Fish Barrier
- Known Rainbow Trout Occurence (tributaries only)
- Known Longnose Sucker Occurence (tributaries only)

5 0 5 10 15 Km

N

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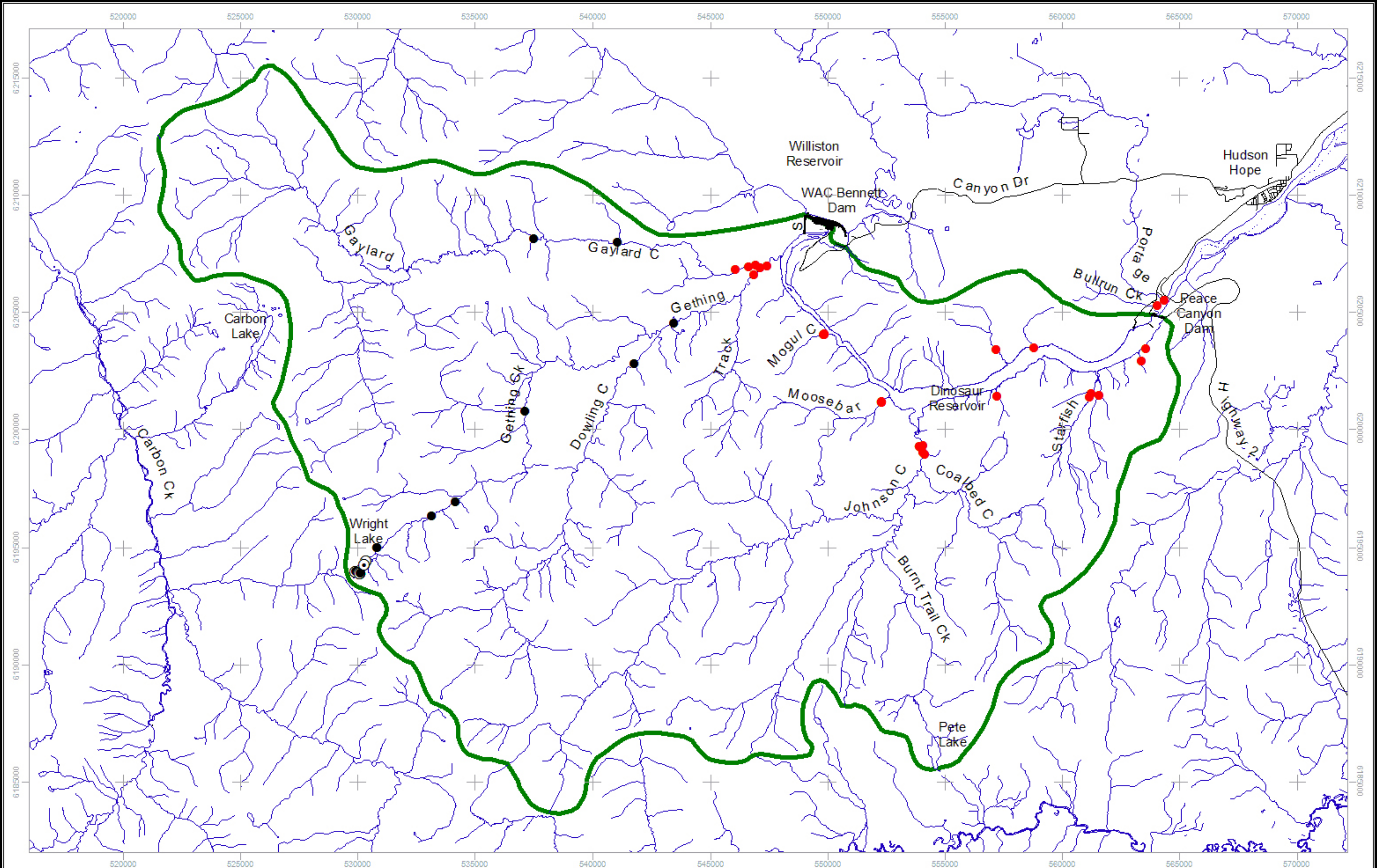
Peace River Site C Hydro Project
Stage 2 Preliminary Reference Information

Figure 23. Distribution of rainbow trout in the upper Gething Creek and Johnson Creek watershed (Scale 1:200,000).

December 2011 | Drawing No. 23 | Revision No. 1

No decision has been made to build the Site C Hydro Project. This map is for information only, for preliminary analysis and planning in stage 2 of the Site C Project. Construction of the Site C Clean Energy Project is subject to required regulatory approvals including environmental certification.



BC Government Data	BC Hydro Data
- BC 1:50,000 Watershed Atlas (June 2005) - Digital Road Atlas (DRA M-PAR 2010-12-01) - Freshwater Atlas Obstructions (2008)	- LeRuez 2009

Legend

- confirmed bull trout occurence (tributaries only)
- longnose sucker (tributaries only)
- confirmed barrier

5 0 5 10 15 Km

N

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Stage 2 Preliminary Reference Information

Figure 24. Distribution of bull trout in the upper Gething Creek watershed including translocation sites (Scale 1:200,000).

December 2011 | Drawing No. 24 | Revision No. 1

No decision has been made to build the Site C Hydro Project. This map is for information only, for preliminary analysis and planning in stage 2 of the Site C Project. Construction of the Site C Clean Energy Project is subject to required regulatory approvals including environmental certification.

Appendix I

Gill net sampling dates and locations in Dinosaur Reservoir

Appendix I. Gill net sampling dates and locations in Dinosaur Reservoir.

Site	Location	Date	East	North	Set No	Time Start	Time End	Soak Time (hr)	Type	Depth of Deep End of Net (m)	Photos	Comments
GN1	Dinosaur Reservoir	18-Aug-10	562521	6204170	1	10:15	11:15	1.00	floating	8.2	P8180063	64mm mesh on shore
					2	11:26	12:55	1.48				
					3	12:55	14:17	1.37				
GN2	Dinosaur Reservoir	18-Aug-10	561992	6204086	1	10:27	11:32	1.08	sinking	3.6		64mm mesh on shore
					2	11:32	13:15	1.72				
					3	13:15	14:20	1.08				
GN3	Dinosaur Reservoir	18-Aug-10	561783	6202905	1	12:20	13:30	1.17	sinking	9.7	P8180068	14 °C
					2	13:30	14:55	1.25				
GN4	Dinosaur Reservoir	19-Aug-10	557450	6202431	1	9:42	10:45	1.05	sinking	7.4		25mm on shore, at pipeline
GN5	Dinosaur Reservoir	19-Aug-10	557312	6202394	1	9:55	11:05	1.17	floating	12		floating for entire length
GN6	Dinosaur Reservoir	19-Aug-10	553006	6200447	1	12:20	14:00	1.67	floating	11.2	P8190074	
					2	14:00	15:20	1.33				
GN7	Dinosaur Reservoir	19-Aug-10	552938	6200367	1	12:35	14:20	1.75	sinking	13.5	P8190073	11.6 °C
					2	14:20	15:30	1.17				
GN8	Dinosaur Reservoir	20-Aug-10	548188	6205539	1	10:12	11:22	1.17	sinking	9.2		downstream end of lowermost island, sinking snagged on LWD and retrieved
GN9	Dinosaur Reservoir	20-Aug-10	547800	6206714	1	10:29	12:05	1.60	floating	10.5		set from downstream end of Gething Ck Delta
					2	12:10	14:30	2.33				
					3	14:30	17:15	2.75				
GN10	Dinosaur Reservoir	21-Aug-10	553260	6200264	1	10:42	11:50	1.13	sinking	9.4		
GN11	Dinosaur Reservoir	21-Aug-10	553233	6200412	1	10:52	12:00	2.13	floating	15.5		floating at surface for full length
GN12	Dinosaur Reservoir	27-Aug-10	552315	6201543	1	10:10	14:45	4.58	floating	4		Set here in an attempt to capture LSU. LSU previously captured at this location.

Appendix II

Minnow trap sampling dates and locations in Dinosaur Reservoir

Appendix II. Minnow trap sampling dates and locations in Dinosaur Reservoir.

Site Name	Date Start	Time Set	Date End	Time Pulled	Duration (hr)	Set Depth (m)	Bottom Substrate	Waypoint	East	North	Photos	Comments
MT1	18-Aug-10	10:36	19-Aug-10	8:52	22.27	1	sand, fines, small gravel	MT1&2	562342	6203300	P8180064	
MT2	18-Aug-10	10:36	19-Aug-10	8:52	22.27	1	sand, fines, small gravel	MT1&2	562342	6203300	P8180065	
MT3	18-Aug-10	10:50	19-Aug-10	8:57	22.12	1	rock shoreline steep drop-off	MT3&4	562194	6203231	P8180066	
MT4	18-Aug-10	10:50	19-Aug-10	8:58	22.13	1	rock shoreline steep drop-off	MT3&4	562194	6203231		
MT5	18-Aug-10	10:55	19-Aug-10	9:02	22.12	1	sand, small gravel	MT5&6	562076	6203038	P8180067	
MT6	18-Aug-10	10:55	19-Aug-10	9:00	22.08	1	sand, small gravel	MT5&6	562076	6203038		
MT7	19-Aug-10	9:09	20-Aug-10	9:06	23.95	1.5	bedrock drop-off	MT7&8	560469	6201958	P8190069	
MT8	19-Aug-10	9:09	20-Aug-10	9:10	24.02	2	bedrock drop-off	MT7&8	560469	6201958	P8190070	
MT9	19-Aug-10	9:22	20-Aug-10	9:18	23.95	1.5	mud with submerged vegetation	MT9&10	557436	6202308	P8190071	
MT10	19-Aug-10	9:23	20-Aug-10	9:20	23.95	1	sand, fine gravel with submerged vegetation nearby	MT9&10	557436	6202308	P8190072	
MT11	19-Aug-10	14:55	20-Aug-10	9:45	18.83	1	fines & mud, no vegetation	MT11&12	552093	6201280	P8190083	
MT12	19-Aug-10	14:55	20-Aug-10	9:45	18.83	1	fines & mud, no vegetation	MT11&12	552093	6201280	P8190084	
MT13	20-Aug-10	9:30	21-Aug-10	11:00	23.5	1	mud with vegetation nearby	MT13	553274	6200046	P8200089	Johnson Ck forebay
MT14	20-Aug-10	9:35	21-Aug-10	11:05	23.5	2	mud with vegetation nearby	MT14	553270	6200118	P8200090	Johnson Ck forebay
MT15	20-Aug-10	9:56	21-Aug-10	12:25	26.48	2	bedrock ledges & LWD	MT15&16	549642	6203832	P8200091	
MT16	20-Aug-10	9:58	21-Aug-10	12:25	26.45	1.5	gravel, silt, rock ledges	MT15&16	549642	6203832	P8200092	
MT17	20-Aug-10	15:34	21-Aug-10	12:15	20.68	1.5	gravel, silt, LWD	MT17&18	552247	6201623		
MT18	20-Aug-10	15:34	21-Aug-10	12:16	20.7	1.5	gravel, silt, LWD	MT17&18	552247	6201623		

Appendix III

Beach seine sampling dates and locations in Dinosaur Reservoir

Appendix III. Beach seine sampling dates and locations in Dinosaur Reservoir.

Site Name	Date	Hauls	Substrate	Depth	East	North	Photos	Comments
BS01	21-Aug-10	3x	fines with emergent and submergent vegetation	0.5 - 1m	561878	6203982	P8210110	at boat Launch
BS02	21-Aug-10	3x	fines with emergent and submergent vegetation	0.5 - 1m	557471	6202324	P8210111	at Pipeline
BS03	21-Aug-10	3x	fines with emergent and submergent vegetation	0.5 - 1m	553244	6200042	P8210112	Johnson Creek Forebay, 25mm sucker fry and 65 cm BT observed, NFC
GethingBT	21-Aug-10	1x	gravel	1m	547707	6206940		1st pool upstream from reservoir
Gething Falls	27-Aug-10	6x	gravel/boulder	2.5 - 3m	547201	6206510	P8200102P8200107	plunge pool at base of 6m falls

Appendix IV

Backpack electro-fishing sampling locations in Dinosaur Reservoir, August 19, 2010.

Appendix IV. Backpack electro-fishing sampling locations in Dinosaur Reservoir, August 19, 2010.

Site	Location	Start	East	North	End	East	North	Freq	Voltage	Effort (sec)	Temp (°C)	Channel Width (m)	Wetted Width (m)	Photos	Comments
EF1	Johnson Ck	EF1DS	553307	6199941	EF1US	553172	6199765	60	250	402	15.1	12-16	2.5	P8190075 to P8180078	Very low discharge, est. 0.03 cu.m^3/s, high density of sculpin, LSU & RB YOY, low beaver dam constructed within 100m upstream of reservoir , water spilling over but creating difficult passage at present low flows
EF2	Moosebar Ck	EF2DS	552045	6201253	EF2US	551998	6201244	60	250	123	11.8		1	P8190079 to P8180082	Very low flow, rainbows captured between 1.2 m and 1.4 m high falls
EF3	Gething Ck	EF3DS	547758	6206905	EF3US	547562	6206763	60	250	532	14.5	18	9	P8190085 to P8190088,	High density of rainbow and sculpin

Appendix V

Boat electro-fishing sampling locations
in Dinosaur Reservoir, August 23, 2010.

Appendix V. Boat electro-fishing sampling locations in Dinosaur Reservoir, August 23, 2010.

Site Name	Location	Location Description	Start WP	Easting	Northing	End WP	Easting	Northing	Amps	Freq	Voltage	Effort (Sec)	Dist (m)	Temp (°C)	Comments
ES01	Dinosaur Reservoir	boat launch to anti-vortex dike	1	562761	6204016	2	561967	6204071	6.5	60	354	987	870	12.1	sand/mud occasional weed patches
ES02	Dinosaur Reservoir	boat launch area	2	561967	6204071	3	561782	6203972	6.5	60	354	524	300	12.1	sand/mud occasional weed patches
ES03	Dinosaur Reservoir	right bank of tailrace	4	549438	6207827	5	548811	6207826	6.5	60	354	445	627	12.1	downstream with current
ES04	Dinosaur Reservoir	left bank of tailrace	6	549441	6207757	7	548845	6207742	6.5	60	354	447	637	12.1	downstream with current
ES05	Dinosaur Reservoir	spillway plunge pool and backwater behind WAC Bennett Dam deflection weir	7	548845	6207742	7	548845	6207742	6.5	60	354	662	1300	-	completed a circle through spillway plunge pool and backwater behind deflection weir
ES06	Dinosaur Reservoir	right bank of tailrace from spillway to Gething Ck	5	548811	6207826	8	547845	6207742	5.5	60	354	847	1310	-	downstream with current
ES07	Dinosaur Reservoir	vicinity of Gething Creek delta/confluence	8	547845	6207742	9	547746	6206715	5.5	60	354	265	320	-	perimeter of Gething Creek delta and back eddy area behind delta
ES08	Dinosaur Reservoir	left bank along canyon wall 375 m downstream of lower island	10	548500	6205315	11	548903	6204883	5.5	60	354	517	633	-	somewhat shallow shelf with old cut-off tree stumps from original reservoir clearing
ES09	Dinosaur Reservoir	left bank point opposite of Johnson Forebay, entrance to canyon	12	552131	6201702	13	552673	6201467	5.5	60	354	735	656	-	shallow gravel and mud with weed patches
ES10	Dinosaur Reservoir	perimeter of Johnson Creek forebay	14	553038	6200861	15	553447	6200537	5.5	60	354	1622	1854	-	shallow mud with frequent weed patches
ES11	Dinosaur Reservoir	right bank near pipeline crossing	16	556620	6201895	17	557645	6202482	5.5	60	354	1001	1300	-	shallow mud/sand with weed patches

Appendix VI

Angling sample dates and locations in Dinosaur Reservoir

Appendix VI. Angling sampling dates and locations in Dinosaur Reservoir.

Site	Waterbody	Description	Date	Easting	Northing
ANG01	Dinosaur Reservoir	pipeline bay in vicinity of gill net GN01	19-Aug-10	557450	6202431
ANG02	Dinosaur Reservoir	pipeline bay in vicinity of gill net GN02	19-Aug-10	557450	6202431
ANG03	Dinosaur Reservoir	lower end of WAC Bennett Dam tailrace at Gething Creek delta	20, 21-Aug-10	547800	6206714
ANG04	Dinosaur Reservoir	spillway plunge pool and WAC Bennett Dam tailrace	21-Aug-10	548845	6207742
ANG05	Dinosaur Reservoir	multiple locations with Johnson Creek forebay	23-Aug-10	552938	6200367
Gething Falls	Gething Creek	plunge pool below Gething Falls	21-Aug-10	547201	6206510

Appendix VII

Individual Fish Data

Appendix VII. Individual fish data.

Fish ID	Location	Method	Site Name	Species	Site Sample Number	Sample Envelope Number	Fork Length (mm)	Weight (g)	Sex	Mat	Ageing Structure Type	Age	Scale Photo Record	Comments
1	Dinosaur	GN	GN01	RB	1	D001	232	160			SC	3	PC080001	
2	Dinosaur	GN	GN01	RB	2	D002	284	220			SC	4	PC080002	
3	Dinosaur	GN	GN01	RB	3	D003	262	210			SC	3	PC080003	
4	Dinosaur	GN	GN01	RB	4	D004	292	330			SC	4	PC080004	
5	Dinosaur	GN	GN01	RB	5	D005	246	230			SC	3	PC080005	
6	Dinosaur	GN	GN01	RB	6	D006	246	290			SC	3	PC080006	
7	Dinosaur	GN	GN02	RB	1	D007	276	350			SC	3	PC080007	
8	Dinosaur	GN	GN02	MW	2	D008	263	310			OT	4		
9	Dinosaur	GN	GN02	MW	3	D009	246	230	M	IM	OT	3		
10	Dinosaur	GN	GN02	MW	4	D010	301	330	M	IM	SC/OT	5		
11	Dinosaur	GN	GN02	MW	5	D011	183	130						
12	Dinosaur	GN	GN02	MW	6	D012	225	70	M	IM	OT	3		
13	Dinosaur	GN	GN02	LW	7	D013	382				SC	5	PC080008	
14	Dinosaur	GN	GN02	MW	8	D014	304	670	F	IM	OT	4		
15	Dinosaur	GN	GN02	MW	9	D015	349	350	F	IM	OT	9		
16	Dinosaur	GN	GN01	RB	10	D016	291	290			SC	3	PC080009	
17	Dinosaur	GN	GN01	RB	11	D017	267	190			SC	3	PC080010	
18	Dinosaur	GN	GN01	RB	12	D018	240	170			SC	3	PC080011	
19	Dinosaur	GN	GN01	RB	13	D019	252	170			SC	3	PC080012	
20	Dinosaur	GN	GN01	RB	14	D020	246	230			SC	3	PC080013	
21	Dinosaur	GN	GN01	RB	15	D021	243	190			SC	3	PC080014	
22	Dinosaur	GN	GN01	RB	16	D022	217	170			SC	2	PC080015	
23	Dinosaur	GN	GN02	MW	17	D023	302	370	M	IM	OT	6		
24	Dinosaur	GN	GN02	MW	18	D024	322	410	F	IM	OT	7		
25	Dinosaur	GN	GN02	MW	19	D025	312	370			SC	5	PC080016	
26	Dinosaur	GN	GN02	MW	20	D026	269	270						
27	Dinosaur	GN	GN02	MW	21	D027	253	210						
28	Dinosaur	GN	GN02	MW	22	D028	276	290						
29	Dinosaur	GN	GN02	MW	23	D029	321	350			SC	4	PC080017	
30	Dinosaur	GN	GN02	MW	24	D030	301	350			SC	4	PC080018	
31	Dinosaur	GN	GN01	RB	25	D031	334				SC	5	PC080019	
32	Dinosaur	GN	GN01	RB	26	D032	322	390			SC	4	PC080020	
33	Dinosaur	GN	GN01	RB	27	D033	291	150			SC	2	PC080021	
34	Dinosaur	GN	GN01	RB	28	D034	270	130			SC	3	PC080022	
35	Dinosaur	GN	GN01	RB	29	D035	217	70			SC	3	PC080023	
36	Dinosaur	GN	GN01	RB	30	D036	236	90			SC	3	PC080024	
37	Dinosaur	GN	GN03	MW	31	D037	218	70	M	IM	OT	3		
38	Dinosaur	GN	GN03	MW	32	D038	234	70	M	IM	OT	2		

Appendix VII cont'd. Individual fish data.

Fish ID	Location	Method	Site Name	Species	Site Sample Number	Sample Envelope Number	Fork Length (mm)	Weight (g)	Sex	Mat	Ageing Structure Type	Age	Scale Photo Record	Comments
39	Dinosaur	GN	GN03	MW	33	D039	246	90	M	IM	OT	4		
40	Dinosaur	GN	GN03	KO	34	D040	210		M	SP				
41	Dinosaur	GN	GN03	KO	35	D041	231		M	M				
42	Dinosaur	GN	GN03	KO	36	D042	225		F	M				
43	Dinosaur	GN	GN03	KO	37	D043	223		M	M				
44	Dinosaur	AG	ANG01	RB	1	D044	248	148			SC	3	PC080025	
45	Dinosaur	AG	ANG01	KO	2	D045	216	124						
46	Dinosaur	GN	GN04	MW	3	D046	270	190			SC	3	PC080027	
47	Dinosaur	GN	GN04	LW	4	D047	363	470			SC	6	PC080026	
48	Dinosaur	GN	GN04	MW	5	D048	243	150			SC	4	PC080028	
49	Dinosaur	GN	GN04	MW	6	D049	127	26			SC	1	PC080029	
50	Dinosaur	GN	GN04	MW	7	D050	248	166			SC	4	PC080030	
51	Dinosaur	GN	GN04	MW	8	D051	270	216			SC	5	PC080031	
52	Dinosaur	GN	GN04	MW	9	D052	252	174			SC	5	PC080038	
53	Dinosaur	GN	GN04	KO	10	D053	141	38			SC	1	PC080032	
54	Dinosaur	GN	GN04	LW	11	D054	128	26			SC	1	PC080033	
55	Dinosaur	GN	GN04	LW	12	D055	151	34			SC	1	PC080034	
56	Dinosaur	GN	GN04	LW	13	D056	158	48			SC	1	PC080035	
57	Dinosaur	GN	GN04	LW	14	D057	150	36			SC	1	PC080036	
58	Dinosaur	GN	GN04	LW	15	D058	146	38			SC	1	PC080037	
59	Dinosaur	GN	GN04	LW	16	D059	135	32			SC	1	PC080039	
60	Dinosaur	GN	GN04	MW	17	D060	301	282			SC	6	PC080040	
61	Dinosaur	GN	GN04	MW	18	D061	313	374			SC	6	PC080041	
62	Dinosaur	GN	GN04	RB	19	D062	324	314			SC	4	PC080042	
63	Dinosaur	GN	GN04	RB	20	D063	311	312			SC	4	PC080043	
64	Dinosaur	GN	GN04	RB	21	D064	182	64			SC	2	PC080044	
65	Dinosaur	GN	GN04	MW	22	D065	135	28			SC	1	PC080045	
66	Dinosaur	GN	GN04	MW	23	D066	304	310			SC	6	PC080046	
67	Dinosaur	GN	GN04	MW	24	D067	317	400			SC	7	PC080047	
68	Dinosaur	GN	GN04	MW	25	D068	370	542			SC	8	PC080048	
69	Dinosaur	GN	GN04	MW	26	D069	357	418			SC	8	PC080049	
70	Dinosaur	GN	GN05	MW	27	D070	310	330			SC	5	PC080050	
71	Dinosaur	GN	GN05	MW	28	D071	323	354			SC	6	PC080051	
72	Dinosaur	GN	GN05	MW	29	D072	170	46			SC	2	PC080052	
73	Dinosaur	GN	GN05	MW	30	D073	168	50			SC	2	PC080053	
74	Dinosaur	GN	GN05	MW	31	D074	272	214			SC	5	PC080054	
75	Dinosaur	GN	GN05	RB	32	D075	258	156			SC	3	PC080055	
76	Dinosaur	GN	GN05	RB	33	D076	317	334			SC	3	PC080056	

Appendix VII cont'd. Individual fish data.

Fish ID	Location	Method	Site Name	Species	Site Sample Number	Sample Envelope Number	Fork Length (mm)	Weight (g)	Sex	Mat	Ageing Structure Type	Age	Scale Photo Record	Comments
77	Dinosaur	GN	GN05	RB	34	D077	257	178			SC	3	PC080057	
78	Dinosaur	GN	GN05	MW	35	D078	132	24			SC	1	PC080058	
79	Dinosaur	GN	GN05	MW	36	D079	154	32			SC	2	PC080059	
80	Dinosaur	GN	GN05	MW	37	D080	140	30			SC	1	PC080060	
81	Dinosaur	GN	GN05	RB	38	D081	192	78			SC	2	PC080061	
82	Dinosaur	GN	GN05	MW	39	D082	165	50			SC	2	PC080062	
83	Dinosaur	GN	GN05	RB	40	D083	185	62			SC	2	PC080065	
84	Dinosaur	GN	GN05	RB	41	D084	288	238			SC	4	PC080063	
85	Dinosaur	GN	GN05	MW	42	D085	152	34			SC	1	PC080064	
86	Dinosaur	GN	GN05	RB	43	D086	197	78			SC	2	PC090066	
87	Dinosaur	AG	ANG02	RB	44	D087	227	118			SC	2	PC090067	
88	Dinosaur	AG	ANG02	RB	45	D088	225	116			SC	2	PC090068	
89	Dinosaur	AG	ANG02	RB	46	D089	234	118			SC	3	PC090069	
90	Dinosaur	AG	ANG02	RB	47	D090	182	66			SC	2	PC090070	
91	Dinosaur	AG	ANG02	RB	48	D091	220	100			SC	2	PC090071	
92	Dinosaur	GN	GN06	KO	49	D092	195	76			SC	2	PC090073	
93	Dinosaur	GN	GN06	RB	50	D093	333	416			SC	6	PC090072	
94	Dinosaur	GN	GN06	RB	51	D094	286	236			SC	4	PC090074	
95	Dinosaur	GN	GN07	MW	52	D095	310	270			SC	6	PC090078	
96	Dinosaur	GN	GN07	LW	53	D096	368	500			SC	5	PC090079	
97	Dinosaur	GN	GN07	LW	54	D097	371	640			SC	8	PC090077	
98	Dinosaur	GN	GN07	LW	55	D098	356	506			SC	7	PC090076	
99	Dinosaur	GN	GN07	MW	56	D099	337	348			SC	7	PC090075	
100	Dinosaur	GN	GN07	LT	57	D100	366	410	F	IM	SC	5		
101	Dinosaur	GN	GN06	RB	58	D101	260	178			SC	3	PC090080	
102	Dinosaur	GN	GN07	MW	59	D102	341	358			SC	7	PC090081	
103	Dinosaur	AG	ANG03	LT	1	D103	342	480			SC	5		
104	Dinosaur	AG	ANG03	LT	2	D104	324	262			SC	5		
105	Dinosaur	AG	ANG03	LT	3	D105	330	320			SC	5		
106	Dinosaur	GN	GN08	RB	4	D106	272	126			SC	3	PC090082	
107	Dinosaur	GN	GN08	LW	5	D107	395	510			SC	7	PC090083	
108	Dinosaur	GN	GN08	LW	6	D108	420	600			SC	6	PC090084	
109	Dinosaur	GN	GN08	LW	7	D109	392	686			SC	7	PC090085	
110	Dinosaur	GN	GN08	LW	8	D110	287	265			SC	5	PC090086	
111	Dinosaur	GN	GN08	LW	9	D111	287	250			SC	5	PC090087	
112	Dinosaur	GN	GN08	LW	10	D112	387	458			SC	9	PC090088	
113	Dinosaur	GN	GN08	LW	11	D113	377	650			SC	7	PC090089	
114	Dinosaur	GN	GN08	LW	12	D114	307	332			SC	4	PC090091	

Appendix VII cont'd. Individual fish data.

Fish ID	Location	Method	Site Name	Species	Site Sample Number	Sample Envelope Number	Fork Length (mm)	Weight (g)	Sex	Mat	Ageing Structure Type	Age	Scale Photo Record	Comments
115	Dinosaur	GN	GN08	MW	13	D115	271	190			SC	4	PC090092	
116	Dinosaur	GN	GN09	LW	14	D116	281	236			SC	4	PC090090	
117	Dinosaur	GN	GN09	RB	15	D117	282	225			SC	3	PC090093	
118	Dinosaur	AG	ANG03	RB	16	D118	322	336			SC	3	PC090094	
119	Dinosaur	AG	ANG03	RB	17	D119	454	1070			SC	6	PC090095	
120	Dinosaur	AG	ANG03	RB	18	D120	338	406			SC	4	PC090096	
121	Dinosaur	AG	ANG03	LT	19	D121	495	1350			SC	9		
122	Dinosaur	AG	ANG03	LT	20	D122	330	326			SC	5		
123	Dinosaur	AG	ANG03	LT	21	D123	354	416			SC	6		
124	Dinosaur	AG	ANG03	LT	22	D124	322	320			SC	6		
125	Dinosaur	GN	GN08	RB	23	D125	311	330			SC	4	PC100097	
126	Dinosaur	GN	GN08	RB	24	D126	243	152			SC	3	PC100098	
127	Gething Ck	SN	GethingBT	BT	25	D127	810				FR	10		4 biopsy punches from left dorsal, left pect fin clipped, photos 8200099-P8200101
128	Gething Ck	AG	Gething Falls	BT	26	D128	285	262			FR	3		photos P8200103 to P8010106
129	Dinosaur	AG	ANG03	RB	1	D129	236				SC	2	PC100099	
130	Dinosaur	AG	ANG03	RB	2	D130	264	210			SC	3	PC100100	
131	Dinosaur	AG	ANG03	RB	3	D131	185	68			SC	2	PC100101	
132	Dinosaur	AG	ANG03	KO	4	D132	221	96			SC	3	PC100102	
133	Dinosaur	GN	GN10	MW	5	D133	273	200			SC	5	PC100103	
134	Dinosaur	GN	GN10	LW	6	D134	409	798			SC	7	PC100104	
135	Dinosaur	GN	GN10	MW	7	D135	311	314			SC	6	PC100105	
136	Dinosaur	GN	GN10	MW	8	D136	299	302			SC	4	PC100106	
137	Dinosaur	GN	GN10	MW	9	D137	288	274			SC	4	PC100107	
138	Dinosaur	GN	GN10	MW	10	D138	322	352			SC	5	PC100108	
139	Dinosaur	GN	GN10	MW	11	D139	245	158			SC	3	PC100109	
140	Dinosaur	GN	GN10	LW	12	D140	375	468			SC	5	PC100110	
141	Dinosaur	GN	GN10	RB	13	D141	202	84			SC	2	PC100111	
142	Dinosaur	GN	GN10	MW	14	D142	277	264			SC	4	PC100112	
143	Dinosaur	GN	GN10	MW	15	D143	294	204			SC	4	PC100113	
144	Dinosaur	GN	GN10	LSU	16	D144	139	34						
145	Dinosaur	GN	GN11	RB	17	D145	278	194			SC	3	PC100114	
146	Dinosaur	GN	GN11	RB	18	D146	298	268			SC	4	PC100115	
147	Gething Ck	SN	GethingBT	BT	19	D147	723	4080	F	M	FR	7		tissue plugs from left dorsal, left pect girdle mostly missing, right eye missing, tail damaged, photos P8210122 to P8210126
148	Gething Ck	SN	GethingBT	BT	20	D148	811	7775	M	M	FR	7		4 tissue plugs from left dorsal, left pectoral fin clip, photos P8210134-P8210143

Appendix VII cont'd. Individual fish data.

Fish ID	Location	Method	Site Name	Species	Site Sample Number	Sample Envelope Number	Fork Length (mm)	Weight (g)	Sex	Mat	Ageing Structure Type	Age	Scale Photo Record	Comments
149	Dinosaur	AG	ANG04	LT	21	D149	587	2313			FR	10		
150	Dinosaur	AG	ANG04	LT	22	D150	405	700			FR	6		
151	Dinosaur	AG	ANG04	LT	23	D151	538	1724			FR			
152	Dinosaur	AG	ANG04	LT	24	D152	355	406			FR	6		
153	Dinosaur	AG	ANG04	LT	25	D153	630	2676			FR			
154	Dinosaur	AG	ANG04	LT	26	D154	431	922			FR	7		
155	Dinosaur	AG	ANG04	LT	27	D155	445	720			FR	7		
156	Dinosaur	AG	ANG04	LT	28	D156	433	910			FR	7		
157	Dinosaur	AG	ANG04	LT	29	D157	444	896			FR	10		
158	Dinosaur	AG	ANG04	LT	30	D158	505	1588			FR	10		
159	Dinosaur	AG	ANG04	LT	31	D159	300	244			FR	4		
160	Dinosaur	AG	ANG04	RB	32	D160	455	1145	M	M	SC	regen	-	
161	Dinosaur	AG	ANG04	LT	33	D161	446	982			FR	7		
162	Dinosaur	AG	ANG04	BT	34	D162	292	262			FR	3		
163	Dinosaur	AG	ANG04	LT	35	D163	347	388			FR	5		
164	Dinosaur	AG	ANG04	RB	36	D164	256	190			SC	3	PC100116	
165	Dinosaur	AG	ANG04	RB	37	D165	366	410			SC	4	PC100117	
166	Dinosaur	EF	ES01	KO	1	D166	205	108			SC	2	PC100118	boat electro-fishing
167	Dinosaur	EF	ES01	KO	2	D167	221	104			SC	3	PC100119	boat electro-fishing
168	Dinosaur	EF	ES01	KO	3	D168	222	128			SC	3	PC100120	boat electro-fishing
169	Dinosaur	EF	ES01	MW	4	D169	348	362	F	IM	SC/OT	12		boat electro-fishing
170	Dinosaur	EF	ES04	MW	5	D170	386	572	M	IM	OT	13		boat electro-fishing
171	Dinosaur	EF	ES04	MW	6	D171	360	494	F	IM	OT	8		boat electro-fishing
172	Dinosaur	EF	ES05	RB	7	D172	336	440			SC/FR	6	PC100121	boat electro-fishing
173	Dinosaur	EF	ES10	LSU	8	D173	400	852	F	IM	FR	17		boat electro-fishing
174	Dinosaur	EF	ES10	MW	9	D174	395	692	M	IM	OT	15		boat electro-fishing
175	Dinosaur	EF	ES10	MW	10	D175	275	220	F	IM	OT	5		boat electro-fishing
176	Dinosaur	AG	ANG05	RB	11	D176	265	198			SC/FR	4	PC100122	
177	Gething Ck	SN	GethingFalls	BT	1	D177	777		F	IM	FR	9		
178	Gething Ck	SN	GethingFalls	BT	2	D178	761		M	SP	FR	8		
179	Gething Ck	SN	GethingFalls	BT	3	D179	751		M	SP	FR	7		
180	Gething Ck	SN	GethingFalls	BT	4	D180	835		M	SP	FR	10		photos P8270156-P8270159
181	Gething Ck	SN	GethingFalls	BT	5	D181	796		F	SP	FR	9		
182	Gething Ck	SN	GethingFalls	BT	6	D182	642		F	SP	FR	5		
183	Gething Ck	SN	GethingFalls	BT	7	D183	820		M	SP	FR			photos P8270170-P8270176
184	Gething Ck	SN	GethingFalls	BT	8	D184	763		M	SP	FR	8		
185	Dinosaur	GN	GN12	RB	9	D185	215	104			SC	2	PC100124	
186	Dinosaur	GN	GN12	RB	10	D186	337	370			SC	5	PC100123	

Appendix VII cont'd. Individual fish data.

Fish ID	Location	Method	Site Name	Species	Site Sample Number	Sample Envelope Number	Fork Length (mm)	Weight (g)	Sex	Mat	Ageing Structure Type	Age	Scale Photo Record	Comments
187	Dinosaur	GN	GN12	LW	11	D187	345	450			SC	5	PC100125	
188	Dinosaur	GN	GN12	MW	12	D188	300	320			SC	5	PC100126	
189	Dinosaur	GN	GN12	LW	13	D189	334	454			SC	4	PC100127	
190	Dinosaur	GN	GN12	MW	14	D190	295	306			SC	6	PC100128	
191	Dinosaur	GN	GN12	LW	15	D191	279	264			SC	4	PC100129	
192	Dinosaur	GN	GN12	MW	16	D192	306	340			SC	4	PC100130	
193	Dinosaur	GN	GN12	MW	17	D193	294	274			SC	5	PC100131	
194	Dinosaur	GN	GN12	MW	18	D194	250	162			SC	4	PC100132	
195	Dinosaur	GN	GN12	MW	19	D195	320	392			SC	5	PC100133	
196	Dinosaur	GN	GN12	MW	20	D196	248	164			SC	4	PC100134	
197	Dinosaur	GN	GN12	MW	21	D197	222	126			SC	3	PC100135	
198	Dinosaur	GN	GN12	MW	22	D198	318	420			SC	7	PC100136	
199	Dinosaur	GN	GN12	MW	23	D199	268	232			SC	4	PC100137	
200	Dinosaur	GN	GN12	MW	24	D200	311	352			SC	5	PC100138	
201	Dinosaur	GN	GN12	MW	25	D201	252	196			SC	3	PC100139	
202	Dinosaur	GN	GN12	LW	26	D202	303	364			SC	5	PC100140	
203	Dinosaur	GN	GN12	MW	27	D203	346	522			SC	7	PC100141	
204	Dinosaur	GN	GN12	MW	28	D204	145	38			SC	1	PC100142	
205	Dinosaur	GN	GN12	KO	29	D205	219	124			SC	3	PC100143	
206	Dinosaur	GN	GN12	KO	30	D206	209	96			SC	2	PC100144	
207	Dinosaur	GN	GN12	KO	31	D207	222	136			SC	3	PC100145	
208	Dinosaur	GN	GN12	KO	32	D208	206	98			SC	2	PC100146	
209	Dinosaur	GN	GN12	KO	33	D209	217	104			SC	3	PC100147	
210	Dinosaur	GN	GN12	KO	34	D210	211	98			SC	2	PC100148	
211	Dinosaur	GN	GN12	KO	35	D211	225	126			SC	3	PC100149	
212	Dinosaur	GN	GN12	KO	36	D212	212	84			SC	3	PC100150	
213	Dinosaur	GN	GN12	RB	37	D213	157	50			SC	2	PC100151	
214	Dinosaur	GN	GN12	KO	38	D214	207	98			SC	3	PC100152	
215	Dinosaur	GN	GN12	BT	39	D215	324	320			OT			
216	Dinosaur	GN	GN12	LW	40	D216	356	464			SC	6	PC100153	
217	Dinosaur	GN	GN12	MW	41	D217	246	170			SC	3	PC100154	
218	Dinosaur	GN	GN12	KO	42	D218	136	26			SC	1	PC100155	
219	Dinosaur	GN	GN12	KO	43	D219	140	22			SC	1	PC100156	
220	Dinosaur	EF	ES02	WSU	1	D220	381	834						boat electro-fishing
221	Dinosaur	EF	ES02	MW	2	D221	165	50			SC	1	PC100157	boat electro-fishing
222	Dinosaur	EF	ES02	MW	3	D222	149	34			SC	1	PC100158	boat electro-fishing
223	Dinosaur	EF	ES02	MW	4	D223	158	38			SC	1	PC100159	boat electro-fishing
224	Dinosaur	EF	ES02	MW	5	D224	152	36			SC	1	PC100160	boat electro-fishing

Appendix VII cont'd. Individual fish data.

Fish ID	Location	Method	Site Name	Species	Site Sample Number	Sample Envelope Number	Fork Length (mm)	Weight (g)	Sex	Mat	Ageing Structure Type	Age	Scale Photo Record	Comments
225	Dinosaur	EF	ES02	MW	6	D225	161	4			SC	1	PC100161	boat electro-fishing
226	Dinosaur	EF	ES02	KO	7	D226	126	26			SC	1	PC100162	boat electro-fishing
227	Dinosaur	EF	ES02	MW	8	D227	141	34			SC	1	PC100163	boat electro-fishing
228	Dinosaur	EF	ES02	MW	9	D228	136	26						boat electro-fishing
229	Dinosaur	EF	ES02	KO	10	D229	210	94			SC	3	PC100164	boat electro-fishing
230	Dinosaur	EF	ES02	MW	11	D230	126	18						boat electro-fishing
231	Dinosaur	EF	ES02	MW	12	D231	155	34						boat electro-fishing
232	Dinosaur	EF	ES01	MW	13	D232	244	138			SC	4	PC100165	boat electro-fishing
233	Dinosaur	EF	ES01	MW	14	D233	155	46						boat electro-fishing
234	Dinosaur	EF	ES01	KO	15	D234	224	108			SC	3	PC100166	boat electro-fishing
235	Dinosaur	EF	ES01	KO	16	D235	215	114						boat electro-fishing
236	Dinosaur	EF	ES01	LSU	17	D236	106	12						boat electro-fishing
237	Dinosaur	EF	ES01	MW	18	D237	135	30						boat electro-fishing
238	Dinosaur	EF	ES01	RB	19	D238	188	74			SC	2	PC100167	boat electro-fishing
239	Dinosaur	EF	ES06	KO	20	D239	185	64			SC	2	PC100168	boat electro-fishing
240	Dinosaur	EF	ES06	RB	21	D240	154	28			SC	2	PC100169	boat electro-fishing
241	Dinosaur	EF	ES07	BT	22	D241								boat electro-fishing
242	Dinosaur	EF	ES08	LW	23	D242	165	46			SC	1	PC100170	boat electro-fishing
243	Dinosaur	EF	ES08	MW	24	D243	190	64						boat electro-fishing
244	Dinosaur	EF	ES08	MW	25	D244	332	332						boat electro-fishing
245	Dinosaur	EF	ES08	MW	26	D245	280	284						boat electro-fishing
246	Dinosaur	EF	ES08	MW	27	D246	343	372						boat electro-fishing
247	Dinosaur	EF	ES09	KO	28	D247	205	102						boat electro-fishing
248	Dinosaur	EF	ES10	MW	29	D248	309	342						boat electro-fishing
249	Dinosaur	EF	ES10	MW	30	D249	322	406						boat electro-fishing
250	Dinosaur	EF	ES10	MW	31	D250	314	338						boat electro-fishing
251	Dinosaur	EF	ES10	MW	32	D251	310	328						boat electro-fishing
252	Dinosaur	EF	ES10	RB	33	D252	167	52			SC	2	PC100171	boat electro-fishing
253	Dinosaur	EF	ES11	RB	34	D253	183	70			SC	2	PC100172	boat electro-fishing
254	Dinosaur	EF	ES11	MW	35	D254	212	108						boat electro-fishing
255	Dinosaur	EF	ES11	MW	36	D255	196	82						boat electro-fishing
256	Dinosaur	EF	ES11	RB	37	D256	215	98			SC	2	PC100175	boat electro-fishing
257	Dinosaur	EF	ES11	MW	38	D257	233	140						boat electro-fishing
258	Dinosaur	EF	ES11	RB	39	D258	164	52			SC	2	PC100173	boat electro-fishing
259	Dinosaur	EF	ES11	MW	40	D259	190	74						boat electro-fishing
260	Dinosaur	GN	GN2	KO	1	D260	210		F	MG	SC	2	PC100174	
261	Dinosaur	GN	GN2	KO	2	D261	231		M	MG	SC	3	PC100176	
262	Dinosaur	GN	GN2	KO	3	D262	225		F	M	SC	3	PC100177	

Appendix VII cont'd. Individual fish data.

Fish ID	Location	Method	Site Name	Species	Site Sample Number	Sample Envelope Number	Fork Length (mm)	Weight (g)	Sex	Mat	Ageing Structure Type	Age	Scale Photo Record	Comments
263	Dinosaur	GN	GN2	KO	4	D263	223		M	MG	SC	3	PC100178	
264	Dinosaur	GN	GN2	KO	5	D264	224		F	MG	SC	3	PC100179	
265	Dinosaur	GN	GN2	KO	6	D265	223		M	M	SC	no scale		
266	Dinosaur	GN	GN2	KO	7	D266	215		M	MG	SC	2	PC100180	
267	Dinosaur	GN	GN2	KO	8	D267	221		M	MG	SC	2	PC100181	
268	Dinosaur	GN	GN2	KO	9	D268	226		M	MG	SC	3	PC100182	
269	Dinosaur	GN	GN2	KO	10	D269	225		F	MG	SC	2	PC100183	
270	Dinosaur	GN	GN2	KO	11	D270	210		M	MG	SC	2	PC100184	
271	Dinosaur	GN	GN2	KO	12	D271	222		M	MG	SC	2	PC100185	
272	Dinosaur	GN	GN2	KO	13	D272	225		M	MG	SC	3	PC130001	
273	Dinosaur	GN	GN2	MW	14	D273	244		M	IMM	SC	4	PC130002	
274	Dinosaur	GN	GN2	MW	15	D274	310		F	MG	SC	6	PC130003	
275	Dinosaur	GN	GN2	KO	16	D275	216		F	MG	SC	3	PC130004	
276	Dinosaur	MT	MT2	CAS			100							
277	Johnson Ck	EF	EF1	RB			54							
278	Johnson Ck	EF	EF1	RB			44							
279	Johnson Ck	EF	EF1	RB			50							
280	Johnson Ck	EF	EF1	RB			148							
281	Johnson Ck	EF	EF1	RB			51							
282	Johnson Ck	EF	EF1	RB			51							
283	Johnson Ck	EF	EF1	RB			49							
284	Johnson Ck	EF	EF1	RB			50							
285	Johnson Ck	EF	EF1	RB			50							
286	Johnson Ck	EF	EF1	RB			52							
287	Johnson Ck	EF	EF1	RB			56							
288	Johnson Ck	EF	EF1	RB			51							
289	Johnson Ck	EF	EF1	RB			54							
290	Johnson Ck	EF	EF1	RB			50							
291	Johnson Ck	EF	EF1	RB			58							
292	Johnson Ck	EF	EF1	RB			45							
293	Johnson Ck	EF	EF1	RB			46							
294	Johnson Ck	EF	EF1	RB			52							
295	Johnson Ck	EF	EF1	RB			49							
296	Johnson Ck	EF	EF1	RB			45							
297	Johnson Ck	EF	EF1	RB			50							
298	Johnson Ck	EF	EF1	RB			50							
299	Johnson Ck	EF	EF1	RB			41							

Appendix VII cont'd. Individual fish data.

Fish ID	Location	Method	Site Name	Species	Site Sample Number	Sample Envelope Number	Fork Length (mm)	Weight (g)	Sex	Mat	Ageing Structure Type	Age	Scale Photo Record	Comments
300	Johnson Ck	EF	EF1	RB			58							
301	Johnson Ck	EF	EF1	RB			40							
302	Johnson Ck	EF	EF1	RB			46							
303	Johnson Ck	EF	EF1	RB			43							
304	Johnson Ck	EF	EF1	RB			42							
305	Johnson Ck	EF	EF1	RB			52							
306	Johnson Ck	EF	EF1	RB			49							
307	Johnson Ck	EF	EF1	RB			42							
308	Johnson Ck	EF	EF1	RB			51							
309	Johnson Ck	EF	EF1	RB			54							
310	Johnson Ck	EF	EF1	RB			46							
311	Johnson Ck	EF	EF1	RB			41							
312	Johnson Ck	EF	EF1	RB			41							
313	Johnson Ck	EF	EF1	RB			54							
314	Johnson Ck	EF	EF1	RB			45							
315	Johnson Ck	EF	EF1	RB			52							
316	Johnson Ck	EF	EF1	CAS			80							
317	Johnson Ck	EF	EF1	CAS			67							
318	Johnson Ck	EF	EF1	CAS			59							
319	Johnson Ck	EF	EF1	CAS			62							
320	Johnson Ck	EF	EF1	CAS			53							
321	Johnson Ck	EF	EF1	CAS			71							
322	Johnson Ck	EF	EF1	CAS			52							
323	Johnson Ck	EF	EF1	CAS			54							
324	Johnson Ck	EF	EF1	CAS			60							
325	Johnson Ck	EF	EF1	CAS			60							
326	Johnson Ck	EF	EF1	CAS			58							
327	Johnson Ck	EF	EF1	CAS			56							
328	Johnson Ck	EF	EF1	CCG			30							
329	Johnson Ck	EF	EF1	CCG			86							
330	Johnson Ck	EF	EF1	CCG			65							
331	Johnson Ck	EF	EF1	CCG			60							
332	Johnson Ck	EF	EF1	CCG			70							
333	Johnson Ck	EF	EF1	CCG			65							
334	Johnson Ck	EF	EF1	CCG			74							
335	Johnson Ck	EF	EF1	CCG			73							

Appendix VII cont'd. Individual fish data.

Fish ID	Location	Method	Site Name	Species	Site Sample Number	Sample Envelope Number	Fork Length (mm)	Weight (g)	Sex	Mat	Ageing Structure Type	Age	Scale Photo Record	Comments
336	Johnson Ck	EF	EF1	CCG			62							
337	Johnson Ck	EF	EF1	CCG			56							
338	Johnson Ck	EF	EF1	CCG			51							
339	Johnson Ck	EF	EF1	CCG			71							
340	Johnson Ck	EF	EF1	CCG			48							
341	Johnson Ck	EF	EF1	CCG			73							
342	Johnson Ck	EF	EF1	CCG			64							
343	Johnson Ck	EF	EF1	CCG			31							
344	Johnson Ck	EF	EF1	CCG			31							
345	Johnson Ck	EF	EF1	LSU			171							
346	Johnson Ck	EF	EF1	LSU			28							
347	Johnson Ck	EF	EF1	LSU			34							
348	Johnson Ck	EF	EF1	LSU			34							
349	Johnson Ck	EF	EF1	LSU			120							
350	Johnson Ck	EF	EF1	LSU			66							
351	Johnson Ck	EF	EF1	LSU			31							
352	Johnson Ck	EF	EF1	LSU			98							
353	Johnson Ck	EF	EF1	LSU			70							
354	Johnson Ck	EF	EF1	LSU			97							
355	Johnson Ck	EF	EF1	LSU			96							
356	Johnson Ck	EF	EF1	LSU			29							
357	Johnson Ck	EF	EF1	LSU			32							
358	Johnson Ck	EF	EF1	LSU			31							
359	Johnson Ck	EF	EF1	LSU			31							
360	Johnson Ck	EF	EF1	LSU			42							
361	Johnson Ck	EF	EF1	LSU			41							
362	Johnson Ck	EF	EF1	LSU			29							
363	Johnson Ck	EF	EF1	LSU			90							
364	Johnson Ck	EF	EF1	LSU			29							
365	Johnson Ck	EF	EF1	LSU			28							
366	Johnson Ck	EF	EF1	LSU			31							
367	Johnson Ck	EF	EF1	LSU			31							
368	Johnson Ck	EF	EF1	LSU			29							
369	Johnson Ck	EF	EF1	LSU			23							
370	Johnson Ck	EF	EF1	LSU			101							
371	Johnson Ck	EF	EF1	LSU			111							
372	Johnson Ck	EF	EF1	LSU			28							
373	Johnson Ck	EF	EF1	RB	1	D276	225	140			Scale	regen	-	

Appendix VII cont'd. Individual fish data.

Fish ID	Location	Method	Site Name	Species	Site Sample Number	Sample Envelope Number	Fork Length (mm)	Weight (g)	Sex	Mat	Ageing Structure Type	Age	Scale Photo Record	Comments
374	Johnson Ck	EF	EF1	RB	2	D277	133	30			Scale	1	PC130005	
375	Johnson Ck	EF	EF1	RB	3	D278	137	30			Scale	1	PC130006	
376	Johnson Ck	EF	EF1	RB	4	D279	155				Scale	1	PC130007	
377	Johnson Ck	EF	EF1	RB	5	D280	146				Scale	1	PC130008	
378	Moosebar Ck	EF	EF2	RB	1	D281	98				Scale	0	PC130009	
379	Moosebar Ck	EF	EF2	RB	2	D282	146				Scale	1	PC130010	
380	Moosebar Ck	EF	EF2	RB	3	D283	92				Scale	0	PC130011	
381	Moosebar Ck	EF	EF2	RB	4	D284	92				Scale	0	PC130012	
382	Moosebar Ck	EF	EF2	CAS			70							
383	Moosebar Ck	EF	EF2	CAS			75							
384	Moosebar Ck	EF	EF2	CAS			77							
385	Moosebar Ck	EF	EF2	CAS			47							
386	Dinosaur	MT	MT1	CAS			100							
387	Dinosaur	MT	MT7	PCC			89							
388	Dinosaur	MT	MT7	CAS			75							
389	Dinosaur	MT	MT9	CCG			86							
390	Dinosaur	MT	MT9	CAS			86							
391	Dinosaur	MT	MT9	CAS			94							
392	Dinosaur	MT	MT9	CAS			73							
393	Dinosaur	MT	MT11	CAS			75							
394	Dinosaur	SN	BS01	CAS			72							boat launch area
395	Dinosaur	SN	BS01	CAS			86							boat launch area
396	Dinosaur	SN	BS01	CAS			78							boat launch area
397	Dinosaur	SN	BS01	CAS			72							boat launch area
398	Dinosaur	SN	BS01	CAS			81							boat launch area
399	Dinosaur	SN	BS01	CAS			66							boat launch area
400	Dinosaur	SN	BS01	CAS			67							boat launch area
401	Dinosaur	SN	BS01	CAS			56							boat launch area
402	Dinosaur	SN	BS01	CAS			68							boat launch area
403	Dinosaur	SN	BS01	CAS			65							boat launch area
404	Dinosaur	SN	BS01	CAS			70							boat launch area
405	Dinosaur	SN	BS01	CAS			93							boat launch area
406	Dinosaur	SN	BS01	CAS			76							boat launch area
407	Dinosaur	SN	BS01	CAS			71							boat launch area
408	Dinosaur	SN	BS01	CAS			84							boat launch area
409	Dinosaur	SN	BS01	CAS			65							boat launch area
410	Dinosaur	SN	BS01	CAS			62							boat launch area
411	Dinosaur	SN	BS01	CAS			71							boat launch area

Appendix VII cont'd. Individual fish data.

Fish ID	Location	Method	Site Name	Species	Site Sample Number	Sample Envelope Number	Fork Length (mm)	Weight (g)	Sex	Mat	Ageing Structure Type	Age	Scale Photo Record	Comments
412	Dinosaur	SN	BS01	CAS			68							boat launch area
413	Dinosaur	SN	BS01	CAS			67							boat launch area
414	Dinosaur	SN	BS01	CAS			61							boat launch area
415	Dinosaur	SN	BS01	CAS			67							boat launch area
416	Dinosaur	SN	BS01	CAS			82							boat launch area
417	Dinosaur	SN	BS01	CAS			64							boat launch area
418	Dinosaur	SN	BS01	CAS			73							boat launch area
419	Dinosaur	SN	BS01	CAS			69							boat launch area
420	Dinosaur	SN	BS01	CAS			71							boat launch area
421	Dinosaur	SN	BS01	CAS			64							boat launch area
422	Dinosaur	SN	BS01	LSU			58							boat launch area
423	Dinosaur	SN	BS01	LSU			30							boat launch area
424	Dinosaur	SN	BS01	CCG			54							boat launch area
425	Dinosaur	SN	BS01	CCG			62							boat launch area
426	Dinosaur	SN	BS01	RSC			35							boat launch area
427	Dinosaur	MT	MT13	CAS			100							
428	Dinosaur	MT	MT13	CAS			82							
429	Dinosaur	SN	BS02	CCG			81							
430	Dinosaur	SN	BS02	CAS			55							
431	Dinosaur	MT	MT17	CAS			93							
432	Gething Ck	SN	GethingFalls	KO			225		M	SP				photos P8270165-P8270168
433	Gething Ck	SN	GethingFalls	KO			222		M	SP				
434	Gething Ck	SN	GethingFalls	KO			231		F	M				cysts on stomach
435	Gething Ck	SN	GethingFalls	KO			233		F	M				eggs still tight in skeins
436	Gething Ck	SN	GethingFalls	KO			220		M	SP				
437	Gething Ck	SN	GethingFalls	KO			230		F	M				eggs still tight in skeins, P8270169
438	Gething Ck	SN	GethingFalls	KO			223		M	SP				
439	Gething Ck	SN	GethingFalls	KO			211		M	SP				
440	Gething Ck	SN	GethingFalls	KO			220		M	SP				
441	Gething Ck	SN	GethingFalls	KO			218		M	SP				
442	Gething Ck	SN	GethingFalls	KO			221		M	SP				
443	Gething Ck	SN	GethingFalls	KO			228		M	SP				
444	Gething Ck	SN	GethingFalls	KO			212		M	SP				
445	Gething Ck	SN	GethingFalls	KO			221		M	SP				
446	Gething Ck	SN	GethingFalls	KO			225		F	M				eggs still tight in skeins
447	Gething Ck	SN	GethingFalls	KO			224		M	SP				
448	Gething Ck	SN	GethingFalls	KO			221		M	SP				

Appendix VII cont'd. Individual fish data.

Fish ID	Location	Method	Site Name	Species	Site Sample Number	Sample Envelope Number	Fork Length (mm)	Weight (g)	Sex	Mat	Ageing Structure Type	Age	Scale Photo Record	Comments
449	Gething Ck	SN	GethingFalls	KO			222		M	SP				
450	Gething Ck	SN	GethingFalls	KO			228		M	SP				
451	Gething Ck	SN	GethingFalls	KO			220		M	SP				
452	Gething Ck	SN	GethingFalls	KO			228		M	SP				
453	Gething Ck	SN	GethingFalls	KO			202		M	SP				
454	Gething Ck	SN	GethingFalls	KO			228		F	M				eggs still tight in skeins
455	Gething Ck	SN	GethingFalls	KO			221		M	SP				
456	Gething Ck	SN	GethingFalls	KO			231		M	SP				
457	Gething Ck	SN	GethingFalls	KO			222		F	M				eggs still tight in skeins
458	Gething Ck	SN	GethingFalls	KO			220		M	SP				
459	Gething Ck	SN	GethingFalls	KO			214		M	SP				
460	Gething Ck	SN	GethingFalls	KO			220		M	SP				
461	Gething Ck	SN	GethingFalls	KO			224		M	SP				
462	Gething Ck	SN	GethingFalls	KO			230		F	M				eggs still tight in skeins
463	Gething Ck	SN	GethingFalls	KO			220		F	M				eggs still tight in skeins
464	Gething Ck	SN	GethingFalls	KO			213		M	SP				
465	Gething Ck	EF	EF3	RB			48							
466	Gething Ck	EF	EF3	RB			44							
467	Gething Ck	EF	EF3	RB			55							
468	Gething Ck	EF	EF3	RB			61							
469	Gething Ck	EF	EF3	RB			54							
470	Gething Ck	EF	EF3	RB			52							
471	Gething Ck	EF	EF3	RB			51							
472	Gething Ck	EF	EF3	RB			52							
473	Gething Ck	EF	EF3	RB			51							
474	Gething Ck	EF	EF3	RB			45							
475	Gething Ck	EF	EF3	RB			45							
476	Gething Ck	EF	EF3	RB			45							
477	Gething Ck	EF	EF3	RB			36							
478	Gething Ck	EF	EF3	RB			45							
479	Gething Ck	EF	EF3	RB			46							
480	Gething Ck	EF	EF3	RB			52							
481	Gething Ck	EF	EF3	RB			56							
482	Gething Ck	EF	EF3	RB			45							
483	Gething Ck	EF	EF3	RB			162							
484	Gething Ck	EF	EF3	RB			46							
485	Gething Ck	EF	EF3	RB			51							
486	Gething Ck	EF	EF3	RB			46							

Appendix VII cont'd. Individual fish data.

Fish ID	Location	Method	Site Name	Species	Site Sample Number	Sample Envelope Number	Fork Length (mm)	Weight (g)	Sex	Mat	Ageing Structure Type	Age	Scale Photo Record	Comments
487	Gething Ck	EF	EF3	RB			46							
488	Gething Ck	EF	EF3	RB			54							
489	Gething Ck	EF	EF3	RB			32							
490	Gething Ck	EF	EF3	RB			53							
491	Gething Ck	EF	EF3	RB			39							
492	Gething Ck	EF	EF3	RB			50							
493	Gething Ck	EF	EF3	RB			53							
494	Gething Ck	EF	EF3	RB			51							
495	Gething Ck	EF	EF3	CCG			75							
496	Gething Ck	EF	EF3	CCG			89							
497	Gething Ck	EF	EF3	CCG			81							
498	Gething Ck	EF	EF3	CCG			88							
499	Gething Ck	EF	EF3	CCG			86							
500	Gething Ck	EF	EF3	CCG			66							
501	Gething Ck	EF	EF3	CCG			65							
502	Gething Ck	EF	EF3	CCG			66							
503	Gething Ck	EF	EF3	CCG			80							
504	Gething Ck	EF	EF3	CCG			80							
505	Gething Ck	EF	EF3	CCG			65							
506	Gething Ck	EF	EF3	CCG			77							
507	Gething Ck	EF	EF3	CCG			64							
508	Gething Ck	EF	EF3	CCG			78							
509	Gething Ck	EF	EF3	CCG			80							
510	Gething Ck	EF	EF3	CCG			84							
511	Gething Ck	EF	EF3	CCG			63							
512	Gething Ck	EF	EF3	CCG			68							
513	Gething Ck	EF	EF3	CCG			88							
514	Gething Ck	EF	EF3	CCG			78							
515	Gething Ck	EF	EF3	CCG			93							
516	Gething Ck	EF	EF3	CCG			59							
517	Gething Ck	EF	EF3	CCG			70							
518	Gething Ck	EF	EF3	CCG			75							
519	Gething Ck	EF	EF3	CCG			26							
520	Gething Ck	EF	EF3	CCG			79							
521	Gething Ck	EF	EF3	CCG			76							
522	Gething Ck	EF	EF3	CCG			84							
523	Gething Ck	EF	EF3	CCG			81							
524	Gething Ck	EF	EF3	CCG			76							

Appendix VII cont'd. Individual fish data.

Fish ID	Location	Method	Site Name	Species	Site Sample Number	Sample Envelope Number	Fork Length (mm)	Weight (g)	Sex	Mat	Ageing Structure Type	Age	Scale Photo Record	Comments
525	Gething Ck	EF	EF3	CCG			27							
526	Gething Ck	EF	EF3	CCG			31							
527	Gething Ck	EF	EF3	CCG			26							
528	Gething Ck	EF	EF3	CCG			23							
529	Gething Ck	EF	EF3	CAS			62							
530	Gething Ck	EF	EF3	CAS			110							
531	Gething Ck	EF	EF3	CAS			74							
532	Gething Ck	EF	EF3	CAS			74							
533	Gething Ck	EF	EF3	CAS			75							
534	Gething Ck	EF	EF3	CAS			58							
535	Gething Ck	EF	EF3	CAS			86							
536	Gething Ck	EF	EF3	CAS			68							
537	Gething Ck	EF	EF3	CAS			60							
538	Gething Ck	EF	EF3	CAS			51							
539	Gething Ck	EF	EF3	CAS			66							
540	Gething Ck	EF	EF3	CAS			84							
541	Gething Ck	EF	EF3	CAS			72							
542	Gething Ck	EF	EF3	CAS			74							
543	Gething Ck	EF	EF3	CAS			66							
544	Gething Ck	EF	EF3	CAS			61							
545	Gething Ck	EF	EF3	CAS			63							
546	Gething Ck	EF	EF3	CAS			52							
547	Gething Ck	EF	EF3	CAS			71							
548	Gething Ck	EF	EF3	CAS			51							
549	Gething Ck	EF	EF3	CAS			76							
550	Gething Ck	EF	EF3	CAS			50							
551	Gething Ck	EF	EF3	CAS			46							
552	Gething Ck	EF	EF3	CAS			50							
553	Gething Ck	EF	EF3	CAS			76							
554	Gething Ck	EF	EF3	CAS			58							
555	Gething Ck	EF	EF3	CAS			46							
556	Gething Ck	EF	EF3	CAS			67							
557	Gething Ck	EF	EF3	CAS			30							
558	Gething Ck	EF	EF3	CAS			69							
559	Gething Ck	EF	EF3	CAS			57							
560	Gething Ck	EF	EF3	CAS			32							
561	Gething Ck	EF	EF3	RB	1	D285	199				SC	2	PC130013	
562	Gething Ck	EF	EF3	RB	2	D286	170				SC	1	PC130014	

Appendix VII cont'd. Individual fish data.

Fish ID	Location	Method	Site Name	Species	Site Sample Number	Sample Envelope Number	Fork Length (mm)	Weight (g)	Sex	Mat	Ageing Structure Type	Age	Scale Photo Record	Comments
563	Gething Ck	EF	EF3	RB	3	D287	165				SC	1	PC130015	
564	Gething Ck	EF	EF3	RB	4	D288	201				SC	2	PC130016	
565	Gething Ck	EF	EF3	RB	5	D289	160				SC	1	PC130017	
566	Gething Ck	EF	EF3	RB	6	D290	180				SC	2	PC130018	
567	Gething Ck	EF	EF3	RB	7	D291	156				SC	1	PC130019	
568	Gething Ck	EF	EF3	RB	8	D292	162				SC	1	PC130020	
569	Gething Ck	EF	EF3	RB	9	D293	168				SC	1	PC130021	
570	Gething Ck	EF	EF3	RB	10	D294	209				SC	2	PC130022	
571	Gething Ck	EF	EF3	RB	11	D295	168				SC	1	PC130023	
572	Gething Ck	EF	EF3	RB	12	D296	138				SC	1	PC130024	
573	Gething Ck	EF	EF3	RB	13	D297	164				SC	1	PC130025	
574	Gething Ck	EF	EF3	RB	14	D298	161				SC	1	PC130026	
575	Gething Ck	EF	EF3	RB	15	D299	145				SC	1	PC130027	
576	Gething Ck	EF	EF3	RB	16	D300	130				SC	1	PC130028	
577	Gething Ck	EF	EF3	RB	17	D301	167				SC	2	PC130029	
578	Gething Ck	EF	EF3	RB	18	D302	140				SC	1	PC130030	
579	Gething Ck	EF	EF3	RB	19	D303	173				SC	2	PC130031	
580	Gething Ck	EF	EF3	RB	20	D304	145				SC	1	PC130032	
581	Gething Ck	EF	EF3	RB	21	D305	162				SC	1	PC130033	
582	Gething Ck	EF	EF3	RB	22	D306	101				SC	0	PC130034	