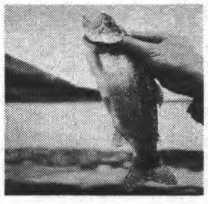
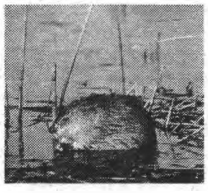
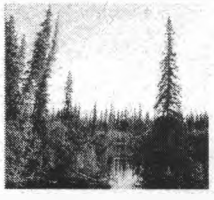
Canada Alberta Northwest Territories

Northern River Basins Study





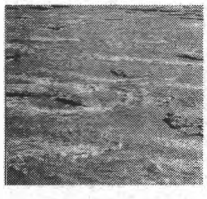




NORTHERN RIVER BASINS STUDY PROJECT REPORT NO. 61

FISH COLLECTIONS

PEACE, ATHABASCA AND SLAVE RIVER BASINS SEPTEMBER TO DECEMBER, 1994






Prepared for the
Northern River Basins Study
under Project 3144-D1

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NORTHERN RIVER BASINS STUDY PROJECT REPORT NO. 61

FISH COLLECTIONS
PEACE, ATHABASCA AND SLAVE RIVER BASINS
SEPTEMBER TO DECEMBER, 1994

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PREFACE:

The Northern River Basins Study was initiated through the "Canada-Alberta-Northwest Territories Agreement Respecting the Peace-Athabasca-Slave River Basin Study, Phase II - Technical Studies" which was signed September 27, 1991. The purpose of the Study is to understand and characterize the cumulative effects of development on the water and aquatic environment of the Study Area by coordinating with existing programs and undertaking appropriate new technical studies.

This publication reports the method and findings of particular work conducted as part of the Northern River Basins Study. As such, the work was governed by a specific terms of reference and is expected to contribute information about the Study Area within the context of the overall study as described by the Study Final Report. This report has been reviewed by the Study Science Advisory Committee in regards to scientific content and has been approved by the Study Board of Directors for public release.

It is explicit in the objectives of the Study to report the results of technical work regularly to the public. This objective is served by distributing project reports to an extensive network of libraries, agencies, organizations and interested individuals and by granting universal permission to reproduce the material.

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Whereas the above publication is the result of a project conducted under the Northern River Basins Study and the terms of reference for that project are deemed to be fulfilled,
IT IS THEREFORE REQUESTED BY THE STUDY OFFICE THAT;
this publication be subjected to proper and responsible review and be considered for release to the public.

F. J. Wrona — 4 Apr 96

(Dr. F. J. Wrona, Ph.D., Science Director) (Date)

Whereas it is an explicit term of reference of the Science Advisory Committee "to review, for scientific content, material for publication by the Board",
IT IS HERE ADVISED BY THE SCIENCE ADVISORY COMMITTEE THAT;
this publication has been reviewed for scientific content and that the scientific practices represented in the report are acceptable given the specific purposes of the project and subject to the field conditions encountered.
SUPPLEMENTAL COMMENTARY HAS BEEN ADDED TO THIS PUBLICATION: [ ] Yes [ ] No

P. A. Larkin — 15 April 96

(Dr. P. A. Larkin, Ph.D., Chair) (Date)

Whereas the Study Board is satisfied that this publication has been reviewed for scientific content and for immediate health implications,
IT IS HERE APPROVED BY THE BOARD OF DIRECTORS THAT;
this publication be released to the public, and that this publication be designated for: **[ ] STANDARD AVAILABILITY [ ] EXPANDED AVAILABILITY**

Lucille Partington — 21 April 1996

(Lucille Partington, Co-chair) (Date)

R. McLeod — 10 April 1996

(Robert McLeod, Co-chair) (Date)

FISH COLLECTIONS, PEACE, ATHABASCA AND SLAVE RIVER BASINS SEPTEMBER TO DECEMBER, 1994

STUDY PERSPECTIVE

The aquatic fauna of the Peace, Athabasca and Slave rivers are exposed to bleached kraft pulp mill effluent, and other types of industrial and municipal effluents. In 1992, collections of fish species for contaminant and biochemical analyses on tissues was conducted under the Northern River Basins Study (NRBS). Subsequently, bleached draft pulp mills within the northern river basins have undergone major process changes to reduce the levels of organochlorines in the aquatic environment by substituting chlorine dioxide for molecular chlorine in the bleaching process. Additional collections and analyses were required to determine the basin-wide variability on contaminant levels and effects on fish.

Related Study Questions

1a) *How has the aquatic ecosystem, including fish and/or other aquatic organisms been affected by exposure to organochlorines or other toxic compounds?*

4a) *Describe the contents and nature of the contaminants entering the system and describe their distribution and toxicity in the aquatic ecosystem with particular reference to water, sediments and biota?*

4b) *Are toxins such as dioxins, furans, mercury, etc. increasing or decreasing and what is their rate of change?*

8) *Recognizing that people drink water and eat fish from these river systems, what is the current concentration of contaminants in water and edible fish tissue and how are these levels changing through time and by location?*

The purpose of this project was to collect and prepare fish from 23 sites on the Peace, Athabasca and Slave River drainages for conducting physical, physiological, contaminant and biophysical analyses. Sites were located on the Peace, Smoky, Little Smoky, Wapiti, Wabasca, Athabasca, McLeod, Pembina, Lesser Slave and Clearwater Rivers. The fish species targeted for collection and analyses were burbot (primary target species), northern pike, longnose sucker and flathead chub. The sampling and handling protocols for the collection of fish tissues were designed to allow for a wide range of contaminant and biochemical analyses on an individual fish. These analyses included gross pathology, contaminants, metals (e.g., mercury), liver mixed function oxygenase induction, sex steroids and gonad morphology, retinols (Vitamin A), metallothioneins (proteins produced by exposure to heavy metals) and basic life history information.

A total of 535 fish and 13 species were caught, including 222 burbot, 50 northern pike, 88 longnose sucker and 24 flathead chub. Fish tissues were extracted and prepared for subsequent analyses according to a rigorous set of NRBS protocols. Most fish examined externally and internally for gross pathological abnormalities and deformities appeared normal (84%). Of the abnormalities observed, tumours and lesions of longnose suckers were the most common.

Analytical data obtained as a result of these collections in this study will (1) provide a basin-wide comparison of contaminants in fish, (2) further determine if contaminant levels vary between fish species, and (3) determine if fish from near-field sites associated with major industrial development are affected significantly more than those from far-field sites. Data from these fish will also provide comparative information in relation to previous contaminant and biochemical analyses conducted for these species by NRBS and other agencies. Results from this study will be linked to contaminant fate and food chain modelling, ecosystem health, cumulative effects assessment and human health consumption advisory assessments.

The Science Advisory Committee has indicated readers should be cautioned that while the interpretations and comparisons provided by the authors is very general, it is not based on rigorous statistical analyses. It should also be noted that these additional analyses go beyond the requirements in the project terms of reference.

REPORT SUMMARY

Burbot, northern pike, longnose sucker, and flathead chub were collected from mid-September to late October 1994 and in mid-December for gross pathological examination and contaminant, biochemical, stomach content, and gonad morphology analyses. Other fish species caught were retained for contaminant and stomach content analyses (maximum 10 fish per species) or were released. Fish were sampled for the analyses according to Northern River Basins Study protocols, frozen on dry ice, and transported to Edmonton and Winnipeg.

Fish were collected from 23 sites using baited setlines, electrofishing, gill nets, and angling. Nine sites were sampled during fall in the Peace River drainage, including sites on the Peace River, Smoky River, Little Smoky River, Wapiti River, and Wabasca River. Two sites were sampled in mid-December, one on the Smoky River and one on the Little Smoky River. Nine sites were sampled in the Athabasca River drainage: five Athabasca River sites, the McLeod River, Pembina River, Lesser Slave River, and Clearwater River. The McLeod River also was sampled in December. Fish were also collected from the Peace-Athabasca Delta and the Slave River Delta.

A total of 535 fish was caught including 222 burbot, 50 northern pike, 88 longnose sucker, and 24 flathead chub. Most burbot were caught by set line (N=119). Burbot were caught at all sites sampled except the Smoky River near Grande Cache and the Peace-Athabasca Delta near Jackfish Village. Most burbot were caught on set lines in backwater habitats.

Northern pike were collected using set lines, electrofishing, gill nets, and angling. Northern pike were not collected at the Wabasca River, McLeod River, Lesser Slave River, and four of the five Athabasca River sites. They were relatively scarce at the other sites sampled.

Most longnose sucker were caught by electrofishing (N=85). They were caught in the Peace River, Smoky River, Little Smoky River, and Wapiti River. They were rare in the Athabasca River and were caught only at one site on the Athabasca River and in the McLeod River.

Flathead chub were found in the Peace River, Smoky River, Little Smoky River, and Wapiti River. They were caught by electrofishing and set lines.

Most fish examined (84%) externally and internally for gross pathological abnormalities and deformities appeared normal. Of the abnormalities observed, tumours and lesions of longnose suckers were the most common.

ACKNOWLEDGEMENTS

G. Wagner (formerly with Alberta Environmental Protection) and R. Chabaylo (Northern River Basins Study) are thanked for their support throughout the study. Dr. B. Barton (University of South Dakota) and D. Metner (Department of Fisheries and Oceans) are acknowledged for providing advice and demonstrating field techniques to sample fish. Dr. Scott Brown (Department of Fisheries and Oceans) is thanked for his timely provision of Histoprep capsules. Thanks are given to J. Green and T. Ethier (AXYS Environmental Consulting Ltd.) for coordinating fish sampling for the Peace-Athabasca and Slave River deltas.

Many people assisted with field sampling. Thanks to P. Hvenegaard, G. Todd, and M. Dahl (Alberta Environmental Protection, Fish and Wildlife Services, Peace River) for their volunteer work. J. Walker (Alberta Environmental Protection, Fish and Wildlife Services, Edson) and B. Lucko (Alberta Environmental Protection, Fish and Wildlife Services, Valleyview) provided insight on where deeper pools could be found on the McLeod and Little Smoky rivers during winter and early fall, respectively. The staff at Edson and Hinton Fish and Wildlife and the Eagle River campground are thanked for their ideas on good fishing sites on the Athabasca River.

T. Boag, C. Godwin-Sheppard, T.-L. Jacobson, and D. Lightle lead crews during the fall sampling. A. Basso, D. Knutscher, G. Latham, C. Oishi, and I. Schmeltzer assisted with fall field sampling on the Peace River and Athabasca River drainages. T. Ethier and R. Kashino (AXYS Environmental Consulting Ltd.) assisted with fall field sampling at the Peace-Athabasca Delta and Slave River Delta. B. Redmond built dipnets, live wells and aged fish.

Special thanks are given to several people who assisted sampling in the Peace-Athabasca Delta and Slave River Delta. Daniel Marcel (Fort Chipewyan) was guide for the Peace-Athabasca Delta field crew and provided field equipment, accommodation, and his knowledge of the area. His contribution is gratefully acknowledged. Reggie Mackay, Michael Cardinal, R. Matsuba (Fort Chipewyan Fish and Wildlife), and D. Creurer of Fort Chipewyan are thanked for their assistance and advice. Tommy Unka and Darwin Unka (Fort Resolution) were guides for the Slave River Delta and provided field equipment. Deninu Kue First Nation, Fort Resolution, provided storage for dry ice and photocopies. S. Flett (NRBS Traditional Knowledge Component Leader) is thanked for his assistance.

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1.0 INTRODUCTION

Burbot (*Lota lota*) has been used as a sentinel species for monitoring contaminants in northern rivers. They have been collected for biochemical and contaminant analyses from the Mackenzie River following complaints by local residents that the quality of fish had deteriorated and to assess the possible impacts of petroleum developments (Lockhart *et al.* 1987, Hrudey and Associates 1988, Muir *et al.* 1990). They also have been collected from the Peace River drainage (Swanson 1992, Brown *et al.* 1993, Hvenegaard and Boag 1993).

Burbot was selected as a sentinel species based on several characteristics (Environment Canada 1993). Burbot are widely distributed and are relatively easy to catch (Paetz 1984, Wallace and McCart 1984, Hvenegaard and Boag 1993, R.L. & L. 1994). Movements appear to consist of only relatively short spawning migrations in midwinter in the Slave drainage (R.L.&L./E.M.A 1985) and Athabasca drainage (Berry 1986); therefore, burbot can be collected in upstream reaches not affected by point-source contaminants in addition to reaches downstream of effluent sources. They are bottom feeders and are at the top of the aquatic food chain, and can indicate contaminant bioaccumulation through the food chain. In addition, burbot have large livers with a high percentage of lipids which tend to accumulate chlorinated organic compounds (Muir *et al.* 1990). Both the flesh and livers of burbot are consumed by people in northern communities (Balagus *et al.* 1993, Lockhart *et al.* 1987).

Contaminants in the aquatic environment and existing environmental quality are being assessed throughout the Peace River and Athabasca River basins as part of the research program of the Northern River Basins Study (NRBS). The last major collections of burbot and other fish species for contaminant and biochemical analyses by NRBS and other agencies were done in 1992, before significant process changes to pulp mills. These changes should lead to reduced organochlorine levels in the aquatic environment. The main purpose of the basin-wide fall burbot collection was to collect burbot and other fish species from the Peace River, Athabasca River, and Slave River to determine if contaminant levels are decreasing and what affects contaminants are having on burbot populations (Terms of Reference). Northern River Basins Study contracted EnviResource Consulting Ltd. to collect fish during fall 1994 from sites in the Peace, Athabasca, and Slave drainages.

1.1 STUDY OBJECTIVES

The primary objective of the project was to collect burbot for specialized fish contaminant and biochemical analyses, conduct gross pathological examinations on collected fish, and prepare blood and tissue samples for delivery. Other fish species were collected to provide complimentary information. Specific study objectives were to:

1. Collect adult burbot (> 400 g), longnose sucker (*Catostomus catostomus*), and northern pike (*Esox lucius*) from the Peace River, Athabasca River, and Slave River and major tributaries from September to mid-October for gross pathology, stomach content, contaminant, and biochemical analyses.

2. Collect flathead chub (*Platygobio gracilis*) from the Peace River and in major tributaries from September to mid-October for gross pathology, stomach content, contaminant, and biochemical analyses.

3. Collect other fish species opportunistically in conjunction with the collection of target species listed above in the Peace and Athabasca River drainages for possible contaminant analyses.

4. Collect other fish species opportunistically in conjunction with the collection of target species listed above on the Slave River for gross pathology, stomach content, biochemical, and possible contaminant analyses.

5. Record habitat information for each fish collection site.

2.0 STUDY AREA

Fish were collected from sites throughout the Peace River, Athabasca River, and Slave River basins (Figure 1). In total, 11 sites were sampled in the Peace River drainage, 11 sites were sampled in the Athabasca River drainage, and one site was sampled in the Slave River Delta (Table 1). The Wapiti River was sampled twice to collect additional burbot to replace a sample that might have exceeded temperature protocols during shipping. Three of the sites were sampled in winter, the Smoky River Site SR3, Little Smoky River Site LSR2, and McLeod River Site MR2. Sites were preselected by NRBS to coincided with locations sampled previously on behalf of NRBS and are described by Hvenegaard and Boag (1993), Barton *et al.* (1993a, b) and R.L. & L. (1994). Sites were located upstream, near, and downstream from effluent sources. Collection sites in tributaries were located a minimum of 10 river kilometres upstream from the confluence with the mainstem river to increase the probability of capturing resident fish.

Three sampling sites were sampled at two different locations in an attempt to collect the required sample size of burbot. Two locations were sampled at the Athabasca River Site A1 downstream from Hinton to collect burbot (Table 1). The second location was sampled because most burbot colleced at the first site were too small (< 400 g), and few burbot were caught. Two locations in the Peace-Athabasca Delta were recommended by the guide; both were locations where burbot had previously been caught. Two locations in the Slave River Delta (SRD1 and SRD2) were sampled to collect a sufficient sample of burbot.

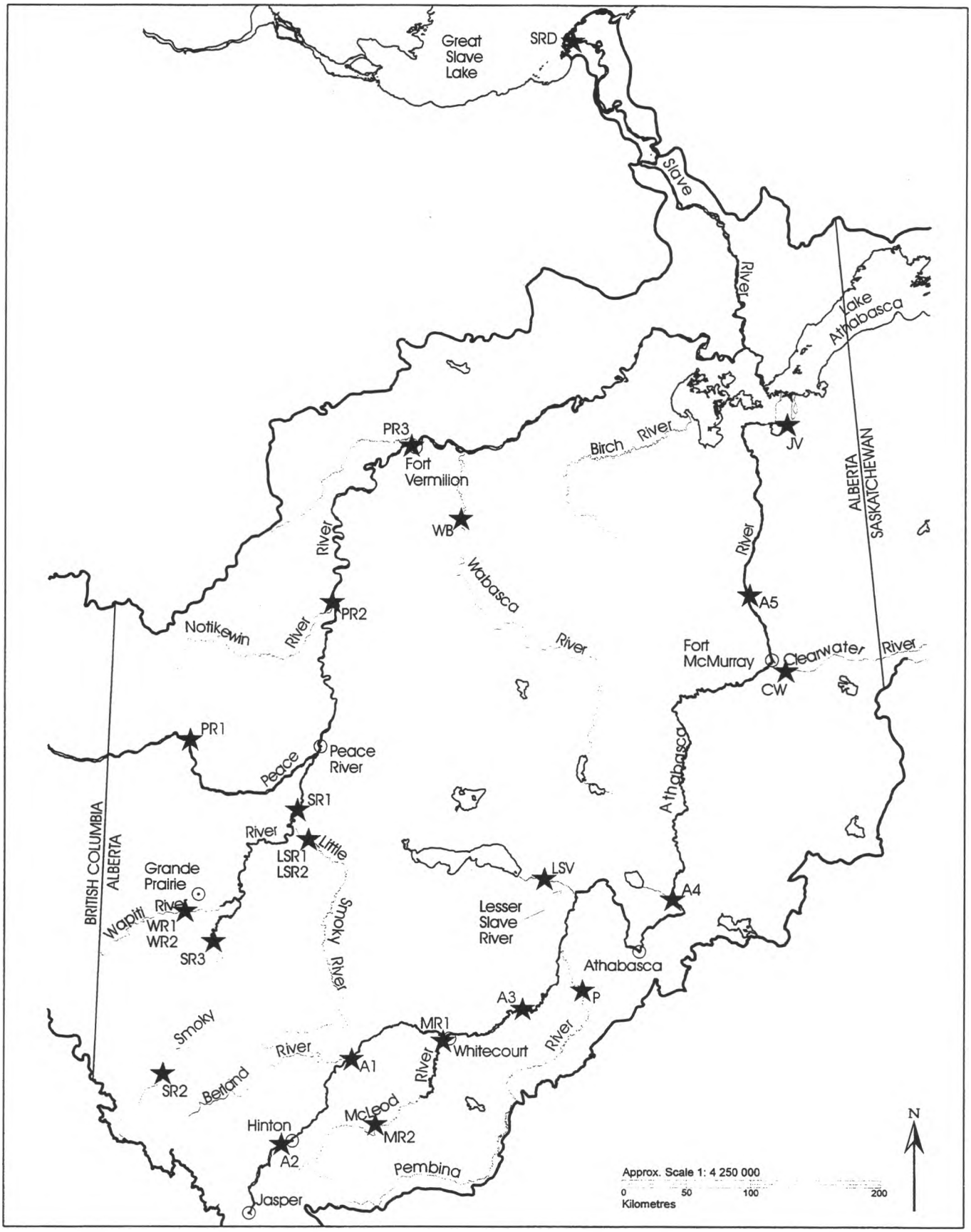

Figure 1. Fish collection sites within the Peace River, Athabasca River, and Slave River drainages.

Table 1. Fish collection sites in the Northern River Basins Study area.

River/Delta	Site	Description
Peace River	PR1	Upstream from Dunvegan (near Many Islands)
	PR2	Downstream from Diashowa (near Notikewin River)
	PR3	Near Fort Vermilion
Smoky River	SR1	Downstream from confluence of Wapiti R. (near Highway 49 crossing)
	SR2	Upstream from confluence of Wapiti R. (near Grande Cache)
	SR3[a]	Upstream from confluence of Wapiti R. (near Canfor main haul bridge)
Wapiti River	WR1	Upstream from Grande Prairie (near Pipestone Creek Provincial Park)
	WR2	Upstream from Grande Prairie (near O'Brian Provincial Park)
Little Smoky River	LSR1	Near Highway 744 crossing
	LSR2[a]	Downstream from Highway 744 crossing
Wabasca River	WB	Near Highway 67 crossing
Athabasca River	A1 a	Downstream from Hinton (near Highway 947 crossing)
	A1 b	Downstream from Hinton (near Berland River)
	A2	Upstream from Hinton
	A3	Downstream from Whitecourt (near Fort Assiniboine)
	A4	Downstream from AlPac (near Calling River)
	A5	Near Fort MacKay
McLeod River	MR1	Near Eagle Campground
	MR2[a]	At Big Eddy upstream from Edson
Pembina River	P	Near Jarvie
Lesser Slave River	LSV	Downstream from Slave Lake Pulp
Clearwater River	CW	Upstream from Fort McMurray
Peace-Athabasca Delta	JVa	Near Jackfish Village
	JVb	Near Big Eddy
Slave River Delta	SRDa	Upstream from Nagle Channel
	SRDb	At mouth of Nagle Channel

[a]Collections were made in mid-December 1994.

3.0 METHODS

Fish originally were to be collected from 22 sites: three sites on the Peace River and five sites on tributaries to the Peace River drainage, five sites on the Athabasca River and seven sites on its tributaries and in the Peace-Athabasca Delta, and two sites on the Slave River (Appendix A). Sampling was scheduled for August to mid-October. Burbot was the primary target species. A minimum of 10 male and 10 female adult burbot (> 400 g), longnose sucker, and flathead chub were to be collected from the sites. Up to 15 northern pike of each sex caught during collection of other species were to be retained from each site. However, it was evident shortly after collections were started that fish abundance was low, and the requested number of fish could not be collected within the time and budget allotted.

Changes were made to the Terms of Reference after discussion with NRBS in early September. The minimum number of fish to be sampled at each site was reduced to six of each sex for burbot. Sampling time at each site was limited to a maximum of five nights; at some sites the requested number of burbot, longnose sucker, flathead chub, and northern pike could not be collected. Only limited habitat information was collected, and temperature profiles were not done.

The Peace-Athabasca Delta site at Jackfish Village was sampled in mid-September when requested by NRBS. Because no burbot were caught, the other site in the Delta at the Birch River, the Lake Athabasca site, and the Slave River sites were scheduled to be sampled at a later date (G. Wagner, pers. comm.) Eventually, three sites in the original Terms of Reference were removed from the sampling schedule as requested by NRBS (Birch River, Lake Athabasca, Slave River at Fort Fitzgerald).

Winter sampling was not required in the original Terms of Reference but was done to provide additional burbot for contaminant and biochemical analyses. Collections of burbot were conducted in mid-December at the McLeod River Site MR2, Little Smoky River Site LSR2, and Smoky River Site SR3 (Table 1).

3.1 FISH COLLECTION

3.1.1 Set Lines

Setlines were used to catch burbot at all sampling sites. Setlines were similar to those used by Hvenegaard and Boag (1993). Twenty snelled fish hooks (Size 1/0 to 3/0) were attached at 0.5 m intervals along a 15.2 m length of heavy (22.7 kg), braided Dacron fishing line. Hooks usually were baited with commercial smelt (*Osmerus mordaxi*), but when smelt were not available other bait was used. At Athabasca River Site A4, northern pike and wieners were used. Bacon and northern pike were used for bait at the Jackfish Village sites. Northern pike was used for bait at the Slave River Delta sites. Fish collected during the winter sampling were caught on set lines baited with liver.

Lines were set in late afternoon and evening and fished through the night as requested by the Terms of Reference and following the methods of Hvenegaard and Boag (1993). Each day, 7 to 22 setlines were cast from shore and fished on the bottom in backwater, deeper run, or snye habitats as recommended by Hvenegaard and Boag (1993). Setlines were anchored with bricks or rocks and secured to shore. The number of setlines fished nightly varied from site to site. The intent was to maximize hours fished but not capture too many fish to sample the next day for biochemical and contaminant analyses. The maximum number of fish which could be sampled completely in day light was 20 to 23. Attempts were made to distribute sampling effort evenly between lines and across sites at the first sites sampled. However, catch rates were unpredictable. Consequently, efforts were made to maximize the number of lines fished the first night at a new site and when catch rates were low or to reduce the number of lines fished per night when more fish (> 10) were caught.

Data recorded at set line sites included number of lines set, number of hooks per line, time set, time pulled, general habitat characteristics, depth, and location. Set line locations were recorded in latitude and longitude using hand-held Garmin GPS 75 units. Fish abundance (catch per unit effort) was calculated using number of fish caught per 100 hook hours.

3.1.2 Electrofishing

Boat electrofishing was used to collect additional fish from the Peace River, Athabasca River, and their major tributaries. A 5 m aluminum jet boat equipped with a Smith-Root Type 5.0 GPP electrofisher was used in the Peace River drainage. A portable, Smith-Root Type 2.5 GPP boat electrofisher mounted in a 4.4 m Bombardier Explorer was used to sample the Athabasca River and its tributaries.

Data recorded for boat electrofishing included fish caught and observed, electrofishing seconds, and electrofisher settings. The upstream and downstream extent of the river sections electrofished were recorded using hand-held Garmin GPS 75 units. Fish abundance was calculated as number of fish caught per 100 seconds electrofishing.

3.1.3 Gill Nets

Monofilament gill nets were used to collect fish other than burbot at the Peace-Athabasca Delta and the Slave River Delta sites. The nets were 1.2 m deep and 45 m long with 8.9 cm (stretched) mesh. One gill net was set in Jackfish Creek near Jackfish Village and fished for a maximum of 22 minutes between pulls to ensure sampling live fish. At the Slave River Delta Site SRD2, the gill net was set at the mouth of Nagle Channel and fished for a maximum of 75 minutes per set. Set duration, water velocity, and location were recorded. Catch per unit effort data were generated for each set based on gill net surface area fished for the equivalent of a 24-hour period.

3.1.4 Angling

Angling was used at some sites to collect additional non-target fish and to collect northern pike. Northern pike caught angling also were used at bait for set lines. Angling was done at set line locations.

3.2 FISH BLOOD AND TISSUE SAMPLING

3.2.1 Workshop

Dr. B. Barton (University of South Dakota) conducted a two-day workshop to demonstrate and review fish blood and tissue sampling techniques. Sampling protocols and the handling of tissues and blood samples, as presented in the Terms of Reference (Appendix A), were discussed. Dr. Barton emphasized time constraints required to sample individual tissues, discussed tissue preparation and storage, and the need to maintain sampling homogeneity between field crews.

3.2.2 Target Species

Blood and tissues from burbot, northern pike, longnose sucker, and flathead chub were sampled, stored, and transported as described in detail in the Terms of Reference (Appendix A). The sampling protocol was developed to ensure the rapid removal and preservation of blood and tissues within the required time for sex steroid, contaminant, hepatic MFO induction, retinol, and metallothionein analyses. The sampling regime is summarized below and presented schematically in Figure 2.

Fish caught by setlines were sampled each morning. Fish were removed from each hook or the dropper (to which the hook was attached) was cut if the hook was swallowed deeply. As each fish was removed from a setline, its blood was sampled. Fish caught by electrofishing were held in a live well until sampled. Blood was sampled immediately from fish caught by gill net and angling.

To sample blood, a fish was placed ventral side up in a longitudinal slit in high density foam. A 5 mL, heparinized, disposable syringe was used to withdraw 1 to 2 mL of blood from the caudal vessel. The blood sample was placed in a cooler with ice but not frozen. After a blood sample was taken, the fish was marked with a unique fin clip and placed in a floating live well. Blood from each fish was placed in separate, labelled 1.5 mL microcentrifuge tubes and spun in a microcentrifuge for 5 minutes. A maximum of 30 minutes was allowed to elapse between blood collection and centrifuging. Plasma was aspirated from each tube with Pasteur pipettes into separate, labelled microcentrifuge tubes. The microcentrifuge tubes with the plasma and red blood cells then were inserted into labelled Ziploc bags and placed immediately on dry ice. When several fish were caught at a time (e.g., on a setline) blood was sampled from all fish before tissue sampling was begun.

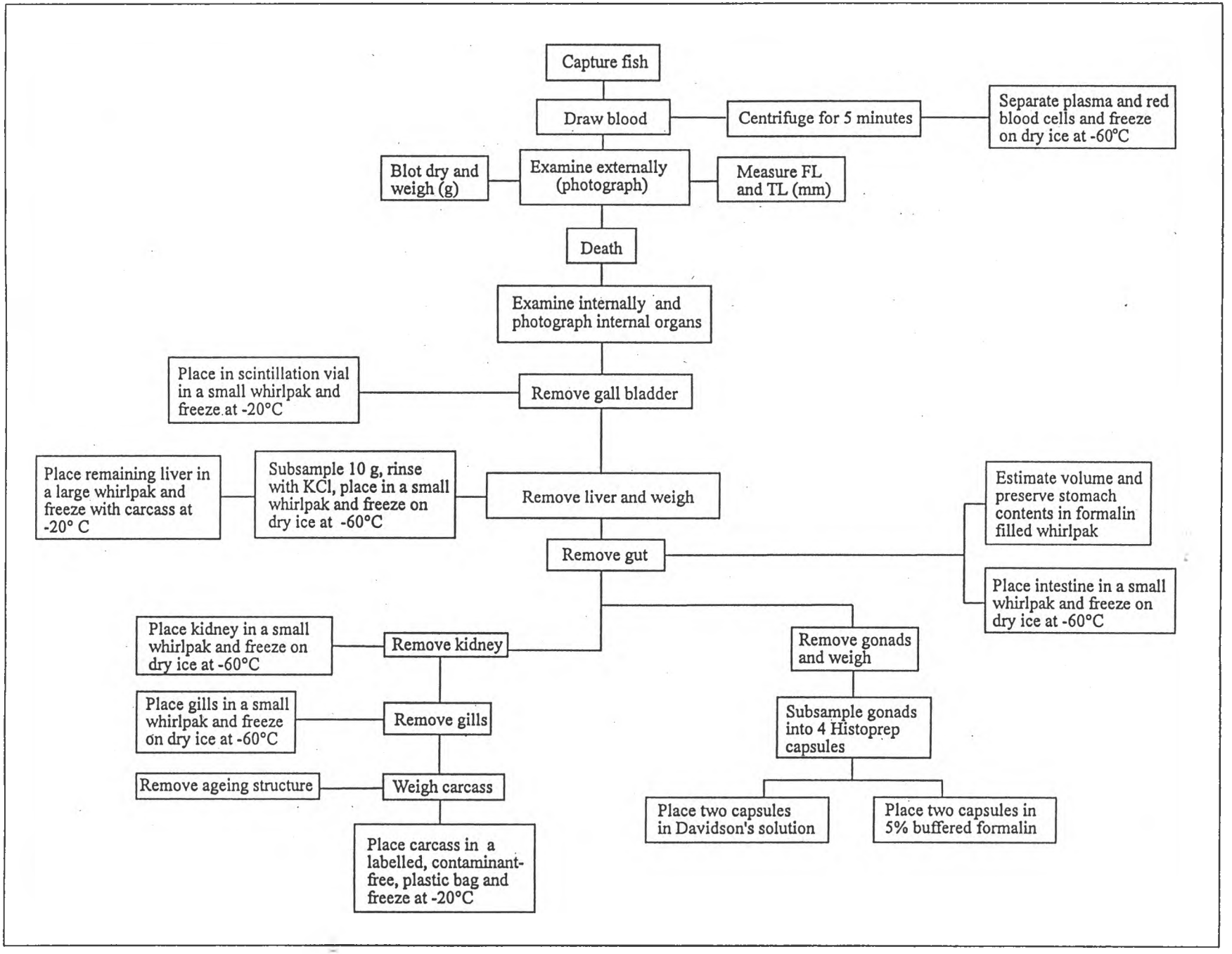

Figure 2. Flow chart summarizing fish blood and tissue sampling protocol.

After blood sampling was completed, individual fish were removed from the live well for processing. First, a fish was examined for external pathological abnormalities (Appendix A). Any abnormalities were noted and photographed. Then the fish was measured, towel dried, and weighed before being sacrificed by concussion. The fish was opened ventrally, and an internal gross pathological examination was done. A colour photograph was taken of the internal organs with Fujicolor ASA 200 film with a Kodak™ colour chart and a fish identification label in the background. The gall bladder then was removed and placed in a 7 mL scintillation vial in a whirlpak or, if too large, directly into a whirlpak. Next, the liver was removed and weighed. The longest posterior branch of the liver was cut (about 10 g), rinsed with 0.15 M KCl, placed in a labelled whirlpac, and frozen between slabs of dry ice. The remaining liver was placed in a labelled, contaminant-free bag and frozen between slabs of dry ice. Internal examinations, photograph, and removal of the gall bladder and liver were done within 2 minutes of death for each fish.

The next steps of the sampling protocol were to remove the gut, kidneys, gonads, and gills and place each tissue in separate labelled bags. Stomach volume was visually estimated, and stomach contents were preserved in 5% buffered formalin (to be examined later). Gonads were subsampled and put into Histoprep tissue capsules in Davidson's fixative and in 5% buffered formalin (Appendix A). The fish carcass was weighed and placed in a labelled, contaminant-free bag on dry ice.

Each fish and its tissue samples were numbered using sequential labelled codes containing the location, species and sample number. For example, LSR1 BURB 1 represents the first burbot (BURB) captured from the Little Smoky River Site 1 (LSR1). During tissue sampling, measurements were recorded including: sample number, date, location, species, capture method, fork length (mm), total length (mm), total weight, liver weight, gonad weight, carcass weight, sex, state of maturity, time blood was sampled, time blood was centrifuged, time of death, time each tissue sample was removed, and stomach fullness. All tissue samples were weighed to the nearest 0.1 g using an electronic balance. Total weight and carcass weight were measured to the nearest gram.

All internal and external abnormalities were recorded on special data sheets. The gross pathology examination sheet checklist was used as a guide for describing internal and external abnormalities on each fish (Appendix A). Colour photographs were taken of external and internal abnormalities.

Appropriate ageing structures were removed from each fish before the carcass was frozen. Otoliths from burbot, cleithra from northern pike, pectoral fin rays from longnose sucker, and scales from flathead chub were used to age fish as described by Mackay *et al.* (1990). Otoliths were rinsed with water and then stored in a glycerin/ethanol solution in small whirlpak bags. Cleithra and scales were cleaned and stored in labelled scale envelopes.

To ensure that tissue samples and dissecting equipment were not contaminated, fish were not sampled near generators, exhaust, oil, or smoke. Dissecting equipment was rinsed in hexane and acetone and air dried between fish samples. Cutting surfaces were cleaned with wet paper towels after each fish was processed. Disposable latex gloves were worn for processing fish and were changed between fish.

3.2.3 Non-target Species

A maximum of 10 fish of each non-target species was kept from each site (except the Peace-Athabasca Delta and Slave River Delta sites) for contaminant analyses. An external pathological examination was done, and any external abnormalities were noted and photographed. The date, time, site, capture method, sampler(s), total weight (g), fork length (mm), sex and state of maturity (if distinguishable externally) were recorded. An appropriate ageing structure was taken as recommended by Mackay *et al.* (1990). Each fish was placed in a labelled, contaminant-free plastic bag and stored on dry ice.

Other fish caught that were too small for tissue sampling (only adult fish and burbot > 400 g were sampled) or were extra fish (caught after 10 were kept for contaminant analyses) were measured and released. The date, time, site, capture method, sampler(s), total weight (g), fork length (mm), sex and state of maturity (if distinguishable externally) were recorded. Fish caught but which escaped were included in the total number of fish captured, although no length or weight data could be recorded. If a fish was in good physical condition and exhibiting normal behaviour, it was tagged with a NRBS Floy T-bar anchor tag. The tag number was recorded. Non-target fish species caught at the Peace-Athabasca Delta site were released or given to the guide. They were not sampled because dry ice supply was limited.

3.2.3 Sample Storage and Transport

All tissue samples, except gonads in Histoprep tissue capsules, were stored on dry ice and transported in coolers. Tissue and blood samples from fish caught at the same site were frozen together. Carcasses were transported in labelled coolers wrapped with duct tape. Contaminant tissue samples were transported in labelled coolers with slabs of dry ice around and between the tissue samples. An air courier was used to ship biochemical and histological tissue samples to the Freshwater Institute in Winnipeg. All samples from the Peace-Athabasca Delta and Slave River Delta were shipped by air courier.

3.3 WATER QUALITY AND HABITAT DESCRIPTIONS

Water samples were taken at each site in the Peace River and Athabasca River drainages. Surface water samples were collected in triple rinsed, 500 mL Nalgene water bottles and kept cool until shipped to Chemex Laboratories for analysis. Parameters analyzed included pH, conductivity, and alkalinity. At the Peace-Athabasca Delta and the Slave River Delta sites, surface pH and conductivity were measured in the field.

Channel velocity was measured with a Price AA current metre and wading rod at the Peace River, Athabasca River, and tributary sites. Velocity was measured at 60% of depth when depth was < 75 cm and at 80% and 20% of depth for depths >75 cm. Measurements were made from three backwater and

three mainstem channel locations selected randomly at each site where set lines were set. Mean column velocities were calculated as described by Orth (1983).

Habitat descriptions were recorded in the field at set line sites. Descriptions included substrate type, channel type, and special habitat features (Appendix A). Setline depth was averaged and summarized as shallow (< 1 m), moderate (1 - 2 m), and deep (> 2 m). Only limited habitat information was recorded as requested by NRBS.

3.4 DATA ANALYSIS

All fish life history data were entered into computer files (dBase and QuattroPro). Length-frequency distributions, length-weight relationships, and length-at-age were determined. Length-weight relationships were plotted for each target fish species for each drainage.

Condition factor, gonadosomatic index, and liver somatic index were calculated for each target fish and reported in Appendix B. Condition factor (CF) was calculated as CF = (total weight/length^3) x 10^5 (Appendix A). Gonadosomatic index (GSI) was calculated as GSI = (gonad weight/gutted weight) x 100. Liver somatic index (LSI) was calculated as LSI = (liver weight/gutted weight) x 100.

4.0 RESULTS AND DISCUSSION

The Peace River, Athabasca River, and Slave River drainages were sampled from 11 September to 20 October and 14 to 21 December, 1994 (Appendix B). In total, 535 fish were found, 384 (72%) target fish and 151 (28%) non-target fish (Table 2). The majority of the target fish caught were burbot (58%).

Table 2. Number of fish caught during the fall and winter 1994 burbot collection.

Fish Species		River Drainage		Delta		Total
Name	Code	Peace	Athabasca	Peace-Athabasca	Slave	
Burbot	BURB	78	123	0	21	222
Northern pike	NRPK	24	14	6	6	50
Longnose sucker	LNSC	81	7	0	0	88
Flathead chub	FLCH	24	0	0	0	24
Arctic grayling	ARGR	4	0	0	0	4
Bull trout	BLTR	29	11	0	0	40
Goldeye	GOLD	5[a]	0	1	0	5
Lake whitefish	LKWH	0	0	4	0	4
Mountain whitefish	MNWH	6	6	0	0	12
Northern squawfish	NRSQ	1	0	0	0	1
Rainbow trout	RNTR	0	14	0	0	14
Walleye	WALL	24	28	3	0	55
White sucker	WHSC	14	2	0	0	16
Total						535

[a] Young-of-the-year goldeye were observed (>100).

Although 222 burbot were caught, the minimum requested number of burbot per site (n=12) was collected only at eight of the sampling sites (Table 3). Burbot were found at all river sites sampled except the Smoky River Site SR2.

Burbot were not caught at the Peace-Athabasca Delta sites (Jackfish Village) in mid-September. Surface water temperature was 14°C on 20 September in the Delta channel. Water depth at the two set line sites in the Peace-Athabasca Delta was greater than 13 m, and burbot, northern pike, suckers and lake whitefish have been caught there (D. Marcel, pers. comm.). Local fishermen were not catching burbot at this time in the Delta or Lake Athabasca. Several residents of Fort Chipewyan suggested it was too early to catch burbot.

Table 3. Number of target fish captured by set line (SL), electrofishing (EF), and gill net (GN) at sites during fall and winter, 1994.

River/Delta	Site	Burbot		Northern pike			Longnose sucker		Flathead chub	
		SL	EF	SL	EF	GN	SL	EF	SL	EF
Peace River	PR1	10	0	0	4	-[a]	0	17	0	1
	PR2	9	1	1	2	-	0	8	4	0
	PR3	9	0	0	0	-	0	23	0	0
Smoky River	SR1	20	0	2	1	-	0	13	3	9
	SR2	0	-	0	-	-	1	-	0	-
	SR3	1	-	0	-	-	0	-	0	-
Wapiti River	WR1	4	0	2	10	-	0	13	0	5
	WR2	13	-	1	-	-	0	-	0	-
Little Smoky River	LSR1	0	1	1	0	-	0	6	0	1
	LSR2	1	-	0	-	-	0	-	0	-
Wabasca River	WB	9	0	0	0	-	0	0	1	0
Athabasca River	A1 a	4	0	3	1[b]	-	0	1		
	A1 b	11	0	0	0	-	0	0		
	A2	8	0	0	0	-	2	3		
	A3	23	0	0	0	-	0	0		
	A4	15	0	0	0	-	0	0		
	A5	21	0	0	0	-	0	0		
McLeod River	MR1	1	1	6	0	-	0	1		
	MR2	7	-	0	-	-	0	-		
Pembina River	P	7	-	1	2[c]	-	0	-		
Lesser Slave	LSV	21	0	0	0	-	0	0		
Clearwater River	CW	5	-	1	-	-	0	-		
Peace-Athabasca Delta	JV 1	0	-	1	-	-	0	-		
	JV 2	0	-	0	-	5	0	-		
Slave River Delta	SRD 1	5	-	2	-	-	0	-		
	SRD 2	16	-	3	-	1	0	-		
Total		**219**	**3**	**24**	**20**	**6**	**3**	**85**	**8**	**16**

[a] capture method not used
[b] caught angling
[c] caught angling; one escaped

Of the total number of fish caught, only 30% consisted of the three other target species. Northern pike were caught in both mainstem rivers and some tributaries and at both delta sites but in low numbers (Table 3). Most longnose suckers were caught in the Peace River drainage; they were caught at all sites electrofished except at the Wabasca River (Table 3). In the Athabasca River drainage, longnose suckers were caught only in the mainstem river and the McLeod River. Flathead chub were collected from all rivers sampled within the Peace River Drainage although they were not caught at all sites (Table 3).

Nine non-target fish species were found during the fall collections (Appendix C). Rainbow trout (*Oncorhynchus mykiss*) were caught only in the Athabasca River drainage, and Arctic grayling (*Thymallus arcticus*) were caught only in the Peace River (Appendix C). Bull trout (*Salvelinus confluentus*) were caught in the Smoky River, Wapiti River, and the Athabasca River upstream from Hinton. Goldeye *(Hiodon alosoides)* > 300 mm fork length (FL) were caught in the Peace River, Smoky River, and Peace-Athabasca Delta (Appendix C). Young-of-the-year goldeye were caught in the Wapiti River (average 72 mm FL) and at the Peace River Site PR3. One northern squawfish (*Ptychocheilus oregonensis*) was caught in the Little Smoky River. Walleye (*Stizostedion vitreum*) were caught at several sites in the Peace and Athabasca drainages. Only three non-target fish species were caught in the Peace-Athabasca Delta (Table 2). Non-target fish species were not caught at the Slave River Delta.

Some non-target fish species were tagged and released. Two bull trout *(Salvelinus confluentus)* were tagged with yellow NRBS tags and released in the Wapiti River. One burbot (241 g) was tagged and released (tag number 7903) in the Athabasca River. Twenty five bull trout were caught on set lines at Site SR2 on the Smoky River near Grande Cache (Appendix D). All fish appeared in poor condition and were tagged (yellow NRBS tags 013003 to 013027) and released immediately. They were not measured.

4.1 CATCH PER UNIT EFFORT

Most burbot were caught in the Athabasca River drainage (Table 2). The overall catch per unit effort was higher in the Athabasca River drainage (0.10 burbot/100 hook hours) than the Peace River drainage (0.08 burbot/100 hook hours). The highest catch per unit effort (0.29 burbot/100 hook hours) found was in the Slave River drainage.

Catch per unit effort varied with sampling method and sites for each fish species (Table 4, Appendix D). Most burbot (99%) were caught on set lines (Table 3). Only three burbot were caught electrofishing, and none were caught by gill net or angling. The highest catch rate for burbot was 0.61 burbot/ 100 hook hours at the Athabasca River Site A3. Catch rates were also high at Smoky River Site SR1, Athabasca River Site A4, Athabasca River Site A5, and at the Slave River Delta. Catch per unit effort was also high at the McLeod River Site MR2 which was sampled in December. Catch rates did not appear to be related to substrate type, habitat type (Appendix D), water temperature or velocity during this study. In general, catch rates were lower than those found by Hvenegaard and Boag (1993) in the Peace River, Smoky River, and Wapiti River in late October to mid-November.

Table 4. Catch per unit effort (CPUE) for target fish species caught by set line (number/ 100 hook hours) and electrofishing (number/100 seconds) during fall and winter 1994.

Site	Set Line CPUE				Electrofishing CPUE			
	BURB[a]	NRPK	LNSC	FLCH	BURB	NRPK	LNSC	FLCH
PR1	0.07			0.04		0.12	0.52	0.03
PR2	0.09	0.01			0.01	0.05	0.09	
PR3	0.06						0.50	
SR1	0.44	0.04		0.07		0.01	0.15	0.10
SR2			0.01					
SR3	0.09							
WR	0.11	0.02				0.13	0.17	0.07
LSR1	0.14	0.01			0.05	0.05	0.30	0.05
LSR2								
WB	0.06			0.01				
A1	0.08	0.02					0.06	
A2	0.02		0.01				0.07	
A3	0.61							
A4	0.36							
A5	0.13	0.01						
MR1	0.01	0.04			0.05		0.05	
MR2	0.49							
P	0.14	0.02	0.02					
LSV	0.17							
CW	0.04	0.01						
JV		0.03						
SRD	0.29	0.08						

[a] BURB - burbot; NRPK - northern pike; LNSC - longnose sucker; FLCH - flathead chub

Northern pike were present but scarce at some of the sites sampled in the fall (Appendix B). Pike were not caught at four of the five sites in the Athabasca River, the McLeod River, the Lesser Slave River, and the Wabasca River. Electrofishing and set lines caught approximately equal numbers of pike (Table 2). Catch rates for northern pike using set lines was highest at the Slave River Delta (Table 4). Electrofishing was most successful at the Peace River near Many Islands and at the Wapiti River site.

Gill nets were used successfully at the Peace-Athabasca Delta and Slave River Delta sites to catch northern pike. Catch rates for northern pike were higher in the shallow, warmer, slower velocity water in Jackfish Creek (1.7 fish/100m^2/hour) than at the mouth of the Nagle Channel (0.7 fish/100m^2/hour) (Appendix D).

Most longnose sucker were caught by electrofishing (Table 3). Catch per unit effort was higher at all Peace River sites than the Athabasca River drainage (Table 4). More suckers were caught in the Athabasca River during sampling in fall 1992 at sites upstream from Whitecourt (Barton *et al.* 1993b).

Flathead chub were scarce or absent from sites sampled in the Peace River Drainage in the fall (Appendix D). Both electrofishing and setlines caught flathead chub, although only half as many were caught with set lines.

4.2 POPULATION CHARACTERISTICS

The length-frequency distributions of burbot from the three river drainages were similar, all peaking at 500 mm (Figure 3). Burbot caught in the Peace River Drainage ranged from 279 to 804 mm total length (TL). Those in the Athabasca River drainage ranged from 310 to 843 mm TL. Length-at-age of burbot is shown in Table 5. Length-age relationships were similar for the sites sampled within each drainage (Figure 4 and 5). Length-weight relationships of burbot were also similar for all sites sampled within each drainage (Figure 6 and 7). However, burbot caught at the Slave River Delta were heavier at any given length than burbot from the Peace River and Athabasca River drainages (Figure 7). Condition factor (CF) was also higher for burbot from the Slave River Delta (CF = 0.60, N = 20, SD = 0.09) than burbot from the Peace River drainage (CF = 0.50, N = 78, SD = 0.05) and the Athabasca River drainage (CF = 0.50, N = 116, SD = 0.09).

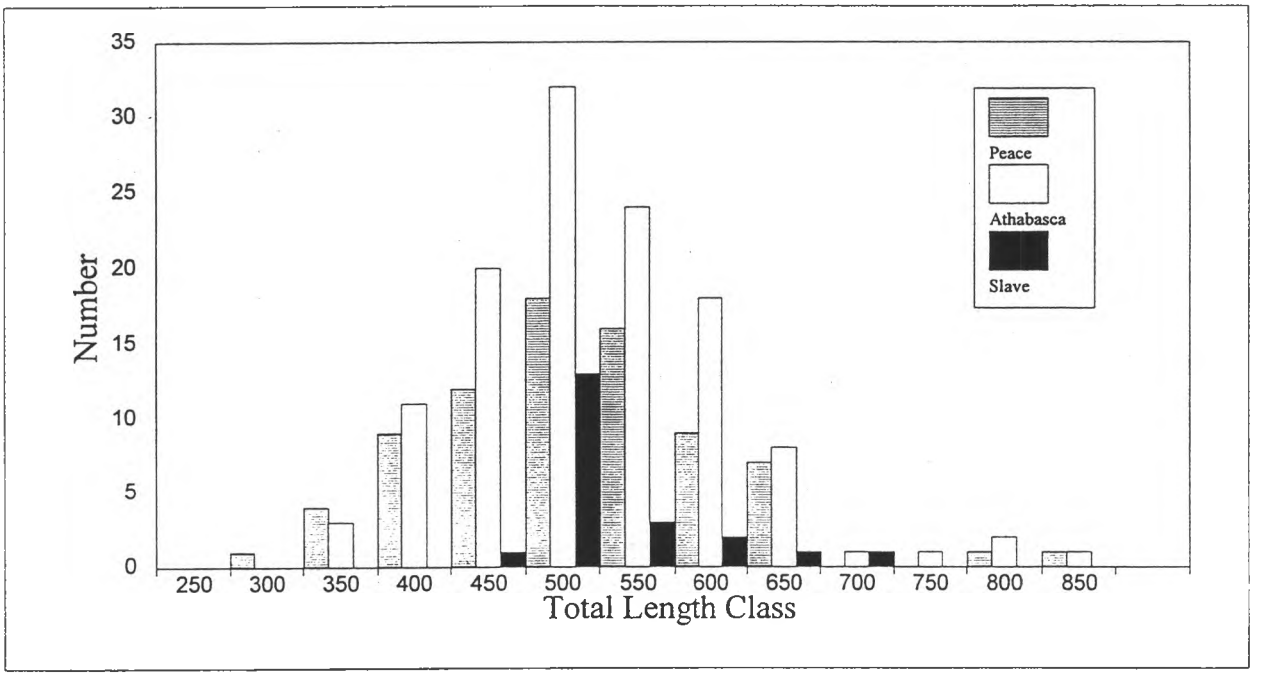

Figure 3. Total length-frequency distribution of burbot caught in the Peace River, Athabasca River, and Slave River drainages.

Table 5. Total length (TL)-at-age (mm) of burbot collected from the Peace River, Athabasca River, and Slave River drainages.

Age	Peace River						Athabasca River						Slave River					
	Female			Male			Female			Male			Female			Male		
	TL	N[a]	SD[b]	TL	N	SD	TL	N	SD	TL	N	SD	TL	N	SD	TL	N	SD
3							343	2	31	420	2	43						
4	350	4	24	369	2	17	433	5	19	448	7	56						
5	350	2	30	395	1		426	8	35	453	9	39						
6	443	7	59	453	4	37	462	5	35	464	5	51						
7	492	8	69	488	9	51	513	16	57	513	10	47	482	1		473	4	27
8	532	8	60	483	4	61	550	5	57	506	6	37	558	2	18	476	6	30
9	566	4	68	473	3	24	589	5	28	484	5	40	490	2	0			
10	599	2	62	497	2	22	554	5	38	521	3	6	495	2	30			
11	613	2	13	514	4	40	625	4	80	582	3	35	598	1				
12	540	4	31	570	1		564	2	8	787	1							
13				659	2	46	806	2	38				642	1				
14													695	1				

[a] N - sample size

[b] SD - standard deviation

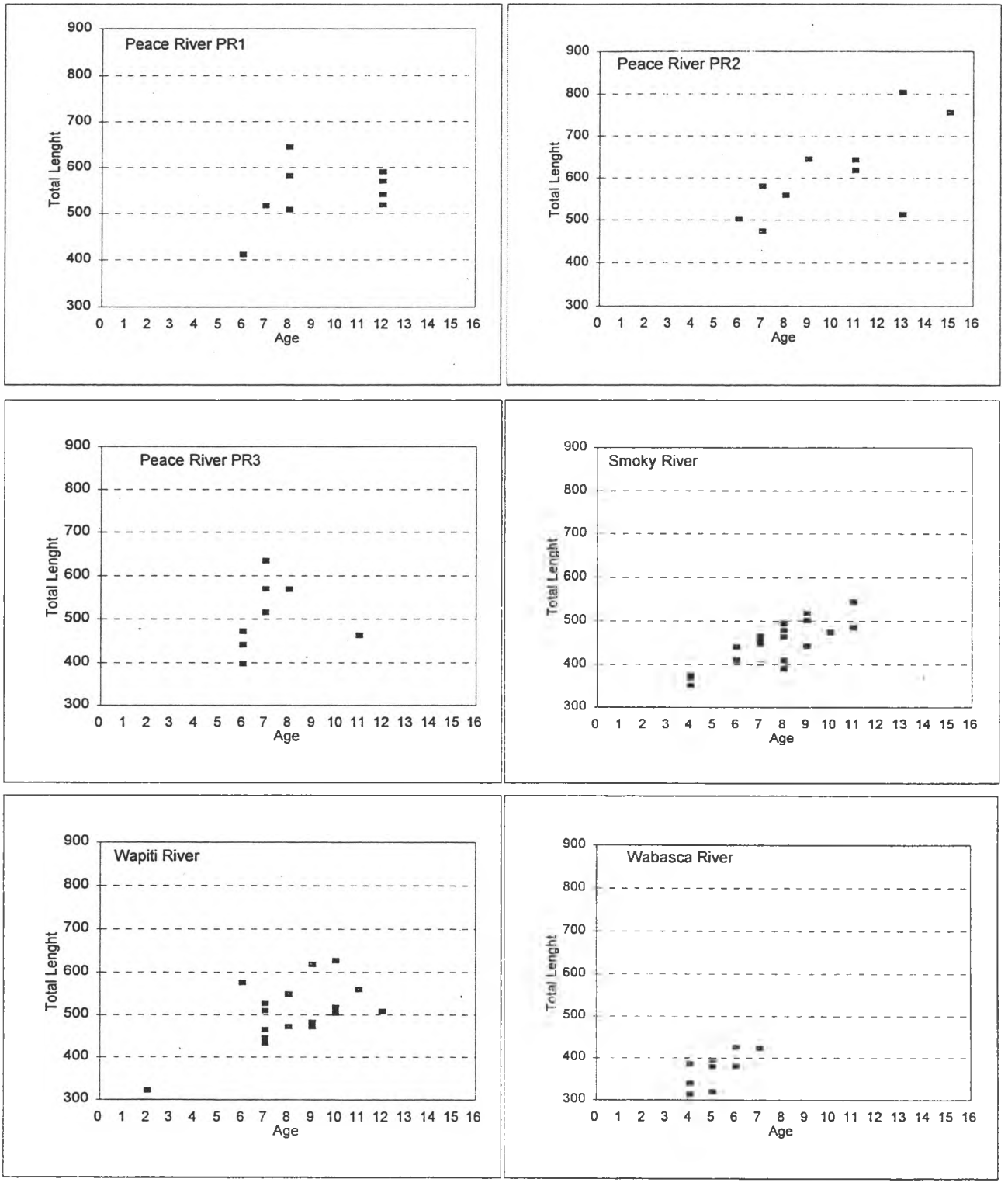

Figure 4. Total length-at-age relationships of burbot caught at sites within the Peace River Drainage.

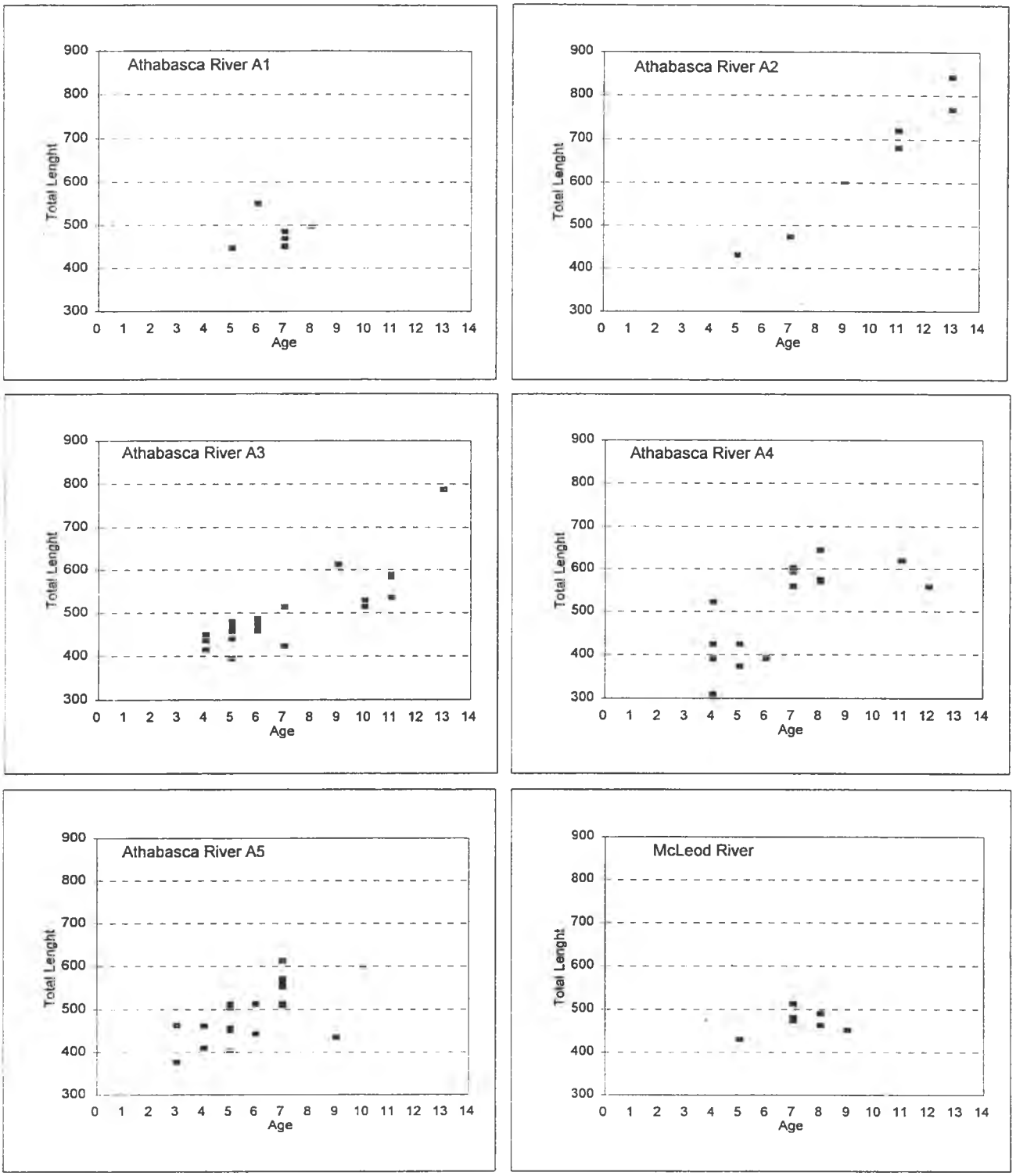

Figure 5. Total length-at-age relationships of burbot caught at sites within the Athabasca River Drainage and the Slave River Delta.

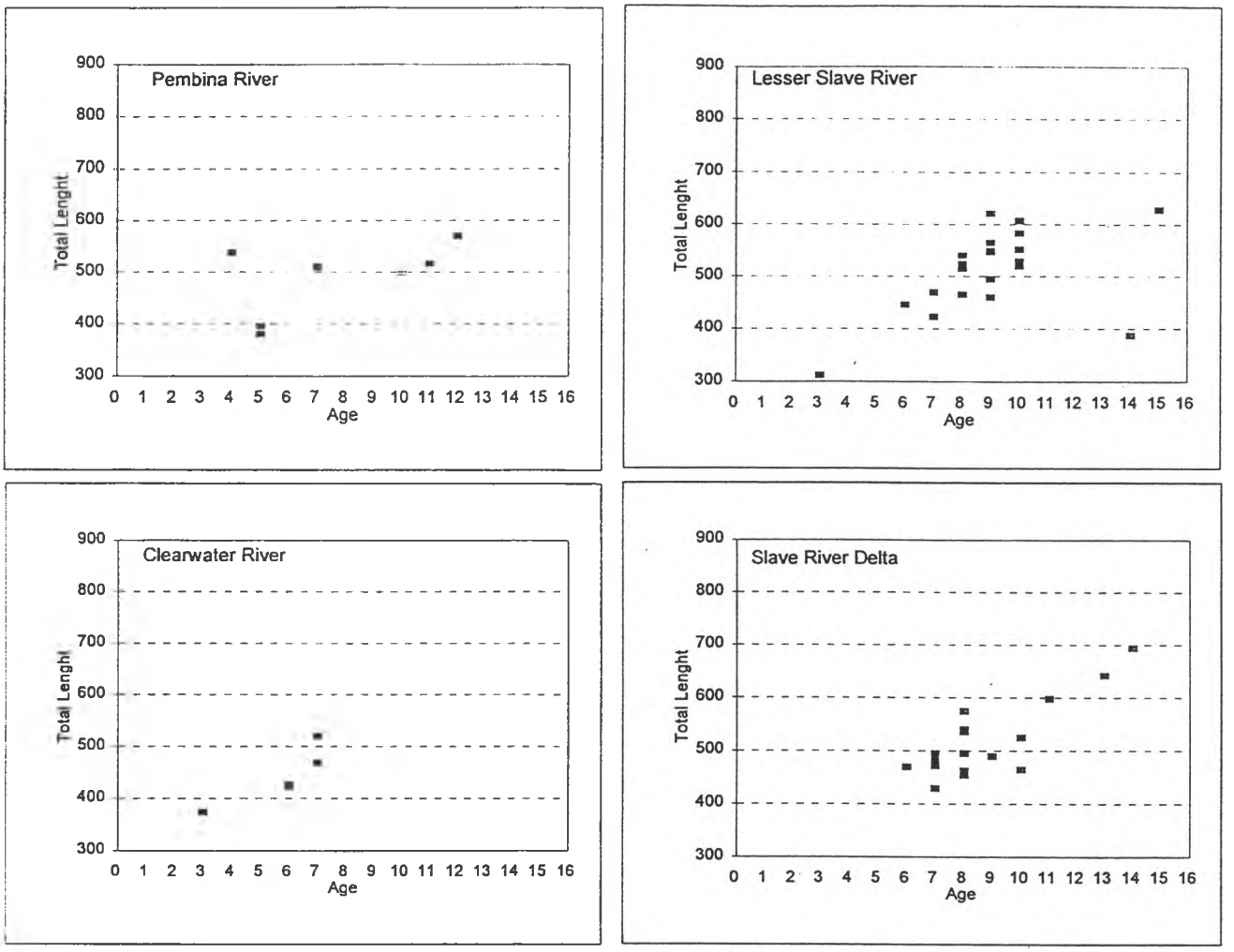

Figure 5. Concluded.

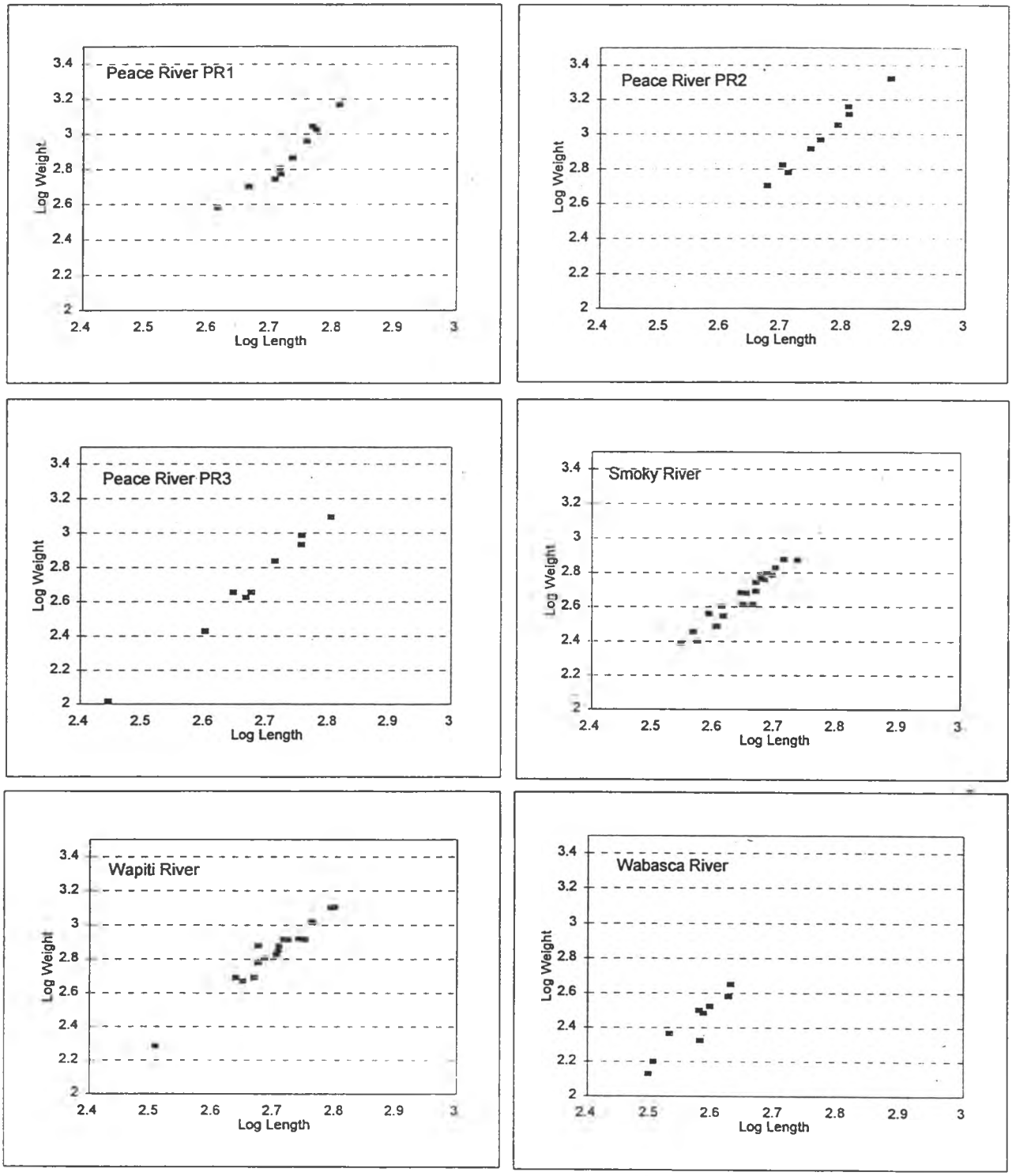

Figure 6. Total length-weight relationships of burbot caught in the Peace River Drainage.

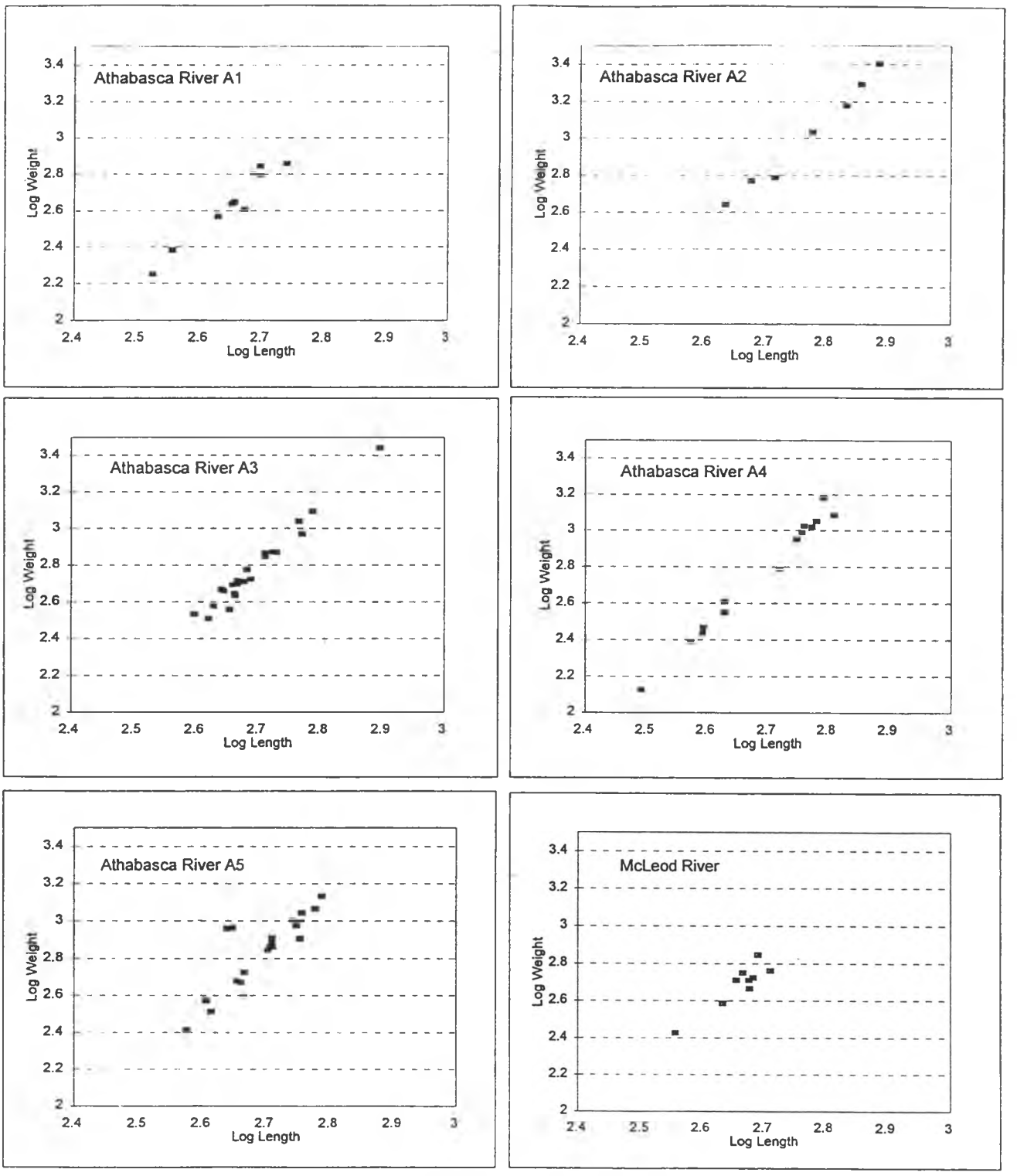

Figure 7. Total length-weight relationships of burbot caught in the Athabasca River Drainage and the Slave River Delta.

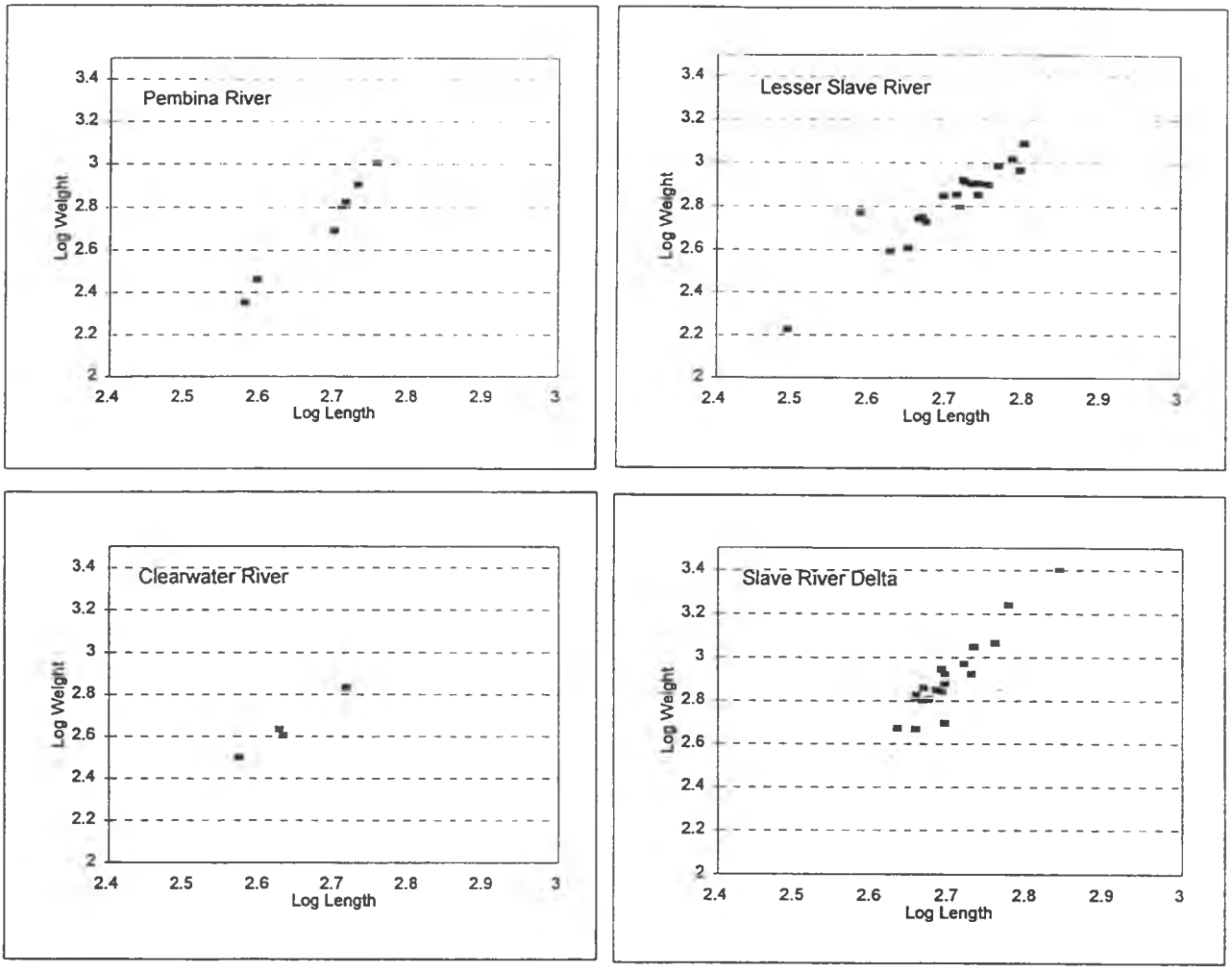

Figure 7. Concluded.

Northern pike sampled from the Peace and Athabasca River drainages ranged from 255 to 710 mm FL (Figure 8). Northern pike collected from the Peace River Drainage were smaller at ages 2 to 5 than those collected at sites in the Athabasca River Drainage (Table 6). Growth of pike caught in the Peace River and Athabasca River drainages appeared similar (Figure 9). Length-weight relationships were similar (Figure 10). Condition factor was similar for all pike caught (mean CF = 0.68, N=39) (Appendix B).

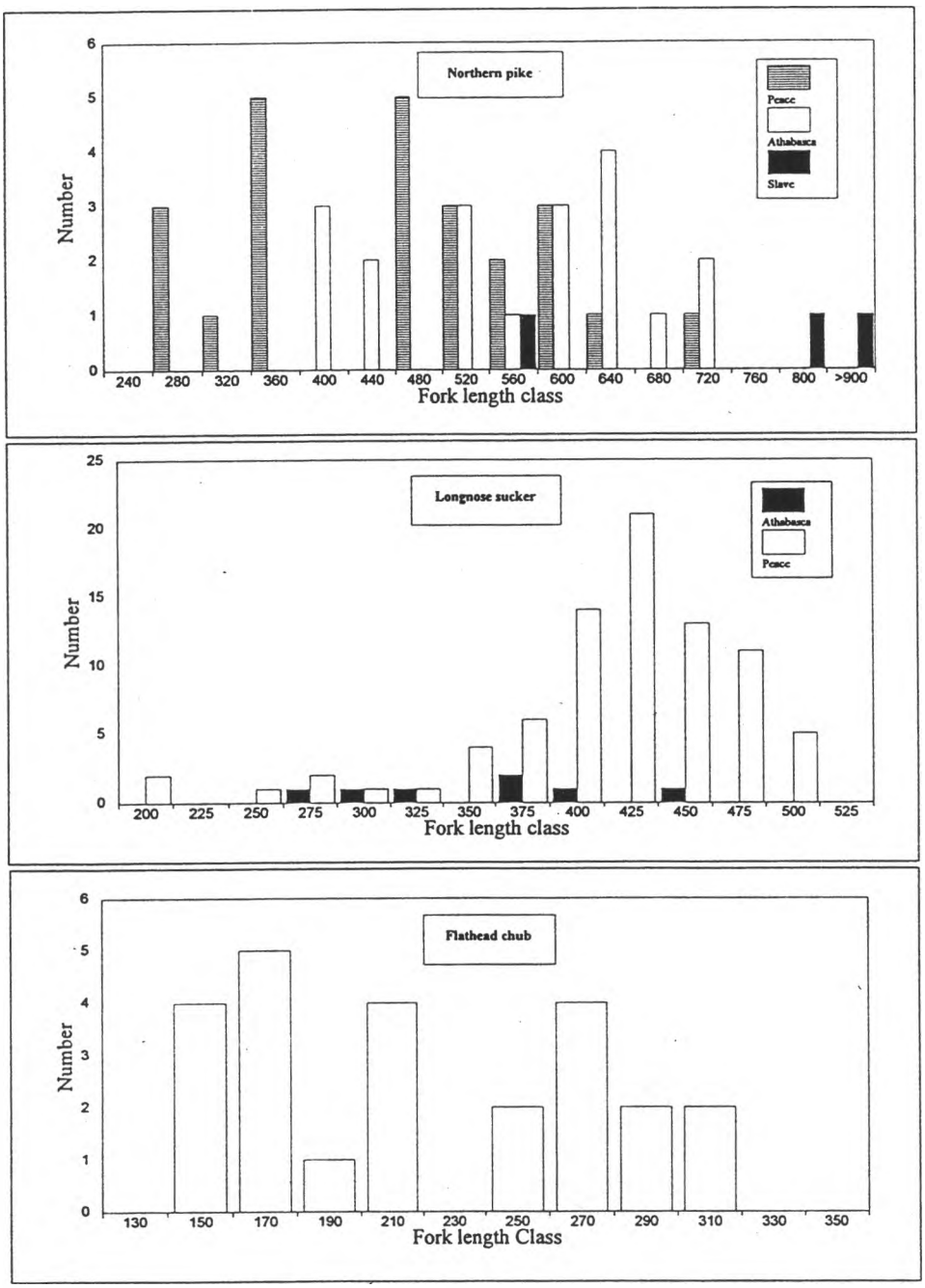

Figure 8. Fork length-frequency distributions of northern pike, longnose sucker, and flathead chub collected during fall 1994.

Table 6. Fork length-at-age (mm) of northern pike collected from the Peace River and Athabasca River drainages.

Age	Peace River			Athabasca River		
	FL	N	SD	FL	N	SD
2	382	2	12	321	5	37
3	470	5	29	414	5	52
4	570	5	23	519	8	46
5	625	1		600	2	10
6						
7	663	2	33			
8	705	1				

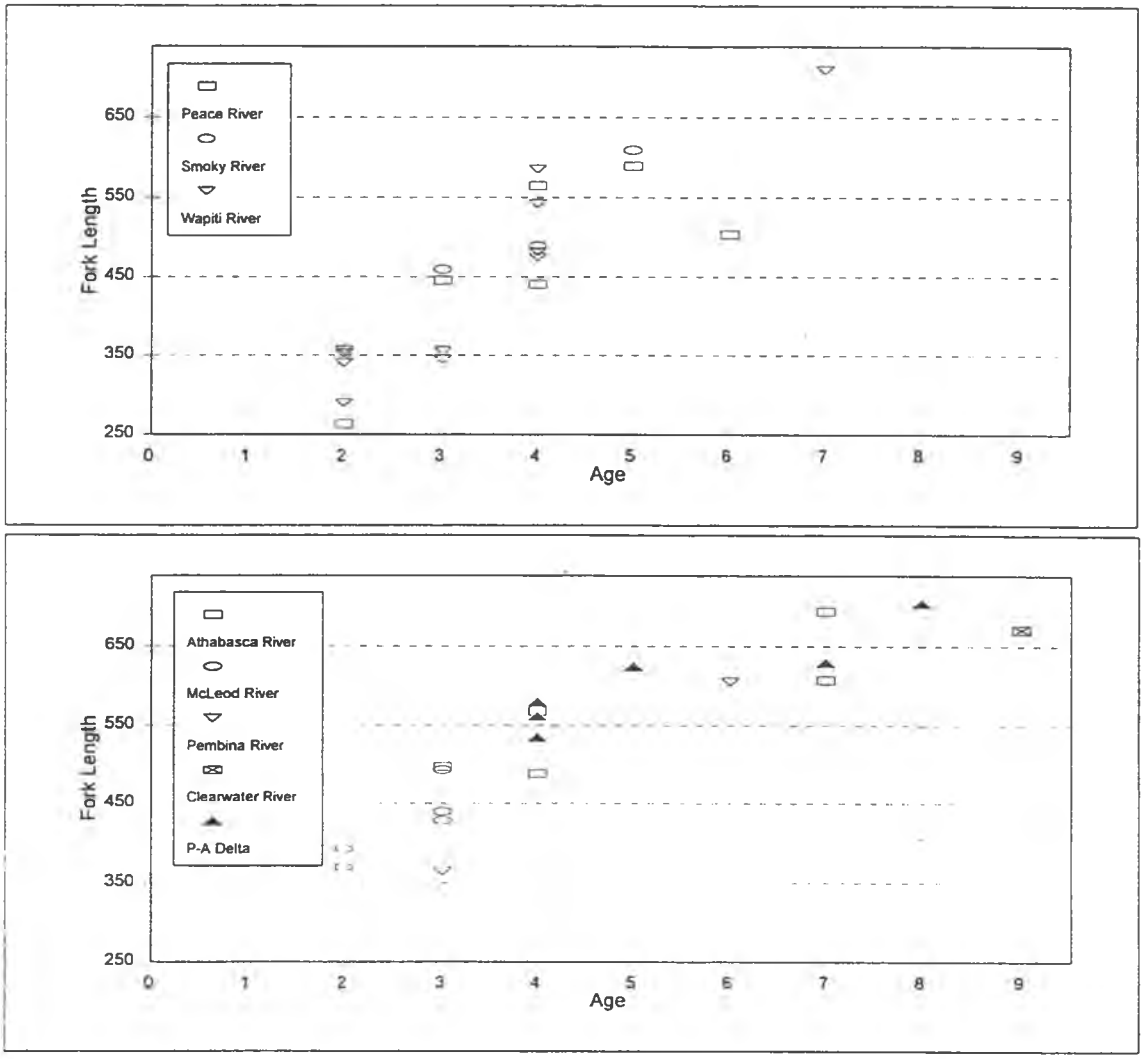

Figure 9. Fork length-at-age relationships of northern pike caught at sites in the Peace River and Athabasca River drainages.

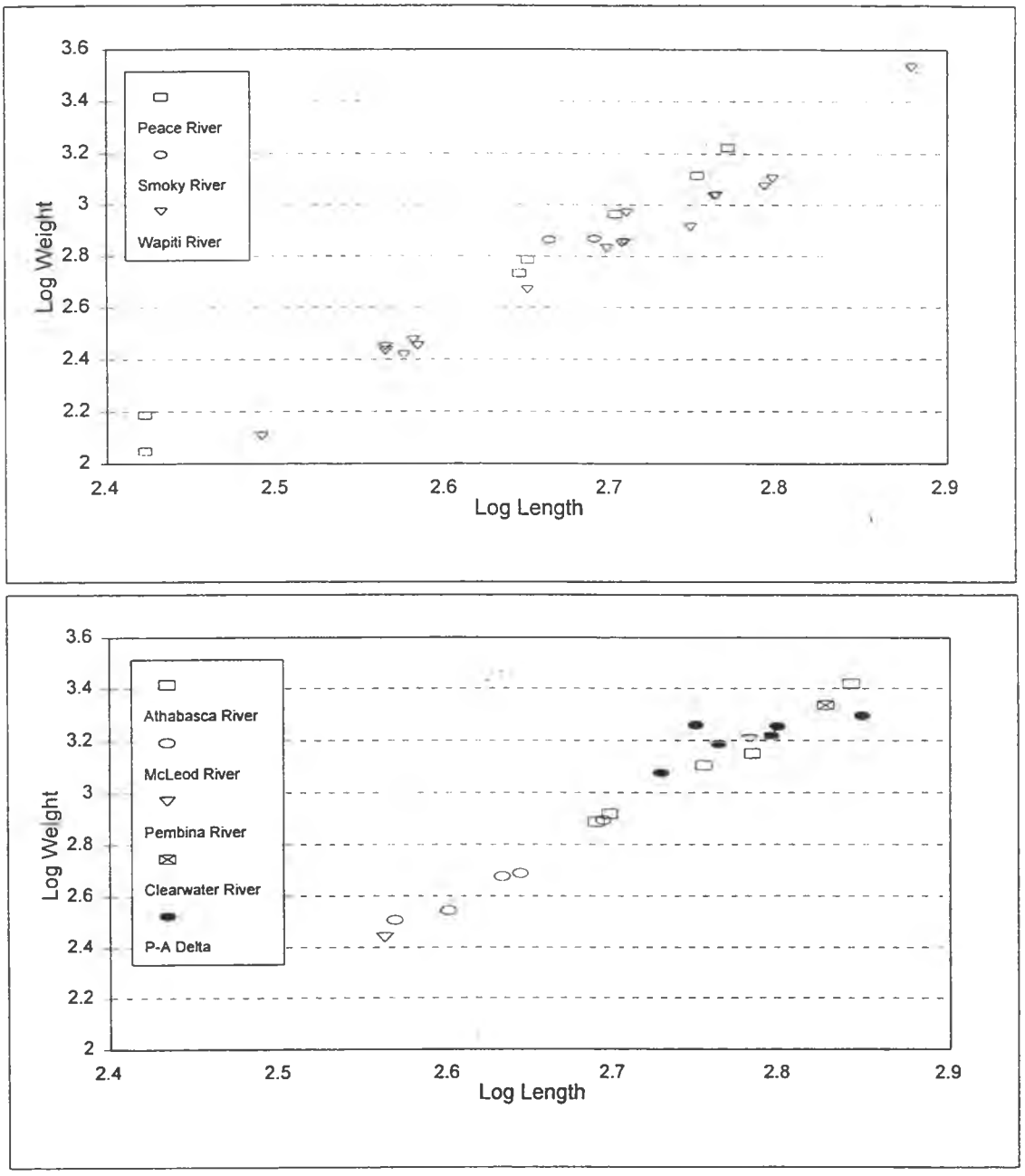

Figure 10. Fork length-weight relationships of northern pike caught at sites in the Peace River and Athabasca River drainages.

Longnose sucker sampled from the Peace River drainage ranged from 196 to 500 mm FL (Figure 11). Although only a few longnose suckers were caught in the Athabasca River, those sampled were smaller at all ages than those from the Peace River Drainage (Figure 11, Table 7). Growth of longnose sucker from the Wapiti River and the Peace River was similar (Figure 11). Condition factor and length-weight relationships of longnose sucker were similar for the Peace River and its tributaries and the Athabasca River (Figure 12, Appendix B).

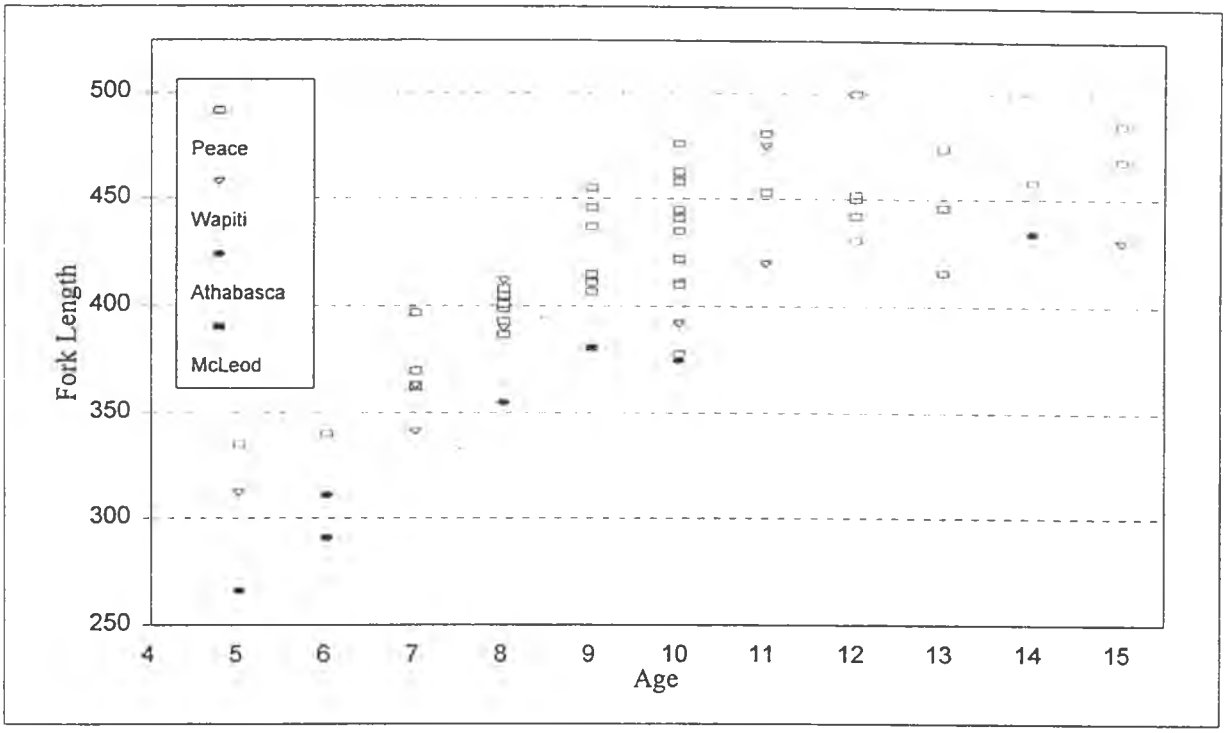

Figure 11. Fork length-at-age relationships of longnose sucker caught at sites in the Peace River and Athabasca River drainages.

Table 7. Fork length-at-age (mm) of longnose sucker collected from the Peace River and Athabasca River drainages.

Age	Peace River						Athabasca River	
	Females			Males			Sexes combined	
	FL	N	SD	FL	N	SD	FL	N
5				335	1		266	1
6							301	2
7	377	3	15	363	2	1		
8	398	6	9	389	5	24	355	1
9	430	6	17	424	3	16	381	1
10	441	7	28	410	3	26		
11	451	3	25	446	2	30		
12	455	5	24					
13	460	2	14					
14							434	1
15	461	3	23					

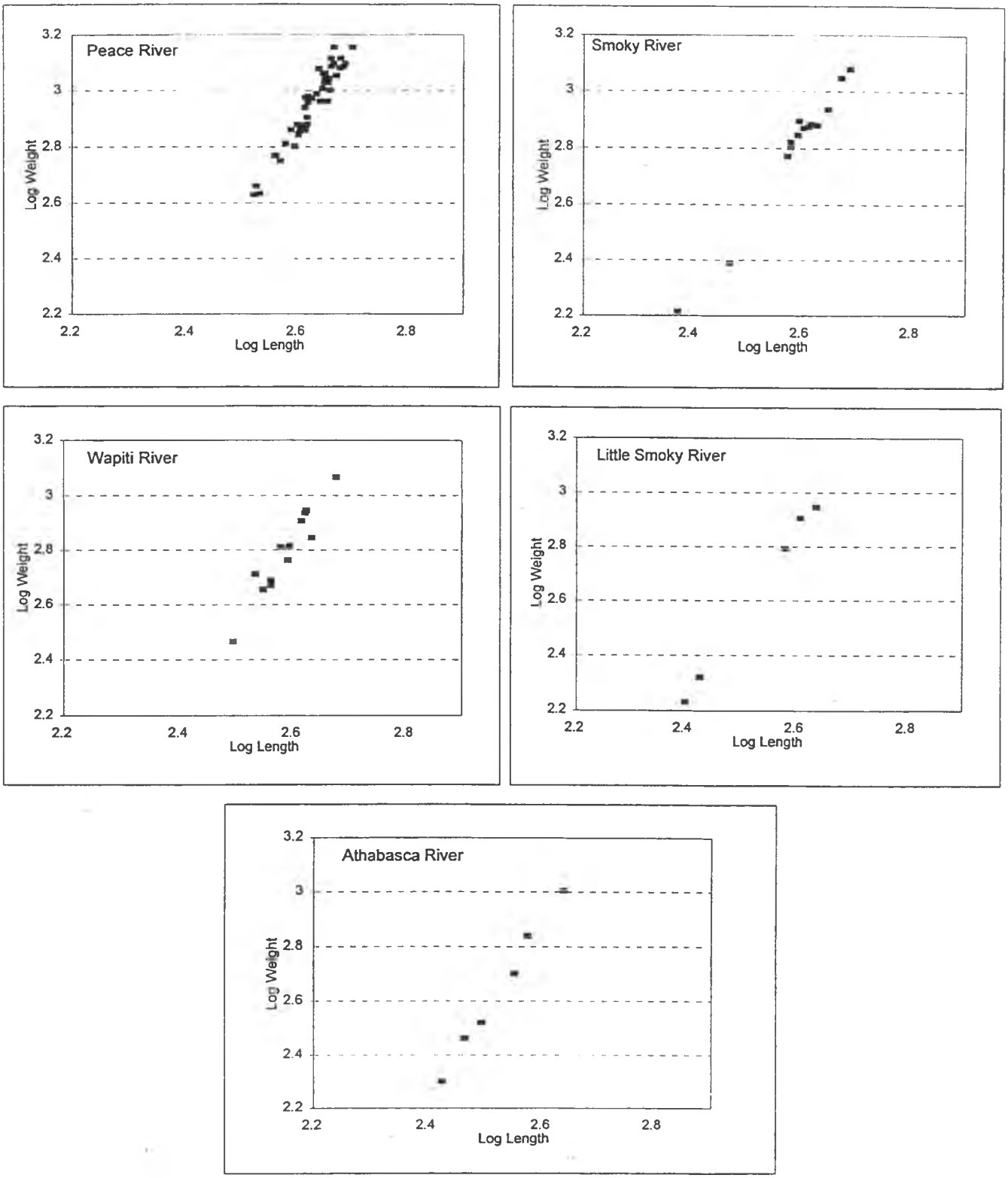

Figure 12. Fork length-weight relationships of longnose sucker caught at sites in the Peace River drainage and the Athabasca River.

Flathead chub caught ranged from 132 to 300 mm FL (Figure 7) and from age 3 to age 8 (Table 8, Figure 13). Condition (CF = 0.97, N=19) and length-weight relationships were similar for flathead chub caught at the Peace River, Smoky River, and Wapiti River sites (Figure 14).

Table 8. Fork length-at-age (mm) of flathead chub collected from the Peace River Drainage.

Age	Fork Length	Number	SD
3	147	6	11
4	186	3	16
5	200	2	0
6	263	2	2
7	273	2	3
8	272	5	23

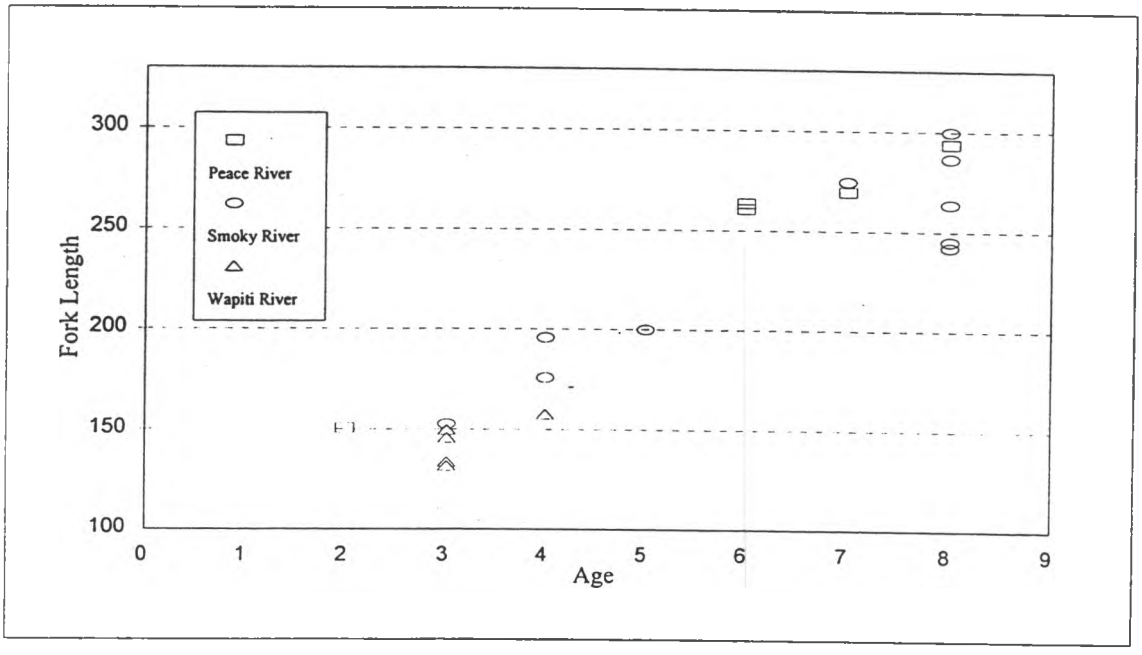

Figure 13. Fork length-at-age relationship of flathead chub collected from the Peace River drainage.

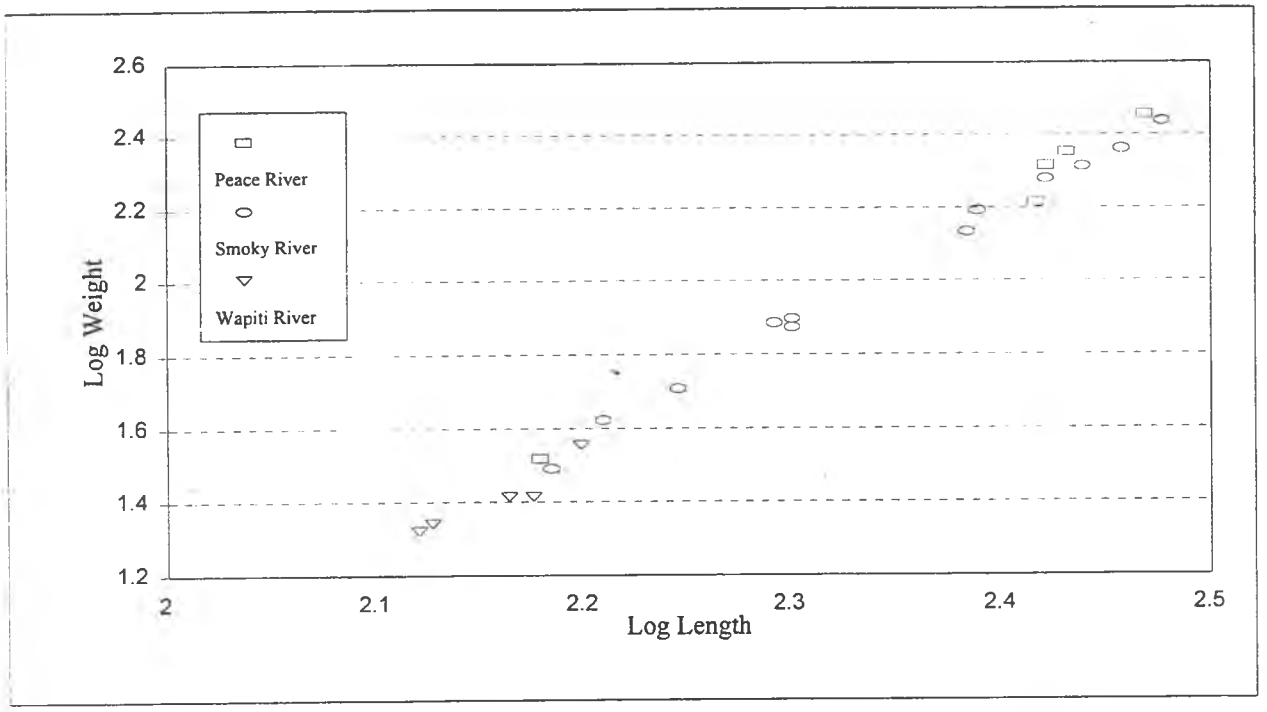

Figure 14. Fork length-weight relationship of flathead chub collected from the Peace River drainage.

4.3 GROSS PATHOLOGY

Most of the fish examined externally and internally appeared normal. Only 16% (n=84/535) exhibited external and internal abnormalities or physical deformities (Table 9, Appendix E). The most commonly observed external abnormalities were tumours and lesions associated with the skin or fins. Internal abnormalities were most commonly associated with the liver (abnormal colour).

Table 9. Number of fish with external and internal gross pathological abnormalities.

Species	Total Number	Abnormalities					
		Number	External			Internal	Other[a]
			Wounds	Lesion/tumour	Eye		
Burbot	222	23	3	3	3	7	7
Northern pike	50	12	4	5	0	2	1
Longnose sucker	88	40	2	26		11[b]	1
Flathead chub	24	2	0	1	0	1[c]	
Bull trout	40	4	1	1			2
Mountain whitefish	12	1					1
Walleye	55	1				1[c]	
White sucker	16	1		1			

[a] includes colour, deformities, haemorrhages
[b] excessive fat, parasites
[c] parasite

Both open and closed wounds were observed on fish captured. Some open wounds and haemorrhages were caused by set lines injuries (Appendix E). Closed wounds and some physical deformities may have resulted from predators. Photographs of the external pathological aberrations were included in a separate volume.

Twenty-three burbot had notable external and internal abnormalities (Table 9). Only three had tumours. The most common internal abnormality observed was mottled colour liver. Other abnormalities included wounds, deformities (missing eye and deformed fins), and pale gills caused by blood loss.

Longnose sucker had more pathological disorders than did other fish species (Table 9). Approximately half of the suckers examined had some type of abnormality. Most commonly, the fish had tumours or lesions. Some had necrotic gills. Internal abnormalities were not observed other than parasites and excessive fat (in seven females) (Appendix E). The "sickest" fish was a longnose sucker caught in the Wapiti River which had a cranial infection, tumours, a blind eye, and an inflamed lower lip.

Fish with pathological abnormalities other than wounds were found at 11 sites. Most fish with abnormalities were caught in the Peace River and its tributaries where most longnose suckers were caught (Table 3). The Wapiti River upstream from Grand Prairie, the Smoky River downstream from the confluence of the Wapiti River, and the Peace River near Fort Vermilion had the most fish, primarily suckers, with the highest frequency of tumours and lesions. The seven longnose sucker caught in the Athabasca River and McLeod River had no abnormalities. No pathological aberrations were recorded from burbot sampled in the Lesser Slave River, McLeod River, Pembina River, Clearwater River and the Athabasca River Site A3. Northern pike caught in the McLeod River, Pembina River, Clearwater River, and Peace-Athabasca Delta had no abnormalities.

4.4 DIET

Approximately half of the burbot stomachs examined contained contents (Table 10, Appendix F). Burbot had eaten invertebrates and white sucker (*Catostomus catostomus)*, trout perch (*Percopsis omiscomaycus*), walleye (*Stizostedion vitreum*), brook stickleback (*Culaea inconstans*), goldeye, and yearling burbot. Burbot sampled during the fall from the Clearwater, Lesser Slave and Wabasca rivers had fed predominantly on stonefly nymphs. Burbot collected from the McLeod River in mid-December contained perlodid stonefly and hydropsychid caddisfly nymphs. Some stomachs also contained sand and pebbles suggesting that burbot at this site fed under ice and inhaled dislodged invertebrates and small particles of substrate. This phenomenon was not reported from the other sites in the fall.

In total 38% of the northern pike stomachs sampled contained contents. Their diet was predominantly fish. White sucker, burbot, goldeye, and flathead chub were found in stomachs. Invertebrates were not identified as part of the stomach contents of any northern pike examined. One small rodent was found in a pike caught in the Wapiti River.

Table 10. Stomach contents of target fish species caught in the Peace River, Athabasca River, and Slave River drainages.

Species	River/Delta	Number of fish	Number of Stomachs Containing:					Empty Stomachs
			Fish	Bait	Insects	Chyme	Other[a]	
Burbot	Peace	20	10			2	1	7
	Smoky	21		4	1	1		15
	Wapiti	17	6					11
	Little Smoky	2	1		1			0
	Wabasca	9	1		7			1
	Athabasca	75	15	10	6	1	2	41
	McLeod	8	2	3	2			1
	Pembina	6	1	1	2			2
	Lesser Slave	21	2	3	4			12
	Clearwater	5			5			0
	Slave	21	2				2	17
	Total	205	40	21	28	4	5	107
Northern pike	Peace	7	3					4
	Smoky	3	1					2
	Wapiti	13	6					7
	Athabasca	5				1		4
	McLeod	4		1				3
	Pembina	2					1	1
	Clearwater	1	1					0
	Peace-Athabasca	4						4
	Slave	3	1				1	1
	Total	42	12	1	0		2	26
Longnose sucker	Peace	45			20	20	1	4
	Smoky	11	1		3			7
	Wapiti	13			5		2	6
	Little Smoky	6					2	4
	Athabasca	6	2				2	2
	McLeod	1					1	0
	Total	82	3	0	28	20	8	23
Flathead chub	Peace	3			1			2
	Smoky	11		1		1		9
	Wapiti	5			1			4
	Little Smoky	1						1
	Wabasca	1					1	0
	Total	12	0	1	2	1	1	16

[a] Includes unidentified items, leaves, sand, and small rodents.

Corixid beetles dominated the identifiable diet of longnose suckers sampled in the Peace River and Athabasca River drainages in the fall (Appendix F). Of the 82 stomachs examined, 72% contained contents dominated by mayfly and caddisfly larvae. Sand particles and pieces of detritus were also relatively common. Exoskeletons of corixid beetles were common in stomachs by October. Corixids were abundant in shallow backwater and snye habitat.

Most flathead chub examined had empty stomachs (Table 10). Invertebrates identified in stomachs were mayfly, stonefly and caddisfly nymphs.

4.5 HABITAT

Backwater and snye habitats were sampled extensively for target species as recommended by Hvenegaard and Boag (1993). Although set lines also were set in other habitats, most burbot were caught on those set in backwater areas (Table 11, Appendix D). Burbot were also caught on lines set in snyes and along eddy lines. Most of these were shallow areas with cobble, gravel, and sand substrate (Table 11). Aerial photographs of sites fished are presented in Appendix G. Catch rates of burbot did not appear to be related to water temperature, velocity or other water quality parameters (Table 12).

Longnose sucker tended to be most common along the downstream edge of point bars and the backwater areas created immediately downstream of islands and point bars in the Peace River near Fort Vermilion and near Notikewin Provincial Park.

Table 11. General habitat characteristics of set line sites.

River/Delta	Site	Bottom Type	Channel Type	Banks	Habitat of Set Lines with Burbot	Comments
Peace	PR1	silt/sand and gravel	multiple islands	stable	backwater < 2 m deep	
	PR2	cobble/silt and gravel	unobstructed	depositional sand	backwater, snye	some depositional
	PR3	gravel/cobble/sand	single islands	armoured stable	backwater < 2 m deep	deep pool under bridge
Smoky	SR1	silt/cobble		unstable, slumping	backwater, pool, mud flat	
	SR2					
	SR3				shallow run	
Wapiti	WR1	silt and cobble, some boulders	run, some islands backwater no flow		backwater < 2 m deep	cobble/silt near island
	WR2	cobble/silt/boulder	some islands		backwater, run < 2 m deep	cobble/silt near island
Little Smoky	LSR1	cobble/silt	some pools			
Wabasca	WB1				backwater, run < 2 m deep	
Athabasca	A1 a	cobble/sand/silt	cobble sand bars/ islands u/s bridge unobstructed d/s bridge	armoured/stable	backwater, run < 2 m deep	mostly run/riffle
	A1 b	cobble/sand	unobstructed	armoured/stable	run < 1.5 m deep	
	A2	sand/some cobble	unobstructed/ few single islands	stable/erosional	backwater < 2m, some pools	some deep backwaters
	A3	cobble/gravel	unobstructed/ few single islands	cobble/stable	backwater < 1.5 m deep	
	A4	cobble/sand and mud	unobstructed	stable	backwater < 2 m deep	
	A5	gravel/sand	unobstructed	stable	backwater < 1.5 m deep	some cobble sand bars
McLeod	MR1	cobble/sand	multiple islands, straight flow	stable/some erosional	run < 1.5 m deep	some deep holes
Pembina	P	sand/mud	unobstructed	mud/erosional	run < 1 m deep	turbid
Lesser Slave	LSV	sand/mud, some cobble	unobstructed/ few single islands	erosional	eddy line, run < 1.5 m deep	brown water
Clearwater	CW	sand/some cobble	unobstructed/ few single islands	erosional	backwater 1 to 2 m deep	some deep holes
Peace-Athabasca	JV	sand/silt	Delta channel, flat, > 10 m deep	depositional		burbot have been caught
Slave	SRD1	sand/silt	unobstructed channel	depositional/erosional	> 2 m deep	high velocity, turbid
	SRD2	sand/silt	mouth of Nagle Channel	depositional/erosional	> 5 m deep	turbid

Table 12. Burbot catch per unit effort (CPUE, number/100 hook hours), water quality, temperature and velocity measurements at sites sampled in the Peace River, Athabasca River and Slave River drainages during fall 1994.

Site	CPUE	Temperature (°C)		pH	Total Alkalinity ($CaCO_3$) (mg/L)	Conductivity (µohms/cm)	Mean Velocity (m/s) (Mean depth[a] m)	
		Start	Finish				Backwater[b]	Mainstem
Peace River PR1	0.07	11.5	11.0	6.7	91	200	0.11 (0.42)	0.25 (1.00)
Peace River PR2	0.09	11.0	11.0	7.0	136	361	0.00 (0.69)	0.38 (0.39)
Peace River PR3	0.06	11.5	11.0	6.8	102	229	0.14 (0.63)	0.59 (0.63)
Smoky River SR1	0.44	17.0	17.0	7.1	146	349	0.18 (0.66)	0.62 (0.51)
Smoky River SR2	0	5.0	5.0	7.0	99	352	0.08 (0.57)	0.77 (0.31)
Wapiti River WR1	0.06	4.0	4.0	7.4	147	321	0.01 (0.53)	0.37 (0.63)
Little Smoky River[c]	0	16.5	17.5	N/A	N/A	N/A	0.28 (0.26)	0.28 (0.41)
Wabasca River	0.08	8.0	8.0	7.0	127	321	0.18 (0.41)	0.78 (0.52)
Athabasca River A1	0.08	13	13	8.0	191	381	0.35 (1.00)	0.95 (0.68)
Athabasca River A2	0.02	12.5	12.5	6.6	91	254	0.00 (1.00)	0.51 (0.60)
Athabasca River A3	0.61	11.5	11.5	7.0	118	297	0.35 (0.42)	0.64 (0.60)
Athabasca River A4	0.36	7.0	7.0	7.1	115	279	N/A	0.60 (0.70)
Athabasca River A5	0.13	6.0	6.0	7.0	119	301	N/A	0.66 (0.70)
McLeod River	0.01	12	12	7.2	166	326	N/A	0.21 (0.60)
Pembina River	0.14	8.5	8.5	7.6	192	405	N/A	0.40 (0.66)
Lesser Slave River	0.17	8.5	8.5	6.7	96	200	N/A	0.72 (0.48)
Clearwater River	0.04		4.5	6.6	71	287	0.29 (0.62)	N/A
Peace-Athabasca Delta	0	12	14	6.9	N/A	118	0.89	
Slave River Delta	0.29	5.8	5.8	7.1	N/A	130		

[a] Mean of measured depths

[b] Represent the average of three random measurements of velocity at each site.

[c] Water sample bottle broken in transit.

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6.0 APPENDICES

APPENDIX A. TERMS OF REFERENCE

NORTHERN RIVER BASINS STUDY

TERMS OF REFERENCE

Project 3144-D1: Basin-Wide Fall Burbot Collection

I. Introduction

Burbot have been selected as a sentinel species (Environment Canada and Department of Fisheries and Oceans 1993) by the Northern River Basins Study (NRBS) for monitoring the effects of contaminants from developments within the northern river basins. Burbot have been selected as a sentinel species for the following reasons:

1. they have large livers containing a high percentage of lipids, which tend to accumulate chlorinated organic compounds (Muir *et al.* 1990);

2. they are distributed throughout the northern river basins, including upstream reaches not affected by point-source contaminants, and are relatively easy to catch (Paetz 1984, Wallace & McCart 1984, Swanson 1992, Hvenegaard & Boag 1993, Boag 1993; R. L. & L 1994a);

3. they tend to be more sedentary than other fish species and within the northern river basins appear to only make relatively short spawning migrations in mid-winter (R. L. & L./EMA 1985, Berry 1986, McLeod and Clayton 1993, Clayton and McLeod 1994, T. Boag unpublished data);

4. burbot livers are frequently consumed by native populations (Lockhart & Metner 1992);

5. burbot have previously been collected from the Peace and Athabasca rivers for contaminant and biochemical analyses (Swanson 1992, Hvenegaard & Boag 1993, Alberta Fish and Wildlife Division unpublished data, L. Lockhart pers. comm.);

6. burbot have also been collected for biochemical and contaminant analyses from the MacKenzie River in response to fish tainting concerns raised by local residents

(Morgan *et al.* 1987, Hrudey & Associates Ltd. 1988, Muir *et al.* 1990, Lockhart & Metner 1992) and from the Slave River (Slave River Monitoring Programme unpublished data);

7. burbot are at the top of the food chain and can provide an indication of biomagnification of contaminants through the food chain; and,

8. recent ecological studies have been carried out on burbot in Alberta (Boag and MacKay in prep. a & b).

Since the last major collections of burbot and other fish species, for contaminant and biochemical analyses, were carried out by the NRBS and other government agencies, pulp mills within the northern river basins have undergone major process changes. These changes should lead to reduced organochlorine levels in the aquatic environment. The purpose of this project is therefore to collect additional numbers of burbot from the Peace, Athabasca and Slave river systems to determine if contaminant levels are dropping in this species and what effects contaminants are having on burbot populations. The sampling and handling protocols for the burbot collection have been designed to allow for a wide-range of contaminant and biochemical analyses including: gross pathology, contaminants, hepatic MFO induction, retinols, metallothionein, sex steroids and gonad morphology, life history information and population (catch per unit effort) data. The information provided from these studies will help to answer questions regarding the fate and effect of contaminants in the aquatic environment (NRBS Study Board Questions 1a, 4a, 4b, 8, 13b & 14) and will assist in the development of a long-term ecosystem monitoring program for the northern river basins.

The study design for this project calls for the collection of fish at sites distributed throughout the Peace, Athabasca and Slave river basins. Collections will be made in reference areas located upstream of effluent sources and along major tributaries, and at near-field and far-field sites downstream of effluents sources (Environment Canada and Department of Fisheries and Oceans 1993).

Other fish species will also be collected under this project for biochemical and contaminant analyses to provide complimentary information to that collected for burbot. Data from these fish will also provide comparative information in relation to previous contaminant and biochemical analyses carried out on these species by the NRBS and other agencies (Swanson 1992, Brown *et al.* 1993, Lockhart *et al.* 1993).

Flathead chub are known to be widely distributed in the Peace-Wapiti-Smoky and Slave river systems (Paetz 1984, Boag 1993, S. Swanson unpublished data, R. Tallman pers. comm.) and are thought to be relatively sedentary. They also occupy a lower trophic level than burbot and may therefore provide an earlier indication of stress related impacts in the aquatic ecosystem (Environment Canada and Department of Fisheries and Oceans 1993). This study will determine

if flathead chub can also be used as a sentinel species for ongoing monitoring in the Peace and Slave river systems.

Northern pike and longnose suckers will also be collected from designated sampling locations throughout the Study Area. However, the use of these species in the design of long-term monitoring program is somewhat problematic because of their distribution or movement patterns. Northern pike tend to be relatively sedentary (Berry 1986, T. Clayton pers. comm.), but while they are widely distributed in the northern rivers they tend to occur infrequently in upper reaches (Paetz 1984, Wallace & McCart 1984, Hvenegaard & Boag 1993, R. L. & L. 1994a, S. Swanson pers. comm.). Large numbers of fish may not be available in upstream locations, although it may be possible to collect reference fish from tributaries. Longnose suckers are widely distributed in large numbers throughout the Peace, Athabasca and Slave river systems (Paetz 1984, Wallace & McCart 1984, Swanson 1992, Boag 1993, R. L. & L. 1994a&b). They are, however, known to make long-distance migrations often moving between areas exposed to effluents and unimpacted sites (Berry 1986, McLeod and Clayton 1993, Swanson 1992, Clayton and McLeod 1994, R. L. & L. 1994b).

Fish collections at sites on the Slave River have also been designed to provide information for fish ecology and populations studies being carried out under NRBS project 3143-D1 by Dr. Ross Tallman of the Freshwater Institute, Winnipeg.

II. Requirements

General Objectives

1. To collect burbot from sites upstream and downstream of effluent sources and in major tributaries of the Peace, Athabasca and Slave river systems from August to mid-October 1994 (before water levels recede because of freeze-up in headwater areas) for gross pathology, contaminant, hepatic MFO induction, retinol, metallothionein, sex steroid, bile and gonad morphology analyses.

2. To collect longnose sucker and northern pike from sites upstream and downstream of effluent sources and in major tributaries of the Peace, Athabasca and Slave river systems from August to mid-October 1994 for gross pathology, contaminant, hepatic MFO induction, retinol, metallothionein, sex steroid, bile and gonad morphology analyses.

3. To collect flathead chub from sites upstream and downstream of effluent sources and in major tributaries of the Peace and Slave rivers from August to mid-October 1994 for gross pathology, contaminant, hepatic MFO induction, retinol, metallothionein, sex steroid, bile and gonad morphology analyses.

4. To collect other fish species opportunistically in conjunction with the collection of burbot, longnose sucker, northern pike and flathead chub on the Peace and Athabasca river systems from August to mid-October 1994 for possible contaminant analyses.

5. To collect other fish species opportunistically in conjunction with the collection of burbot, longnose sucker, northern pike and flathead chub on the Slave River from August to mid-October 1994 for histological, stomach content, stable isotope and possible contaminant analyses.

6. To prepare collected fish tissue samples in accordance with prescribed protocols, and to deliver them to the Freshwater Institute, Winnipeg and Alberta Environmental Protection, Edmonton for storage, processing and analysis.

7. To collect sediments from the lower Birch River, in accordance with prescribed protocols, during September or October 1994 for grain size analysis, organic carbon determination and possible contaminant analyses.

8. To transport and deliver sediment samples, in accordance with prescribed protocols, to Environment Canda, Calgary.

Specific Objectives

The contractor will complete the following tasks:

1. Obtain the necessary collection permits from appropriate regulatory authorities. While obtaining the permit the contractor should seek written instructions from the appropriate regulatory authority regarding the disposal of fish killed incidently under this contract. The sampling location, date, collector, species, weight, fork length, total length, sex and maturity should be recorded for each fish incidentally killed under this contract. An appropriate ageing structure should be retained (McKay *et al.* 1990) for analyses. Gut contents should be examined in the field and the contents recorded.

2. Using Geographic Positioning System Technology, record the geographic location (latitude and longitude) of all fish and sediment sampling locations.

3. At the beginning and end of each fish collection period at each sampling location record water temperature (depth profile), surface pH, alkalinity and conductivity. This information is to be presented as an appendix in the final report.

4. Collect fish samples of the species, in the quantities and at the locations described in Schedule A.

5. Collect adult burbot (>400 g) using capture methods and equipment described in Schedule B.

6. Handle, sub-sample, preserve, label and transport burbot tissue samples in accordance with the protocols outlined in Schedule B. Before commencing field collections the contractor should review the following papers to become familiar with sampling and analytical protocols related to tissue sampling for this contract:

Hepatic MFO Induction	Hodson *et al.* (1991)
Circulating Gonadal Sex Steroid Levels	McMaster *et al.* (1992)
Retinols	Palace and Brown (1994), Guillou *et al.* (1993)
Metallothionein	Dutton *et al.* (1993)
Bile	Swanson (1993)

7. Transport and deliver, in a timely and competent manner, burbot tissue samples in accordance with the procedures outlined in Schedule B. During the transport and delivery of burbot tissue samples ensure that the integrity and continuity (i.e., document possession and transfer) of the samples are safeguarded. Designated tissue samples **must** remain

frozen in liquid nitrogen or on dry ice during transport to the Freshwater Institute or Alberta Environmental Protection.

8. Collect adult northern pike, longnose sucker and flathead chub using capture methods and equipment described in Schedule C.

9. Handle, sub-sample, preserve, label and transport northern pike, longnose sucker and flathead chub in accordance with the protocols outlined in Schedule C.

10. Transport and deliver, in a timely and competent manner, northern pike, longnose sucker and flathead chub tissue samples in accordance with the procedures outlined in Schedule C. During the transport and delivery of fish tissue samples ensure that the integrity and continuity (i.e., document possession and transfer) of the samples are safeguarded.

11. With the exception of sampling sites on the Slave River, handle, preserve, label and transport non-target fish species (species other than burbot, northern pike, longnose sucker and flathead chub) caught incidentally under this contract in accordance with the procedures outlined in schedule D.

12. With the exception of sampling sites on the Slave River, transport and deliver, in a timely and competent manner non-target fish species in accordance with the procedures outlined in Schedule D. During the transport and delivery of fish samples ensure that the integrity and continuity (i.e., document possession and transfer) of the samples are safeguarded.

13. For sampling locations on the Slave River, handle, preserve and transport non-target fish species (species other than burbot, northern pike, longnose sucker and flathead chub) caught incidentally under this contract in accordance with the procedures outlined in Schedule E.

14. For sampling locations on the Slave River, transport and deliver, in a timely and competent manner non-target fish species in accordance with the procedures outlined in Schedule E. During the transport and delivery of fish samples ensure that the integrity and continuity (i.e., document possession and transfer) of the samples are safeguarded.

15. Record the location of all fish and sediment sampling reaches on 1:50,000 aerial photo enlargements. Indicate the location of all gill nets, set lines, etc. deployed in the sampling reach on the aerial photo enlargements. Also indicate on the aerial photographs areas that were electrofished. These aerial photographs are to be included as an appendix in the final report along with detailed habitat information for each site.

16. Record habitat information for each collection site as outlined in Schedule G. The Other Uses Group of the NRBS is currently developing meso-scale habitat categories for use on the Study. Slight modifications may therefore be made to the habitat categories presented

in Schedule G. The contractor should consult with Dr. Gordon Walder (Alberta Environmental Protection, Edmonton - (403) 427-2375) before commencing field collections to determine if other habitat information is required. Any modifications that may be made to the habitat categories outlined in Schedule E are expected to be modest.

The intent of this clause is that the contractor will spend only a minimum amount of time (no more than an hour) at each sampling location recording habitat information.

17. Document any internal and external abnormalities/deformities on any fish captured under this contract as outlined in Schedule H.

18. Age all fish samples in accordance with the methods outlined in MacKay *et al.* (1990).

19. All fish caught under this contract that are of a sufficient size and that are not required for the purpose outlined in these Terms of Reference are to be tagged, measured and released alive. Information to be recorded must include: date, time, sampling site, sampling method, sampler(s), species, weight, fork length, total length, sex (where known), breeding condition (where known) and tag number. This information is to be included as an appendix to the final report. Tagging of fish is to be considered a low priority and should only be undertaken after other fish collected for MFO, sex steroid, contaminant analyses, etc. have been processed. Any external abnormalities/deformities observed on tagged fish should be recorded as outlined in Schedule H.

20. Record the tag number, species, weight, total length, fork length and breeding conditions (where known) of any previously tagged fish collected during this project.

21. Provide an estimate of Catch Per Unit Effort for each species, for each collection method used at each collection site. This information is to be included in a table(s) in the main report. Record the time all nets, traps, setlines, etc. were placed in and removed from the water. Record the time all electrofishing was started and ended and indicate the area fished. For all nets and seines used record the length of the net and the mesh size. For set lines record the number of hooks on each line, hook size and the bait used. For each net, seine or setline set record the number (including sample or tag number of each fish) of each species in the catch.

22. The sexual maturity of fish is to be determined using a qualitative description of the degree of gonadal development. The scale used by Bond & Erickson (1985) is recommended for use.

23. All garbage, etc. generated by the contractor during the processing of fish and camping at collection sites is to be removed from the site and disposed of in an appropriate manner.

Particular care must be taken during the disposals of chemical compounds used under this project.

24. Sediment samples are to be collected from the lower reaches of the Birch River in September or October 1994 in accordance with the protocols outlined in Schedule I. These samples are also to be handled, stored, transported and delivered in accordance with the protocols outlined in Schedule I.

25. Provide the Component Coordinator with written documentation indicating the chain of custody of all samples collected under this project. Staff at the Freshwater Institute, Winnipeg should be advised over the phone and by fax when samples are to be shipped. Copies of all faxes and weigh bills are to be submitted to the Component Coordinator. Chain of custody forms should be developed for samples being shipped to Alberta Environmental Protection. Signed-off forms are to be delivered to the Component Coordinator.

26. The contractor is expected to be in regular contact with the Component Coordinator throughout the duration of this contract. At the very least, the contractor must contact the Component Coordinator every other day or the same day if difficulties are encountered in collecting the desired numbers of target species at a particular collection site. Approval for additional sampling effort at any collection site must be granted in advance and in writing by the Component Coordinator.

III. Reporting Requirements

1. The contractor is to prepare a comprehensive report on the fish collections outlined in this Terms of Reference. To facilitate inter-basin and inter-year comparisons of catch data, site collections and population data, and to allow for an assessment of ecosystem health, the format of the report should be consistent with Hvenegaard and Boag (1993). Specifically, the report should include a detailed listing of all sampling locations (including latitude and longitude), a map showing sampling locations, a discussion of sampling, handling and transportation methods, tables and or/figures reporting Catch per Unit Effort data and fish capture techniques, length-frequency distributions, length-weight relationships, length-age relationships and a listing of any individuals from local communities contacted or who participated on this contract.

   The report should also include, but not necessarily be limited to, the following:

   a) a summary table noting any internal or external deformities/abnormalities encountered on fish collected under this contract. The presence of any trends in internal or external deformities/abnormalities should be presented as a figure or on a map. Detailed gross pathology sheets prepared for fish with external or internal deformities/abnormalities, along with colour photographs of the deformities/abnormalities, are to be included as an appendix to the report.
   b) a table or appendix documenting the date, sampling location, sample number, collector(s), time of collection, time of processing, age, sex, maturity, total weight, fork length, total length, gutted weight, liver weight, gonad weight, stomach fullness, condition factor, gonadosomatic index and liver somatic index of all fish collected for MFO, sex steroid and contaminant analyses.
   c) a table or appendix documenting relevant information recorded for fish that were tagged and released.
   d) a table or appendix documenting relevant information, including gut contents, in relation to fish killed incidentally under this contract.
   e) a table summarizing habitat characteristics at each collection site. Detailed habitat information is to be presented as an appendix to the report and is to include 1:50,000 aerial photographs of each collection site.
   f) a table or appendix outlining water quality parameters recorded at the beginning and end of each collection period at each collection site.
   g) an appendix containing colour photographs showing the general colour and condition of all internal organs of fish collected. Only one copy of the appendix is to be submitted along with the final report. All print negatives are to be submitted along with the appendix
   h) a summary table and appendix outling the gut contents of fish collected for biochemical and contaminant analyses.

2. Ten copies of the draft report are to be submitted to the Component Coordinator by February 15th, 1995.

3. Three weeks after the receipt of review comments the contractor is to submit ten cerlox bound copies and two unbound, camera-ready originals of the final report to the Component Coordinator.

4. The contractor is to prepare a brief report outlining sediment collections made under this contract. The report is to include information on sampling locations

5. Ten copies of the draft sediment report are to be submitted to the Component Coordinator by February 15th, 1995.

6. Three weeks after the receipt of review comments the contractor is to submit ten cerlox bound copies and two unbound, camera-ready originals of the final sediment report to the Component Coordinator.

7. The Contractor is to provide draft and final reports in the style and format outlined in the NRBS document, "A Guide for the Preparation of Reports," which will be supplied upon execution of the contract.

   The final report is to include the following: an acknowledgement section that indicates any local involvement in the project, Report Summary, Table of Contents, List of Tables, List of Figures and an Appendix with the Terms of Reference for this project.

   Text for the report should be set up in the following format:

   a) Times Roman 12 point (Pro) or Times New Roman (WPWIN60) font.
   b) Margins; are 1" at top and bottom, 7/8" on left and right.
   c) Headings; in the report body are labelled with hierarchical decimal Arabic numbers.
   d) Text; is presented with full justification; that is, the text aligns on both left and right margins.
   e) Page numbers; are Arabic numerals for the body of the report, centred at the bottom of each page and bold.

   - If photographs are to be included in the report text they should be high contrast black and white.
   - All tables and figures in the report should be clearly reproducible by a black and white photocopier.
   - Along with copies of the final report, the Contractor is to supply an electronic version of the report in Word Perfect 5.1 or Word Perfect for Windows Version 6.0 format.

- Electronic copies of tables, figures and data appendices in the report are also to be submitted to the Component Coordinator along with the final report. These should be submitted in a spreadsheet (Quattro Pro preferred, but also Excel or Lotus) or database (dBase IV) format. Where appropriate, data in tables, figures and appendices should be geo-referenced.

8. All figures and maps are to be delivered in both hard copy (paper) and digital formats. Acceptable formats include: DXF, uncompressed Eøø, VEC/VEH, Atlas and ISIF. All digital maps must be properly geo-referenced.

9. All sampling locations presented in report and electronic format should be geo-referenced. This is to include decimal latitudes and longitudes (to six decimal places) and UTM coordinates. The first field for decimal latitudes/longitudes should be latitudes (10 spaces wide). The second field should be longitude (11 spaces wide).

10. The contractor is also to prepare a presentation package of 10-25, 35 mm colour slides that can be used at public meetings to summarize the project, methods and key findings. One original and four duplicates of each slide are to be given to the Component Coordinator by December 1, 1994.

IV. Contract Administration

This project is being conducted under the Contaminants Component of the Northern River Basins Project (Dr. John Carey, National Water Research Institute, Burlington - Contaminants Component Leader).

The component coordinator for this project is:

Greg Wagner
Alberta Environmental Protection
9th Floor, Oxbridge Place
9820 - 106th Street
Edmonton, Alberta
T5K 2J6
work phone: (403) 427-2375
fax: (403) 422-4190
home phone: (403) 425-2060

Questions of an administrative nature should be directed to him.
In his absence, the following person is to be notified:

Richard Chabaylo
Office of the Science Director
Northern River Basins Study
690, Standard Life Centre
10405 - Jasper Avenue
Edmonton, Alberta T5J 3N4
work phone: (403) 427-1742
fax: (403) 422-3055
home phone: (403) 469-8446

The Scientific Authorities for this project are:

Dr. Lyle Lockhart
Research Scientist
Fisheries and Oceans Canada
Fresh Water Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6
work phone: (204) 983-7113
fax: (204) 984-2401
home phone: (204) 832-2878

Questions of a scientific nature related to the collection of fish for MFO analysis should be directed to him.

Dr. Derek Muir
Research Scientist
Fisheries and Oceans Canada
Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6
work phone: (204) 983-5168
fax: (204) 984-2403

Questions of a scientific nature related to the collection of fish for contaminant analyses should be directed to him.

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NORTHERN RIVER BASINS STUDY

PROJECT 3144-D1: BASIN-WIDE FALL BURBOT COLLECTION

SCHEDULE A
LOCATION AND QUANTITY OF FISH TO BE COLLECTED

1. The study area includes the Peace, Athabasca and Slave river basins of Alberta and the Northwest Territories. Fish collections are to be made at the following locations:

Athabasca River[1]

Upstream of Hinton (between Muskata Creek and Brule Lake)
Downstream of Hinton (between Hinton and Whitecourt)
Downstream of Whitecourt
Downstream of AlPac
In the vicinity of Fort MacKay[6]
Peace-Athabasca Delta (Quatre Fourche[7] or Jackfish Lake Fishing Village)[6]
Lake Athabasca (off Goose Island)[6]

Wapiti-Smoky-Peace Rivers[2]

Wapiti River upstream of Grande Prairie

Smoky River upstream of confluence with the Wapiti River (near Grande Cache)
Smoky River downstream of confluence with the Wapiti River

Peace River between BC border and Dunvegan (preferably near BC border)
Peace downstream of the Daishowa mill
Peace downstream of Fort Vermilion[6]

Slave River[3]

Slave River at Fort Fitzgerald[6]
Slave River Delta/Great Slave Lake[6,8]

Tributaries

McLeod River[4]
Lesser Slave River (downstream of Slave Lake Pulp)[4]
Clearwater River[4]

Pembina River[4]
Little Smoky River[5]
Wabasca River[5]

Reference Site

Birch River[4,6,7,9]

1 Target species to be collected are to include burbot, northern pike and longnose sucker. To the extent possible, sampling should be carried out in appropriate habitats at locations near to those outlined in Barton *et al.* (1993a & b) and R. L. & L. Environmental Services Ltd. (1994a). Please note that northern pike do not frequently occur on the Athabasca River upstream of the Berland River Bridge.

2 Target species to be collected are to include burbot, northern pike, longnose sucker and flathead chub. To the extent possible, sampling locations should be similar to those outlined in Hvenegaard and Boag (1993).

3 Target species to be collected are to include burbot, if available, northern pike, longnose sucker and flathead chub.

4 Target species to be collected are to include burbot, northern pike and longnose sucker. Sampling should be carried out in suitable habitat on the tributaries some distance (at least 10 km) upstream from the confluence with the Athabasca River. The intent is to collect fish that are potentially resident in the tributaries. Where possible, collections should be located upstream of major obstacles that may limit fish passage.

5 Collections are to include burbot, northern pike, longnose sucker and flathead chub. Sampling should be carried out in suitable habitat on the tributaries some distance (at least 10 km) upstream from the confluence with the Peace River. The intent is to collect fish that may be resident in the tributaries. Where possible, collections should be located upstream of major obstacles that may limit fish passage.

6 Mr. Sonny Flett, Traditional Knowledge Component Leader, NRBS (phone: (403) 427-1742, fax: (403) 422-3055) is to be informed one to two weeks in advance about the timing of fish collections at these sites.

7 Collection permit required from Wood Buffalo National Park.

8 Collections at this site require prior authorization from the Science Institute of the Northwest Territories. Contact: Tanya Joyce at (403) 873-7592.

9 Sediment collections are to be made at this site.

2. Fish collections are to be made from August to mid-October 1994.

3. A minimum of ten adult male and a minimum of ten adult female burbot (>400 g), longnose sucker and flathead chub are to be collected from the sites identified in 1, above, for contaminant and biochemical analyses. Ideally, for these species, fifteen adult fish of each sex should be collected at each site (Hodson *et al.* 1991).

4. Northern pike caught incidentally during the collection of other target fish species (burbot, longnose sucker and flathead chub) are also to be collected for contaminant and biochemical analyses. Up to fifteen adult male and fifteen adult female northern pike may be retained from each site.

5. Up to ten individuals of other fish species caught incidentally during target fish collections are to be saved for contaminant analyses at each sampling location.

6. In the event that difficulty is experienced in collecting the desired species and age class at the stipulated sites, the contractor is to consult with the Component Coordinator as soon as possible. Any deviation from the above requirements must be approved in advance and in writing by the Component Coordinator.

NORTHERN RIVER BASINS STUDY

PROJECT 3144-D1: BASIN-WIDE FALL BURBOT COLLECTION

SCHEDULE B
BURBOT COLLECTION AND HANDLING PROTOCOL

1. Burbot are to be collected at all sites using set lines. The sampling period must be standardized between collection sites; suggest one-half hour after sunset to one-half hour after sunrise. **It is important to obtain blood and tissue sub-samples for analyses from fish that are alive after collection and immediately before tissue sampling, and which have experienced minimum handling stress**.

2. Burbot tissues are being collected for the following purposes:

Blood	Sex Steroids, Stable Isotopes
Liver	MFO, Retinols, Possible Metallothionein Analyses, Contaminants
Kidneys	Possible Metallothionein Analyses
Intestine	Possible Metallothionein Analyses
Gills	Possible Metallothionein Analyses
Gonads	Gonad Morphology, State of Sexual Developmen
Stomach Contents	Diet, Possible Stable Isotope Analyses
Carcass	Possible Contaminant and Stable Isotope Analyses
Bile	Possible Contaminant Analyses

3. Several other measurements must be taken on burbot at the time of processing. These include: total body weight (g), gutted carcass weight (weight (g) after removal of viscera), gonad weight (g), liver weight (g), fork length ((cm), tip of the snout to the deepest fork in the tail), total length ((cm), tip of the snout to the longest point of the tail), sex and age (y). From these measurements, the condition factor (CF = (total weight/length^3) x 10^5, gonadosomatic index (GSI = 100 x (gonad weight/gutted weight) and liver somatic index (LSI = 100 x liver weight/gutted weight) are to be calculated.

4. Mr. Don Metner (Freshwater Institute, Fisheries and Oceans Canada, 501 University Crescent, Winnipeg, Manitoba R3T 2N6 - ph. (204) 983-5168, fax - (204) 984-2403) will accompany the contractor to the first collection site to review proper methods for sub-sampling tissue from Burbot. The contractor is to contact Mr. Metner to make arrangements for him to be present during the initial field collections. Mr. Metner's expenses will be paid for by the NRBS. All contractor staff involved with the collection and processing of fish must attend the field session with Mr. Metner.

5. A sample numbering system must be designed and used to facilitate tracking of all tissue sub-samples taken from the same fish. All tissue samples must be appropriately labelled.

6. Data sheets are to be developed for each collection site and are to include the following: 1) sampling location, 2) collection method, 3) set number, 4) date, 5) time the fish is taken out of the water, 6) sample number, 7) names of individuals collecting and processing the fish, 8) time the blood sample is taken, 9) time the blood sample is centrifuged, 10) time the fish is killed, 11) time the liver, gall bladder, kidney, gill arches and intestines are removed from the body and frozen, 12) fork length, 13) total length, 14) amount of bile collected, 15) total weight, 16) gutted weight, 17) liver weight, 18) percent stomach fullness, 19) gonad weight, 20) sex, and 21) sexual maturity.

7. All tissue samples must be quick frozen between slabs of dry ice or in liquid nitrogen **immediately** after removal from the body.

8. **Immediately** after the fish is taken from the water (only live fish are to be used for sex steroid analyses) remove 1-3 mL of blood from the caudal vessel using a separate heparinized needle for each fish. Fish can be immobilized during blood sampling by placing the fish vent side up in a longitudinal slit cut into a piece of high density foam. Transfer each blood sample to an appropriately stoppered centrifuge tube, label and store it on ice until centrifuging. Within 30 minutes after blood removal centrifuge the blood (5 to 7 minutes), aspirate plasma into appropriately labelled storage tubes and freeze on dry ice. This blood sample is being collected for sex steroid analyses and must be stored and transported at -60°C.

9. To minimize within-site variation, **blood samples for sex steroid analyses must be taken from same sex fish within a consistent two to three hour period after removal from the water at all sampling locations** (McMaster et al. 1992: pg. 6).

10. Re-stopper the centrifuge tube with the remaining red blood cells, freeze and retain for possible stable isotope analyses. This blood sample must be stored and transported at -20°C or lower.

11. After bleeding, fish can be marked and placed in a wet well for holding while blood samples are being collected from other fish and while blood samples are being centrifuged.

12. An external examination should then be conducted for abrasions, lesions, secondary sexual characteristics (if obvious), missing fins or eyes, opercular, fin or gill damage, or other anomalous features. All external and internal lesions should be recorded as to position, shape, size, colouration, depth, appearance on cut surface and any other features of note. This information is to be recorded on a gross pathology sheet contained in Schedule G for any fish showing abnormalities/deformities. The checklist presented in Schedule G should be used as a guide for reviewing internal and external abnormalities/deformities on each

fish. Prepare a photographic record of any external or internal abnormalities/deformities encountered. A standard Kodak Colour chart is to be shown in each photograph of external or internal abnormalities or deformities. A label clearly showing the sample number of the fish is also to be shown in each photo.

13. Sampling of other fish tissues can begin after blood sampling and the external examination have been completed. Fish should be euthanized via concussion, cervical dislocation or with an overdose of anaesthetic. Work must progress quickly on the euthanized fish and tissue samples must be quick frozen between slabs of dry ice or in liquid nitrogen as soon as possible after death to avoid spoiling of tissue samples.

14. Total and fork length should be measured to the nearest mm. The fish should then be towelled dry and weighed to the nearest g. Separate towels should be used to dry each fish.

15. Open the fish ventrally and examine fish for internal lesions and record any abnormalities. Care should be taken not to cut into internal organs when opening the fish. A summary table is to be included in the final report outlining the frequency and types of abnormalities and deformities encountered.

16. Prepare a photographic record of the internal organs of the fish before organ removal. Close-up photographs are to be taken of all fish using 35 mm, print film (100 - 200 ASA, lower ASAs preferred because of reduced graininess in the photo) in a camera having a 50-55 mm or other appropriate lens. A standard Kodak Colour Chart is to be shown in each photo. A label clearly showing the sample number of the fish is also to be shown in each photo. The intestines of the fish should be moved to one side of the body before the picture is taken so that the liver and gonads can be clearly seen in the picture.

17. Cut the esophagus and lower intestine (immediately anterior to the vent) to allow total removal of the gastrointestinal tract.

    If only one person is involved with sample processing, the gastrointestinal tract should be kept cool (not frozen) until further work is carried out under step 21. This can be accomplished by placing the sample in a whirlpak bag and storing it over ice or in a container cooled by a small amount of dry-ice. If two people are involved with sample processing, then one person should move immediately to step 21.

18. Tie-off the bile duct leading to the gall bladder using a haemostat or clamp. Sever the bile duct above where it has been tied off and remove the gall bladder from the body cavity. Care must be taken not to rupture the gall bladder as bile leakage can contaminate other tissue samples. Once the gall bladder has been removed from the body cavity, drain the bile using a tuberculin syringe (Becton Dickson, 1cc26G3/8, Tuberculin, part number 9625). Note the volume of bile collected, cap the syringe, label the syringe and freeze the

syringe containing the bile on dry ice or in liquid nitrogen. The bile must be stored and transported at or below -20°C.

19. Next remove the liver (**this must occur within two minutes of the death of the fish**) and weigh and record weight to the nearest 0.1 gm. The spleen should be removed from the liver before weighing.

    a) Immediately after weighing, separate the longest posterior branch of the liver from the liver. This tissue sample will be used for MFO, metallothionein and retinol analyses and at least 10 g of tissue sample are required.

    b) Rinse this sample with 0.15 M KCl to remove traces of blood and bile. Each sample of the longest posterior branch of the liver must then be placed in a whirlpak (air removed as much as possible), labelled and frozen between slabs of dry ice or in liquid nitrogen. For tissue storage and transport, all liver MFO samples must be maintained at -60°C or lower; storage at -20°C is <u>not</u> acceptable even for very short periods of time. Liver tissue <u>must</u> also be stored and transported in the dark.

    c) The remaining portion of the liver is to be placed in a Department of Fisheries and Oceans approved contaminant free bag (to be supplied to the contractor by the NRBS), labelled and frozen between slabs of dry ice. This liver sample will be retained for contaminant analyses. The liver sample for contaminant analyses must be stored and transported at or below -20°C.

20. Remove the kidneys by making lengthwise incisions along each edge of the tissue and then detach using the "spoon" end of a stainless steel weighing spatula by applying firm, but gentle, pressure against the upper abdominal cavity wall (ie. against the dorsal aorta). In this procedure, the kidney is scraped away from the dorsal aorta and all associated connective tissue. The kidney is then to be placed in a cryovial or whirlpak, labelled and frozen in liquid nitrogen or dry ice. The kidney is to be removed from the fish and frozen as soon after death as possible. The kidney tissue <u>must</u> be stored and transported in the dark at -60°C.

21. Remove the intestine by severing immediately posterior to the stomach, or pyloric caeca, if applicable, and immediately anterior to the vent (anus). Remove gut contents from the intestine by running the gut through pinched fingers several times in order to squeeze out the contents. Then place the intestines in a whirlpak (air removed as much as possible), label and freeze on dry ice or in liquid nitrogen. The intestines are to be removed from the fish and frozen as soon after death as possible. Intestinal tissue <u>must</u> be stored and transported in the dark at -60°C.

22. Gut contents from each fish are to be placed in labelled containers and preserved in a 5% formalin solution. Gut contents are being retained for visual inspection and possible nitrogen stable isotope analyses. Gut contents from fish collected at the Slave River sites are to be delivered to the Freshwater Institute. Gut contents from all other locations are to be visually inspected by the contractor and the contents recorded. After visual inspection, these samples are also to be delivered to the Freshwater Institute.

23. Remove the gill arches and attached filaments by severing the dorsal and ventral cartilaginous attachments of the arches to the surrounding oral cavity. Place the gill arches in a whirlpak, label and freeze on dry ice or in liquid nitrogen. Gill arches are to be removed from the fish and frozen as soon after death as possible. Gill arches must be stored and transported in the dark at -60°C.

24. Score each fish for gender and for state of sexual development.

25. Remove gonads, weigh and record the weight to nearest 0.1 gm. Each gonad sample must then be prepared and stored as follows:

Materials

HistoPrep Tissue Capsules ((disposable polypropylene) 38 x 8 mm (Dia XH)) are used in preserving and processing tissues. Pertinent information (e.g., fish sample number) and identification of the specimen should be written on each capsule with an HB pencil. The capsules are available from Fisher Scientific (product number 15-182-218).

Nalgene Square Polyethylene wide mouth bottles (Ngle 2114) of 1 litre capacity have proven to be excellent for field sampling simply because they do not leak. Bottles containing about 750 ml of Davidson's solution are packed (two to a bag) in plastic bags (14" x 22") and secured with masking tape for transportation. The bottles are available from Fisher Scientific (product number 03-3120).

Davidson's fixative is used to preserve the pieces of gonads that have been removed from each fish. Tissue capsules containing gonad samples are immersed in this solution for at least 24 hours and can be stored for several weeks. The Davidson solution can be prepared as follows:

95% ethyl alcohol	300.0 mL
formaldehyde	200.0 mL
glacial acetic acid	100.0 mL
distilled water	300.0 mL
glycerine	100.0 mL

These ingredients should be adequately stirred.

A 5% buffered formalin solution is also used to preserve pieces of ovary. When fresh eggs are placed directly into 5% buffered formalin, there is no significant alteration in egg weight. Labelled tissue capsules are used to hold and identify each sample. The formalin is made up as follows:

formaldehyde	50.0 mL
sodium phosphate monobasic	4.0 g
sodium phosphate dibasic, anhydrous	6.5 g
distilled water added to make 1 litre	

Procedure for Fixation:

Two litre Nalgene bottles containing 750 mL Davidson's and two bottles containing 5% formalin solutions are readied. After weighing the gonads, pieces are dissected out with a scalpel. Generally, the mid-region of the gonad from one side, i.e., the left gonad is used from each fish. It is important that the tissue pieces do not exceed 0.5 cm in thickness but may be slightly larger (usually not greater than 1.0 cm) in the other dimensions. The tissue pieces should easily fit into the tissue capsules without being squashed, and should not take up more than half the capsule space. If a sensitive analytical balance is available, the pieces of tissue to be placed in formalin can be weighed and the weight recorded (0.1 g) in a notebook and on the capsule. Gonad tissue from each fish should be placed into <u>two</u> capsules. Tissue should be placed into each of the fixatives and with forceps, momentarily submersed (the tissue capsules tend to float in the fixatives). No more than 24 tissue capsules are to be placed in each 1 litre bottle to ensure adequate fixative volume. Duplicate tissue samples from the same fish should be stored in separate Nalgene bottles. Nalgene bottles should be labelled to indicate which samples they contain.

For female burbot caught at the Slave River sites, the remaining egg mass should be placed in small glass or plastic jars, or whirlpaks and preserved in 5% buffered formalin. This tissue sample is to be delivered to the Freshwater Institute.

26. Weigh the gutted carcass of the fish.

27. Retain, store and label the appropriate ageing structure (otoliths - see MacKay *et al.* 1990: pgs. 78-80) of all burbot sampled.

28. Place the remaining fish carcass in a contaminant free bag (to be supplied to the contractor by the NRBS), label and store on dry ice or in liquid nitrogen. The carcass must be stored and transported at or below -20°C.

29. The use of dry ice or liquid nitrogen for initial freezing and shipping of all samples is mandatory. If dry ice is used, tissue samples should be placed between slabs of dry ice and liberal quantities of dry ice should be placed along the sides and top and bottom of each cooler.

30. The use of sturdy styrofoam coolers is most practical and is recommended for storage and transport of fish samples. Styrofoam coolers of weak construction may not assure constant freezing and may break down during shipping. Duct tape should be wrapped around coolers before shipping to ensure that the lid is held firmly in place during transport. Coleman type coolers may be used but may not necessarily be returned immediately for repetitive use. The Contractor is responsible for picking up coolers when notified by Alberta Environmental Protection or Freshwater Institute. A listing of the contents of each cooler should be attached to each cooler. A copy of the listing for each cooler should also be submitted to the component coordinator.

31. The gutted carcass, liver sample secured for contaminant analyses and bile samples can be stored together in the same coolers. These tissue samples will be delivered to Alberta Environmental Protection, Edmonton. All other tissue samples can also be stored together in the same cooler (they should be kept in the dark until analyzed), but they must not be stored in the same cooler as the carcass, liver sample secured for contaminant analyses and bile samples. These tissue samples will be delivered to the Freshwater Institute, Winnipeg.

32. With the exception of carcasses, liver samples secured for contaminant analyses and bile samples, all tissues are to be shipped directly to:

Don Metner
Fisheries and Oceans Canada
Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6
work phone: (204) 983-5168
fax: (204) 984-2403

-or-

Dr. Lyle Lockhart

Prior arrangements must be made with Mr. Metner or Dr. Lockhart to ensure that samples are picked-up immediately upon arrival in Winnipeg. The intent is that samples will make

there way to appropriate freezing facilities as soon as they get to Winnipeg. The contractor will be responsible for all approvals and costs related to the shipping of samples for this project.

33. All other samples (livers and carcasses for contaminant analyses, and bile samples) are to be delivered to:

Earle Baddaloo
Alberta Environmental Protection
6th Floor, Oxbridge Place
9820-106th Street
Edmonton, Alberta
T5K 2J6
work phone: (403) 427-6102
fax: (403) 422-9714
home phone: (403) 434-8967

-or-

Dr. Sub Ramamoorthy
Alberta Environmental Protection
6th Floor, Oxbridge Place
9820-106th Street
Edmonton, Alberta
T5K 2J6
work phone: (403) 427-6102
fax: (403) 422-9714
home phone: (403) 435-8137

Prior arrangements must be made with Mr. Baddaloo or Dr. Ramamoorthy to ensure that samples are picked-up immediately upon arrival in Edmonton. The intent is that samples will make there way to appropriate freezing facilities as soon as they are delivered to Edmonton. The contractor will be responsible for all approvals and costs related to the shipping of samples for this project.

34. If any problems are encountered in following the above protocols the contractor is to contact the scientific authority for advice. Any deviation from the above established protocol/procedure should be justified and accounted for in writing and a detailed description of what was done is to be submitted with the fish sample; this is to assure credibility and validity of results.

35. With the exception of Fisheries and Oceans Canada recommended contaminant free bags, the contractor will provide all equipment and supplies required to collect, process, preserve and transport fish collected under this contract.

36. All sampling equipment and specimens must be kept away from fuel, exhaust, oil, smoke, plastic and anything else that may potentially contaminate samples.

37. All dissection equipment **must** be decontaminated before processing begins on each fish. Dissecting equipment is to be rinsed in acetone, air dried, then rinsed in hexane and air dried. Field crews should where masks to avoid inhaling fumes of acetone and hexane. It is also recommended that acetone and hexane not be used in enclosed spaces such as tents and that the decontamination of equipment proceed away from the main work area used to process fish.

38. It is recommended that the contractor use disposal rubber or plastic gloves during the processing fish. A new pair of gloves should be used to process each fish.

39. All cutting surfaces used to process fish should be wiped clean with wet paper towels after each fish has been processed. Separate paper towels must be used for each cleaning session.

NORTHERN RIVER BASINS STUDY

PROJECT 3144-D1: BASIN-WIDE FALL BURBOT COLLECTION

SCHEDULE C
COLLECTION AND HANDLING PROTOCOL FOR NORTHERN PIKE, LONG-NOSE SUCKER AND FLATHEAD CHUB

1. Longnose sucker and flathead chub may be collected using a variety of techniques including:

   - Electrofishing
   - Trap nets
   - Gill nets
   - Seines
   - Set lines
   - Angling

   However, only one sampling method can be selected for each species and once a sampling method is selected it must be employed for that species at all sampling locations (McMaster *et al.* 1992: pg. 6). **It is important to obtain blood and tissue sub-samples for analyses from fish that are alive after collection and immediately before tissue sampling, and which have experienced minimum handling stress.**

2. Northern pike are to be collected incidentally during the collection of burbot, longnose sucker and flathead chub. No collection method is to be employed that specifically targets northern pike.

3. Northern pike, longnose sucker and flathead chub tissue samples are being collected for the following purposes:

Blood	Sex Steroids, Stable Isotopes
Liver	MFO, Retinols, Possible Metallothionein Analyses, Contaminants
Kidneys	Possible Metallothionein Analyses
Intestine	Possible Metallothionein Analyses
Gills	Possible Metallothionein Analyses
Gonads	Gonad Morphology, State of Sexual Development
Stomach Contents	Diet, Possible Stable Isotope Analyses
Carcass	Possible Contaminant and Stable Isotope Analyses
Bile	Possible Contaminant Analyses

4. Several other measurements must be taken on fish at the time of processing. These include: total body weight (g), gutted carcass weight (weight (g) after removal of viscera), gonad weight (g), liver weight (g), fork length ((cm), tip of the snout to the deepest fork in the tail), total length ((cm), tip of the snout to the longest point of the tail) sex and age (y). From these measurements, the condition factor (CF = (total weight/length^3) x 10^5, gonadosomatic index (GSI = 100 x (gonad weight/gutted weight) and liver somatic index (LSI = 100 x liver weight/gutted weight) are to be calculated.

5. Mr. Don Metner (Freshwater Institute, Fisheries and Oceans Canada, 501 University Crescent, Winnipeg, Manitoba R3T 2N6 - ph. (204) 983-5168, fax - (204) 984-2403) will accompany the contractor to the first collection site to review proper methods for sub-sampling tissue from target fish species. The contractor is to contact Mr. Metner to make arrangements for him to be present during the initial field collections. Mr. Metner's expenses will be paid for by the NRBS. All contractor staff involved with the collection and processing of fish must attend the field session with Mr. Metner.

6. A sample numbering system must be designed and used to facilitate tracking of all tissue sub-samples taken from the same fish. All tissue samples must be appropriately labelled.

7. Data sheets are to be developed for each collection site and are to include the following: 1) sampling location, 2) collection method, 3) set number, 4) date, 5) time the fish is taken out of the water, 6) sample number, 7) names of individuals collecting and processing the fish, 8) time the blood sample is taken, 9) time the blood sample is centrifuged, 10) time the fish is killed, 11) time the liver, gall bladder, kidney, gill arches and intestines are removed from the body and frozen, 12) fork length, 13) total length, 14) amount of bile collected, 15) total weight, 16) gutted weight, 17) liver weight, 18) percent stomach fullness, 19) gonad weight, 20) sex, and 21) sexual maturity.

8. All tissue samples should be quick frozen between slabs of dry ice or in liquid nitrogen immediately after removal from the body.

9. **Immediately** after the fish is taken from the water (only live fish are to be used for sex steroid analyses) remove 1-3 Ml of blood from the caudal vessel using a separate heparinized needle for each fish. Fish can be immobilized during blood sampling by placing the fish vent side up in a longitudinal slit cut into a piece of high density foam. Transfer each blood sample to an appropriately stoppered centrifuge tube, label and store it on ice until centrifuging. Within 30 minutes after blood removal centrifuge the blood (5 to 7 minutes), aspirate plasma into appropriately labelled storage tubes and freeze on dry ice. This blood sample is being collected for sex steroid analyses and must be stored and transported at -60°C.

10. To minimize within-site variation, blood samples for sex steroid analyses must be taken from same sex fish within a consistent two to three hour period at all sampling locations (McMaster et al. 1992: pg. 6).

11. Re-stopper the centrifuge tube with the remaining red blood cells, freeze and retain for possible stable isotope analyses. This blood sample must be stored and transported at or below -20°C.

12. After bleeding, fish can be marked and placed in a wet well for holding while blood samples are being collected from other fish and while blood samples are being centrifuged.

13. An external examination should then be conducted for abrasions, lesions, secondary sexual characteristics (if obvious), missing fins or eyes, opercular, fin or gill damage, or other anomalous features. All external and internal lesions should be recorded as to position, shape, size, colouration, depth, appearance on cut surface and any other features of note. This information is to be recorded on a gross pathology sheet contained in Schedule G for any fish showing abnormalities/deformities. The checklist presented in Schedule G should be used as a guide for reviewing internal and external abnormalities/deformities on each fish. Prepare a photographic record of any external or internal abnormalities/deformities encountered. A standard Kodak Colour chart is to be shown in each photograph of external or internal abnormalities or deformities. A label clearly showing the sample number of the fish is also to be shown in each photo.

14. Sampling of other fish tissues can begin after blood sampling and the external examination have been completed. Fish should be euthanized via concussion, cervical dislocation or with an overdose of anaesthetic. Work must progress quickly on the euthanized fish and tissue samples must be quick frozen between slabs of dry ice or in liquid nitrogen as soon as possible after death to avoid spoiling of tissue samples.

15. Total and fork length should be measured to the nearest mm. The fish should then be towelled dry and weighed to the nearest g. Separate towels should be used to dry each fish.

16. Open the fish ventrally and examine fish for internal lesions and record any abnormalities. Care should be taken not to cut into internal organs when opening the fish. A summary table is to be included in the final report outlining the frequency and types of abnormalities and deformities encountered.

17. Prepare a photographic record of the internal organs of the fish before organ removal. Close-up photographs are to be taken of all fish using 35 mm, print film (100 - 200 ASA, lower ASA preferred because of reduced graininess in the photo) in a camera having a 50-

55 mm or other appropriate lens. A standard Kodak Colour Chart is to be shown in each photo. A label clearly indicating the sample number of the fish is also to be shown in each photo. The intestines of the fish should be moved to one side of the body before the picture is taken so that the liver and gonads can be clearly seen in the picture.

18. Cut the oesophagus and lower intestine (immediately anterior to the vent) to allow total removal of the gastrointestinal tract.

    If only one person is involved with sample processing, the gastrointestinal tract should be kept cool (not frozen) until further work is carried out under step 22. This can be accomplished by placing the sample in a whirlpak bag and storing it over ice or in a container cooled by a small amount of dry-ice. If two people are involved with sample processing, then one person should move immediately to step 22.

19. Tie-off the bile duct leading to the gall bladder using a haemostat or clamp. Sever the bile duct above where it has been tied off and remove the gall bladder from the body cavity. Care must be taken not to rupture the gall bladder as bile leakage can contaminate other tissue samples. Once the gall bladder has been removed from the body cavity, drain the bile using a tuberculin syringe (Becton Dickson, 1cc26G3/8, Tuberculin, part number 9625). Note the volume of bile collected, cap the syringe, label the syringe and freeze the syringe containing the bile on dry ice or in liquid nitrogen. The bile must be stored and transported at or below -20°C.

20. Next remove the liver (**this must occur within two minutes of the death of the fish**) and weigh and record weight to the nearest 0.1 gm. The spleen should be removed from the liver before weighing. Rinse the liver with 0.15 M KCl to remove traces of blood and bile. The liver must then be placed in a whirlpak bag (air removed as much as possible), labelled and frozen between slabs of dry ice or in liquid nitrogen. For tissue storage and transport the liver sample must be maintained in the dark at -60°C or lower; storage at -20°C is <u>not</u> acceptable even for very short periods of time.

21. Remove the kidneys by making lengthwise incisions along each edge of the tissue and then detach using the "spoon" end of a stainless steel weighing spatula by applying firm, but gentle, pressure against the upper abdominal cavity wall (ie. against the dorsal aorta). In this procedure, the kidney is scraped away from the dorsal aorta and all associated connective tissue. The kidney is then to be placed in a cryovial or whirlpak, labelled and frozen in liquid nitrogen or dry ice. The kidney is to be removed from the fish and frozen as soon after death as possible. The kidney tissue <u>must</u> be stored and transported in the dark at -60°C.

22. Remove the intestine by severing immediately posterior to the stomach, or pyloric caeca, if applicable, and immediately anterior to the vent (anus). Remove gut contents from the intestine by running the gut through pinched fingers several times in order to squeeze out the contents. Then place the intestines in a whirlpak (air removed as much as possible), label and freeze on dry ice or liquid nitrogen. The intestines are to be removed from the fish and frozen as soon after death as possible. Intestinal tissue must be stored and transported in the dark at -60°C.

23. Gut contents from each fish are to be placed in labelled containers and preserved in a 5% formalin solution. Gut contents are being retained for visual inspection and possible nitrogen stable isotope analyses. Gut contents from fish collected at the Slave River sites are to be delivered to the Freshwater Institute. Gut contents from all other locations are to be visually inspected by the contractor and the contents recorded. After visual inspection, these samples are also to be delivered to the Freshwater Institute.

24. Remove the gill arches and attached filaments by severing the dorsal and ventral cartilaginous attachments of the arches to the surrounding oral cavity. Place the gill arches in a whirlpak, label and freeze on dry ice or in liquid nitrogen. Gill arches are to be removed from the fish and frozen as soon after death as possible. Gill arches must be stored and transported in the dark at -60°C.

25. Score each fish for gender and for state of sexual development.

26. Remove gonads, weigh and record the weight to nearest 0.1 gm. Each gonad sample must then be prepared and stored as follows:

    Materials

    HistoPrep Tissue Capsules ((disposable polypropylene) 38 x 8 mm (Dia XH)) are used in preserving and processing tissues. Pertinent information (e.g., fish sample number) and identification of the specimen should be written on each capsule with an HB pencil. The capsules are available from Fisher Scientific (product number 15-182-218).

    Nalgene Square Polyethylene wide mouth bottles (Ngle 2114) of 1 litre capacity have proven to be excellent for field sampling simply because they do not leak. Bottles containing about 750 ml of Davidson's solution are packed (2 to a bag) in plastic bags (14" x 22") and secured with masking tape for transportation. The bottles are available from Fisher Scientific (product number 03-3120).

    Davidson's fixative is used to preserve the pieces of gonads that have been removed from each fish. Tissue capsules containing gonad samples are immersed in this solution for at

least 24 hours and can be stored for several weeks. The Davidson solution can be prepared as follows:

95% ethyl alcohol	300.0 mL
formaldehyde	200.0 mL
glacial acetic acid	100.0 mL
distilled water	300.0 mL
glycerine	100.0 mL

These ingredients should be adequately stirred.

A 5% buffered formalin solution is also used to preserve pieces of ovary. When fresh eggs are placed directly into 5% buffered formalin, there is no significant alteration in egg weight. Labelled tissue capsules are used to hold and identify each sample. The formalin is made up as follows:

formaldehyde	50.0 mL
sodium phosphate monobasic	4.0 g
sodium phosphate dibasic, anhydrous	6.5 g
distilled water added to make 1 litre	

Procedure for Fixation:

One litre Nalgene bottles containing 750 mL Davidson's and 5% formalin solutions are readied. After weighing the gonads, pieces are dissected out with a scalpel. Generally, the mid-region of the gonad from one side, i.e., the left gonad is used from each fish. It is important that the tissue pieces do not exceed 0.5 cm in thickness but may be slightly larger (usually not greater than 1.0 cm) in the other dimensions. The tissue pieces should easily fit into the tissue capsules without being squashed, and should not take up more than half the capsule space. If a sensitive analytical balance is available, the piece of tissue to be placed in formalin can be weighed and the weight recorded (0.1 g) in a notebook and on the capsule. Gonad tissue from each fish should be placed into <u>two</u> capsules. Tissue should be placed into each of the fixatives and with forceps, momentarily submersed (the tissue capsules tend to float in the fixatives). No more than 24 tissue capsules are to be placed in each 1 litre bottle to ensure adequate fixative volume. Tissue samples from the same fish should be stored in separate Nalgene bottles. Nalgene bottles should be labelled to indicate which samples they contain.

27. Weigh the gutted carcass of the fish.

28. Retain, store and label the appropriate ageing structure (see MacKay *et al.* 1990) of all northern pike, longnose sucker and flathead chub sampled.

29. Place the remaining fish carcass in a contaminant free bag (to be supplied to the contractor by the NRBS), label and store on dry ice or in liquid nitrogen. The carcass must be stored and transported at or below -20°C.

30. The use of dry ice or liquid nitrogen for initial freezing and shipping and shipping of all samples is mandatory. If dry ice is used, tissue samples should be placed between slabs of dry ice and liberal quantities of dry ice should be placed along the sides and top and bottom of each cooler.

31. The use of sturdy styrofoam coolers is mandatory for the storage and transport of fish samples. Styrofoam coolers of weak construction may not assure constant freezing and may break down during shipping. Duct tape should be wrapped around coolers before shipping to ensure that the lid is held firmly in place during transport. Coleman type coolers may be used but may not necessarily be returned immediately for repetitive use. The Contractor is responsible for picking up coolers when notified by Alberta Environmental Protection or Freshwater Institute. A listing of the contents of each cooler should be attached to each cooler. A copy of the listing for each cooler should also be submitted to the component coordinator.

32. Fish carcasses and bile samples retained for contaminant analyses can be stored together in the same coolers. These tissue samples will be delivered to Alberta Environmental Protection, Edmonton. All other tissue samples can also be stored together in the same cooler (they should be kept in the dark until analyzed), but they must not be stored in the same cooler as the carcasses and bile samples secured for contaminant analyses. These tissues will be delivered to the Freshwater Institute, Winnipeg.

33. With the exception of carcasses secured for contaminant analyses and bile samples, all tissue samples are to be shipped directly to:

Don Metner
Fisheries and Oceans Canada
Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6
work phone: (204) 983-5168
fax: (204) 984-2403

-or-

Dr. Lyle Lockhart

Prior arrangements must be made with Mr. Metner or Dr. Lockhart to ensure that samples are picked-up immediately upon arrival in Winnipeg. The intent is that samples will make their way to appropriate freezing facilities as soon as they get to Winnipeg. The contractor will be responsible for all approvals and costs related to the shipping of samples for this project.

34. All other samples (bile samples and carcasses for contaminant analyses) are to be delivered to:

Earle Baddaloo
Alberta Environmental Protection
6th Floor, Oxbridge Place
9820-106th Street
Edmonton, Alberta
T5K 2J6
work phone: (403) 427-6102
fax: (403) 422-9714
home phone: (403) 434-8967

-or-

Dr. Sub Ramamoorthy
Alberta Environmental Protection
6th Floor, Oxbridge Place
9820-106th Street
Edmonton, Alberta
T5K 2J6
work phone: (403) 427-6102
fax: (403) 422-9714
home phone: (403) 435-8137

Prior arrangements must be made with Mr. Baddaloo or Dr. Ramamoorthy to ensure that samples are picked-up immediately upon arrival in Edmonton. The intent is that samples will make there way to appropriate freezing facilities as soon as they are delivered to Edmonton. The contractor will be responsible for all approvals and costs related to the shipping of samples for this project.

35. If any problems are encountered in following the above protocols the contractor is to contact the scientific authority for advice. Any deviation from the above established protocol/procedure should be justified and accounted for in writing and a detailed description of what was done is to be submitted with the fish sample; this is to assure credibility and validity of results.

36. With the exception of Fisheries and Oceans Canada recommended contaminant free bags, the contractor will provide all equipment and supplies required to collect, process, preserve and transport fish collected under this contract.

37. All sampling equipment and specimens must be kept away from fuel, exhaust, oil, smoke, plastic and anything else that may potentially contaminate samples.

38. All dissection equipment **must** be decontaminated before processing begins on each fish. Dissecting equipment is to be rinsed in acetone, air dried, then rinsed in hexane and air dried. Field crews should where masks to avoid inhaling fumes of acetone and hexane. It is also recommended that acetone and hexane not be used in an enclosed spaces such as tents and that the decontamination of equipment proceed away from the main work area used to process fish.

39. It is recommended that the contractor use disposal rubber or plastic gloves during the processing fish. A new pair of glove should be used to process each fish.

40. All cutting surfaces used to process fish should be wiped clean with wet paper towels after each fish has been processed. Separate paper towels used for each cleaning session.

NORTHERN RIVER BASINS STUDY

PROJECT 3144-D1: BASIN-WIDE FALL BURBOT COLLECTION

SCHEDULE D
COLLECTION AND HANDLING PROTOCOL FOR NON-TARGET FISH SPECIES FOR ALL SITES EXCEPT SLAVE RIVER COLLECTION SITES

1. Up to ten individuals of each non-target fish species from each sampling location that are captured during the collection of target fish species (burbot, northern pike, longnose sucker and flathead chub) are to be retained for contaminant analyses.

2. A sample numbering system must be designed and used to facilitate tracking of non-target fish samples.

3. For each fish caught record the following information: 1) species, 2) date and time of capture, 3) sampling location, 4) collector(s), 5) set number, 6) weight, 7) fork length, 8) total length, 9) sex (if it can be determined externally), 10) maturity (where it can be determined externally), 10) maturity and 11) sampling method.

4. An external examination must be conducted on all fish for abrasions, lesions, secondary sexual characteristics (if obvious), missing fins or eyes, opercular, fin or gill damage, external lesions or other anomalous features. All external lesions should be recorded as to position, shape, size, colouration, depth, appearance on cut surface and any other features of note. This information is to be recorded on a gross pathology sheet contained in Schedule G for any fish showing abnormalities/deformities. Gross pathology sheets presented in Schedule G may have to be modified slightly, to show the body type of the species under examination. The checklist presented in Schedule G should be used as a guide for reviewing internal and external abnormalities/deformities on each fish. Prepare a photographic record of any external abnormalities encountered. A standard Kodak Colour chart is to be shown in each photograph of external abnormalities or deformities. A label clearly showing the sample number of the fish is also to be shown in each photo.

5. Retain, store and label the appropriate ageing structure (see MacKay *et al.* 1990) of all fish sampled.

6. All fish samples are to be placed into Fisheries and Oceans recommended contaminant-free plastic bags, labelled and frozen on dry ice or in liquid nitrogen as soon as possible after collection.

7. Dry ice or liquid nitrogen should be used for initial freezing and shipping of samples. Any freeze-thaw, however moderate it may be, will cause contamination migration within a sample and this may affect contaminant concentration levels. During initial on-site storage and transportation whole fish samples must be maintained at temperatures at or below -20°C.

8. The use of sturdy styrofoam coolers is mandatory for the storage and transport of fish samples. Styrofoam coolers of weak construction may not assure constant freezing and may break down during shipping. Duct tape should be wrapped around coolers before shipping to ensure that the lid is held firmly in place during transport. Coleman type coolers may be used but may not necessarily be returned immediately for repetitive use. The Contractor is responsible for picking up coolers when notified by Alberta Environmental Protection or Freshwater Institute. A listing of the contents of each cooler should be attached to each cooler. A copy of the listing for each cooler should also be submitted to the component coordinator.

9. If dry ice is to be used to ship samples, liberal quantities should be placed along the sides and top and bottom of the cooler as well as between fish samples.

10. All fish samples are to be delivered directly to:

Earle Baddaloo
Alberta Environmental Protection
6th Floor, Oxbridge Place
9820-106th Street
Edmonton, Alberta
T5K 2J6
work phone: (403) 427-6102
fax: (403) 422-9714
home phone: (403) 434-8967

-or-

Dr. Sub Ramamoorthy
Alberta Environmental Protection
6th Floor, Oxbridge Place
9820-106th Street
Edmonton, Alberta
T5K 2J6
work phone: (403) 427-6102
fax: (403) 422-9714

home phone: (403) 435-8137

Prior arrangements must be made with Mr. Baddaloo or Dr. Ramamoorthy to ensure that samples are picked-up immediately upon arrival in Edmonton. The intent is that samples will make there way to appropriate freezing facilities as soon as they are delivered to Edmonton. The contractor will be responsible for all approvals and costs related to the shipping of samples for this project.

11. Any deviation from the above established protocol/procedure should be justified and accounted for in writing and a detailed description of what was done is to be submitted with the fish sample; this is to assure credibility and validity of results.

12. With the exception of Fisheries and Oceans Canada recommended contaminant free bags, the contractor will provide all equipment and supplies required to collect, process, preserve and transport fish collected under this contract.

13. All sampling equipment and specimens must be kept away from fuel, exhaust, oil, smoke, plastic and anything else that may potentially contaminate samples.

NORTHERN RIVER BASINS STUDY

PROJECT 3144-D1: BASIN-WIDE FALL BURBOT COLLECTION

SCHEDULE E
COLLECTION AND HANDLING PROTOCOL FOR NON-TARGET FISH SPECIES AT SLAVE RIVER COLLECTION SITES

1. Up to ten individuals of each non-target fish species from each sampling location that are captured during the collection of target fish species (burbot, northern pike, longnose sucker and flathead chub) are to be retained for contaminant analyses.

2. A sample numbering system must be designed and used to facilitate tracking of non-target fish samples.

3. For each fish caught record the following information: 1) species, 2) date and time of capture, 3) sampling location, 4) collector(s), 5) set number, 6) weight, 7) fork length, 8) total length, 9) sex, 10) stage of sexual maturity, 10) maturity and 11) sampling method, 12) an estimate of percent stomach fullness, and 13) gonad weight.

4. An external examination must be conducted on all fish for abrasions, lesions, secondary sexual characteristics (if obvious), missing fins or eyes, opercular, fin or gill damage, external lesions or other anomalous features. All external lesions should be recorded as to position, shape, size, colouration, depth, appearance on cut surface and any other features of note. This information is to be recorded on a gross pathology sheet contained in Schedule G for any fish showing abnormalities/deformities. Gross pathology sheets presented in Schedule G may have to be modified slightly, to show the body type of the species under examination. The checklist presented in Schedule G should be used as a guide for reviewing internal and external abnormalities/deformities on each fish. Prepare a photographic record of any external abnormalities encountered. A standard Kodak Colour chart is to be shown in each photograph of external abnormalities or deformities. A label clearly showing the sample number of the fish is also to be shown in each photo.

5. After the external examination, fish should be euthanized via concussion, cervical dislocation or with an overdose of anaesthetic. Work must progress quickly on the euthanized fish and tissue samples must be quick frozen between slabs of dry ice or in liquid nitrogen as soon as possible after death to avoid spoiling of tissue samples.

6. Open the fish ventrally and examine it for internal lesions and record any abnormalities. Care should be taken not to cut into internal organs when opening the fish. A summary table is to be included in the final report outlining the frequency and types of abnormalities and deformities encountered.

7. Remove the gonads and weigh them to within 0.1 grams.

   In the case of inconnu and Coregoninae species (cisco and whitefish), after weighing place the entire gonad in a whirlpak or other container containing 5% buffered formalin.

8. Estimate and record percent stomach fullness.

9. Remove the stomach and its contents and place them in a labelled container and preserve in a 5% buffered formalin solution. The gut contents are to be delivered to the Freshwater Institute for further analyses.

10. Retain, store and label ageing structure as outlined in MacKay *et al.* (1990) of all fish sampled. In addition, the otoliths of all fish species except pike should be retained for fish ageing. For pike the cliethrum is also to be retained for ageing.

11. The remaining fish carcass is to be placed into Fisheries and Oceans recommended contaminant-free plastic bags, labelled and frozen on dry ice or in liquid nitrogen as soon as possible after collection.

12. Dry ice or liquid nitrogen should be used for initial freezing and shipping of samples. Any freeze-thaw, however moderate it may be, will cause contamination migration within a sample and this may affect contaminant concentration levels. During initial on-site storage and transportation whole fish samples must be maintained at temperatures at or below -20°C.

13. The use of sturdy styrofoam coolers is mandatory for the storage and transport of fish samples. Styrofoam coolers of weak construction may not assure constant freezing and may break down during shipping. Duct tape should be wrapped around coolers before shipping to ensure that the lid is held firmly in place during transport. Coleman type coolers may be used but may not necessarily be returned immediately for repetitive use. The Contractor is responsible for picking up coolers when notified by Alberta Environmental Protection or Freshwater Institute. A listing of the contents of each cooler should be attached to each cooler. A copy of the listing for each cooler should also be submitted to the component coordinator.

14. If dry ice is to be used to ship samples, liberal quantities should be placed along the sides and top and bottom of the cooler as well as between fish samples.

15. All fish carcasses are to be delivered directly to:

Earle Baddaloo
Alberta Environmental Protection
6th Floor, Oxbridge Place
9820-106th Street
Edmonton, Alberta
T5K 2J6
work phone: (403) 427-6102
fax: (403) 422-9714
home phone: (403) 434-8967

-or-

Dr. Sub Ramamoorthy
Alberta Environmental Protection
6th Floor, Oxbridge Place
9820-106th Street
Edmonton, Alberta
T5K 2J6
work phone: (403) 427-6102
fax: (403) 422-9714
home phone: (403) 435-8137

Prior arrangements must be made with Mr. Baddaloo or Dr. Ramamoorthy to ensure that samples are picked-up immediately upon arrival in Edmonton. The intent is that samples will make there way to appropriate freezing facilities as soon as they are delivered to Edmonton. The contractor will be responsible for all approvals and costs related to the shipping of samples for this project.

16. With the exception of carcasses secured for contaminant analyses, all tissue samples are to be shipped directly to:

Don Metner
Fisheries and Oceans Canada
Freshwater Institute
501 University Crescent
Winnipeg, Manitoba
R3T 2N6
work phone: (204) 983-5168
fax: (204) 984-2403

-or-

Dr. Lyle Lockhart

Prior arrangements must be made with Mr. Metner or Dr. Lockhart to ensure that samples are picked-up immediately upon arrival in Winnipeg. The intent is that samples will make there way to appropriate freezing facilities as soon as they get to Winnipeg. The contractor will be responsible for all approvals and costs related to the shipping of samples for this project.

17. Any deviation from the above established protocol/procedure should be justified and accounted for in writing and a detailed description of what was done is to be submitted with the fish sample; this is to assure credibility and validity of results.

18. With the exception of Fisheries and Oceans Canada recommended contaminant free bags, the contractor will provide all equipment and supplies required to collect, process, preserve and transport fish collected under this contract.

19. All sampling equipment and specimens must be kept away from fuel, exhaust, oil, smoke, plastic and anything else that may potentially contaminate samples.

20. All dissection equipment **must** be decontaminated before processing begins on each fish. Dissecting equipment is to be rinsed in acetone, air dried, then rinsed in hexane and air dried. Field crews should where masks to avoid inhaling fumes of acetone and hexane. It is also recommended that acetone and hexane not be used in an enclosed spaces such as tents and that the decontamination of equipment proceed away from the main work area used to process fish.

21. It is recommended that the contractor use disposal rubber or plastic gloves during the processing fish. A new pair of glove should be used to process each fish.

22. All cutting surfaces used to process fish should be wiped clean with wet paper towels after each fish has been processed. Separate paper towels must be used for each cleaning session.

NORTHERN RIVER BASINS STUDY

PROJECT 3144-D1: BASIN-WIDE FALL BURBOT COLLECTION

SCHEDULE F
HABITAT CLASSIFICATION AND DOCUMENTATION SYSTEM FOR USE IN FISHERIES SURVEYS CONDUCTED UNDER THE NORTHERN RIVER BASINS STUDY

1. CHANNEL TYPES

TYPE U - UNOBSTRUCTED CHANNEL

Only one main channel; permanent islands absent; side bars occasionally present with only limited development of exposed med-channel bars during low flows.

TYPE S - SINGULAR ISLAND

Presence of two channels around single, permanent island; side bars and mid-channel bars often present at low flows

TYPE M - MULTIPLE ISLANDS

More than two channels and permanent islands present; generally exhibit extensive side bar and mid-channel bar development during low flows.

TYPE R - RAPIDS

A special channel type used to identify the unique habitat at the Grand Rapids on the Athabasca River.

TYPE F - FALLS

A special channel type used to identify the unique habitat type at Vermilion Falls on the Peace River.

The classification of major habitat units Type U, Type S and Type M is to be based on field observations and air photo interpretation. For example, in instances where a single permanent island is present, but one of the channels around the island is dry, the habitat

classification could be either Type U (unobstructed channel) or Type S (Singular Island) depending on conditions within the dry channel. If the dry channel exhibits a low relief at the inlet and is devoid of permanent vegetation, suggesting that it contained flow during some portion of the open water season (e.g., during spring runoff or freshet flows), the area is to be classed as Type S habitat. If, however, the entrance to the dry channel is at a level near the high water mark, well vegetated with either grasses or willows and appears to contain flows only during extreme flood events, the channel is to be classed Type U. These criteria are also to be used to differentiate between Type S and Type M channel habitats.

2. SPECIAL HABITAT FEATURES

Tributary Confluences (TC)

Confluence area of tributary entering mainstem; classified according to flow at time of survey and wetted width at mouth

TC1 - intermittent flow (dry/trickle); ephermal stream
TC2 - flowing; width at mouth <5.0 m
TC3 - flowing; width at mouth 5-15 m
TC4 - flowing; width at mouth 15-30 m
TC5 - flowing; width at mouth 30-60 m
TC6 - flowing; width at mouth $>$ 60 m

Riffle (RF)

Portion of channel with increased velocity relative to Run and Pool habitat types; broken water surface due to effects of submerged or exposed bed materials; relatively shallow (less than 25 cm) during moderate to low flow periods.

> Riffle (RF) - Typical riffle habitat type; limited submerged or overhead cover for juveniles and adult life stages; coarse substrate.
>
> Riffle-Boulder Garden (RF/BG) - Riffle habitat type with significant occurrence of large boulders; availability of significant instream cover for juveniles (to lesser extent adults) at moderate to high flow events.

Rapids (RA)

Portion of channel with highest velocity relative to other habitat types. Deeper than Riffle (ranging from 25-50 cm); often formed by channel constriction. Substrate extremely

coarse; dominated by large cobble and boulder material. Instream cover provided in pocket eddies (P3) and associated with cobble/boulder substrate.
Runs (RU)

Portion of channel characterized by moderate to high current velocity relative to Pool and Flat habitat; water surface largely unbroken. Deeper than Riffle habitat type. Can be differentiated into four types: deep-slow, deep-fast, shallow-slow, and shallow-fast.

> Run (Class 1) (RU1) - Highest quality Run habitat type. Maximum depth exceeding 1.5 m; average depth 1.0 m. High instream cover at all flow conditions (submerged boulders/bedrock fractures, depth). Generally of deep-slow type (to a lesser extent deep-fast) and situated proximal to upstream food production area (i.e., RF, RU3).
>
> Run (Class 2) (RU2) - Moderate quality Run habitat type. Maximum depth reaching or exceeding 1.0 m, generally exceeding 0.75 m. High instream cover during all but low flow events (baseflow). Generally of either deep-fast type or moderately deep-slow type.
>
> Run (Class 2)/Boulder Garden (RU2/BG) - Moderate quality Run habitat type; presence of large boulders in channel; high instream cover (boulder, bedrock fractures, turbulence) at all but low-flow events (baseflow). Depth characteristics similar to RU2; however, required maximum depth lower due to cover afforded by boulders.
>
> Run (Class 3) (RU3) - Lowest quality Run habitat type. Maximum depth of 0.75 m, but averaging <0.50 m. Low instream cover at all but high flow events. Generally of shallow-fast or shallow-slow types.
>
> Run (Class 3)/Boulder Garden (RU3/BG) - Similar to R# in depth and velocity characteristics; presence of large boulders in channel offers improved instream cover during moderate and high flow events.

Flat (FL)

Area of channel characterized by low current velocities (relative to RF and Ru cover types); near-laminar (i.e., non-turbulent) flow character. Depositional area featuring predominantly sand/silt substrate. Differentiated from Pool habitat type on the basis of high channel uniformity and lack of direct riffle/run association. More depositional in nature than RU3 habitat (sand/silt substrate, lower food production, low cover, etc.).

Flat (Class 1) (F1) - High quality Flat habitat type. Maximum depth exceeding 1.5 m; average depth 1.0 m or greater.

Flat (Class 2) (F2) - Moderate quality Flat habitat type. Maximum depth exceeding 1.0 m; generally average depth exceeding 0.75 m.

Flat (Class 3) (F3) - Low quality Flat habitat type. Maximum depth of 0.75 m, averaging less than 0.50 m.

Pool (P)

Discrete portion of channel featuring increased depth and reduced velocity (downstream oriented) relative to Riffle and Run habitat types.

Pool (Class 1) (P1) - Highest quality Pool habitat type. Maximum depth exceeding 1.5 m; average depth 1.0 m or greater; high instream cover at all flow-conditions (submerged boulder, bedrock fractures, depth, bank irregularities). Generally featuring high Riffle and/or Run association (i.e., food input). Often intergrades with deep-slow type of RU1.

Pool (Class 2) (P2) - Moderately quality Pool habitat type. Maximum depth reaching or exceeding 1.0 m, generally exceeding 0.75 m. High instream cover at all but low flow events (baseflow).

Pool (Class 3) (P3) - Low quality pool habitat type. Maximum depth of 0.75 m, averaging <0.50 m. Low instream cover at all but high flow events. Includes small pocket eddy type habitat.

Other Features

Includes the following instream features:

Chutes (CH) - Area of channel constriction, generally resulting in channel deepening and increased velocity. Associated habitat types are R1 and R2.

Ledges (LG) - Areas of bedrock intrusion into the channel; often create Chutes and Pools.

Other - Miscellaneous features (fallen tree, log jams, large boulder, etc.).

Shoal (SH)

Shallow (<1.0 m depth), submerged areas of coarse (SHC) or fine (SHF) substrates generally found in mid-channel areas or associated with depositional areas around islands and side bars.

Backwater (BW)

Discrete, localized area of variable size, exhibiting a reversed flow direction relative to the main current; generally produced by bank irregularities; velocities variable but generally lower than in adjacent main flow; substrate similar to that in adjacent channel although usually with a higher percentage of fines.

Snye (SN)

Area characterized by a non-flowing body of water (generally within a side channel_ which retained a connection to a flowing channel at its downstream end; most commonly associated with braided channel areas but also occurred in singular channels in association with point or side-bar development; substrate mainly silt/sand; depths within the snye proper were only recorded at snyes in intensive sites.

Slough (SL)

A non-flowing body of water located in the flood plain but completely isolated from flowing waters except during annual or irregular flood events. Often exhibited more extensive littoral development in comparison to snye areas (dependent upon frequency of inundation); substrate of silt and organic material; water levels maintained by seepage, springs, precipitation, etc.

N.B. - In all cases note whether the feature is associated with the main channel or a side channel.

3. BANK HABITAT TYPES

Armoured/Stable

A1 Banks generally stable and at repose with cobble/small boulder/gravel substrates predominating; uniform shoreline configuration with few/minor bank irregularities; velocities adjacent to bank generally low-moderate, instream cover limited to substrate roughness (i.e., cobble/small boulder interstices); overhead cover provided by turbidity.

A2 Banks generally stable and at repose with cobble/small boulder and large boulder substrates predominating; irregular shoreline configuration generally consisting of a series of armoured cobble/boulder outcrops that produce Backwater habitats; velocities adjacent to bank generally moderate with low velocities provided in Backwater habitats; instream cover provided by Backwater areas and substrate roughness; overhead cover provided by depth and turbidity; occasionally associated with C1, E4 and E5 banks.

A3 Similar to A2 in terms of bank configuration and composition, although generally with higher composition of large boulders/bedrock fractures; very irregular shoreline produced by large boulders and bed rock outcrops; velocities adjacent to bank generally moderate to high; instream cover provided by numerous small Backwater areas, eddy pools behind submerged boulders and substrate interstices; overhead cover provided by depth and turbidity; exhibits greater depths offshore than found in A1 or A2 banks; often associated with C1 banks.

A4 Rip-rap substrates consisting of angular boulder-sized materials; may be native rock or concrete debris; often associated with high velocity areas; generally with deep water situated immediately offshore; instream cover provided by substrate roughness; overhead cover provided by depth and turbulence; similar in many ways to A3 habitat but generally with smooth bank profile.

Canyon

C1 Valley walls forming banks; bank substrate consists primarily of large cobble/boulder/bedrock fractures; generally stable at bank-water interface although on upper bank slumps/rock falls common; typically deep with high current velocities offshore; abundant velocity cover provided by substrate roughness and frequent bank irregularities.

C2 Steep, stable bedrock banks associated with canyon cliffs or bedrock outcrops; deep to moderate depths offshore with generally moderate to fast current velocities; regular bank form; velocity cover occasionally provided by bedrock fractures in channel.

C2B Similar to C2 but bank is regular with no instream cover.

C3 Valley wall forming banks, bank substrate consists primarily of fines with some gravel/cobble at base; moderately eroding at bank-water interface, slumping on upper bank common. Moderate-high velocities - no instream cover.

Depositional

D1 Low relief, gently sloping bank type with shallow water depths offshore; substrate consists predominantly of fines (i.e., sand/silt); low current velocities offshore; instream cover generally absent or, if present, consisting of shallow depressions produced by dune formation (i.e., in sand substrates) or embedded cobble or boulders and vegetative debris; this bank type is generally associated with bar formations.

D2 Low relief, gently sloping bank type with shallow water depths offshore; substrate consists of coarse materials (i.e., gravels/cobbles); low-moderate current velocities offshore; areas with higher velocities usually producing riffle areas; overhead cover provided by surface turbidity or surface turbulence in riffle area; instream cover provided by substrate roughness; often associated with bar formations; and shoal habitat.

D3 Similar to D2 but with coarser substrates (i.e., large cobble/small boulder) more dominant; boulders often embedded in cobble/gravel matrix; generally found in areas with higher average flow velocities than D1 or D2 banks; instream cover abundantly available in form of substrate roughness; overhead cover provided by surface turbulence; often associated with fast riffle or rapid areas offshore; generally moderate to high velocities offshore; transitional bank type that exhibits characteristics of both Armoured and Depositional bank types.

Erosional

E1 High, steep, eroding banks often with terraced profile; bank unstable, frequently slumping and eroding; substrate consists of sand/silt materials; moderate to high offshore current velocities; steep bank profile extends under water surfaces resulting in deep water immediately offshore; instream cover provided by abundant submerged bankside vegetation (i.e., trees, shrubs, root wads, etc.) that has fallen into the channel from the eroding bank crest; overhead cover provided by partially submerged vegetation, depth and turbidity.

E2 Similar to A1 except without the high amount of instream vegetative debris (i.e., banks generally clean); depths offshore generally shallower than along E1 banks.

E3 High, steep and eroding banks, substrate consists of loose till deposits (i.e., gravel/cobble/sand mixture); moderate to high current velocities offshore; moderate depths offshore; instream cover availability limited to substrate roughness; overhead cover provided by turbidity.

E4 Steep, eroding or slumping highwall bank; substrates variable but primarily consisting of fines (i.e., clays/silts); moderate to high current velocities offshore; depths offshore generally moderate to deep; instream cover limited to occasional Backwater formed by bank irregularities; overhead cover provided by depth and turbidity.

E4B Same as E4, but instream cover also provided by log-jams and woody debris.

E5 Low, steep banks, often with terraced profile; predominantly composed of silt/sad substrates; generally low current velocities offshore; depths offshore variable but generally shallow to moderate; instream cover usually absent; this bank type is often associated with Backwater habitats in A1 and A2 bank types; overhead cover provided by turbidity.

E6 Low slumping/eroding bank; substrates may either be cobble/gravel or silt with occasional cobble/gravel patches; depths offshore moderate; velocities moderate-high instream cover provided by abundant woody debris of occasional boulders; overhead cover provided by overhanging trees and depth and turbidity; numerous small Backwaters often with A1 or A2 habitats right at bank interface.

Composite

These classifications are used in situations where the bank-water interface (i.e., nearshore bank) is predominantly one bank type but is still strongly influenced by the adjacent farshore bank (e.g., A2/C2 used where the nearshore bank is type A2 but was produced by active bedrock fracturing from the farshore bank type C2). In these composite bank types, the first bank type given is the dominant type at the bank-water interface.

4. SUBSTRATE ANALYSIS

Substrate Classes - plant detritus/organic material; mud/soft clay; silt; sand; gravel (0.2 - 5.0 cm diameter); cobble (5.1 - 20.0 cm diameter); boulder (>20.0 cm diameter); and bedrock.

Where substrates can be visually identified, the percentage composition of each substrate type is to be estimated. In deeper areas, bottom type will be determined by "feeling" the bottom or from echo sounding tracing. Substrate classification in these areas will generally be limited to the identification of the dominant/co-dominant types (e.g., sand/silt, cobble or boulder, etc.).

5. CHANNEL MORPHOLOGY AND STREAM VELOCITIES

At each collection site take water depth measurements to determine the channel cross sectional profile and bankside habitat configuration. Measurements can be taken manually or be surveyed with sonar. These measurements should provide an indication of the average water depth and range of water depths at each collection site. Stream velocity measurements should also be recorded at each collection site. These measurements should also allow for a determination of average water velocity and the range of water velocities at each site.

NORTHERN RIVER BASINS STUDY

PROJECT 3144-D1: BASIN-WIDE FALL BURBOT COLLECTION

SCHEDULE G
GROSS PATHOLOGY EXAMINATION SHEETS

1. Gross Pathology Examination Sheets are to be filled out for any fish captured (collected for contaminant and/or biochemical analyses, tagged or sacrificed) under this project that exhibits any internal or external abnormalities/deformities. Gross Pathology Examination Sheets do not have to be filled out for fish that do not exhibit internal or external abnormalities/deformities.

2. The accompanying checklist is to be used as a guide by the contractor for reviewing the presence of internal or external abnormalities/deformities. To the extent possible, the types of abnormalities/deformities present should be characterized as outlined on the checklist. Descriptive information (colour, size, location, number) should also be provided for any abnormalities/deformities observed.

3. For target fish species (burbot, northern pike, longnose sucker and flathead chub) the location and size of external abnormalities/deformities should be indicated on the diagram at the top of the Gross Pathology Examination Sheet. For non-target fish species the Gross Pathology Examination Sheets provided will have to be modified in the field, to indicate the species and body shape of the specimen under review.

4. Colour photographs are to be taken of all external or internal abnormalities or deformities and are to be submitted with the Gross Pathology Examination Sheets as an appendix to the final report. Appropriate captioning should accompany each photograph to link it to an individual fish specimen. A standard Kodak colour chart is to be included in each photograph of any internal or external abnormalities/deformities.

5. In the event that a large number of specimens at any site have internal or external abnormalities/deformities, the contractor is asked to notify the Component Coordinator immediately.

NORTHERN RIVER BASINS STUDY
GROSS PATHOLOGY EXAMINATION SHEET CHECKLIST

Gross External Examination

Skin:	Normal	Haemorrhagic	Blisters
	Lesions	Tumour	Excessive Mucus
	Open Wounds	Necrotic	Ulcer
	Closed Wounds	Lost Scales	Abnormal Colour (note colour)

Note whether the wound is raised above, depressed or even with the skin surface

Eyes:	Normal	Cataract	Lens Lost
	Opaque cornea	Parasites	Bilateral
	Exophthalmia	Haemorrhagic	

Fins:	Normal	Eroded	Haemorrhagic
	Frayed	Deformed	

Gills:	Normal	Mottled	Excessive Mucus
	Necrotic	Cysts	Gas Emboli
	Telangiectasia	Fungus Visible	Hyperplasia
	Pale	Haemorrhagic	Large Parasites Visible

Gross Internal Examination

Adipose Tissue:

	Normal	Reduced	Abnormal Colour (note colour)
	Excessive	Cysts	Petechial Haemorrhagic

Liver:	Normal	Colour (pale)	Tumour	Haemorrhagic
	Excessive	Colour (mottled)	Necrotic	Cysts (parasites)
	Reduced	Lesions (single or multiple)		Cysts (fluid)

Spleen:

Normal	Raspberry	Abnormal Colour
Enlarged	Cysts (parasite)	
Reduced	Cysts (fluid)	

Intestines:

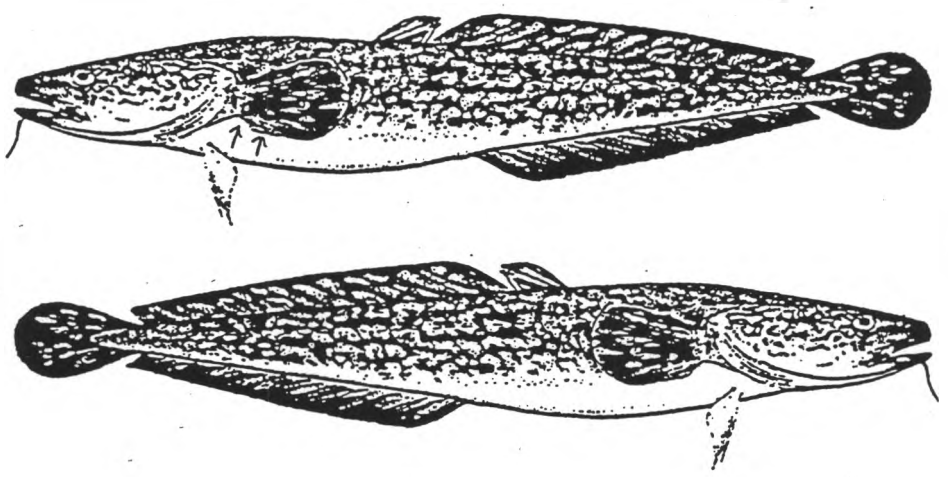
Normal	Haemorrhagic	Tumour
Flaccid	Cysts	
Distended (fluid)	Distended (mucoid)	

Kidney:

Normal	Lesions (single or multiple)	Cysts (parasite)
Enlarged	Gritty and White in Colour	Cysts (fluid)
Multiple	Tumour	

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

BURBOT



Sample No.:..... Location:.....

Collection Date:..... Collection Time:.....

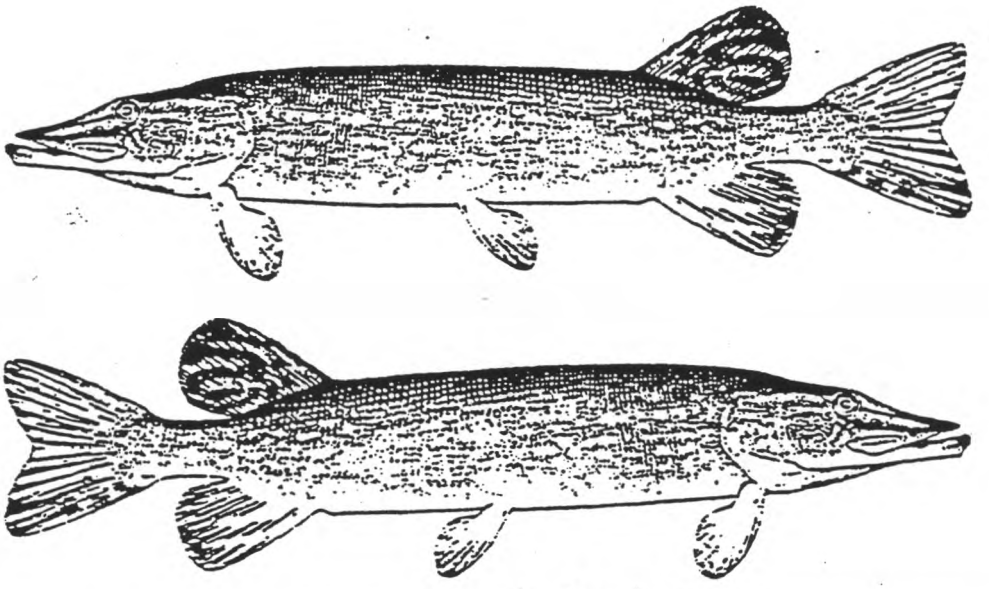
Collector (s)..... Capture Method.....

Comments:

NORTHERN RIVER BASINS STUDY

Gross Pathology Examination Sheet

NORTHERN PIKE



Sample No.:.....

Collection Date:.....

Collector (s).....

Location:.....

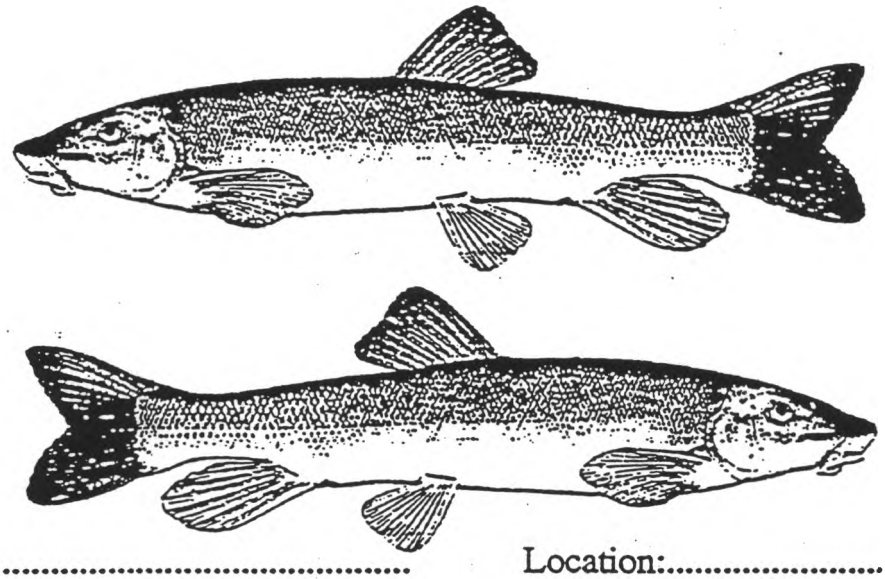
Collection Time:.....

Capture Method.....

Comments:

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



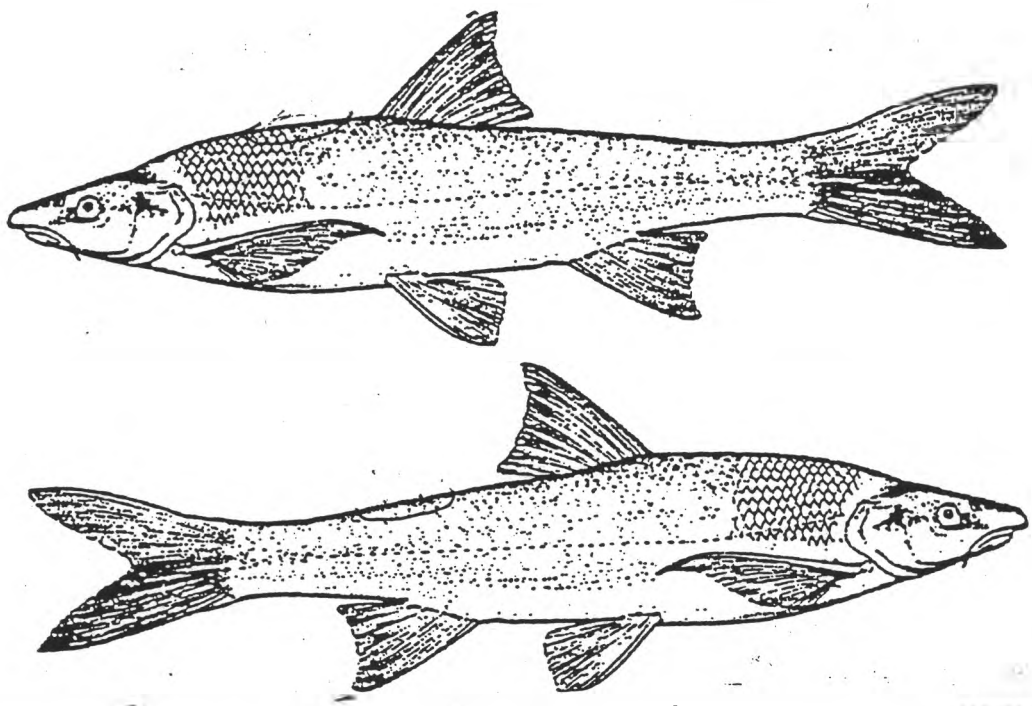
Sample No.:..... Location:.....

Collection Date:..... Collection Time:.....

Collector (s)..... Capture Method.....

Comments:

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet
FLATHEAD CHUB



Sample No.:.....

Collection Date:.....

Collector (s).....

Location:.....

Collection Time:.....

Capture Method.....

Comments:

NORTHERN RIVER BASINS STUDY

PROJECT 3144-D1: BASIN-WIDE FALL BURBOT COLLECTION

SCHEDULE H
PROTOCOL FOR THE COLLECTION OF SEDIMENT ON THE LOWER BIRCH RIVER

1. Sediment samples are to be collected from the lower Birch River in the same area that fish collections are made.

2. Sediment samples are to be collected along a 50 to 100 m river reach. A minimum of ten separate samples (grabs) are to be taken along the reach. Individual sampling locations are to be assigned separate sampling location codes.

3. Sediments are to be collected from depositional areas and should be as fine grained as possible (mud vs. sand). Only the top 5 cm of sediment are to be sampled.

4. Sediment samples may be collected with an Ekman dredge, coring device or a scoop ladle depending on water depth. Collecting equipment should be made from stainless steel and pre-cleaned in the laboratory to trace organic standards. Sampling equipment should be rinsed with river water between sites and before collection.

5. Individual samples are to be placed in separate 500 mL glass jars. Glass jars are to be labelled indicating the latitude and longitude of the sampling location, date of sampling, site # and sampler(s). The 500 mL glass jars will be provided to the contractor by the NRBS.

6. A numbering system is to be developed to designate individual sampling sites. Individual sampling sites are to be indicated on a 1:50,000 air photo enlargement.

7. Glass jars containing sediments are to be placed on dry-ice in styrofoam coolers for on-site storage and transportation. Pieces of styrofoam (or other soft material) should be placed between the glass containers to avoid breakage during shipping.

8. Sediment samples are to be delivered to:

Bob Crosley
Environment Canada
Room 845
220 - 4th Avenue S.E.
Calgary, Alberta
T2G 4X3
phone: (403) 292-5473
fax: (403) 292-5314

9. Sampling gear should be kept away from fuel, exhaust, oil, smoke, plastic and anything else that may potentially contaminate samples.

10. With the exception of 500 mL glass jars, the contractor will provide all equipment and supplies required to collect, preserve and transport sediment collected under this contract.

APPENDIX B. LIFE HISTORY DATA SUMMARY OF TARGET FISH

Abbreviations:

Species	BURB - burbot; NRPK - northern pike; LNSC - longnose sucker; FLCH - flathead chub, etc. (following Mackay et al. 1990)
FL	Fork length
TL	Total length
CF	Condition factor
GSI	Gonadosomatic index
LSI	Liver somatic index
Sex	U - unknown; F - female; M - male
Mat.	Maturity code:

Female	Male	State of Maturity
1	6	immature
2	7	maturing
3	8	mature
4	9	ripe
5	10	spent
0		unknown

Ageing structure	OT - otolith; CL - cleithra; FR - fin ray; SC - scale
Capture method	SL - set line; EF - electrofishing; A - angling; GN - gill net

Date	River/Delta	Site	Species	No.	Time caught	Time of death	FL (mm)	TL (mm)	Weight Total	Carcass	Liver	Gonad	CF	GSI	LSI	Sex	Mat.	Age	Ageing structure	Capture Method	Comments
28-Sep-94	Peace R.	PR1	BURB	1	1018		462	462	505				0.51			U	0		N/A	SL	dead on SL
29-Sep-94	Peace R.	PR1	BURB	2	941	1502	590	590	1063		23.7	27.0	0.52			F	2	12	OT	SL	
30-Sep-94	Peace R.	PR1	BURB	3	921	1403	645	645	1468	1256	38.7	8.1	0.55	0.64	3.08	F	2	8	OT	SL	
30-Sep-94	Peace R.	PR1	BURB	4	925	1455	517	517	642	575	13.2	5.2	0.46	0.90	2.30	F	2	7	OT	SL	
30-Sep-94	Peace R.	PR1	BURB	5	941	1442	411	411	382	328	14.2	13.0	0.55	3.96	4.33	M	7	6	OT	SL	
01-Oct-94	Peace R.	PR1	BURB	6	914	1139	541	541	734	694	13.0	5.0	0.46	0.72	1.87	F	2	12	OT	SL	
01-Oct-94	Peace R.	PR1	BURB	7	917	1104	582	582	1108	984	29.0	9.1	0.56	0.92	2.95	F	2	8	OT	SL	
01-Oct-94	Peace R.	PR1	BURB	8	919	1123	508	508	557	490	14.6	19.0	0.42	3.88	2.98	M	2	8	OT	SL	
01-Oct-94	Peace R.	PR1	BURB	9			518	518	596			6.2	0.43			F	2	12	OT	SL	dead on SL
01-Oct-94	Peace R.	PR1	BURB	10			570	570	911			3.0	0.49			M	7	12	OT	SL	dead on SL
01-Oct-94	Peace R.	PR1	FLCH	1	1021	1052	151	170	33	30	1.6		0.88	0.00	5.33	U	0	2	SC	EF	
28-Sep-94	Peace R.	PR1	LNSC	1	1054	1727	481	517	1217	1035	25.8	52.0	1.09	5.02	2.49	F	2	11	FR	EF	
28-Sep-94	Peace R.	PR1	LNSC	2	1101	1555	397	424	759	629	11.0	52.5	1.21	8.35	1.75	F	2	7	FR	EF	
28-Sep-94	Peace R.	PR1	LNSC	3	1103	1431	370	396	563	504	8.3	3.0	1.11	0.60	1.65	F	1	7	FR	EF	
28-Sep-94	Peace R.	PR1	LNSC	4	1106	1526	405	431	755	654	14.2	11.0	1.13	1.68	2.17	F	2	8	FR	EF	
28-Sep-94	Peace R.	PR1	LNSC	5	1107	1707	422	446	934	871	18.0	67.5	1.24	7.75	2.07	F	2	9	FR	EF	
28-Sep-94	Peace R.	PR1	LNSC	6	1109	1827	335	364	458	404	5.9	0.4	1.21	0.10	1.46	M	6	5	FR	EF	
28-Sep-94	Peace R.	PR1	LNSC	7	1121	1616	363	385	590	510	10.0	6.1	1.23	1.20	1.96	F	2	7	FR	EF	
28-Sep-94	Peace R.	PR1	LNSC	8	1139	1448	455	482	1002	848	15.6	39.0	1.06	4.60	1.84	F	2	9	FR	EF	
28-Sep-94	Peace R.	PR1	LNSC	9	1141	1503	402	435	738	639	9.0	18.0	1.13	2.82	1.41	M	7	8	FR	EF	
28-Sep-94	Peace R.	PR1	LNSC	10	1142	1803	387	414	726	627	13.0	8.0	1.25	1.28	2.07	F	2	8	FR	EF	
28-Sep-94	Peace R.	PR1	LNSC	11	1145		414	441	801				1.12			U	0		N/A	EF	died after blood taken
28-Sep-94	Peace R.	PR1	LNSC	12	1148	1652	408	440	724	620	11.4	33.0	1.06	5.32	1.84	M	7	8	FR	EF	
28-Sep-94	Peace R.	PR1	LNSC	13	1151	1903	414	436	760	648	13.0	5.9	1.07	0.91	2.01	M	7	9	FR	EF	
28-Sep-94	Peace R.	PR1	LNSC	14	1153	1416	437	466	916	740	18.0	68.2	1.09	9.22	2.43	F	2	9	FR	EF	
30-Sep-94	Peace R.	PR1	LNSC	15	1133	1347	431	461	973	785	19.8	66.0	1.21	8.41	2.52	F	2	12	FR	EF	
30-Sep-94	Peace R.	PR1	LNSC	16	1137	1428	407	435	739	650	10.0	1.2	1.09	0.18	1.54	F	1	9	FR	EF	
30-Sep-94	Peace R.	PR1	LNSC	17	1139	1328	415	446	905	708	14.6	53.6	1.26	7.57	2.06	F	2	9	FR	EF	
28-Sep-94	Peace R.	PR1	NRPK	1	1056	1227	504	532	923	836	15.0	18.0	0.72	2.15	1.79	M	7	5	CL	EF	
28-Sep-94	Peace R.	PR1	NRPK	2	1058	1242	446	476	611	564	8.3	6.5	0.69	1.15	1.47	F	2	3	CL	EF	
28-Sep-94	Peace R.	PR1	NRPK	3	1059	1743	590	628	1678	1371	31.3	40.9	0.82	2.98	2.28	M	7	5	CL	EF	
30-Sep-94	Peace R.	PR1	NRPK	4	1135	1511	264	282	154	120	1.6	1.0	0.82	0.83	1.33	M	6		CL	EF	
03-Oct-94	Peace R.	PR2	BURB	1	939	1534	618	618	1137	1115	17.0	7.0	0.48	0.63	1.52	F	2	11	OT	SL	
03-Oct-94	Peace R.	PR2	BURB	2	940	1806	474	474	507	454	6.0	1.0	0.47	0.22	1.32	M	6	7	OT	SL	
03-Oct-94	Peace R.	PR2	BURB	3	942		503	503	667				0.52			M	7	6	OT	SL	
03-Oct-94	Peace R.	PR2	BURB	4	1026	1621	513	513	604	552	4.0	2.0	0.45	0.36	0.72	M	7	13	OT	SL	
03-Oct-94	Peace R.	PR2	BURB	5	1035	1731	804	804	3672	3045	162.0	167.0	0.71	5.48	5.32	M	7	13	OT	SL	
03-Oct-94	Peace R.	PR2	BURB	6	1109	1557	756	756	2108	1818	51.0	46.0	0.49	2.53	2.81	F	2	15	OT	EF	
04-Oct-94	Peace R.	PR2	BURB	7	921	1128	643	643	1452	1291	58.0	9.0	0.55	0.70	4.49	F	2	11	OT	SL	
04-Oct-94	Peace R.	PR2	BURB	8	930	1026	559	559	827	712	22.0	36.0	0.47	5.06	3.09	M	7	8	OT	SL	
04-Oct-94	Peace R.	PR2	BURB	9	917	1057	580	580	931	818	22.0	40.0	0.48	4.89	2.69	M	7	7	OT	SL	
05-Oct-94	Peace R.	PR2	BURB	10	912	1116	645	645	1312	1167	16.0	6.0	0.49	0.51	1.37	F	2	9	OT	SL	
03-Oct-94	Peace R.	PR2	FLCH	1			270	304	225				1.13			F	2	7	SC	SL	dead on SL
04-Oct-94	Peace R.	PR2	FLCH	2	907	1157	261	287	164	146	1.0	3.0	0.91	2.05	0.68	F	2	8	SC	SL	
05-Oct-94	Peace R.	PR2	FLCH	3	915	1056	294	325	285	248	3.0	8.0	1.11	3.23	1.21	M	7	7	SC	SL	
05-Oct-94	Peace R.	PR2	FLCH	4			264	290	207				1.11			F	2	6	SC	SL	dead on SL
03-Oct-94	Peace R.	PR2	LNSC	1	1122	1644	476	505	1304	1102	20.0	17.0	1.21	1.54	1.81	F	2	10	FR	EF	
03-Oct-94	Peace R.	PR2	LNSC	2	1124	1405	462	500	1246	1021	21.0	60.0	1.26	5.88	2.06	F	2	10	FR	EF	
03-Oct-94	Peace R.	PR2	LNSC	3	1126	1430	446	475	1107	910	18.0	75.0	1.24	8.24	1.98	F	2	9	FR	EF	

Date	River/Delta	Site	Species	No.	Time caught	Time of death	FL (mm)	TL (mm)	Weight Total	Carcass	Liver	Gonad	CF	GSI	LSI	Sex	Mat.	Age	Ageing structure	Capture Method	Comments
03-Oct-94	Peace R.	PR2	LNSC	4	1132	1344	393	419	634	565	7.0	3.0	1.04	0.53	1.24	F	2	8	FR	EF	
03-Oct-94	Peace R.	PR2	LNSC	5	1135	1831	474	501	1202	1060	17.0	14.0	1.13	1.32	1.60	F	1	13	FR	EF	
04-Oct-94	Peace R.	PR2	LNSC	6			197	210	69				0.86			U	0		N/A	EF	
05-Oct-94	Peace R.	PR2	LNSC	7	954	1019	401	430	714	623	8.0	31.0	1.10	4.98	1.28	M	7	8	FR	EF	
05-Oct-94	Peace R.	PR2	LNSC	8	956	1036	399	428	697	612	9.0	3.0	1.09	0.49	1.47	F	2	8	FR	EF	
03-Oct-94	Peace R.	PR2	NRPK	1	948	1453	565	599	1307	1197	17.0	32.0	0.72	2.67	1.42	F	2	4	CL	SL	
03-Oct-94	Peace R.	PR2	NRPK	2	1111	1519	441	467	543	504	6.0	9.0	0.63	1.79	1.19	M	7	4	CL	EF	
03-Oct-94	Peace R.	PR2	NRPK	3	1115	1853	264	283	112	104	1.0	1.0	0.59	0.96	0.96	F	1	2	CL	EF	
07-Oct-94	Peace R.	PR3	BURB	1	918		464	464	423			1.0	0.42			M	6	11	OT	SL	
07-Oct-94	Peace R.	PR3	BURB	2	920	1601	635	635	1242	1141	10.0	5.0	0.48	0.44	0.88	F	2	7	OT	SL	
07-Oct-94	Peace R.	PR3	BURB	3	923		516	516	691			20.0	0.50			F	2	6	OT	SL	
07-Oct-94	Peace R.	PR3	BURB	4	928	1713	442	442	454	418	3.0	2.0	0.52	0.48	0.72	F	1	6	OT	SL	
07-Oct-94	Peace R.	PR3	BURB	5	932	1655	569	569	859	778	10.0	6.0	0.46	0.77	1.29	F	2	8	OT	SL	
07-Oct-94	Peace R.	PR3	BURB	6	938	1618	473	473	452	378	4.0	13.0	0.42	3.44	1.06	M	7	6	OT	SL	
08-Oct-94	Peace R.	PR3	BURB	7			279	279	104				0.47			U	0	7	N/A	SL	dead on SL
09-Oct-94	Peace R.	PR3	BURB	8	853	1052	398	398	268	244	2.0	1.0	0.42	0.41	0.82	F	1	6	OT	SL	
09-Oct-94	Peace R.	PR3	BURB	9	920	1032	570	570	972	883	8.0	1.0	0.52	0.11	0.91	M	7	7	OT	SL	
07-Oct-94	Peace R.	PR3	LNSC	1	1002	1150	458	495	1221	1036	22.0	55.0	1.27	5.31	2.12	M	7	13	FR	EF	
07-Oct-94	Peace R.	PR3	LNSC	2	1003	1437	453	473	1106	919	18.0	45.0	1.19	4.90	1.96	F	2	11	FR	EF	
07-Oct-94	Peace R.	PR3	LNSC	3	1005	1212	445	479	1067	887	19.0	72.0	1.21	8.12	2.14	F	2	10	FR	EF	
07-Oct-94	Peace R.	PR3	LNSC	4	1007	1230	416	449	954	804	14.0	39.0	1.32	4.85	1.74	M	7	11	FR	EF	
07-Oct-94	Peace R.	PR3	LNSC	5	1009	1106	468	491	1131	935	22.0	71.0	1.10	7.59	2.35	F	2	15	FR	EF	
07-Oct-94	Peace R.	PR3	LNSC	6	1011	1459	485	524	1252	1063	19.0	11.0	1.09	1.03	1.79	F	2	15	FR	EF	
07-Oct-94	Peace R.	PR3	LNSC	7	1011	1653	362	403	587	507	12.0	1.0	1.23	0.20	2.37	M	6	7	FR	EF	
07-Oct-94	Peace R.	PR3	LNSC	8	1015	1128	463	497	1430	1194	31.0	85.0	1.44	7.12	2.60	F	2	10	FR	EF	
07-Oct-94	Peace R.	PR3	LNSC	9	1020	1524	411	441	943	788	17.0	70.0	1.35	8.88	2.16	F	2	10	FR	EF	
07-Oct-94	Peace R.	PR3	LNSC	10	1023	1355	446	485	1124	896	16.0	10.0	1.26	1.12	1.79	F	2	13	FR	EF	
07-Oct-94	Peace R.	PR3	LNSC	11	1026	1415	378	403	650	567	8.0	30.0	1.20	5.29	1.41	M	7	10	FR	EF	
08-Oct-94	Peace R.	PR3	LNSC	12	1138	1435	411	435	725	630	9.0	26.0	1.04	4.13	1.43	M	7	9	FR	EF	
08-Oct-94	Peace R.	PR3	LNSC	13	1140	1409	458	491	1304	1013	29.0	79.0	1.35	7.80	2.86	F	2	14	FR	EF	
08-Oct-94	Peace R.	PR3	LNSC	14	1141	1639	450	479	915	789	18.0	8.0	1.00	1.01	2.28	F	2	12	FR	EF	
08-Oct-94	Peace R.	PR3	LNSC	15	1142	1659	452	484	1066	837	25.0	76.0	1.15	9.08	2.99	F	2	12	FR	EF	
08-Oct-94	Peace R.	PR3	LNSC	16	1143	1451	410	441	871	737	15.0	2.0	1.26	0.27	2.04	M	7	10	FR	EF	
08-Oct-94	Peace R.	PR3	LNSC	17	1144	1610	441	470	1016	858	19.0	4.0	1.18	0.47	2.21	M	7	10	FR	EF	
08-Oct-94	Peace R.	PR3	LNSC	18	1146	1533	500	537	1433	1219	24.0	16.0	1.14	1.31	1.97	F	2	12	FR	EF	
08-Oct-94	Peace R.	PR3	LNSC	19	1147	1512	446	483	1154	960	19.0	39.0	1.30	4.06	1.98	M	7	9	FR	EF	
08-Oct-94	Peace R.	PR3	LNSC	20	1148	1555	435	464	1198	993	29.0	11.0	1.45	1.11	2.92	F	2	10	FR	EF	
08-Oct-94	Peace R.	PR3	LNSC	21	1150	1734	442	478	1155	914	24.0	83.0	1.33	9.08	2.63	F	2	12	FR	EF	
08-Oct-94	Peace R.	PR3	LNSC	22			332	357	426				1.16			U	0		N/A	EF	
08-Oct-94	Peace R.	PR3	LNSC	23	1152	1719	340	362	431	380	6.0	1.0	1.09	0.26	1.58	U	0	6	FR	EF	
13-Sep-94	Smoky R.	SR1	BURB	1	953	1228	444	444	411	371	17.0	2.0	0.47	0.54	4.58	M	7	9	OT	SL	
13-Sep-94	Smoky R.	SR1	BURB	2	1019	1330	495	495	612	540	21.0	17.0	0.50	3.15	3.89	F	2	8	OT	SL	
13-Sep-94	Smoky R.	SR1	BURB	3	1028	0	460	460	412				0.42			F	2	7	N/A	SL	dead
14-Sep-94	Smoky R.	SR1	BURB	4	856	1120	391	391	364	308	18.0	5.8	0.60	1.88	5.84	M	7	8	OT	SL	
14-Sep-94	Smoky R.	SR1	BURB	5	904	1058	502	502	675	602	17.0	5.7	0.53	0.95	2.82	M	7	9	OT	SL	
14-Sep-94	Smoky R.	SR1	BURB	6	914	1018	480	480	577	489	25.0	17.0	0.52	3.48	5.11	F	2	8	OT	SL	
14-Sep-94	Smoky R.	SR1	BURB	7	916	1154	402	402	306	280	2.4	1.8	0.47	0.64	0.86	F	2	7	OT	SL	
14-Sep-94	Smoky R.	SR1	BURB	8	1216	1248	412	412	352	300	22.0	2.2	0.50	0.73	7.33	F	2	6	OT	SL	
14-Sep-94	Smoky R.	SR1	BURB	9	1226	1410	441	441	483	326	11.0	5.1	0.56	1.56	3.37	F	2	6	OT	SL	

Date	River/Delta	Site	Species	No.	Time caught	Time of death	FL (mm)	TL (mm)	Weight				CF	GSI	LSI	Sex	Mat.	Age	Ageing structure	Capture Method	Comments
									Total	Carcass	Liver	Gonad									
14-Sep-94	Smoky R.	SR1	BURB	10	1432	1526	475	475	597	511	32.0	18.0	0.55	3.52	6.26	M	7	10	OT	SL	
14-Sep-94	Smoky R.	SR1	BURB	11	1438	1541	518	518	756	651	55.0	4.0	0.54	0.61	8.45	F	2	9	OT	SL	
14-Sep-94	Smoky R.	SR1	BURB	12	1442	1503	545	545	749	630	23.4	16.6	0.46	2.63	3.71	M	7	11	OT	SL	
14-Sep-94	Smoky R.	SR1	BURB	13	1637	1729	486	486	628	540	26.0	29.0	0.54	5.37	4.81	M	7	11	OT	SL	
14-Sep-94	Smoky R.	SR1	BURB	14	1641	1648	449	449	479	348	16.0	6.2	0.53	1.78	4.60	M	7	7	OT	SL	moribund
14-Sep-94	Smoky R.	SR1	BURB	15	1708	1747	465	465	495	440	14.8	10.0	0.49	2.27	3.36	F	2	8	OT	SL	
15-Sep-94	Smoky R.	SR1	BURB	16	925	1148	352	352	244	216	7.0	4.0	0.55	1.85	3.24	M	7	4	OT	SL	
15-Sep-94	Smoky R.	SR1	BURB	17	952	1216	375	375	252	219	16.0	1.0	0.47	0.46	7.31	F	1	4	OT	SL	
15-Sep-94	Smoky R.	SR1	BURB	18	1034	1115	369	369	284	249	14.0	1.0	0.56	0.40	5.62	F	1	4	OT	SL	
17-Sep-94	Smoky R.	SR1	BURB	19	1034	1518	466	466	553	484	22.4	16.0	0.54	3.31	4.63	M	7	7	OT	SL	
17-Sep-94	Smoky R.	SR1	BURB	20	846		410	410	400				0.58			U	0	8	N/A	SL	died after blood taken
14-Sep-94	Smoky R.	SR1	FLCH	1	1437	1555	287	317	230	210	1.0	8.0	0.96	3.81	0.48	F	2	8	SC	SL	
15-Sep-94	Smoky R.	SR1	FLCH	2	936	1317	245	274	156	135	1.0	4.0	1.04	2.96	0.74	F	2	8	SC	SL	
15-Sep-94	Smoky R.	SR1	FLCH	3	955	1519	300	331	274	247	1.8	5.7	1.00	2.31	0.73	F	2	8	SC	SL	
17-Sep-94	Smoky R.	SR1	FLCH	4		1443	275	306	206	178	4.0	10.0	0.98	5.62	2.25	F	2	7	SC	EF	
17-Sep-94	Smoky R.	SR1	FLCH	5	1305	1413	264	298	191	171	1.8	5.0	1.02	2.92	1.05	F	2	8	SC	EF	
17-Sep-94	Smoky R.	SR1	FLCH	6		1505	196	222	77	66	1.0	1.0	0.98	1.52	1.52	F	2	4	SC	EF	
19-Sep-94	Smoky R.	SR1	FLCH	7			162	188	42				0.92			U	0		N/A	EF	
19-Sep-94	Smoky R.	SR1	FLCH	8		1111	242	273	136	127	0.6	0.4	0.94	0.31	0.47	M	7	8	SC	EF	
19-Sep-94	Smoky R.	SR1	FLCH	9		1058	153	170	31	30	0.5	1.0	0.78	3.33	1.67	M	6	3	SC	EF	
19-Sep-94	Smoky R.	SR1	FLCH	10		1743	176	196	51	46	0.2		0.88	0.00	0.43	U	0	4	SC	EF	
19-Sep-94	Smoky R.	SR1	FLCH	11		1754	200	228	75	70	0.2	0.3	0.90	0.43	0.29	M	7	5	SC	EF	
19-Sep-94	Smoky R.	SR1	FLCH	12		1733	200	225	79	72	0.3	1.5	0.95	2.08	0.42	F	2	5	SC	EF	
17-Sep-94	Smoky R.	SR1	LNSC	1		1429	381	413	664	579	8.0	35.0	1.20	6.04	1.38	F	2		FR	EF	
17-Sep-94	Smoky R.	SR1	LNSC	2	1305	1359	393	427	704	641	2.0	7.0	1.15	1.09	0.31	M	7	8	FR	EF	
17-Sep-94	Smoky R.	SR1	LNSC	3		1453	296	320	245	225	1.2	1.0	0.93	0.44	0.53	M	6			EF	
19-Sep-94	Smoky R.	SR1	LNSC	4		932	425	454	762	668	8.0	10.0	0.99	1.50	1.20	F	2			EF	
18-Sep-94	Smoky R.	SR1	LNSC	5		2043	395	425	787	577	3.8	31.0	1.27	5.37	0.66	M	7			EF	
19-Sep-94	Smoky R.	SR1	LNSC	6		840	410	445	752	663	5.2	30.0	1.09	4.52	0.78	M	7			EF	
18-Sep-94	Smoky R.	SR1	LNSC	7		2106	470	504	1115	943	16.2	66.0	1.07	7.00	1.72	F	2			EF	
19-Sep-94	Smoky R.	SR1	LNSC	8		947	487	524	1200	1072	9.0	36.0	1.04	3.36	0.84	F	2			EF	
19-Sep-94	Smoky R.	SR1	LNSC	9		1156	415	448	771	696	5.3	6.0	1.07	0.86	0.76	F	2			EF	
19-Sep-94	Smoky R.	SR1	LNSC	10		1123	445	484	866	745	9.0	46.0	0.98	6.17	1.21	F	2			EF	
19-Sep-94	Smoky R.	SR1	LNSC	11		1140	381	407	638	589	4.6	4.0	1.15	0.68	0.78	F	2			EF	
19-Sep-94	Smoky R.	SR1	LNSC	12		1807	376	412	592	533	5.6	24.6	1.11	4.62	1.05	F	2			EF	
19-Sep-94	Smoky R.	SR1	LNSC	13		0	238	257	164				1.19			U	0			EF	
13-Sep-94	Smoky R.	SR1	NRPK	1	1007	1305	610	651		1319	22.0	25.0		1.90	1.67	F	2	5	CL	SL	
14-Sep-94	Smoky R.	SR1	NRPK	2	1224	1354	490	521	740	679	3.3	21.6	0.63	3.18	0.49	M	7	4	CL	SL	
19-Sep-94	Smoky R.	SR1	NRPK	3		824	460	490	733	581	8.0	13.0	0.75	2.24	1.38	F	2	3	CL	EF	
16-Oct-94	Smoky R.	SR2	LNSC	1	1133	1208	402	427	746	616	12.0	64.0	1.14	10.39	1.95	F	2	17	FR	SL	
21-Dec-94	Smoky R.	SR3	BURB	1	1039	1105	456	456	581	417	19.9	76.4	0.61	18.32	4.77	F	2	7	OT	SL	
24-Sep-94	Wapiti R.	WR1	BURB	1	836	927	509	509	712	623	29.0	15.7	0.54	2.52	4.65	F	2	12	OT	SL	
24-Sep-94	Wapiti R.	WR1	BURB	2	835	913	560	560	824	683	30.2	55.0	0.47	8.05	4.42	M	7	11	OT	SL	
26-Sep-94	Wapiti R.	WR1	BURB	3	900	1201	446	446	468	408	10.0	27.7	0.52	6.79	2.45	M	7	7	OT	SL	
26-Sep-94	Wapiti R.	WR1	BURB	4	1018	1218	628	628	1277	1060	55.0	38.3	0.51	3.61	5.19	F	2	10	OT	SL	
23-Sep-94	Wapiti R.	WR1	FLCH	1	1000	1053	150	168	26	25	0.3	0.4	0.68	1.60	1.20	F	0	3	SC	EF	
26-Sep-94	Wapiti R.	WR1	FLCH	2	1406	1454	146	162	26	23	0.2	0.2	0.74	0.87	0.87	F	1	3	SC	EF	
26-Sep-94	Wapiti R.	WR1	FLCH	3	1408	1442	158	179	36	32	0.3	0.2	0.84	0.63	0.94	F	1	4	SC	EF	
26-Sep-94	Wapiti R.	WR1	FLCH	4	1413	1516	134	150	22	20	0.3	0.1	0.79	0.50	1.50	U	0	3	SC	EF	

Date	River/Delta	Site	Species	No.	Time caught	Time of death	FL (mm)	TL (mm)	Weight Total	Carcass	Liver	Gonad	CF	GSI	LSI	Sex	Mat.	Age	Ageing structure	Capture Method	Comments
26-Sep-94	Wapiti R.	WR1	FLCH	5	1415	1504	132	150	21	18	0.4	0.1	0.78	0.56	2.22	U	0	3	SC	EF	
23-Sep-94	Wapiti R.	WR1	LNSC	1	926	1247	420	448	884	723	14.0	74.6	1.19	10.32	1.94	F	2	11	FR	EF	
23-Sep-94	Wapiti R.	WR1	LNSC	2	928	1232	341	370	515	432	7.4	21.3	1.29	4.93	1.71	M	7	7	FR	EF	
23-Sep-94	Wapiti R.	WR1	LNSC	3	930	1145	378	401	648	548	12.7	37.0	1.19	6.75	2.32	F	2		FR	EF	
23-Sep-94	Wapiti R.	WR1	LNSC	4	932	1201	363	383	490	436	5.8	6.0	1.02	1.38	1.33	F	2		FR	EF	
23-Sep-94	Wapiti R.	WR1	LNSC	5	934	1106	352	374	452	407	4.2	3.3	1.03	0.81	1.03	F	0		FR	EF	
23-Sep-94	Wapiti R.	WR1	LNSC	6	937	1215	412	445	808	681	9.2	53.5	1.15	7.86	1.35	F	2	8	FR	EF	
23-Sep-94	Wapiti R.	WR1	LNSC	7	958	1122	418	452	865	693	12.3	59.0	1.18	8.51	1.77	F	2		FR	EF	
23-Sep-94	Wapiti R.	WR1	LNSC	8	1658	1736	392	423	653	555	8.1	30.3	1.08	5.46	1.46	F	2	10	FR	EF	
24-Sep-94	Wapiti R.	WR1	LNSC	9	829	1033	390	423	580	503	9.2	26.0	0.97	5.17	1.83	F	2	8	FR	EF	
24-Sep-94	Wapiti R.	WR1	LNSC	10	831	946	430	461	702	607	8.1	28.8	0.88	4.74	1.33	F	2	15	FR	EF	
24-Sep-94	Wapiti R.	WR1	LNSC	11	834	1044	363	390	469	403	6.1	25.3	0.97	6.28	1.51	M	7	7	FR	EF	
24-Sep-94	Wapiti R.	WR1	LNSC	12	838	1055	312	337	292	266	3.4	0.5	0.95	0.19	1.28	U	0	5	FR	EF	
25-Sep-94	Wapiti R.	WR1	LNSC	13	938	1217	475	506	1165	1016	10.0	59.7	1.08	5.88	0.98	M	7	11	FR	EF	
22-Sep-94	Wapiti R.	WR1	NRPK	1	1629	1658	345	367	282	252	4.0	3.6	0.68	1.43	1.59	M	6	3	CL	EF	
22-Sep-94	Wapiti R.	WR1	NRPK	2	1631	1711	542	580	1095	936	15.0	68.0	0.69	7.11	1.57	M	7	4	CL	EF	
23-Sep-94	Wapiti R.	WR1	NRPK	3	1700	1724	475	511	720	651	5.4	22.0	0.67	3.38	0.83	M	7	4	CL	EF	
25-Sep-94	Wapiti R.	WR1	NRPK	4	934	1053	710	757	3431	2872	68.2	130.6	0.96	4.55	2.37	F	2	7	CL	EF	
25-Sep-94	Wapiti R.	WR1	NRPK	5	939	1138	356	383	283	262	2.3	4.5	0.62	1.72	0.88	M	2	3	CL	EF	
25-Sep-94	Wapiti R.	WR1	NRPK	6	941	1113	464	498	681	631	5.4	12.0	0.68	1.90	0.86	M	7	3	CL	EF	
25-Sep-94	Wapiti R.	WR1	NRPK	7	943	1205	341	367	272	245	3.1	2.4	0.68	0.98	1.27	F	1	2	CL	EF	
25-Sep-94	Wapiti R.	WR1	NRPK	8	948	1152	353	381	299	261	2.2	2.0	0.67	0.77	0.84	F	1	2	CL	EF	
26-Sep-94	Wapiti R.	WR1	NRPK	9	855	1147	586	621	1187	1086	17.7	30.1	0.59	2.77	1.63	F	2	4	CL	SL	
26-Sep-94	Wapiti R.	WR1	NRPK	10	920	1130	543	579	1085	1002	12.2	18.6	0.68	1.86	1.22	M	7	4	CL	SL	
26-Sep-94	Wapiti R.	WR1	NRPK	11	1402	1528	357	376	262	244	2.5	1.6	0.57	0.66	1.02	F	1	2	CL	EF	
26-Sep-94	Wapiti R.	WR1	NRPK	12	1404	1542	290	310	128	120	2.0	2.3	0.51	1.92	1.67	M	6	2	CL	EF	
19-Oct-94	Wapiti R.	WR2	BURB	1	930	1532	472	472	756	555	23.0	126.0	0.72	22.70	4.14	M	7	9	OT	SL	
19-Oct-94	Wapiti R.	WR2	BURB	2	933	1611	576	576	1044	867	53.0	44.0	0.54	5.07	6.11	F	2	6	OT	SL	
19-Oct-94	Wapiti R.	WR2	BURB	3	946	1552	510	510	758	593	29.0	85.0	0.57	14.33	4.89	M	7	7	OT	SL	
19-Oct-94	Wapiti R.	WR2	BURB	4	948	1434	322	322	192	148	6.0	24.0	0.57	16.22	4.05	M	7	2	OT	SL	
19-Oct-94	Wapiti R.	WR2	BURB	5	950	1640	505	505	676	579	35.0	26.0	0.52	4.49	6.04	F	2	10	OT	SL	
19-Oct-94	Wapiti R.	WR2	BURB	6	1010	1743	434	434	491	391	11.0	59.0	0.60	15.09	2.81	M	7	7	OT	SL	
19-Oct-94	Wapiti R.	WR2	BURB	7	1012	1415	549	549	831	697	39.0	30.0	0.50	4.30	5.60	F	2	8	OT	SL	
19-Oct-94	Wapiti R.	WR2	BURB	8	1018	1453	527	527	821	692	39.0	33.0	0.56	4.77	5.64	F	2	7	OT	SL	
19-Oct-94	Wapiti R.	WR2	BURB	9	1042	1514	465	465	491	394	10.0	55.0	0.49	13.96	2.54	M	7	7	OT	SL	
19-Oct-94	Wapiti R.	WR2	BURB	10	1048	1703	472	472	601	476	12.0	78.0	0.57	16.39	2.52	M	7	8	OT	SL	
19-Oct-94	Wapiti R.	WR2	BURB	11	1057		619	619	1262			74.0	0.53			F	2	9	OT	SL	dead on SL
19-Oct-94	Wapiti R.	WR2	BURB	12	1100	1347	518	518	825	663	19.0	94.0	0.59	14.18	2.87	M	7	10	OT	SL	
19-Oct-94	Wapiti R.	WR2	BURB	13	1156	1724	483	483	641	537	25.0	32.0	0.57	5.96	4.66	F	2	9	OT	SL	
20-Oct-94	Wapiti R.	WR2	NRPK	1	926	1013	512	512	933		16.0	31.0	0.69			F	2	4	CL	SL	no bile taken
18-Dec-94	Little Smoky R.	LSR2	BURB	1	1034	1416	450	450	508	387	20.4	52.9	0.55	13.67	5.27	F	2	6	OT	SL	
20-Sep-94	Little Smoky R.	LSR1	BURB	1	1204	1339	471	471	590	446	13.0	14.5	0.56	3.25	2.91	F	2	8	OT	EF	
21-Sep-94	Little Smoky R.	LSR1	FLCH	1	835	953	165	189	47	40	1.8	2.9	0.98	7.25	4.50	F	1	3	SC	EF	
20-Sep-94	Little Smoky R.	LSR1	LNSC	1	1201	1323	405	436	807	682	12.0	42.0	1.21	6.16	1.76	F	2			EF	
21-Sep-94	Little Smoky R.	LSR1	LNSC	2	816	1005	432	461	885	730	11.0	47.0	1.09	6.44	1.51	F	2			EF	
21-Sep-94	Little Smoky R.	LSR1	LNSC	3	821	1023	380	404	623	530	11.0	33.0	1.13	6.23	2.08	F	2			EF	
21-Sep-94	Little Smoky R.	LSR1	LNSC	4	825	1052	268	288	210	191	2.2	1.8	1.08	0.94	1.15	F	1			EF	
21-Sep-94	Little Smoky R.	LSR1	LNSC	5	827	1041	252	272	171	158	3.5	2.0	1.05	1.27	2.22	F	1			EF	
22-Sep-94	Little Smoky R.	LSR1	LNSC	6	831	1105	196	213	85	78	1.6	0.8	1.09	1.03	2.05	U	0			EF	

Date	River/Delta	Site	Species	No.	Time caught	Time of death	FL (mm)	TL (mm)	Weight				CF	GSI	LSI	Sex	Mat.	Age	Ageing structure	Capture Method	Comments
									Total	Carcass	Liver	Gonad									
18-Sep-94	Little Smoky R.	LSR1	NRPK	1			255	270	117				0.69			U	0		N/A	SL	
10-Oct-94	Wabasca R.	WB1	BURB	1	1004	1043	381	381	211	182	4.0	1.0	0.38	0.55	2.20	F	2	6	OT	SL	
11-Oct-94	Wabasca R.	WB1	BURB	2	905	1017	340	340	232	197	4.0	2.0	0.58	1.02	2.03	F	2	4	OT	SL	
11-Oct-94	Wabasca R.	WB1	BURB	3	908	1114	314	314	135	121	2.0	2.0	0.43	1.65	1.65	F	2	4	OT	SL	
11-Oct-94	Wabasca R.	WB1	BURB	4	912	1036	395	395	334	289	12.0	4.0	0.54	1.38	4.15	M	7	5	OT	SL	
11-Oct-94	Wabasca R.	WB1	BURB	5	923	1145	320	320	159	139	3.0	1.0	0.48	0.72	2.16	F	2	5	OT	SL	
11-Oct-94	Wabasca R.	WB1	BURB	6	910	1056	423	423	381	302	14.0	18.0	0.50	5.96	4.64	F	2	7	OT	SL	
11-Oct-94	Wabasca R.	WB1	BURB	7	933		386	386	305			27.0	0.53			M	7	4	OT	SL	
12-Oct-94	Wabasca R.	WB1	BURB	8	927	1124	426	426	447	355	10.0	34.0	0.57	9.58	2.82	M	7	6	OT	SL	
12-Oct-94	Wabasca R.	WB1	BURB	9	1037	1144	380	380	317	260	11.0	13.0	0.57	5.00	4.23	F	2	5	OT	SL	
12-Oct-94	Wabasca R.	WB1	FLCH	1	1007	1054	191	215	75	68	4.0	4.0	1.03	5.88	5.88	M	7	4	SC	SL	
11-Sep-94	Athabasca R.	A1a	BURB		1030		425	425									0			SL	dead on SL
11-Sep-94	Athabasca R.	A1a	BURB		1030		335	335									0			SL	released
13-Sep-94	Athabasca R.	A1a	BURB				360	360								U	0			SL	released pink tag 7903
13-Sep-94	Athabasca R.	A1a	BURB	1	800	834	550	550	722	590	42.7	35.8	0.43	6.07	7.24	M	7	6	OT	SL	
13-Sep-94	Athabasca R.	A1b	BURB	2	1318	1326	498	498	700	594	45.5	38.7	0.56	6.52	7.66	M	7	8	OT	SL	
13-Sep-94	Athabasca R.	A1b	BURB		1417											U	0			SL	died after blood taken
13-Sep-94	Athabasca R.	A1b	BURB		1417		484	484								U	0			SL	died after blood taken
13-Sep-94	Athabasca R.	A1b	BURB		1417											U	0			SL	died after blood taken
13-Sep-94	Athabasca R.	A1b	BURB	6	1537	1544	469	469	406	328	18.9	13.2	0.39	4.02	5.76	F	1	7	OT	SL	
13-Sep-94	Athabasca R.	A1b	BURB	7	1602	1608	450	450	438	356	26.8	11.9	0.48	3.34	7.53	F	1	7	OT	SL	
14-Sep-94	Athabasca R.	A1b	BURB	8	1023	1034	452	452	448	376	20.0	14.4	0.48	3.83	5.32	F	2	7	OT	SL	
14-Sep-94	Athabasca R.	A1b	BURB	9	1448	1451	498	498	624	526	30.4	19.7	0.50	3.75	5.78	F	2	8	OT	SL	
14-Sep-94	Athabasca R.	A1b	BURB	10	1515	1518	447	447	435	372	29.5	12.1	0.48	3.25	7.93	F	2	5	OT	SL	
15-Sep-94	Athabasca R.	A1b	BURB	11	1015	1020	485	485	635	518	44.0	56.5	0.55	10.91	8.49	M	7	7	OT	SL	
12-Sep-94	Athabasca R.	A1a	LNSC	1	1839	2156	375	402	691	612	6.7	40.0	1.30	6.54	1.09	M	7	13	FR	EF	
13-Sep-94	Athabasca R.	A1b	NRPK	1	1625	1629	489	517	773	692	7.6	12.1	0.66	1.75	1.10	M	7	3	CL	SL	
13-Sep-94	Athabasca R.	A1b	NRPK	2	1718	1715	498	529	830	757	9.8	9.2	0.67	1.22	1.29	F	2	3	CL	A	
15-Sep-94	Athabasca R.	A1b	NRPK	3	922	949	695	743	2628	2278	49.9	87.7	0.78	3.85	2.19	F	2	7	CL	SL	
15-Sep-94	Athabasca R.	A1b	NRPK	4	1014	1038	568	609	1273	1148	10.8	24.9	0.69	2.17	0.94	M	7	4	CL	SL	
21-Sep-94	Athabasca R.	A2	BURB	1	1151	1155	519	519	613	546	27.0	29.3	0.44	5.37	4.95	F	2		OT	SL	
21-Sep-94	Athabasca R.	A2	BURB	2	1226	1230	599	599	1082	889	48.4	37.3	0.50	4.20	5.44	F	2	9	OT	SL	
21-Sep-94	Athabasca R.	A2	BURB	3	1238	1241	681	681	1508	1258	84.8	59.0	0.48	4.69	6.74	F	2	11	OT	SL	
22-Sep-94	Athabasca R.	A2	BURB	4	1043	1050	768	768	2530	2092	119.6	107.0	0.56	5.11	5.72	F	2	13	OT	SL	
23-Sep-94	Athabasca R.	A2	BURB	5	925	930	431	431	440	351	17.6	27.1	0.55	7.72	5.01	M	7	4	OT	SL	
23-Sep-94	Athabasca R.	A2	BURB	6			474	474	590			33.5	0.55			M	7	7	OT	SL	dead on SL
23-Sep-94	Athabasca R.	A2	BURB	7	1030	1033	843	843	3890	3071	268.2	170.2	0.65	5.54	8.73	F	2	13	OT	SL	
24-Sep-94	Athabasca R.	A2	BURB	8	1113	1124	720	720	1962	1637	82.5	85.9	0.52	5.25	5.04	F	2	11	OT	SL	
21-Sep-94	Athabasca R.	A2	LNSC	1	1715	1720	291	306	290	251	2.4	1.2	1.16	0.48	0.96	F	1	6	FR	EF	
22-Sep-94	Athabasca R.	A2	LNSC	2	2045	2049	311	330	332	298	2.8	0.3	1.09	0.10	0.94	U	0	6	FR	EF	
24-Sep-94	Athabasca R.	A2	LNSC	3	1200	1205	355	376	503	432	6.1	5.7	1.12	1.32	1.41	F	2	8	FR	SL	
24-Sep-94	Athabasca R.	A2	LNSC	4	1228	1232	434	459	1013	828	10.7	71.6	1.24	8.65	1.29	F	2	14	FR	SL	
24-Sep-94	Athabasca R.	A2	LNSC	5	1747	1757	266	283	200	112	2.2	0.7	1.05	0.63	1.96	U	0	5	FR	EF	
27-Sep-94	Athabasca R.	A3	BURB	1	1012	1015	424	424	378	312	14.2	14.2	0.49	4.55	4.55	M	7	7	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	2	1016	1038	529	529	744	642	12.1	26.4	0.50	4.11	1.88	M	7	10	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	3	1107	1110	440	440	458	385	13.7	18.4	0.53	4.78	3.56	M	7	5	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	4	1100	1131	395	395	342	283	8.6	8.1	0.55	2.86	3.04	M	7	5	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	5	1158	1201	416	416	323	278	10.0	1.6	0.44	0.58	3.60	M	6	4	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	6	1219	1221	463	463	519	432	20.3	25.3	0.52	5.86	4.70	M	7	5	OT	SL	

Date	River/Delta	Site	Species	No.	Time caught	Time of death	FL (mm)	TL (mm)	Weight Total	Carcass	Liver	Gonad	CF	GSI	LSI	Sex	Mat.	Age	Ageing structure	Capture Method	Comments
27-Sep-94	Athabasca R.	A3	BURB	7	1244	1248	450	450	362	316	4.4	9.5	0.39	3.01	1.39	M	7	4	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	8	1243	1308	515	515	704	580	18.1	26.5	0.51	4.57	3.12	M	7	10	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	9	1419	1423	613	613	1242	992	80.5	49.3	0.54	4.97	8.11	F	2	9	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	10	1421	1454	536	536	743	626	20.4	26.8	0.48	4.28	3.26	M	7	11	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	11	1518	1522	467	467	508	430	21.4	0.3	0.50	0.07	4.98	F	1	5	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	12	1516	1546	462	462	496	424	17.2	10.9	0.50	2.57	4.06	F	2	6	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	13	1616	1620	583	583	1094	821	63.2	24.9	0.55	3.03	7.70	F	2	11	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	14	1618	1659	590	590	931	784	33.2	32.3	0.45	4.12	4.23	M	7	11	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	15	1720	1724	458	458	445	387	11.2	2.1	0.46	0.54	2.89	F	1	5	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	16	1718	1806	480	480	594	537	15.4	0.6	0.53	0.11	2.87	M	6	5	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	17	1830	1834	487	487	529	477	11.8	2.6	0.46	0.55	2.47	F	1	6	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	18	1828	1901	475	475	514	440	13.0	24.2	0.48	5.50	2.95	M	7	6	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	19	1921	1925	455	455	493	415	16.5	22.0	0.52	5.30	3.98	M	7			SL	
27-Sep-94	Athabasca R.	A3	BURB	20	1918	1947	514	514	736	630	28.8	32.2	0.54	5.11	4.57	M	7	7	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	21	2011	2015	787	787	2774	2353	115.2	107.7	0.57	4.58	4.90	M	7	13	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	22	2028	2035	459	459	432	378	9.1	14.3	0.44	3.78	2.41	M	7	6	OT	SL	
27-Sep-94	Athabasca R.	A3	BURB	23			436	436	467			12.6	0.56			F	2	4	OT	SL	dead on SL
08-Oct-94	Athabasca R.	A4	BURB	1	1042	1045	570	570	982	831	50.7	0.8	0.53	0.10	6.10	M	7	8	OT	SL	
08-Oct-94	Athabasca R.	A4	BURB	2	1041	1110	558	558	896	754	38.6	17.5	0.51	2.32	5.12	F	2	12	OT	SL	
08-Oct-94	Athabasca R.	A4	BURB	3	1133	1136	559	559	896	736	48.9	21.9	0.51	2.98	6.64	F	2	7	OT	SL	
08-Oct-94	Athabasca R.	A4	BURB	4	1134	1158	523	523	615	546	14.3	0.4	0.43	0.07	2.62	M	7	4	OT	SL	
08-Oct-94	Athabasca R.	A4	BURB	5	1258	1303	575	575	1059	913	34.1	3.1	0.56	0.34	3.73	F	2	8	OT	SL	
08-Oct-94	Athabasca R.	A4	BURB	6	1259	1324	620	620	1523	1199	115.7	85.0	0.64	7.09	9.65	M	7	11	OT	SL	
08-Oct-94	Athabasca R.	A4	BURB	7	1341	1344	593	593	1050	857	35.3	5.0	0.50	0.58	4.12	F	2	7	OT	SL	
08-Oct-94	Athabasca R.	A4	BURB	8	1342	1400	603	603	1128	954	49.3	4.6	0.51	0.48	5.17	F	2	7	OT	SL	
08-Oct-94	Athabasca R.	A4	BURB	9	1417	1423	391	391	274	235	6.5		0.45	0.00	2.77	M	6	4	OT	SL	
08-Oct-94	Athabasca R.	A4	BURB	10	1418	1442	374	374	245	211	3.4	0.8	0.46	0.38	1.61	F	1	5	OT	SL	
08-Oct-94	Athabasca R.	A4	BURB	11			425	425	408			0.2	0.53			M	6	5	OT	SL	dead on SL
08-Oct-94	Athabasca R.	A4	BURB	12			392	392	294			0.3	0.48			M	6	6	OT	SL	dead on SL
08-Oct-94	Athabasca R.	A4	BURB	13			310	310	134			0.2	0.44			M	6	4	OT	SL	dead on SL
09-Oct-94	Athabasca R.	A4	BURB	14	1018	1024	425	425	356	315	5.7	1.6	0.46	0.51	1.81	F	2	4	OT	SL	
09-Oct-94	Athabasca R.	A4	BURB	15	1017	1046	645	645	1213	1040	29.9	5.0	0.45	0.48	2.88	F	2	8	OT	SL	
14-Oct-94	Athabasca R.	A5	BURB	1	1126	1130	571	571	1103	882	17.5	95.8	0.59	10.86	1.98	M	7	7	OT	SL	
14-Oct-94	Athabasca R.	A5	BURB	2	1127	1150	457	457	468	402	23.1	30.5	0.49	7.59	5.75	F	2	5	OT	SL	
14-Oct-94	Athabasca R.	A5	BURB	3	1209	1213	377	377	260	231	3.2	0.1	0.48	0.04	1.39	M	6	3	OT	SL	
14-Oct-94	Athabasca R.	A5	BURB	4	1207	1236	567	567	805	631	22.8	49.7	0.44	7.88	3.61	M	7	7	OT	SL	
15-Oct-94	Athabasca R.	A5	BURB	5	1143	1150	435	435	912	735	19.0	60.9	1.10	8.29	2.59	M	7	9	OT	SL	
15-Oct-94	Athabasca R.	A5	BURB	6	1140	1216	410	410	326	286	5.1	1.6	0.47	0.56	1.78	F	1	4	OT	SL	
15-Oct-94	Athabasca R.	A5	BURB	7	1246	1247	514	514	726	568	10.7	70.4	0.53	12.39	1.88	M	7	7	OT	SL	
15-Oct-94	Athabasca R.	A5	BURB	8	1247	1307	513	513	813	568	28.4	64.2	0.60	11.30	5.00	M	7	5	OT	SL	
15-Oct-94	Athabasca R.	A5	BURB	9	1333	1336	462	462	399	350	5.2	0.5	0.40	0.14	1.49	F	1	4	OT	SL	
15-Oct-94	Athabasca R.	A5	BURB	10	1332	1357	463	463	530	437	10.7	0.6	0.53	0.14	2.45	M	6	3	OT	SL	
15-Oct-94	Athabasca R.	A5	BURB	11	1443	1447	443	443	920	706	35.4	82.2	1.05	11.64	5.01	M	7	6	OT	SL	
15-Oct-94	Athabasca R.	A5	BURB	12	1441	1509	560	560	945	788	19.8	82.4	0.54	10.46	2.51	M	7	7	OT	SL	
15-Oct-94	Athabasca R.	A5	BURB	13	1532	1535	451	451	477	364	6.8	56.0	0.52	15.38	1.87	M	7	5	OT	SL	
15-Oct-94	Athabasca R.	A5	BURB	14	1530	1549	513	513	758	596	26.6	20.6	0.56	3.46	4.46	F	2	6	OT	SL	
15-Oct-94	Athabasca R.	A5	BURB	15	1629	1650	599	599	1162	917	52.9	81.7	0.54	8.91	5.77	M	7	10	OT	SL	
15-Oct-94	Athabasca R.	A5	BURB	16	1628	1631	403	403	373	271	15.7	51.4	0.57	18.97	5.79	M	7	5	OT	SL	
15-Oct-94	Athabasca R.	A5	BURB	17	1627	1705	613	613	1358	1107	47.4	72.6	0.59	6.56	4.28	F	2	7	OT	SL	

Date	River/Delta	Site	Species	No.	Time caught	Time of death	FL (mm)	TL (mm)	Weight Total	Carcass	Liver	Gonad	CF	GSI	LSI	Sex	Mat.	Age	Ageing structure	Capture Method	Comments
15-Oct-94	Athabasca R.	A5	BURB	18			569	569	1002			41.6	0.54			F	2	7	OT	SL	dead on SL
15-Oct-94	Athabasca R.	A5	BURB	19			505	505	701			55.1	0.54			M	7	5	OT	SL	dead on SL
15-Oct-94	Athabasca R.	A5	BURB	20			553	553	1004			116.4	0.59			M	7	7	OT	SL	dead on SL
15-Oct-94	Athabasca R.	A5	BURB	21			510	510	730			37.1	0.55			F	2	7	OT	SL	dead on SL
14-Oct-94	Athabasca R.	A5	NRPK	1	1307	1311	608	637	1411	1261	22.7	55.6	0.63	4.41	1.80	F	2	7	CL	SL	
17-Sep-94	McLeod R.	MR1	BURB		1400		360	360	268				0.57			U	0			EF	released
17-Sep-94	McLeod R.	MR1	BURB	1	1008	1016	475	475	463	402	5.7	3.5	0.43	0.87	1.42	F	1		OT	SL	
16-Sep-94	McLeod R.	MR1	LNSC	1	1838	1851	381	409	655	545	5.7	32.2	1.18	5.91	1.05	M	7	9	FR	EF	
18-Sep-94	McLeod R.	MR1	NRPK	1	1043	1047	370	391	322	301	1.5	1.1	0.63	0.37	0.50	F	1	2	CL	SL	
18-Sep-94	McLeod R.	MR1	NRPK	2	1121	1128	494	526	785	782	3.9	15.8	0.65	2.02	0.50	M	7	3	CL	SL	
19-Sep-94	McLeod R.	MR1	NRPK	3	955	958	393	417	350	328	2.5	1.3	0.57	0.40	0.76	F	1	2	CL	SL	
19-Sep-94	McLeod R.	MR1	NRPK	4	1025	1036	429	451	474	411	2.8	2.4	0.60	0.58	0.68	F	1	3	CL	SL	
18-Sep-94	McLeod R.	MR1	NRPK	5			440	467	488				0.57			M	7	3	CL	SL	dead on SL
15-Dec-94	McLeod R.	MR2	BURB	1	1306	1352	490	490	702	525	37.5	59.8	0.59	11.39	7.14	F	2	8	OT	SL	
15-Dec-94	McLeod R.	MR2	BURB	2	1308	1420	452	452	514	383	9.1	78.0	0.55	20.37	2.38	M	7	9	OT	SL	
15-Dec-94	McLeod R.	MR2	BURB	3	1310	1329	481	481	530	428	16.1	48.9	0.47	11.43	3.76	F	2	7	OT	SL	
15-Dec-94	McLeod R.	MR2	BURB	4	830	1118	430	430	386	299	10.0	34.7	0.48	11.61	3.34	F	2	5	OT	SL	
15-Dec-94	McLeod R.	MR2	BURB	5	835	1137	474	474	513	441	13.6	5.8	0.48	1.32	3.08	F	2	7	OT	SL	
15-Dec-94	McLeod R.	MR2	BURB	6	838	1159	513	513	579	514	31.0	67.7	0.43	13.17	6.03	F	2	7	OT	SL	
16-Dec-94	McLeod R.	MR2	BURB	7	841	1058	463	463	563	413	10.7	91.5	0.56	22.15	2.59	M	7	8	OT	SL	
29-Sep-94	Pembina R.	P	BURB	1	1230	1233	380	380	225	179	3.9	8.7	0.40	4.86	2.18	F	2	5	OT	SL	
29-Sep-94	Pembina R.	P	BURB	2	1228	1303	517	517	671	577	19.4	15.9	0.48	2.76	3.36	F	2	11	OT	SL	
30-Sep-94	Pembina R.	P	BURB	3	1125	1128	500	500	490	431	11.9	17.0	0.39	3.94	2.76	F	2	10	OT	SL	
30-Sep-94	Pembina R.	P	BURB	4	1123	1149	538	538	806	692	11.9	24.0	0.52	3.47	1.72	M	7	4	OT	SL	
01-Oct-94	Pembina R.	P	BURB	5	931	943	394	394	290	240	4.8	8.7	0.47	3.62	2.00	F	2	5	OT	SL	
01-Oct-94	Pembina R.	P	BURB	6			511	511	632			20.5	0.47			F	2	7	OT	SL	dead on SL
01-Oct-94	Pembina R.	P	BURB	7			570	570	1014			32.6	0.55			F	2	12	OT	SL	dead on SL
29-Sep-94	Pembina R.	P	NRPK	1	1813	1815	365	387	275	242	2.0	3.1	0.56	1.28	0.83	M	7	3	CL	A	
30-Sep-94	Pembina R.	P	NRPK	2	943	948	606	641	1606	1341	23.2	34.6	0.72	2.58	1.73	F	2	6	CL	SL	
03-Oct-94	Lesser Slave R.	LSV	BURB	1	1428	1430	460	460	555	449	31.2	34.8	0.57	7.75	6.95	M	7	9	OT	SL	
03-Oct-94	Lesser Slave R.	LSV	BURB	2	1426	1458	549	549	715	634	18.8	31	0.43	0.49	2.97	F	2	9	OT	SL	
03-Oct-94	Lesser Slave R.	LSV	BURB	3	1532	1556	465	465	566	453	33.9	32.8	0.56	7.24	7.48	M	7	8	OT	SL	
03-Oct-94	Lesser Slave R.	LSV	BURB	4	1534	1536	470	470	538	462	17.7	23.7	0.52	5.13	3.83	M	7	7	OT	SL	
03-Oct-94	Lesser Slave R.	LSV	BURB	5	1533	1616	552	552	802	690	46.3	5.8	0.48	0.84	6.71	F	2	10	OT	SL	
03-Oct-94	Lesser Slave R.	LSV	BURB	6			607	607	1042			4.2	0.46			F	2	10	OT	SL	dead on SL
04-Oct-94	Lesser Slave R.	LSV	BURB	7	1051	1054	446	446	405	336	10.8	21.7	0.45	6.46	3.21	M	7	6	OT	SL	
04-Oct-94	Lesser Slave R.	LSV	BURB	8	1049	1115	515	515	718	582	46.0	36.0	0.52	6.19	7.90	M	7	8	OT	SL	
04-Oct-94	Lesser Slave R.	LSV	BURB	9	1146	1149	621	621	926	803	33.2	4.3	0.39	0.54	4.13	F	2	9	OT	SL	
04-Oct-94	Lesser Slave R.	LSV	BURB	10	1143	1215	520	520	631	546	20.0	0.9	0.45	0.16	3.66	M	6	10	OT	SL	
04-Oct-94	Lesser Slave R.	LSV	BURB	11	1332	1336	540	540	800	652	44.3	23.9	0.51	3.67	6.79	F	2	8	OT	SL	
04-Oct-94	Lesser Slave R.	LSV	BURB	12	1328	1400	565	565	793	703	18.3	3.7	0.44	0.53	2.60	F	2	9	OT	SL	
04-Oct-94	Lesser Slave R.	LSV	BURB	13	1426	1429	629	629	1226	1001	50.3	58.4	0.49	5.83	5.02	M	7	15	OT	SL	
04-Oct-94	Lesser Slave R.	LSV	BURB	14	1424	1453	583	583	970	841	28.7	6.4	0.49	0.76	3.41	F	2	10	OT	SL	
04-Oct-94	Lesser Slave R.	LSV	BURB	15	1517	1520	423	423	392	321	15.5	15.2	0.51	4.74	4.83	F	2	7	OT	SL	
04-Oct-94	Lesser Slave R.	LSV	BURB	16	1515	1538	387	387	593	487	22.4	27.2	1.02	5.59	4.60	M	7	4	OT	SL	
04-Oct-94	Lesser Slave R.	LSV	BURB	17	1613	1616	312	312	169	140	3.1	0.5	0.55	0.36	2.21	F	1	3	OT	SL	
04-Oct-94	Lesser Slave R.	LSV	BURB	18	1611	1637	525	525	835	742	21.5	1.5	0.57	0.20	2.90	M	6	8	OT	SL	
04-Oct-94	Lesser Slave R.	LSV	BURB	19	1609	1655	547	547	805	652	27.2	46.7	0.49	7.16	4.17	M	7	9	OT	SL	
04-Oct-94	Lesser Slave R.	LSV	BURB	20			529	529	819			26.8	0.55			F	2	10	OT	SL	dead on SL

Date	River/Delta	Site	Species	No.	Time caught	Time of death	FL (mm)	TL (mm)	Weight Total	Carcass	Liver	Gonad	CF	GSI	LSI	Sex	Mat.	Age	Ageing structure	Capture Method	Comments
04-Oct-94	Lesser Slave R.	LSV	BURB	21			495	495	706			42.0	0.58			M	7	9	OT	SL	dead on SL
11-Oct-94	Clearwater R.	CW	BURB	1	1349	1352	520	520	688	528	25.6	33.5	0.49	6.34	4.85	F	2	7	OT	SL	
11-Oct-94	Clearwater R.	CW	BURB	2	1348	1410	374	374	317	269	12.1	15.5	0.60	5.76	4.50	F	2	3	OT	SL	
11-Oct-94	Clearwater R.	CW	BURB	3	1425	1430	423	423	432	314	15.6	22.6	0.57	7.20	4.97	F	2	6	OT	SL	
11-Oct-94	Clearwater R.	CW	BURB	4	1426	1447	427	427	404	320	13.1	18.3	0.52	5.72	4.09	F	2	6	OT	SL	
13-Oct-94	Clearwater R.	CW	BURB	5	1158	1212	469	469	586	450	24.2	33.6	0.57	7.47	5.38	F	2	7	OT	SL	
11-Oct-94	Clearwater R.	CW	NRPK	1	1502	1505	672	709	2168	1355	39.2	29.5	0.71	1.59	2.11	M	7	9	CL	SL	
19-Oct-94	P-A Delta	JV1	NRPK	1	1026	1123	562	585	1820	1108	9.6	17.5	1.02	1.58	0.87	M	7	4	CL	GN	
19-Oct-94	P-A Delta	JV1	NRPK	2	1032	1141	625	652	1660	1315	21.3	45.0	0.68	3.42	1.62	F	2	5	CL	GN	
19-Oct-94	P-A Delta	JV1	NRPK	3	1022	1059	705	740	1975		25.3	19.3	0.56			F	2	8	CL	GN	
19-Oct-94	P-A Delta	JV1	NRPK	4	1329	1434	580	619	1536	1342	30.7	25.7	0.79	1.92	2.29	M	7	4	CL	GN	
19-Oct-94	P-A Delta	JV1	NRPK	5	1801	1817	535	558	1190		18.5	43.2	0.78			F	2	4	CL	GN	
20-Oct-94	P-A Delta	JV2	NRPK				630	665	1796				0.72			F	2	7	CL	SL	tangled in SL; dead
15-Oct-94	Slave R. Delta	SRD1	BURB	1	1015	1240	536	536	840	670	23.0	54.9	0.54	8.19	3.43	M	7	8	OT	SL	
15-Oct-94	Slave R. Delta	SRD1	BURB	2	1017	1226	575	575	1170	904	91.0	39.3	0.61	4.35	10.07	F	7	8	OT	SL	
15-Oct-94	Slave R. Delta	SRD1	BURB	3	1022	1202	642	642		1100	87.0	118.4		10.76	7.91	F	7	13	OT	SL	
15-Oct-94	Slave R. Delta	SRD1	BURB	4	1023	1141	454	454	465	310	44.0	76.6	0.49	24.71	14.19	M	7	8	OT	SL	
15-Oct-94	Slave R. Delta	SRD1	BURB	5			495	495	496				0.41			M	7	7	OT	SL	
16-Oct-94	Slave R. Delta	SRD2	BURB	6	905	1021	454	454	646	534	38.8	66.0	0.69	12.36	7.27	M	7	8	OT	SL	
16-Oct-94	Slave R. Delta	SRD2	BURB	7	907	955	470	470	642	524	99.1	45.4	0.62	8.66	18.91	M	7	6	OT	SL	
16-Oct-94	Slave R. Delta	SRD2	BURB	8	910	1118	463	463	630	445	18.8	42.5	0.63	9.55	4.22	M	7	8	OT	SL	
16-Oct-94	Slave R. Delta	SRD2	BURB	9	912	1104	540	540	1120	730	81.3	64.5	0.71	8.84	11.14	F	7	8	OT	SL	
16-Oct-94	Slave R. Delta	SRD2	BURB	10	914	1033	598	598	1740	1210	176.0	60.5	0.81	5.00	14.55	F	7	11	OT	SL	
16-Oct-94	Slave R. Delta	SRD2	BURB	11	916	1053	495	495	760	584	39.6	56.1	0.62	9.61	6.78	M	7	7	OT	SL	
16-Oct-94	Slave R. Delta	SRD2	BURB	12	919	1129	472	472	650	669	43.5	106.9	0.62	15.98	6.50	M	7	7	OT	SL	
16-Oct-94	Slave R. Delta	SRD2	BURB	13	921	1009	465	465	724	549	72.4	28.8	0.72	5.25	13.19	F	7	10	OT	SL	
16-Oct-94	Slave R. Delta	SRD2	BURB	14	1154	1436	455	455	675	477	20.5	69.2	0.71	14.51	4.30	M	7	8	OT	SL	
16-Oct-94	Slave R. Delta	SRD2	BURB	15	1156	1405	490	490	699	520	42.7	46.3	0.59	8.90	8.21	F	2	9	OT	SL	
16-Oct-94	Slave R. Delta	SRD2	BURB	16	1157	1419	495	495	842	666	43.3	65.3	0.69	9.80	6.50	M	7	8	OT	SL	
16-Oct-94	Slave R. Delta	SRD2	BURB	17	1159	1338	482	482	710	550	38.7	43.0	0.63	7.82	7.04	F	2	7	OT	SL	
16-Oct-94	Slave R. Delta	SRD2	BURB	18	1201	1352	490	490	886	660	70.0	36.9	0.75	5.59	10.61	F	2	9	OT	SL	
16-Oct-94	Slave R. Delta	SRD2	BURB	19			430	430	470				0.59			M	7	7	OT	SL	dead on SL
17-Oct-94	Slave R. Delta	SRD2	BURB	20	907	951	695	695	2500	1977	241.0	111.5	0.74	5.64	12.19	F	7	14	OT	SL	
17-Oct-94	Slave R. Delta	SRD2	BURB	21	908	939	525	525	936	633	101.1	62.6	0.64	9.89	15.97	F	7	10	OT	SL	
15-Oct-94	Slave R. Delta	SRD2	NRPK	1			765	790								M	7	12	CL	SL	
17-Oct-94	Slave R. Delta	SRD2	NRPK	2	904	1010	540	575	913	849	16.1	21.1	0.58	2.49	1.90	F	7	3	CL	SL	
17-Oct-94	Slave R. Delta	SRD2	NRPK	3	1403	1408	870	910	>5000		153.8	49.5				F	7	10	CL	GN	

APPENDIX C. LIFE HISTORY DATA SUMMARY OF NON-TARGET FISH

Date	Location	Site	Species	No.	FL (mm)	TL (mm)	Total Weight (g)	Sex	Capture Method	Tag Number
9/28/94	Peace R.	PR1	MNWH	1	436	471	741	U	EF	
9/28/94	Peace R.	PR1	MNWH	2	362	393	525	U	EF	
9/28/94	Peace R.	PR1	MNWH	3	326	355	316	U	EF	
9/30/94	Peace R.	PR1	MNWH	4	409	445	601	U	EF	
9/28/94	Peace R.	PR1	WHSC	1	381	406	636	U	EF	
9/28/94	Peace R.	PR1	WHSC	2	431	459	862	U	EF	
9/30/94	Peace R.	PR1	WHSC	3	456	485	1118	U	EF	
10/4/94	Peace R.	PR2	GOLD	1	326	357	371	F	EF	
10/4/94	Peace R.	PR2	GOLD	2	348	385	526	M	EF	
10/4/94	Peace R.	PR2	GOLD	3	334	368	440	M	EF	
10/4/94	Peace R.	PR2	GOLD	4	355	393	494	M	EF	
10/5/94	Peace R.	PR2	WALL	1	277	295	196	U	SL	
10/5/94	Peace R.	PR2	WALL	2	280	296	211	U	EF	
10/4/94	Peace R.	PR2	WHSC	1	436	469	960	U	EF	
10/7/94	Peace R.	PR3	ARGR	1	285	314	257	U	EF	
10/7/94	Peace R.	PR3	ARGR	2	293	323	282	U	EF	
10/9/94	Peace R.	PR3	WALL	1	377	402	562	U	SL	
10/9/94	Peace R.	PR3	WALL	2	381	410	580	U	SL	
10/9/94	Peace R.	PR3	WALL	3	386	412	613	U	SL	
9/18/94	Smoky R.	SR1	GOLD	1	388	430	754	F	EF	
9/15/94	Smoky R.	SR1	WALL	1	231		120	U	SL	
9/15/94	Smoky R.	SR1	WALL	2	273			U	SL	
9/16/94	Smoky R.	SR1	WALL	3	442	465		U	SL	
9/16/94	Smoky R.	SR1	WALL	4	460	491		U	EF	
9/16/94	Smoky R.	SR1	WALL	5	420	449		U	EF	
9/16/94	Smoky R.	SR1	WALL	6	473	500		U	EF	
9/16/94	Smoky R.	SR1	WALL	7	312	330		U	EF	
9/18/94	Smoky R.	SR1	WALL	8	610	644	2465	U	EF	
9/18/94	Smoky R.	SR1	WALL	9	520	552	1552	U	EF	
9/18/94	Smoky R.	SR1	WALL	10	430	453	768	U	EF	
9/18/94	Smoky R.	SR1	WALL	11	406	432	734	U	EF	
9/18/94	Smoky R.	SR1	WALL	12	442	470	940	U	EF	
9/18/94	Smoky R.	SR1	WALL	13	313	335	308	U	EF	
10/17/94	Smoky R.	SR2	ARGR	1	366	401	646	U	SL	
10/15/94	Smoky R.	SR2	BLTR	1	372	393	524	U	SL	
10/16/94	Smoky R.	SR2	BLTR	2	402	427	577	U	SL	
10/16/94	Smoky R.	SR2	BLTR	3	402	428	611	U	SL	
10/16/94	Smoky R.	SR2	BLTR	4	360	380	420	U	SL	
10/16/94	Smoky R.	SR2	BLTR	5	415	443	696	U	SL	
10/16/94	Smoky R.	SR2	BLTR	6	389	414	540	U	SL	
10/16/94	Smoky R.	SR2	BLTR	7	358	375	413	U	SL	
10/16/94	Smoky R.	SR2	BLTR	8	386	397	522	U	SL	
10/16/94	Smoky R.	SR2	BLTR	9	385	404	522	U	SL	
10/16/94	Smoky R.	SR2	BLTR	10	336	358	324	U	SL	
10/16/94	Smoky R.	SR2	BLTR	11	315	335	309	U	SL	
10/16/94	Smoky R.	SR2	BLTR	12	309	332	270	U	SL	
10/16/94	Smoky R.	SR2	BLTR	13	291	312	231	U	SL	
10/16/94	Smoky R.	SR2	BLTR	14	287	304	232	U	SL	
10/16/94	Smoky R.	SR2	BLTR	15	268	287	169	U	SL	
10/16/94	Smoky R.	SR2	BLTR	16	232	258	134	U	SL	
10/16/94	Smoky R.	SR2	BLTR	17	220	234	111	U	SL	
10/16/94	Smoky R.	SR2	BLTR	18	387	408	578	U	SL	

Date	Location	Site	Species	No.	FL (mm)	TL (mm)	Total Weight (g)	Sex	Capture Method	Tag Number
10/17/94	Smoky R.	SR2	BLTR	19	356	376	473	U	SL	
10/17/94	Smoky R.	SR2	BLTR	20	288	306	219	U	SL	
10/17/94	Smoky R.	SR2	BLTR	21	356	379	429	U	SL	
10/17/94	Smoky R.	SR2	BLTR	22	353	374	422	U	SL	
10/17/94	Smoky R.	SR2	BLTR	23	362	385	481	U	SL	
10/17/94	Smoky R.	SR2	BLTR	24	312	332	314	U	SL	
10/17/94	Smoky R.	SR2	BLTR	25	321	341	337	U	SL	
10/16/94	Smoky R.	SR2	MNWH	1	351	377	441	U	SL	
9/23/94	Wapiti R.	WR1	ARGR	1	264	291	212	U	EF	
9/23/94	Wapiti R.	WR1	BLTR	1	446	467		U	SL	013001
9/23/94	Wapiti R.	WR1	BLTR	2	373	394		U	EF	013002
9/23/94	Wapiti R.	WR1	MNWH	1	390	422	637	U	EF	
9/22/94	Wapiti R.	WR1	WHSC	1	475	508	1124	U	EF	
9/22/94	Wapiti R.	WR1	WHSC	2	485	512	1242	U	EF	
9/22/94	Wapiti R.	WR1	WHSC	3	337	364	458	U	EF	
9/22/94	Wapiti R.	WR1	WHSC	4	341	366	460	U	EF	
9/22/94	Wapiti R.	WR1	WHSC	5	388	415	558	U	EF	
9/22/94	Wapiti R.	WR1	WHSC	6	375	397	584	U	EF	
9/23/94	Wapiti R.	WR1	WHSC	7	347	366	472	U	EF	
9/23/94	Wapiti R.	WR1	WHSC	8	393	422	654	U	EF	
9/25/94	Wapiti R.	WR1	WHSC	9	374	404	601	U	EF	
10/19/94	Wapiti R.	WR2	BLTR	1				U	SL	
10/19/94	Wapiti R.	WR2	BLTR	2				U	SL	
9/18/94	Little Smoky R.	SR1	NRSQ	1	453	488	1054	U	SL	
9/18/94	Little Smoky R.	SR1	WALL	1	356	375	472	U	SL	
9/18/94	Little Smoky R.	SR1	WALL	2	360	375	462	U	SL	
9/18/94	Little Smoky R.	SR1	WALL	3	529	561	1420	U	A	
9/18/94	Little Smoky R.	SR1	WALL	4	296	315	0	U	A	
9/19/94	Little Smoky R.	SR1	WALL	5	367	392	496	U	SL	
9/19/94	Little Smoky R.	SR1	WALL	6	468	499	1081	U	SL	
9/21/94	Little Smoky R.	SR1	WHSC	1	358	383	525	U	EF	
9/12/94	Athabasca R.	A1	MNWH	1	211	236	103	U	EF	
9/12/94	Athabasca R.	A1	MNWH	2	157	175	33	U	EF	
9/10/94	Athabasca R.	A1	RNTR	1	412	415	858	U	SL	
9/12/94	Athabasca R.	A1	RNTR	2	315	333	377	U	SL	
9/12/94	Athabasca R.	A1	RNTR	3	296	315	262	U	SL	
9/12/94	Athabasca R.	A1	RNTR	4	212	226	96	U	SL	
9/12/94	Athabasca R.	A1	WHSC	1	406	433	840	U	EF	
9/12/94	Athabasca R.	A1	WHSC	2	375	396	621	U	EF	
9/13/94	Athabasca R.	A1	BLTR			280		U	A	
9/13/94	Athabasca R.	A1	BLTR		531	555	1508	U	SL	
9/24/94	Athabasca R.	A2	BLTR	6	418	441	720	F	SL	
9/22/94	Athabasca R.	A2	BLTR	5	503	523	1276	F	SL	
9/25/94	Athabasca R.	A2	BLTR	8	328	349	349	F	SL	
9/25/94	Athabasca R.	A2	BLTR	7	336	353	362	F	SL	
9/21/94	Athabasca R.	A2	BLTR	1	342	359	389	U	SL	
9/21/94	Athabasca R.	A2	BLTR	1	490	512	1060	M	SL	
9/21/94	Athabasca R.	A2	BLTR	2	322	346	337	U	SL	
9/22/94	Athabasca R.	A2	BLTR	4	572	593	1114	F	SL	
9/22/94	Athabasca R.	A2	BLTR	3	314	331	294	F	SL	
9/23/94	Athabasca R.	A2	MNWH	1	348	379	529	F	EF	
9/23/94	Athabasca R.	A2	MNWH	2	315	344	336	F	EF	

Date	Location	Site	Species	No.	FL (mm)	TL (mm)	Total Weight (g)	Sex	Capture Method	Tag Number
9/23/94	Athabasca R.	A2	MNWH	3	277	308	235	M	EF	
9/21/94	Athabasca R.	A2	RNTR	1	327	346	425	M	SL	
9/21/94	Athabasca R.	A2	RNTR	2	314	332	308	F	SL	
9/21/94	Athabasca R.	A2	RNTR	3	240	256	144	F	SL	
9/22/94	Athabasca R.	A2	RNTR	4	403	422	768	F	SL	
9/22/94	Athabasca R.	A2	RNTR	5	285	299	280	F	SL	
9/23/94	Athabasca R.	A2	RNTR	6	227	236	117	F	SL	
9/24/94	Athabasca R.	A2	RNTR	7	320	339	340	F	SL	
9/25/94	Athabasca R.	A2	RNTR	8	350	364	490	F	SL	
9/25/94	Athabasca R.	A2	RNTR	9	367	385	517	M	SL	
9/25/94	Athabasca R.	A2	RNTR	10	287	301	234	F	SL	
10/8/94	Athabasca R.	A4	WALL	1	401	422	675	F	SL	
10/8/94	Athabasca R.	A4	WALL	2	388	405	559	F	SL	
10/8/94	Athabasca R.	A4	WALL	3	345	367	352	M	SL	
10/8/94	Athabasca R.	A4	WALL	4	414	440	744	M	SL	
10/8/94	Athabasca R.	A4	WALL	5	329	348	362	M	SL	
10/9/94	Athabasca R.	A4	WALL	6	350	374	403	M	SL	
10/9/94	Athabasca R.	A4	WALL	7	396	420	644	M	SL	
10/9/94	Athabasca R.	A4	WALL	8	377	401	541	M	SL	
10/9/94	Athabasca R.	A4	WALL	9	487	512	1182	M	SL	
10/15/94	Athabasca R.	A5	GOLD	1	386	424	677	F	SL	
10/14/94	Athabasca R.	A5	WALL	1	459	482	1082	M	SL	
10/14/94	Athabasca R.	A5	WALL	2	437	460	837	M	SL	
10/14/94	Athabasca R.	A5	WALL	3	406	425	598	F	SL	
10/14/94	Athabasca R.	A5	WALL	4	321	335	305	M	SL	
10/15/94	Athabasca R.	A5	WALL	5	486	508	1189	M	SL	
10/15/94	Athabasca R.	A5	WALL	6	425	443	778	M	SL	
10/15/94	Athabasca R.	A5	WALL	7	505	527	1295	F	SL	
10/15/94	Athabasca R.	A5	WALL	8	378	398	577	M	SL	
10/15/94	Athabasca R.	A5	WALL	9	381	402	582	M	SL	
10/15/94	Athabasca R.	A5	WALL	10	398	419	683	M	SL	
9/18/94	McLeod R.	MR1	MNWH		250	262	157	U	EF	
10/1/94	Pembina R.	P	WALL	1		339	388	F	SL	
10/3/94	Lesser Slave R.	LSV	WALL	1	341	365	451	F	SL	
10/11/94	Clearwater R.	A4	WALL	1	381	410	545	M	SL	
10/11/94	Clearwater R.	A4	WALL	2	406	428	698	M	SL	
10/11/94	Clearwater R.	A4	WALL	3	374	399	613	F	SL	
10/11/94	Clearwater R.	A4	WALL	4	379	401	517	F	SL	
10/11/94	Clearwater R.	A4	WALL	5	331	349	348	F	SL	
10/12/94	Clearwater R.	A4	WALL	6	482	511	1172	F	SL	
10/13/94	Clearwater R.	A4	WALL	7	384	403	600	F	SL	
9/19/94	P-A Delta	JV1	WALL		>200				GN	
9/20/94	P-A Delta	JV1	WALL		>200				GN	
9/20/94	P-A Delta	JV1	WALL		>200				GN	
9/19/94	P-A Delta	JV1	GOLD		>200				SL	escaped

APPENDIX D. CATCH PER UNIT EFFORT FOR SET LINES, ELECTROFISHING, AND GILL NETS.

Table 14. Catch per unit effort for set lines.

Set Line	Habitat type	Depth	Number of Hooks	Effort (h)	Hook Hours	BURB No.	BURB CPUE	NRPK No.	NRPK CPUE	LNSC No.	LNSC CPUE	FLCH No.	FLCH CPUE	Non-target Species WALL	NRSQ	BLTR	RNTR	ARGR	MNWH
Peace River upstream of Dunvegan (near Many Islands): September 12 - 18, 1994																			
1	backwater	m	20	17.1	342														
2	backwater	m	20	17	340														
3	run	m	20	17	340														
4	run	m	20	16.6	332														
5	run	s	20	17	340														
6	backwater	d	20	72.5	1450	1	0.07												
7	backwater	d	20	72.5	1450	1	0.07												
8	backwater	d	20	73	1460	1	0.07												
9	run	s	20	16.8	336														
10	run	m	20	16.8	336														
11	run	m	20	16.8	336														
12	snye	m	20	16.5	330														
13	snye	m	20	15.6	312														
14	snye	m	20	15.6	312														
15	backwater	m	20	39.8	796	1	0.13												
16	backwater	m	20	40	800														
17	backwater	m	20	39.9	798	3	0.38												
18	backwater	m	20	40	800	1	0.13												
19	backwater	m	20	40.2	804	1	0.12												
20	backwater	m	20	40.3	806														
21	backwater	m	20	40.1	802	1	0.12												
	Site PR1 total =				13622	10	0.07												
Peace River downstream of Diashowa (near mouth of Notikewin River): October 2 - 5, 1994																			
1	backwater	m	20	30.1	602							1	0.17						
2	backwater	m	20	29.9	598														
3	backwater	d	20	46	920														
4	backwater	d	20	45.8	916	2	0.22					1	0.11						
5	backwater	d	20	45.7	914	1	0.11					1	0.11						
6	backwater	m	20	46.3	926														
7	backwater	m	20	46.2	924	1	0.11												
8	snye	m	20	29.7	594														
9	snye	m	20	47.1	942	4	0.42												
10	snye	s	20	47.2	944	1	0.11	1	0.11			1	0.11	1					
11	backwater	m	20	34.3	686														
12	backwater	m	20	16.8	336														
13	backwater	m	20	16.8	336														
	Site PR2 total =				9638	9	0.09	1	0.01			4	0.04	1					

Set Line	Habitat type	Depth	Number of Hooks	Effort (h)	Hook Hours	BURB No.	BURB CPUE	NRPK No.	NRPK CPUE	LNSC No.	LNSC CPUE	FLCH No.	FLCH CPUE	Non-target Species WALL	NRSQ	BLTR	RNTR	ARGR	MNWH
Peace River near Fort Vermilion: October 6 - 9, 1994																			
1,2,3	backwater	m	60	104.8	6288	2	0.03												
4,5	backwater	d	40	74.3	2972	1	0.03												
6	backwater	m	20	45.4	908	2	0.22												
7	backwater	m	20	45.3	906	1	0.11												
8	backwater	m	20	29.7	594														
9	backwater	m	20	29.7	594														
10	backwater	m	20	30.3	606	1	0.17												
11	backwater	m	20	29.7	594	1	0.17												
12	snye	m	20	15.3	306									1					
13	snye	m	20	15.5	310														
14	snye	m	20	15.5	310	1	0.32												
15	snye	m	20	15.1	302									1					
16	backwater	s	20	15.1	302									1					
	Site PR3 total =				14992	9	0.06							3					

Set Line	Habitat type	Depth	Number of Hooks	Effort (h)	Hook Hours	BURB No.	BURB CPUE	NRPK No.	NRPK CPUE	LNSC No.	LNSC CPUE	FLCH No.	FLCH CPUE	Non-target Species WALL	NRSQ	BLTR	RNTR	ARGR	MNWH
Smoky River downstream of confluence with Wapiti River: September 12 - 18, 1994																			
1	backwater	m	20	33.3	666	5	0.75					1	0.15	1					
2	backwater	m	20	15.7	314	3	0.96	1	0.32										
3	inside current line	m	20	13.9	278	0	0.00												
4	backwater	m	20	41.7	834	2	0.24							1					
5	hole	d	20	41.6	832	4	0.48					1	0.12	1					
6	hole	d	20	43.1	862	3	0.35	1	0.12			1	0.12						
7	mud flat	s	20	20	400	2	0.50												
8	mud flat	s	20	19	380	1	0.26												
	Site SR1 total =				4566	20	0.44	2	0.04			3	0.07	3					
Smoky River upstream of confluence with the Wapiti River near Grande Cache: October 15 - 17, 1994																			
1	backwater	d	20	26.4	528											3	1		
2	backwater	d	20	26.6	532											2			
3	run	m	20	25.8	516											4		1	
4	run	m	20	27.3	546											1			
5	run	m	20	26.3	526					1	0.19					3	1		
6	run	m	20	26	520											3			
7	run	m	20	27.5	550														
8	run	m	20	28.6	572											3			
9	backwater	s	20	28.1	562											6			
10	run	m	20	35	700											3			
11	run	m	20	34.7	694											2			
12	hole	d	20	30.8	616											4			
13	backwater under bridge	m	20	14.2	284											2			
14	backwater under bridge	m	20	14.5	290											1			
15	backwater under bridge	m	20	30.6	612											1			
16	run	m	20	30.7	614											1			
17	run	m	20	13.5	270														
18	backwater	m	20	14	280											1			1
19	backwater	m	20	15.8	316											2			
20	run	s	20	16	320											2			
21	run	s	20	16	320											2			
22	run	s	20	15.8	316											4			
	Site SR2 total =				19616	0	0.00			1	0.01					50	2	1	1
Smoky River upstream of confluence with Wapiti River (at Canfor haul road bridge): December 19 - 21, 1994																			
1,2,3,4	backwater	m	8	32	256														
4,5,6,7	backwater	m	8	32	256														
8,9,10	run	m	6	32	192														
11,12,13	run	s	6	16	96	1	1.04												
14,15,16	run	s	6	16	96														
17	backwater	s	2	15.5	31														
18	backwater	s	2	15.5	31														
19	backwater	m	2	15.5	31														
20	backwater	m	2	15	30														
21,22,23	backwater	m	6	15	90														
24	backwater	d	2	15	30														
25	backwater	d	2	15	30														
	Site SR3 total =				1169	1	0.09												

Set Line	Habitat type	Depth	Number of Hooks	Effort (h)	Hook Hours	BURB No.	BURB CPUE	NRPK No.	NRPK CPUE	LNSC No.	LNSC CPUE	FLCH No.	FLCH CPUE	Non-target Species WALL	NRSQ	BLTR	RNTR	ARGR	MNWH
Wapiti River upstream from Grande Prairie: September 22 - 26, 1994																			
1	run	m	20	15.6	312														
2	run	m	20	16.5	330														
3	backwater	m	20	17.2	344														
4	backwater	d	20	17.2	344														
5	backwater	d	20	33.5	670											1			
6	backwater	d	20	33.7	674														
7	backwater	m	20	17.2	344														
8	backwater	m	20	33.5	670														
9	backwater	m	20	16.6	332	2	0.60												
10	backwater	d	20	16.6	332	1	0.30												
11	backwater	m	20	18.5	370														
12	snye	m	20	18.2	364														
13	along eddyline	m	20	18.2	364														
14	backwater	m	20	17	340														
15	backwater	m	20	15.5	310	1	0.32												
16	backwater	m	20	15.2	304	1	0.33	2	0.66										
	Site WR1 total =				6404	4	0.06	2	0.03							1			
Wapiti River upstream from Grande Prairie: October 18 - 20, 1994																			
1	run	m	20	19	380														
2	run	m	20	19	380											1			
3	run	m	20	19	380	1	0.26												
4	run	m	20	19	380														
5	run	m	20	18.5	370											1			
6	backwater	m	20	18.5	370														
7	backwater	m	20	17.5	350														
8	backwater	m	20	18.5	370	1	0.27												
9	backwater	m	20	33	660	1	0.15												
10	run below bridge	d	20	32.3	646	2	0.31												
11	run below bridge	d	20	32.1	642														
12	run below bridge	d	20	31.6	632	3	0.47	1	0.16										
13	run below bridge	d	20	31	620	2	0.32												
14	run below bridge	m	20	31.5	630														
15	run below bridge	m	20	31.5	630														
16	run	m	20	31.6	632	1													
17	run	m	20	31.6	632	1	0.16												
18	run	m	20	31.6	632	1	0.16												
	Site WR2 total =				9336	13	0.14	1	0.01							2			

Set Line	Habitat type	Depth	Number of Hooks	Effort (h)	Hook Hours	BURB No.	BURB CPUE	NRPK No.	NRPK CPUE	LNSC No.	LNSC CPUE	FLCH No.	FLCH CPUE	Non-target Species WALL	NRSQ	BLTR	RNTR	ARGR	MNWH
Little Smoky River downstream from Hwy 744 crossing: September 17 - 21, 1994																			
1	run	d	20	34	680									1					
2	run	m	20	34.1	682									1					
3	backwater	m	20	34.2	684										1				
4	backwater	m	20	34.3	686									1					
5	backwater	s	20	32.3	646														
6	backwater	s	20	32.3	646														
7	backwater	s	20	32.3	646			1	0.15										
8	backwater	m	20	32.5	650														
9	backwater	m	20	32.5	650									1					
10	backwater	d	20	32.5	650														
11	backwater	d	20	32.5	650														
	Site LSR2 total =				7270	0	0.00	1	0.01					4	1				
Little Smoky River 3 km downstream of Hwy 744 bridge: December 17 - 19, 1994																			
1,2,3,4	pool	d	8	32	256	1	0.39												
5,6,7,8	pool	d	8	32	256														
9,10,11	pool	d	6	32	192														
12,13,14	pool	d	6	32	192														
15,16,17	run	m	6	32	192														
18,19,20	run	m	6	32	192														
21,22,23	run	m	6	32	192														
24,25,26	backwater	m	6	16	96														
27,28,29	backwater	m	6	16	96														
30	backwater	d	2	16	32														
	Site LSR2 total =				1696	1	0.06												

Set Line	Habitat type	Depth	Number of Hooks	Effort (h)	Hook Hours	BURB No.	BURB CPUE	NRPK No.	NRPK CPUE	LNSC No.	LNSC CPUE	FLCH No.	FLCH CPUE	Non-target Species WALL	NRSQ	BLTR	RNTR	ARGR	MNWH
Wabasca River: October 10 - 14, 1994																			
1	run	m	20	31	620														
2	backwater	m	20	47.8	956														
3	run	m	20	47.7	954	1	0.10												
4	run	m	20	17.3	346														
5	backwater	m	20	33	660	3	0.45												
6	backwater	m	20	33.2	664														
7	backwater	m	20	50.4	1008							1	0.10						
8	backwater	m	20	50.6	1012														
9	backwater	d	20	50.5	1010														
10	backwater	d	20	50.8	1016														
11	backwater	d	20	49.5	990														
12	backwater	d	20	49.1	982	3	0.31												
13	run	m	20	15.5	310														
14	run	m	20	15.3	306														
15	backwater	m	20	16.6	332														
16	backwater	m	20	16.5	330	2	0.61												
17	backwater	m	20	16.5	330														
	Site WB total =				11496	9	0.08					1	0.01						

Set Line	Habitat type	Depth	Number of Hooks	Effort (h)	Hook Hours	BURB No.	BURB CPUE	NRPK No.	NRPK CPUE	LNSC No.	LNSC CPUE	FLCH No.	FLCH CPUE	Non-target Species WALL	NRSQ	BLTR	RNTR	ARGR	MNWH
Athabasca River downstream from Hinton (near Hwy 947): September 11 - 15, 1994																			
1	backwater at boat launch	m	20	14.25	285														
2	mouth of Marshhead Creek	m	40	25.6	1024	1	0.10												
3	backwater	m	20	14.5	290												1		
4	backwater	m	40	27	1080	2	0.19												
5	backwater	m	20	14.5	290														
6	backwater	m	20	14	280														
7	backwater	m	20	14.6	292														
8	eddie	m	20	14.75	295														
9	mouth of Pine Creek	m	20	14.8	296														
10	run	m	20	14.2	284												3		
11	run	m	20	11.5	230	1	0.43												
12	run off of gravel bar	m	60	12	720														
	Site A1a total =				5366	4	0.07										4		
Athabasca River downstream from Hinton (downstream from mouth of Berland River: September 12 - 15, 1994																			
1	run	m	40	42.1	1684	1	0.06									1			
2	run	m	60	53.6	3216	5	0.16												
3	run	d	40	41.45	1658	1	0.06	1	0.06031										
4	run	m	60	55.25	3315	2	0.06	1	0.03017										
5	run	m	60	54.25	3255	1	0.03	1	0.03072										
6	along edge of mud flat	s	20	21	420	1	0.24												
	Site A1b total =				13548	11	0.08	3	0.02214										
Athabasca River upstream from Hinton: September 20 - 25, 1994																			
1	run	m	20	15.6	312												1		
2	backwater	m	20	59.6	1192	2	0.17									3	1		
3,4,5	backwater	s	60	47.9	2874	2	0.07												
6,7,8	backwater	m	60	116.2	6972	4	0.06										2		
9,10	run	s	40	49.5	1980											3	1		
11,12,13	backwater	m	60	93.1	5586											4	2		
14,15,16	backwater	m	60	88.7	5322											2	2		
17,18	run	m	40	29.1	1164											1			
19,20	backwater	m	40	28.7	1148												1		
21,22	run	m	40	55.6	2224					2	0.09					3			
23,24,25	backwater	m	60	53.3	3198														
26,27,28	backwater	m	60	58	3480											2			
	Site A2 total =				35452	8	0.02			2	0.01					18	10		

Set Line	Habitat type	Depth	Number of Hooks	Effort (h)	Hook Hours	BURB No.	BURB CPUE	NRPK No.	NRPK CPUE	LNSC No.	LNSC CPUE	FLCH No.	FLCH CPUE	Non-target Species WALL	NRSQ	BLTR	RNTR	ARGR	MNWH
Athabasca River downstream of Whitecourt (at Fort Assiniboine): September 26 - 28, 1994																			
1	backwater	m	20	15.5	310														
2	run	m	20	15.6	312	3	0.96												
3	backwater	m	20	15	300	2	0.67												
4	backwater	m	20	28	560	5	0.89												
5	backwater	m	20	14.3	286														
6	backwater	m	20	28.5	570	2	0.35												
7	backwater	m	20	29.1	582	5	0.86												
8	backwater	m	20	29	580	2	0.34												
9	backwater	d	20	13.5	270	4	1.48												
	Site A3 total =				3770	23	0.61												
Athabasca River downstream from ALPAC: October 7 - 9, 1994																			
1	backwater	m	20	30.5	610	6	0.98							2					
2	backwater	m	20	30.7	614	2	0.33							2					
3	backwater	m	20	31.8	636									1					
4	backwater	m	20	31.8	636	5	0.79							3					
5	backwater	m	20	31.4	628														
6	backwater	m	20	32.6	652														
7	backwater	m	20	16.8	336	2	0.60							1					
	Site A4 total =				4112	15	0.36							9					
Athabasca River near Fort MacKay: October 14 - 18, 1994																			
1,2,3	backwater	m	60	48.9	2934									3					
4,5,6	backwater	m	60	83.9	5034	4	0.08	1	0.02										
7,8,9	backwater	m	60	49.3	2958	6	0.20							4					
10,11,12	backwater	m	60	48.9	2934	10	0.34							2					
13,14	backwater	m	60	35.6	2136	1	0.05							1					
	Site A5 total =				15996	21	0.13	1	0.01					10					

Set Line	Habitat type	Depth	Number of Hooks	Effort (h)	Hook Hours	BURB No.	BURB CPUE	NRPK No.	NRPK CPUE	LNSC No.	LNSC CPUE	FLCH No.	FLCH CPUE	Non-target Species WALL	NRSQ	BLTR	RNTR	ARGR	MNWH
McLeod River near Eagle campground: September 16 - 19, 1994																			
1	backwater	m	20	20.3	406			2	0.49										
2	run	s	20	32.1	642	1	0.16												
3	run	s	20	19.6	392			2	0.51										
4	run	s	20	19.5	390														
5	run	m	20	13.5	270			1	0.37										
6	run	m	20	13.1	262														
7	backwater	m	20	12.5	250														
8	backwater	m	20	16	320														
9,10	backwater	s	40	27.6	1104														
11,12	backwater	s	40	25.2	1008														
13,14,15	run	m	60	42.8	2568														
16,17	run	s	40	28.6	1144														
18	backwater	m	20	14.3	286														
19,20,21	backwater	m	60	41.3	2478														
	Site MR1 total =				11520	1	0.01	5	0.04										
McLeod River upstream from Edson (at Big Eddy): December 15 - 17, 1994																			
1,2,3	backwater	m	6	48	288	5	1.74												
4,5	backwater	m	4	32	128	2	1.56												
6,7,8,9	backwater	s	8	64	512														
10,11,12	backwater	m	6	48	288														
13,14	backwater	s	4	32	128														
15	run	d	2	16	32														
16	backwater	m	2	16	32														
17	backwater	s	2	16	32														
	Site MR2 total =				1440	7	0.49												

Set Line	Habitat type	Depth	Number of Hooks	Effort (h)	Hook Hours	BURB No.	BURB CPUE	NRPK No.	NRPK CPUE	LNSC No.	LNSC CPUE	FLCH No.	FLCH CPUE	Non-target Species WALL	NRSQ	BLTR	RNTR	ARGR	MNWH
Pembina River near Jarvie: September 29 - October 1, 1994																			
1	backwater under bridge	m	20	44.5	890	3	0.34												
2	backwater under bridge	m	20	44.1	882	1	0.11												
3	run	m	20	14.6	292														
4	run	m	20	29.2	584									1					
5	run	m	20	28.5	570	1	0.18												
6	run	m	20	14.8	296														
7	pool	d	20	14.8	296														
8	backwater	m	20	15.5	310	1	0.32	1	0.32										
9	backwater	m	20	13.5	270					1	0.37								
10	backwater	m	20	13.5	270	1	0.37												
11	backwater	m	20	13.5	270														
	Site P total =				4930	7	0.14	1	0.02	1	0.02			1					
Lesser Slave River downstream from Slave Lake Pulp: October 3-5, 1994																			
1	run	s	60	46.05	2763														
2	run	s	20	15.5	310	3	0.97												
3	run	s	60	46.85	2811														
4	along eddie line	d	20	15.5	310														
5	run	s	40	29.7	1188	1	0.08												
6	run	s	40	29.95	1198	6	0.50							1					
7	along eddie line	s	40	31.6	1264	1	0.08												
8	eddie	s	40	30.5	1220	2	0.16												
9	along eddie line	s	40	30.25	1210	8	0.66												
	Site LSV total =				12274	21	0.17							1					
Clearwater River upstream from Ft. McMurray: October 10 - 13, 1994																			
1,2	run	s	40	37.1	1484	1	0.07												
3,4	backwater	s	40	54.5	2180	1	0.05												
5	backwater	m	20	36	720	1	0.14							1					
6	backwater	d	20	34.9	698	1	0.14							1					
7	backwater	s	20	34.8	696	1	0.14	1						1					
8	snye	m	20	16.6	332									1					
9,10	backwater	m	40	33.6	1344									1					
11,12	run	m	40	33.6	1344														
13	backwater	m	20	16.5	330														
14,15	snye	m	40	29.6	1184									1					
16	run	m	20	16.5	330														
17	backwater	s	20	16.5	330									1					
18	backwater	m	20	16.5	330														
	Site CW total =				11302	5	0.04	1	0.01					7					

Set Line	Habitat type	Depth	Number of Hooks	Effort (h)	Hook Hours	BURB No.	BURB CPUE	NRPK No.	NRPK CPUE	LNSC No.	LNSC CPUE	FLCH No.	FLCH CPUE	Non-target Species WALL	GOLD	LKWH	RNTR	ARGR	MNWH
Peace-Athabasca Delta near Jackfish Village: September 17 - 18, 1994																			
1	along eddie line	d	20	15.25	305														
2	along eddie line	d	20	15.2	304														
3	pool	d	20	15.2	304										1				
4	along eddie line	d	20	15	300														
5	run	d	20	15	300														
6	run	d	20	15.25	305														
	Site JV1 total =				1818	0	0.00								1				
Peace-Athabasca Delta at Big Eddy: September 18 - 20, 1994																			
1	run	d	40	17.5	700														
2	run	d	40	17.1	684														
3	run	d	40	17.5	700														
	Site JV2 total =				2084			1	0.05					2					

Set Line	Habitat type	Depth	Number of Hooks	Effort (h)	Hook Hours	BURB No.	BURB CPUE	NRPK No.	NRPK CPUE	LNSC No.	LNSC CPUE	FLCH No.	FLCH CPUE	Non-target Species WALL	GOLD	LKWH	RNTR	ARGR	MNWH
Slave River at "Big Eddy": October 14, 1994																			
1	run	d	20	16.25	325	2	0.62												
2	run	d	20	16.25	325														
3	run	d	20	16	320	2	0.63	1	0.31										
4	run	d	20	16	320	1	0.31	1	0.31										
	Site SRD1 total =				1290	5	0.39	2	0.16										
Slave River at mouth of Nagle Channel: October 15 - 17, 1994																			
1	channel	d	20	20	400														
2	channel	d	20	20	400			1	0.25										
3	run	d	20	20.1	402			1	0.25										
4	run	d	40	36.75	1470	8	0.54												
5	run	d	40	38.5	1540	6	0.39	1	0.06										
6	run	d	20	22	440														
7	run	d	20	23	460			1	0.22										
8	channel	d	20	23.25	465														
9	run	d	20	16.5	330	2	0.61												
	Site SRD2 total =				5907	16	0.27	4	0.07										

Table 15. Number of fish caught electrofishing (N) and catch per unit effort (CPUE) electrofishing (number/100 seconds).

River	Site	Effort (second)	BURB		NRPK		LNSC		FLCH		WHSC		MNWH		GOLD		WALL		ARGR		BLTR	
			N	CPUE	N	CPUE	N	CPUE	N	CPUE	N	CPUE	N	CPUE	N	CPUE	N	CPUE	N	CPUE	N	CPUE
Peace River	PR1	3245			4	0.12	17	0.52	1	0.03	3	0.09	4	0.12								
	PR2	8499	1	0.01	4	0.05	8	0.09			1	0.01	1	0.01	5	0.06	1	0.01				
	PR3	4585					23	0.50							2	0.04			2	0.04		
Smoky River	SR1	8905			1	0.01	13	0.15	9	0.10			1	0.01	1	0.01	10	0.11				
Wapiti River	WR1	5642			10	0.18	13	0.23	5	0.09	9	0.16	1	0.02					1.0	0.02	1	0.02
Little Smoky River	LSR1	2013	1	0.05	1	0.05	6	0.30	1	0.05	1	0.05										
Wabasca River	WB	545																				
Athabasca River	A1	1747					1	0.06			2	0.11	2	0.11								
	A2	4302					3	0.07					3	0.07								
	A3	708											2	0.28								
	A4	2201																				
	A5	508																				
McLeod River	MR1	2133	1	0.05			1	0.05					1	0.05								
Lesser Slave River	LSV	612																				

Table 16. Gill net catch.

Delta	Site	Set Number	Time Set	Time Pulled	Effort (hour)	Catch NRPK	Catch LKWH	Catch WALL
Peace-Athabasca Delta at Jackfish Creek near Jackfish Village	JV1	1	952	1010	0.30	3	2	
		2	1309	1331	0.37	1	1	
		3	1332	1350	0.30	0	1	
		4	1725	1738	0.22	1		1
		5	1748	1755	0.17	1		
		Total			1.36	6	4	1
Slave River Delta at mouth of Nagle Channel	SRD2	1	1110	1130	0.33	0		
		2	1145	1300	1.25	0		
		3	1300	1400	1.00	1		
		Total			5.3	1		

APPENDIX E. GROSS PATHOLOGY SUMMARY AND RECORDS.

Gross Pathology Examination Sheet Checklist

Gross External Examination

Skin:	L lesion	H haemorrhagic	B blister
	O open wound	T tumor	E excessive mucus
	C closed wound	N necrotic	U ulcer
	A abnormal color	L lost scales	

Note whether wound is raised above, depressed or even with skin surface

Eyes:	O opaque cornea	P parasites	B bilateral
	E exophthalmia	H haemorrhagic	M missing
	C cataract	L lens lost	
Fins:	F frayed	D deformed	T tumor
	E eroded	H haemorrhagic	R ripped
Gills:	N necrotic	H haemorrhagic	G gas emboli
	P pale	C cysts	E excessive mucus

Gross Internal Examination

Adipose Tissue:	E excessive	C cysts	H haemorrhagic
	R reduced	A abnoral color	
Liver:	E excessive	C color (mottled)	T tumor
	R reduced	L lesions	N necrotic
	P cysts (parasites)	H haemorrhagic	
Spleen:	E enlarged	A raspberry	A abnormal color
	R reduced	C cysts	
Gut:	F flaccid	H haemorrhagic	T tumor
	D distended	C cysts	P parasites
Kidney:	E enlarged	L lesions	W white
	M multiple	G gritty	C cysts
	T tumor		

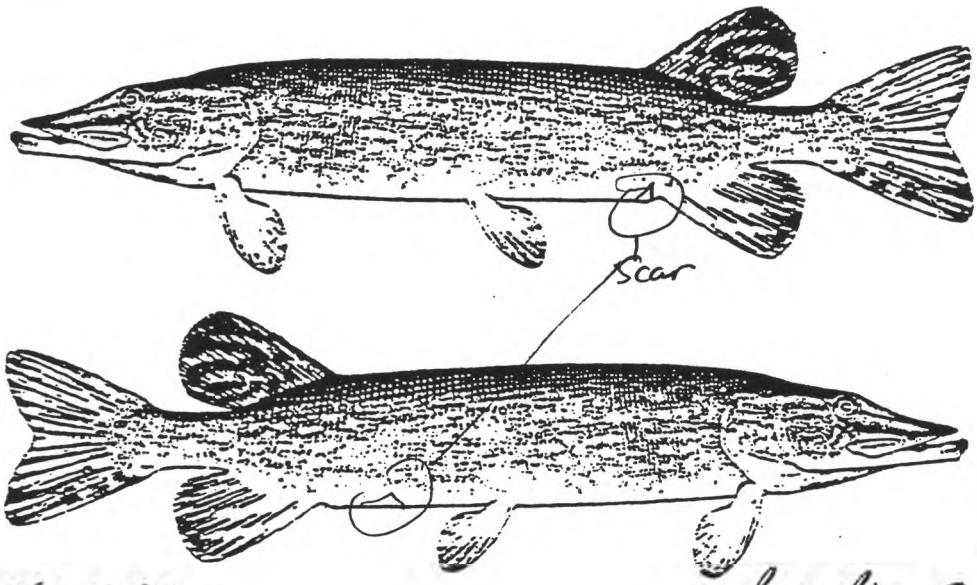
Table 17. Summary of external and internal abnormalities and deformities observed on fish caught in the Peace River, Athabasca River, and Slave River drainages.

Site	Species	No.	Sex	Skin	Eyes	Fins	Gills	Fat	Liver	Gut	Spleen	Kidney	Description
PR1	BURB	6	F						C				purple mottled
PR2	BURB	2	M								A		raspberry spleen
PR3	BURB	2	F						P				
PR3	BURB	3	U			F							
SR1	BURB	9	F		E								left eye
SR1	BURB	7	F		M								left eye
SR1	BURB	14	M				P						blood loss
SR1	BURB	10	M	T									below midline below dorsal fin
WR1	BURB	4	F	T									tumors on ventral side
WR1	BURB	2	M	O									open wound left side mid-body; guts extruding from wound
WR1	BURB	3	M						H				
WR2	BURB	7	F							P			
WR2	BURB	8	F						T				dark, hard, granular mass on liver
WR2	BURB	10	M	T									on skull
A5	BURB	16	M				P						
CW	BURB	1	F				P						
SRD	BURB	8	M						C				mottled with small red spots
SRD	BURB	2	F						C				mottled with small red spots
SRD	BURB	6	M	C									predator scar near caudal fin
SRD	BURB	15	F			H							
SRD	BURB	4	M	C					C				mottled with small red spots; small (1 cm) round slightly depressed old
SRD	BURB	17	F		M								no left eye
SRD	BURB	3	F										left ovary four times the size of right ovary
SR1	FLCH	8	M							P			
SR1	FLCH	4	F			T							growth on dorsal fin
PR1	LNSC	15	F					E					
PR1	LNSC	8	F	L		L							red lesions
PR1	LNSC	14	F							P			
PR1	LNSC	5	F							P			
PR1	LNSC	6	M			H							pelvic fin
PR1	LNSC	1	F	L									on caudal peduncle
PR1	LNSC	17	F					E					
PR1	LNSC	10	F					E					

Site	Species	No.	Sex	Skin	Eyes	Fins	Gills	Fat	Liver	Gut	Spleen	Kidney	Description
PR1	LNSC	2	F					E					
PR2	LNSC	5	F			H							dorsal fin
PR2	LNSC	3	F	T		H/D							tumor at base of dorsal fin; missing left pectoral fin
PR3	LNSC	13	F			T							tumors on anal, caudal, and left pelvic fins
PR3	LNSC	1	M	L									red lesions on right side between pelvic and pectoral fin
PR3	LNSC	12	M			L	N						3 gill arches on right side necrotic; old wound on right pectoral fin
PR3	LNSC	11	M			D							right pelvic fin and lower lobe of caudal fin deformed
PR3	LNSC	19	M			D							anal fin (old wound?)
PR3	LNSC	20	F			H/T	N						anal fin haemorrhagic; left pelvic fin tumor
PR3	LNSC	18	F			H	N						caudal fin
PR3	LNSC	14	F			T/H	N						anal fin tumor; dorsal fin haemorrhagic
PR3	LNSC	8	F			T							base of dorsal fin
PR3	LNSC	10	F	L		T/D							tumor on anal fin; caudal fin deformed (may be predator scar)
SR1	LNSC	8	F	T		T		E					tumor on left side and dorsal fin; mouth red and inflammed
SR1	LNSC	7	F	L									near left pectoral fin and on ventral surface
SR1	LNSC	2	M	T									at base of dorsal fin
SR1	LNSC	6	M	L									lesions on dorsal surface
SR1	LNSC	1	F	T/L						P			
SR1	LNSC	4	F	L/H									lesions along dorsal surface; haemorrhage on left side
SR1	LNSC	12	F	U						P			at base of caudal fin
SR1	LNSC	2	M	T									tumor at base of dorsal fin
SR1	LNSC	9	F	L									near caudal fin
WR1	LNSC	13	M			R			N				liver appeared granular
WR1	LNSC	7	F	T		T		E					tumor on left pectoral fin; red lesions below dorsal fin
WR1	LNSC	4	F	L		H							lesions along both sides
WR1	LNSC	2	M	L/T		T							lesions along both sides; tumors at bases of anal, pelvic and pectoral fin
WR1	LNSC	10	F	T/C									tumor at base of dorsal fin; predator scars
WR1	LNSC	8	F	T									tumors at base of dorsal and right pectoral fins
WR1	LNSC	5	F	O		T							open wound on skull; growth on right pectoral fin
WR1	LNSC	3	F	L		H		E					lesions along right side
LSR2	LNSC	2	F							P			
LSR2	LNSC	6	U							P			
PR1	NRPK	1	M	C									scar anterior to anal fin
PR1	NRPK	3	M	T									on right side below dorsal fin .
PR2	NRPK	1	F			R							right pectoral

Site	Species	No.	Sex	Skin	Eyes	Fins	Gills	Fat	Liver	Gut	Spleen	Kidney	Description
SR1	NRPK	1	F		E								left eye
SR1	NRPK	3	F			D							under-developed left pelvic fin
SR1	NRPK	2	M	L	H								left eye
WR1	NRPK	12	M	T									tumor at base of right operculum
WR1	NRPK	7	F			H							caudal fin
WR1	NRPK	8	F			T							caudal fin
WR1	NRPK	2	M	L		H							caudal fin
A1	NRPK	3	F	O	H								wounds from SL
A5	NRPK	1	F			R							caudal fin wound from SL
A2	BLTR	5	F	O		F/E							open wound on dorsal side anterior to dorsal fin
A2	BLTR	2	U	P									
A2	BLTR		M			T							base of caudal fin
A2	BLTR	1	U	P									
A2	MNWH	3	M		H								
A1	WHSC	1	U	L									lesions along left side near midline and near pectoral fin
A4	WALL	8	M								P		

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet
NORTHERN PIKE



Sample No.: PR1-NRPK-1 Location: Peace River @ MANY ISLANDS

Collection Date: 28/09/94 Collection Time:

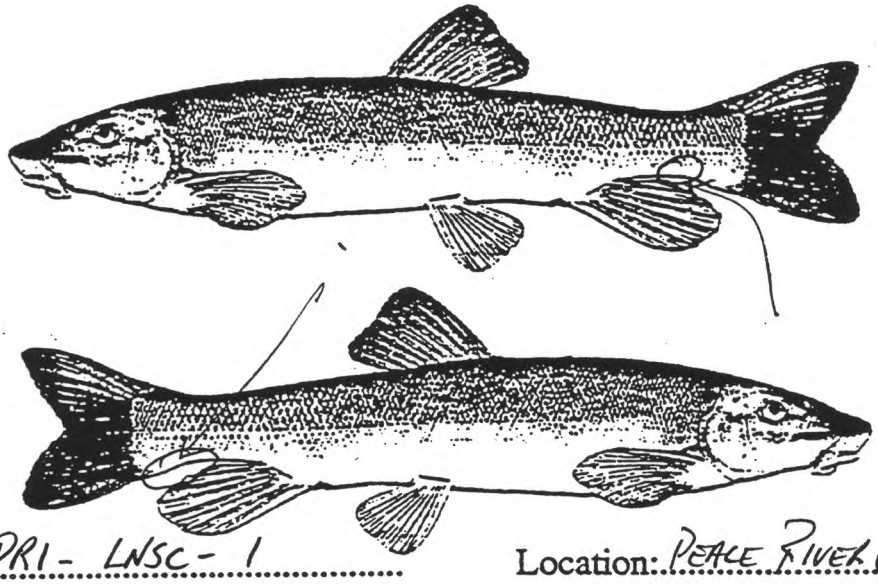
Collector (s): BOAG/SHEPPARD/OISHI Capture Method: EF

Comments:

- Broad scar on ventral surface, anterior to anal fin

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: PRI - LNSC - 1 Location: PEACE RIVER @ MANY ISLANDS

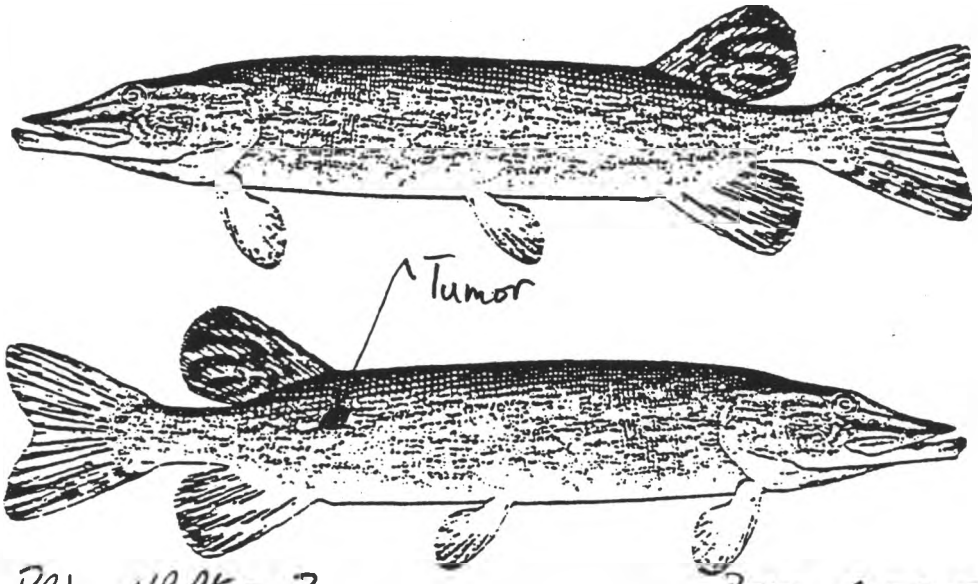
Collection Date: 28/09/94 Collection Time:

Collector (s): BOAG / SHEPPARD / OLSHI Capture Method: EF

Comments:

- Small, red lesions present at the base of caudal peduncle

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet
NORTHERN PIKE



Sample No.: PRI - NRPK - 3 Location: PEACE RIVER @ MANY ISLANDS

Collection Date: 28/09/94 Collection Time:

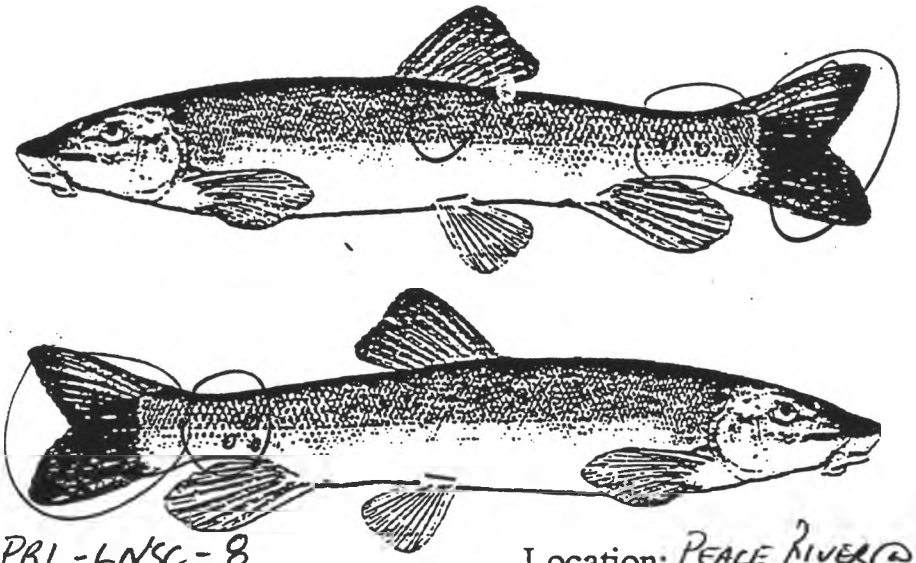
Collector (s): BOAG / SHEPPARD / OISHI Capture Method: EF

Comments:

- Tumor above lateral line, below dorsal fin, on fish's right side

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: PRI-LNSC-8 Location: PEACE RIVER @ MANY ISLANDS

Collection Date: 28/09/94 Collection Time:

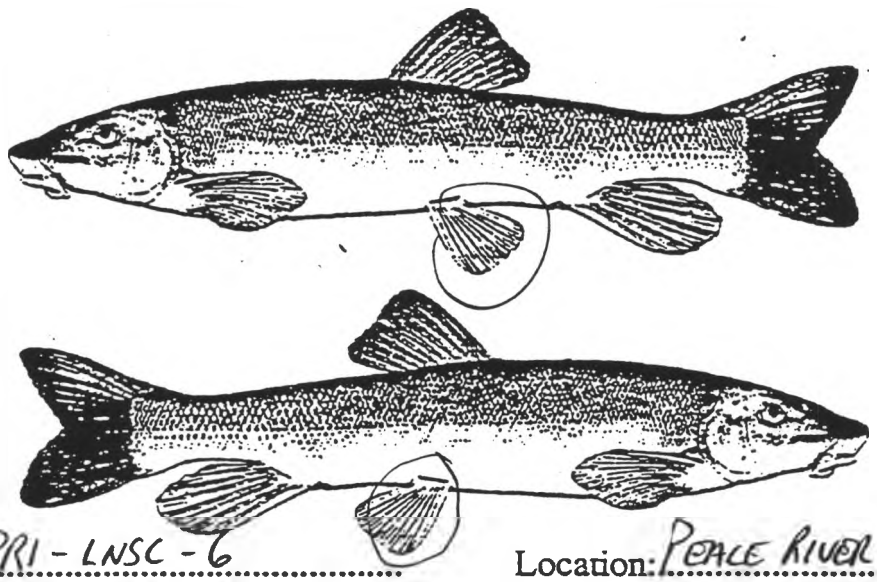
Collector (s): BOAG/SHEPPARD/ISHI Capture Method: EF

Comments:

- Small, red lesions on caudal peduncle, below dorsal fin (on left side), and on the tail.

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: PRI - LNSC - 6 Location: PEACE RIVER @ MANY ISLANDS

Collection Date: 28/09/94 Collection Time:

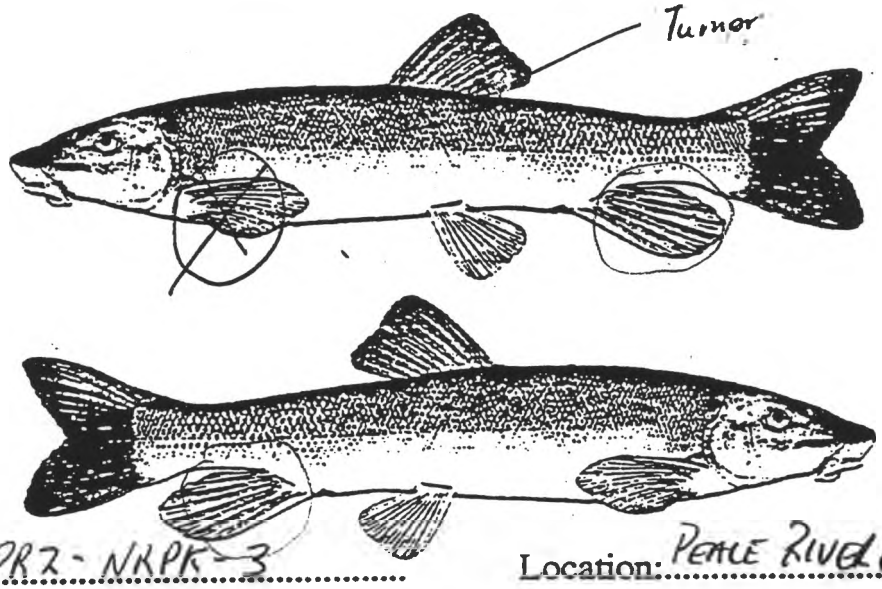
Collector (s): BOAS/SHEPPARD/ORSHI Capture Method: EF

Comments:

- Pelvic fins hemorrhagic

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: PR2-NRPK-3 Location: PEACE RIVER @ NOTIKEWIN PK.

Collection Date: 10/03/94 Collection Time:

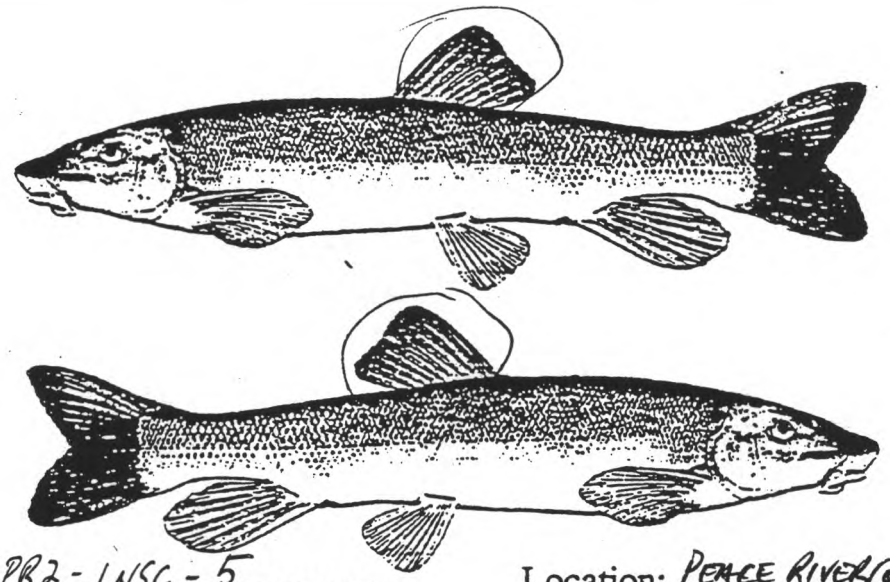
Collector (s): BOAG/SHEPPARD/OISHI/LATHAM Capture Method: EF

Comments:

- Tumor @ base of dorsal fin
- Anal fin hemorrhagic
- Left pectoral fin absent.

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: PR2 - LNSC - 5 Location: PEACE RIVER @ NOTIKEWIN PARK

Collection Date: 10/03/94 Collection Time:

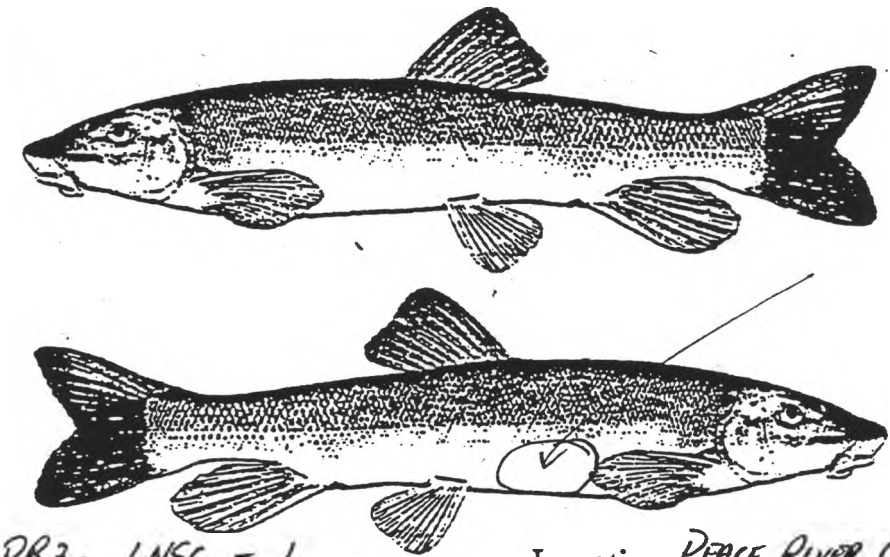
Collector (s): BOAG / SHEPPARD / OISHI / LATHAM Capture Method: E.F.

Comments:

- Small, red lesions on dorsal fin.

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: PR3 - LNSC - 1 Location: PEACE RIVER @ FT. VERMILION

Collection Date: 07/10/94 Collection Time:

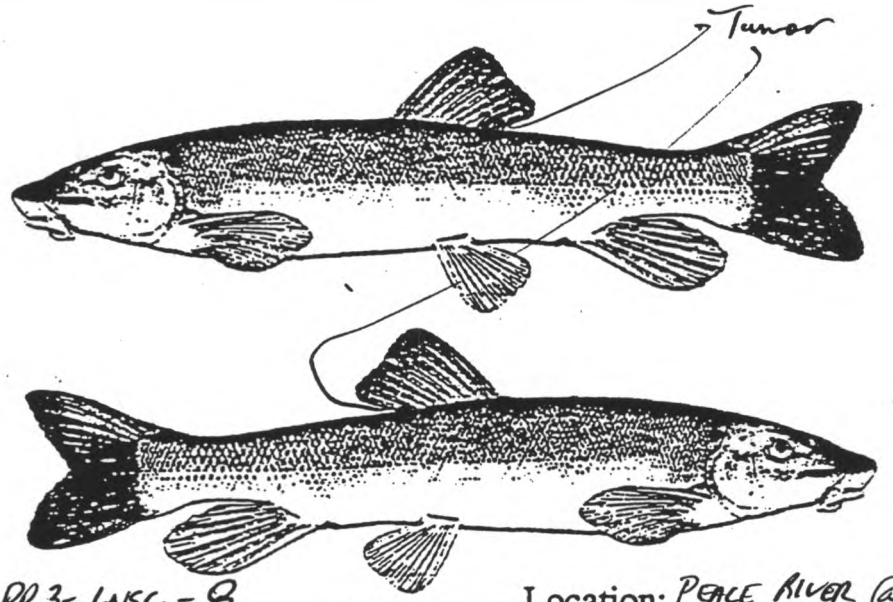
Collector (s) SHEPPARD / JACOBSON / LATHAM Capture Method EF

Comments:

- Small, red lesion on fish's right side, below lateral line, and between the pelvic & pectoral fins.

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: PR3-LNSC-B

Location: PEACE RIVER @ FT. VERMILION

Collection Date: 07/10/94

Collection Time:

Collector (s) JACOBSON/SHEPPARD/LATHAM

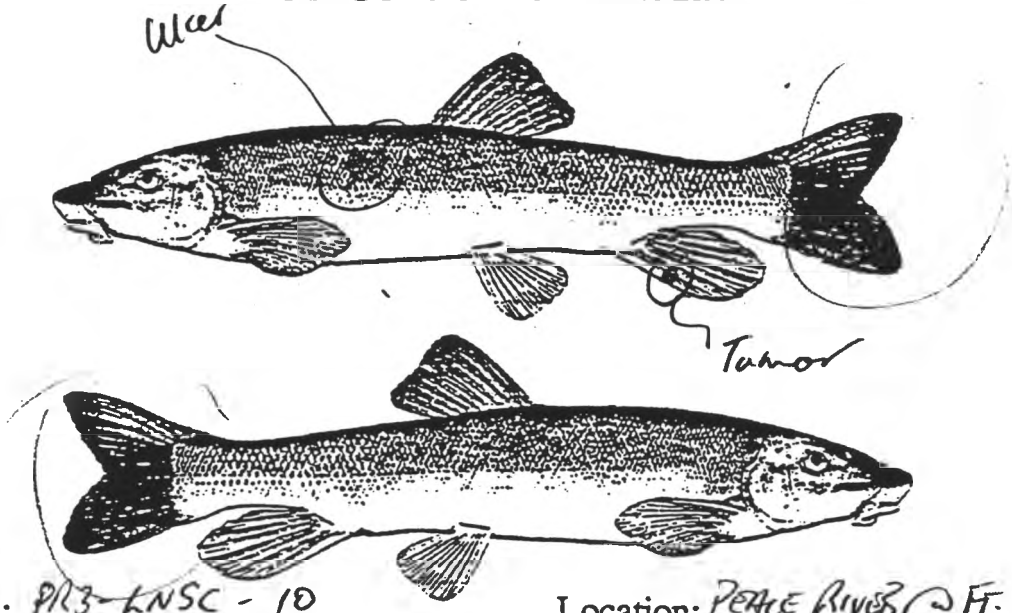
Capture Method EF

Comments:

- Tumor on the base of the last ray of the dorsal fin

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: PR3-LNSC-10 Location: PEACE RIVER @ FT. VERMILION

Collection Date: 07/10/94 Collection Time:

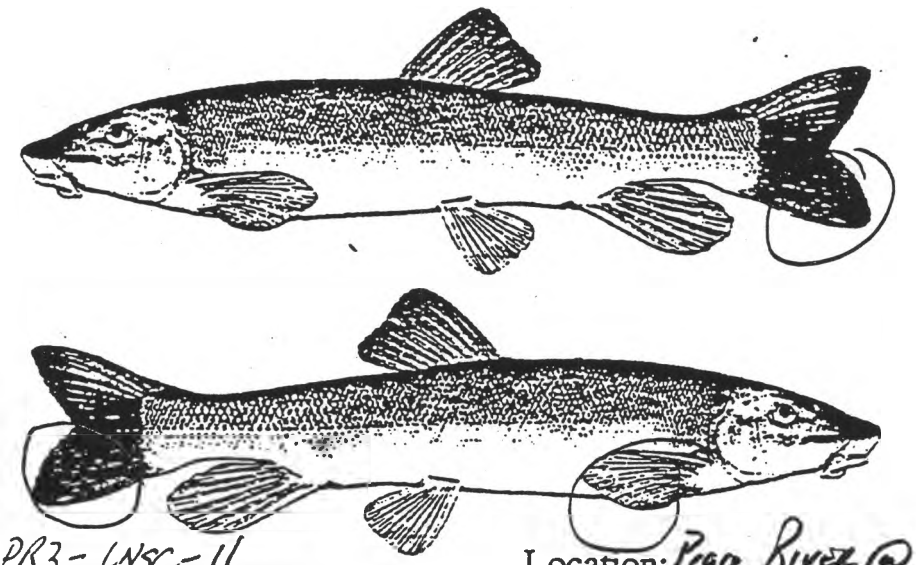
Collector (s): JACOBSON/SHEPPARD/LATHAM Capture Method: EF

Comments:

- Caudal fin deformed: upper lobe may have been scarred by a predator.
- Small tumor present on the anal fin
- Ulcerous lesion above lateral line, on fish's left side, anterior to the dorsal fin

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: PR3-LNSC-11 Location: Peace River @ Ft. Vermilion

Collection Date: 07/10/94 Collection Time:

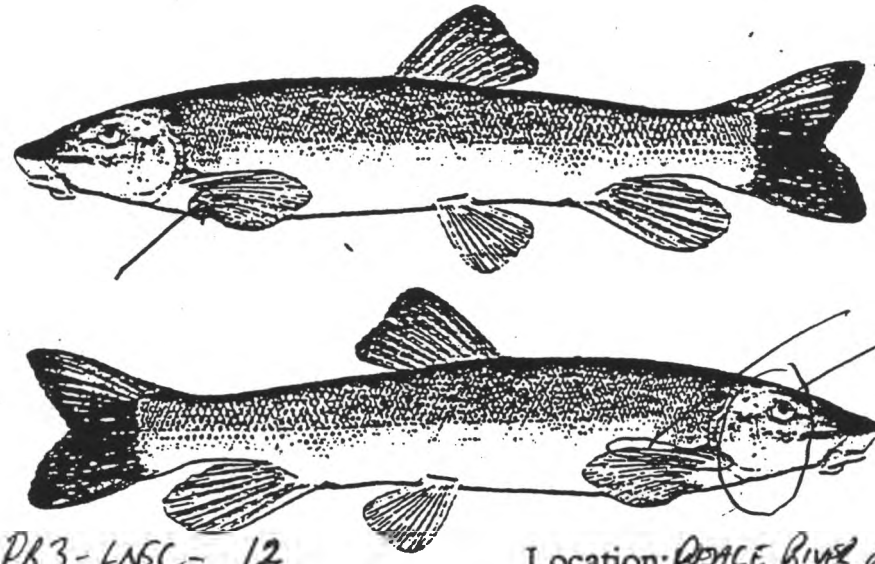
Collector (s): JACOBSON/SHEPPARD/OLSEN Capture Method: EF

Comments:

- Right pelvic and lower lobe of caudal fin are malformed.

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: PR3-LNSC-12 Location: PEACE RIVER @ FT. VERMILION

Collection Date: 08/10/94 Collection Time:

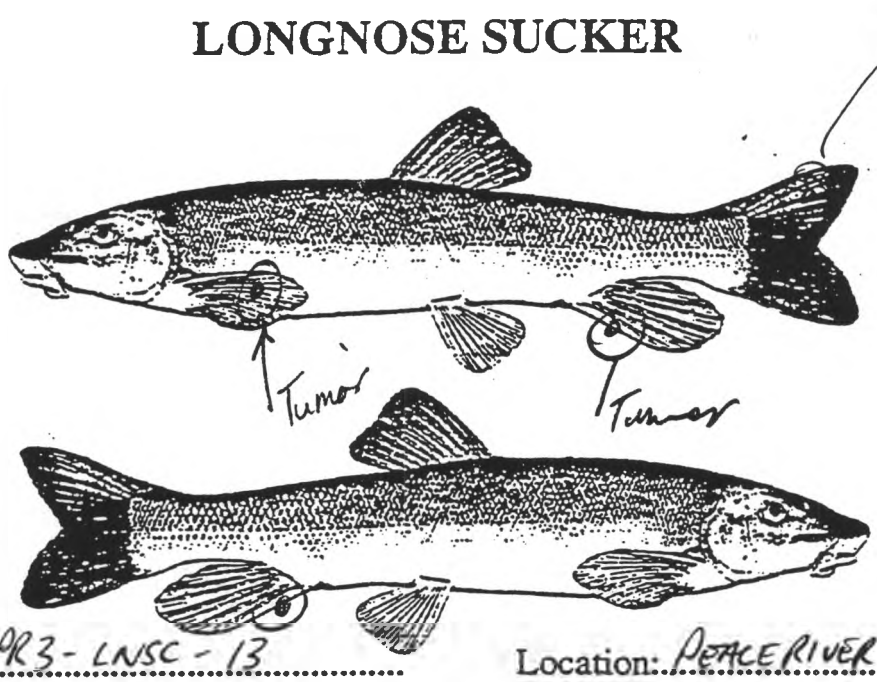
Collector (s): SHEPHARD/SCHMIDT-BOCK/LATHAM Capture Method: EF

Comments:

- Lesion present at the base of the left pectoral fin
- First and second rays of right pectoral fin previously wounded, now healed
- 3 gill arches on right side of sucker are necrotic, 4th is frayed

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: PR3 - LNSC - 13 Location: PEACE RIVER @ FT. VERMILION

Collection Date: 08/10/94 Collection Time:

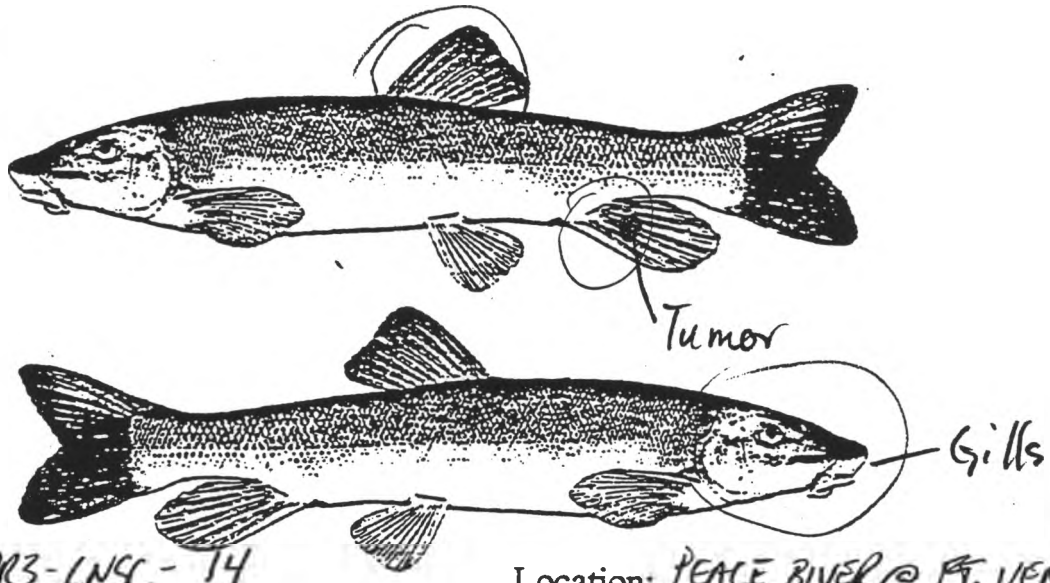
Collector (s): SCHMELTER/SHEPPARD/LATHAM Capture Method: EF

Comments:

- Tumor on left pelvic fin.
- Tumor on anal fin
- Caudal fin upper lobe has a small tumor

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: PR3-LNSC-14 Location: PEACE RIVER @ FT. VERMILION

Collection Date: 08/10/94 Collection Time:

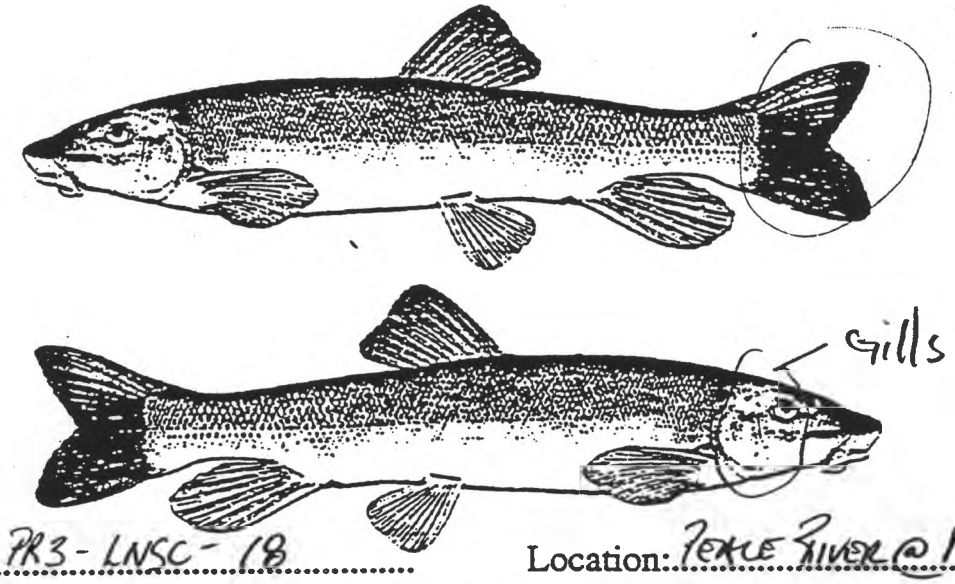
Collector (s): SHEPPARD/SCHMELTZER/LATHAM Capture Method: EF

Comments:

- Dorsal fin hemorrhagic
- Tumor present on anal fin
- Gill filaments necrotic

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: PR3-LNSC-18 Location: PEACE RIVER @ FT. VERMILION

Collection Date: 08/10/94 Collection Time:

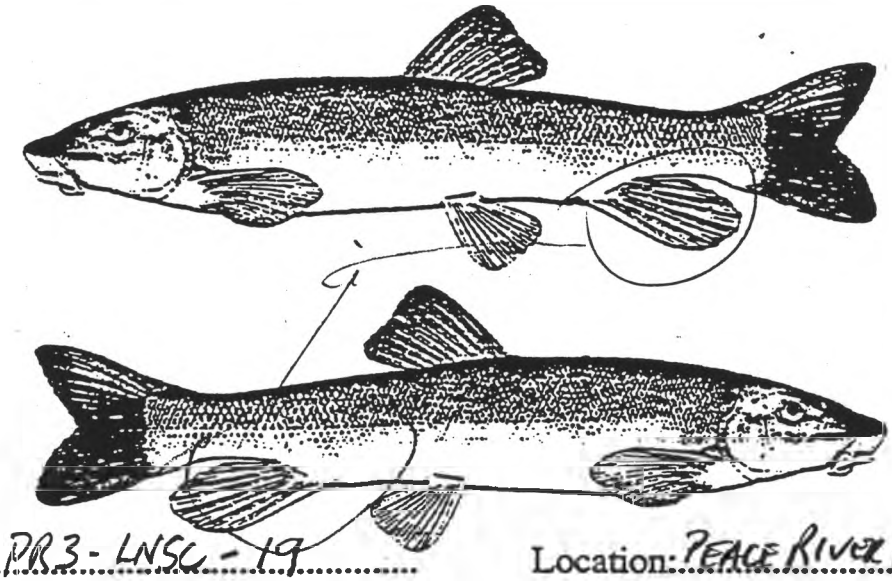
Collector (s): SHEPPARD/SCHMELTZER/LATVAN Capture Method: EF

Comments:

- Caudal fin hemorrhagic
- Gill filaments frayed/necrotic

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: PR3-LNSC-19 Location: PEACE RIVER @ E. VERMILION

Collection Date: 08/10/94 Collection Time:

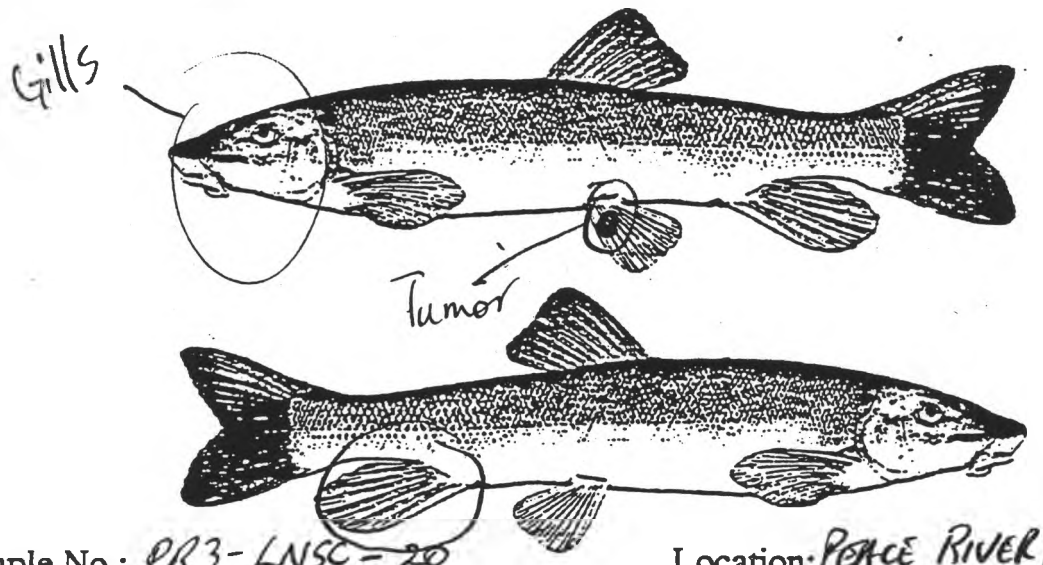
Collector (s): SHEPPARD/SCHMELTZER/LATHAM Capture Method: EF

Comments:

- ANAL FIN is deformed. May be an old predator scar and has subsequently healed

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: PR3-LNSC-20 Location: PEACE RIVER @ FT. VERMILION

Collection Date: 08/10/94 Collection Time:

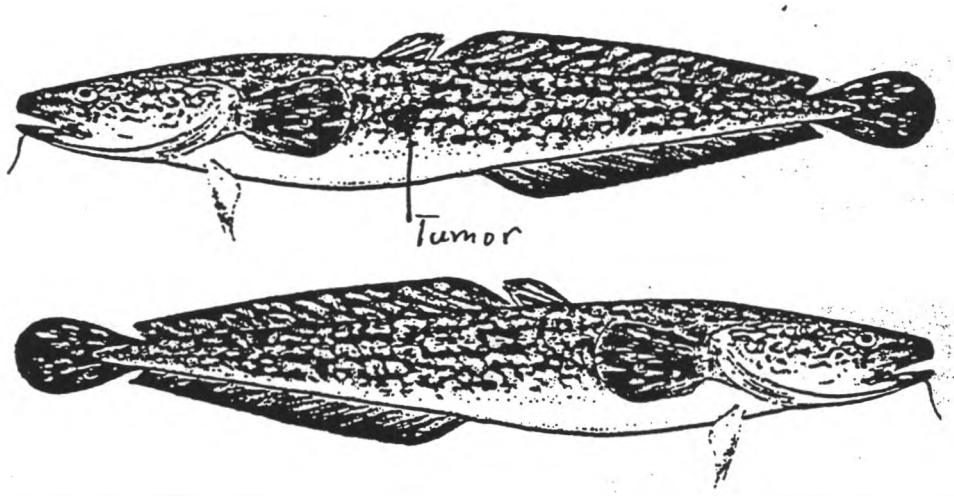
Collector (s) SHEPPARD/SCHMELTZER/LATHAM Capture Method EF

Comments:

- Small tumor on left pelvic fin
- Anal fin hemorrhagic
- Gill filaments frayed + necrotic

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

BURBOT



Sample No.: SR1-BURB-10 Location: SMOKY RIVER @ Watino

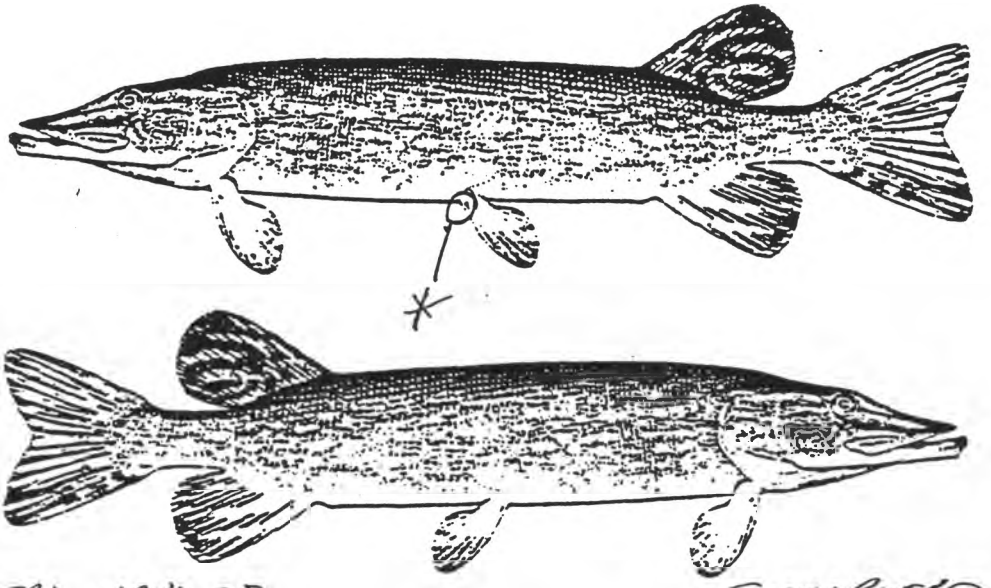
Collection Date: SEPT 14/94 Collection Time: 10:35 PM

Collector (s): BOAG/SHEPPARD/OSH1 Capture Method: SETLINE

Comments:

- Left side, below midline, directly under the anterior dorsal fin is a subdermal tumor. (photographed)

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet
NORTHERN PIKE



Sample No.: SRI-NRPK-03 Location: SMOKY RIVER @ WATINO

Collection Date: 19/09/94 Collection Time: /

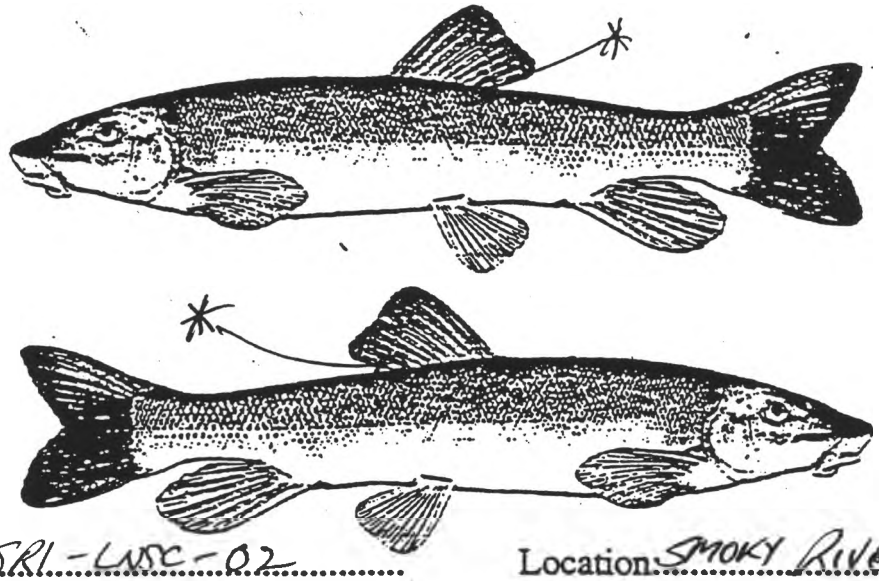
Collector (s): BOAG / SHEPPARD / OISHI Capture Method:

Comments:

* Under-developed, left pelvic fin: 1st & 2nd ray present, but small, other rays grossly deformed or absent.

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: SRI-LNSC-02 Location: SMOKY RIVER @ Watino

Collection Date: 13/09/94 Collection Time: 1500

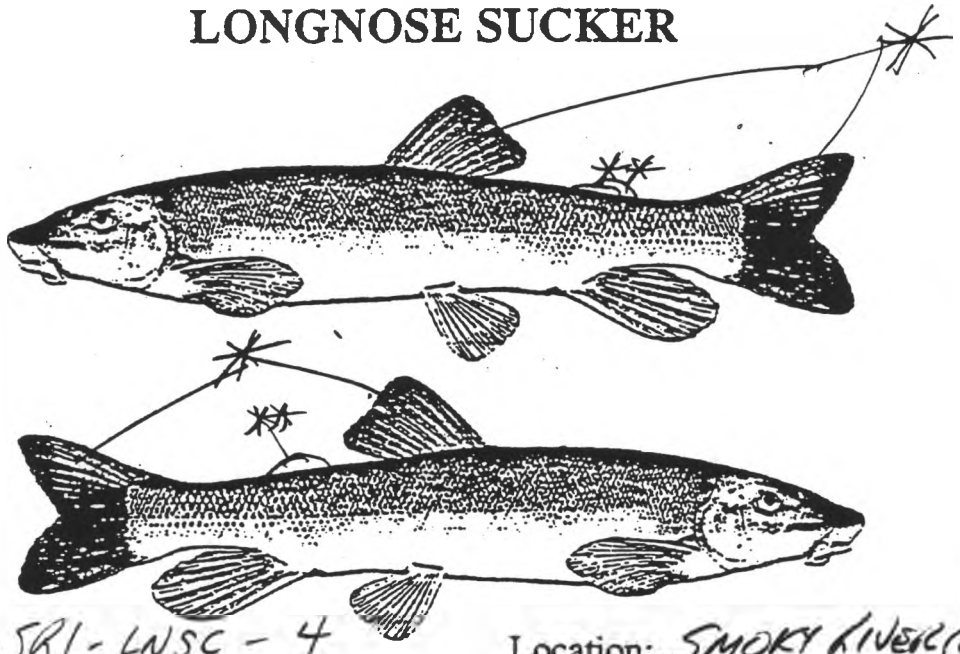
Collector (s): NOAG/SHEPPARD/OTSHI Capture Method: EF

Comments:

* Small, white tumor @ caudal end, base of dorsal fin.

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: SRI-LNSC-4 Location: SMOKY RIVER @ Watino

Collection Date: Collection Time: 1500

Collector (s): BOAG/SHEPPARD/OSHI Capture Method: EF

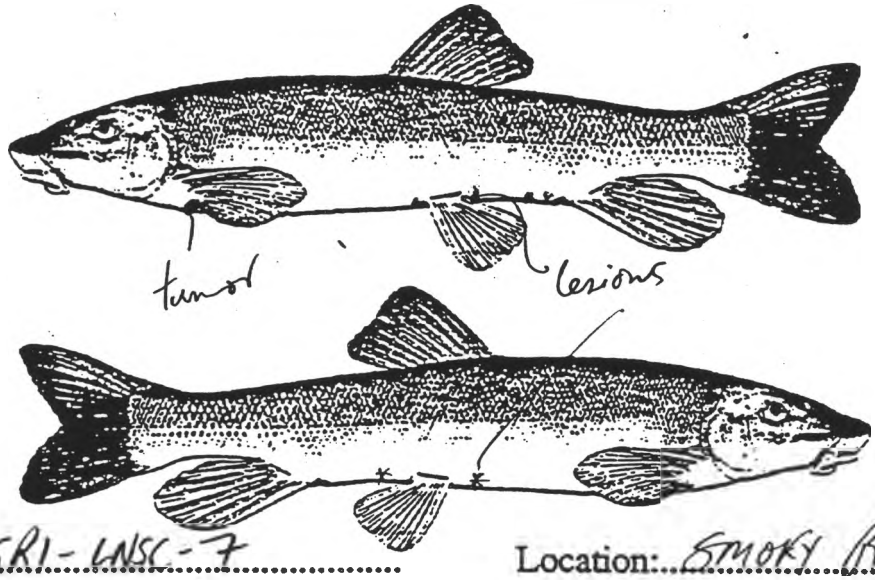
Comments:

* Caudal & dorsal fins hemorrhagic

** Small, red lesions along dorsal side

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: SRI-LNSC-7 Location: SMOKY RIVER @ Watino

Collection Date: 13/09/94 Collection Time: 1500

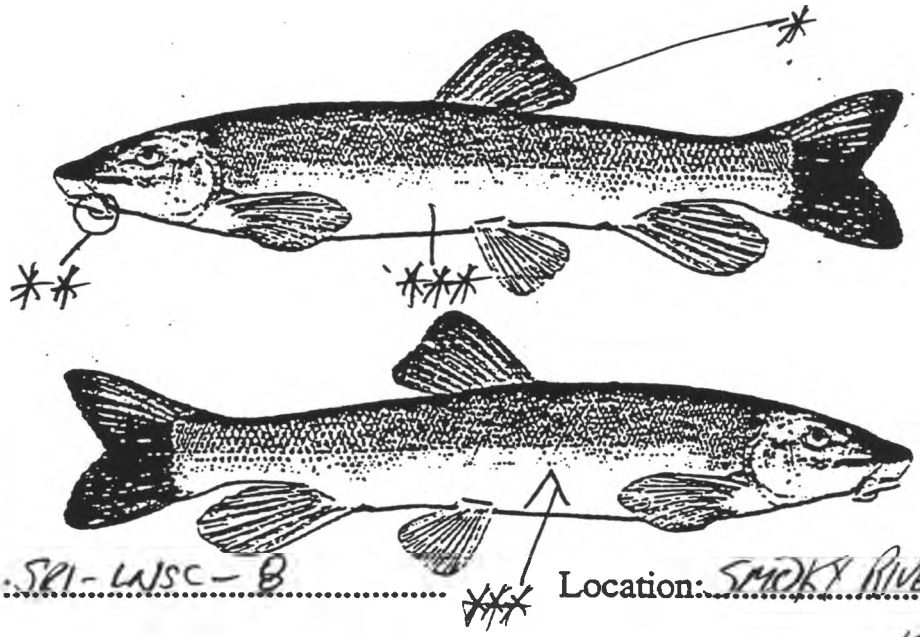
Collector (s): BOAG / SHEPPARD / OISHI Capture Method: EF

Comments:

Small, red lesions along underside and a small tumor (red) at the base of the left pectoral fin.

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: SRI-LNSC-8 Location: SMOKY RIVER @ Watino

Collection Date: Collection Time: 1500

Collector (s): BOAG/SHEPARD/OSHI Capture Method: EF

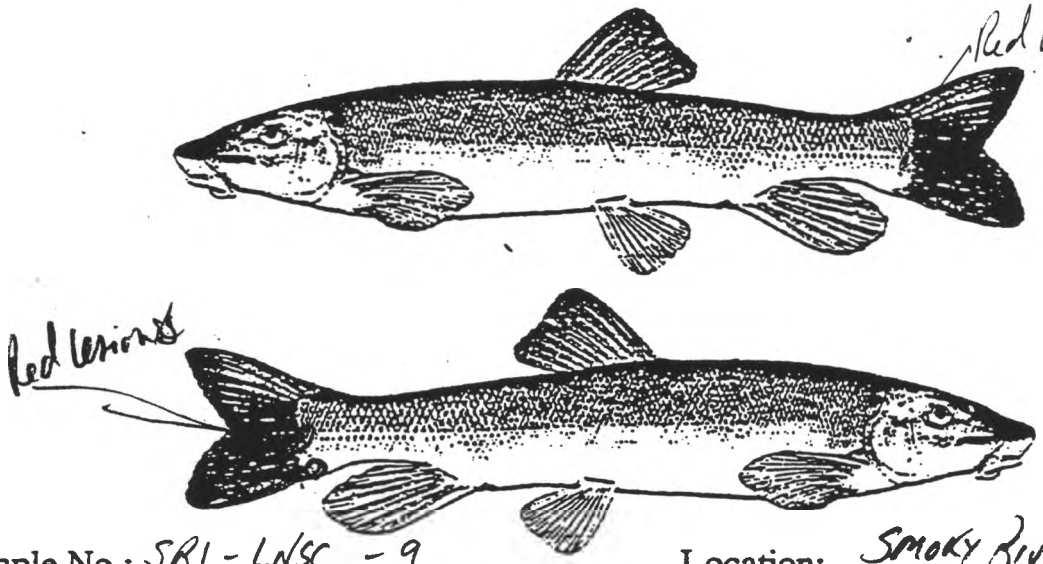
Comments: * Tumor on left side, dorsal fin.

** Left "sucker" of mouth "inflamed" and red

*** Excessive fat along intestine & around stomach.

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: SRI-LNSC-9 Location: SMOKY RIVER @ Watino

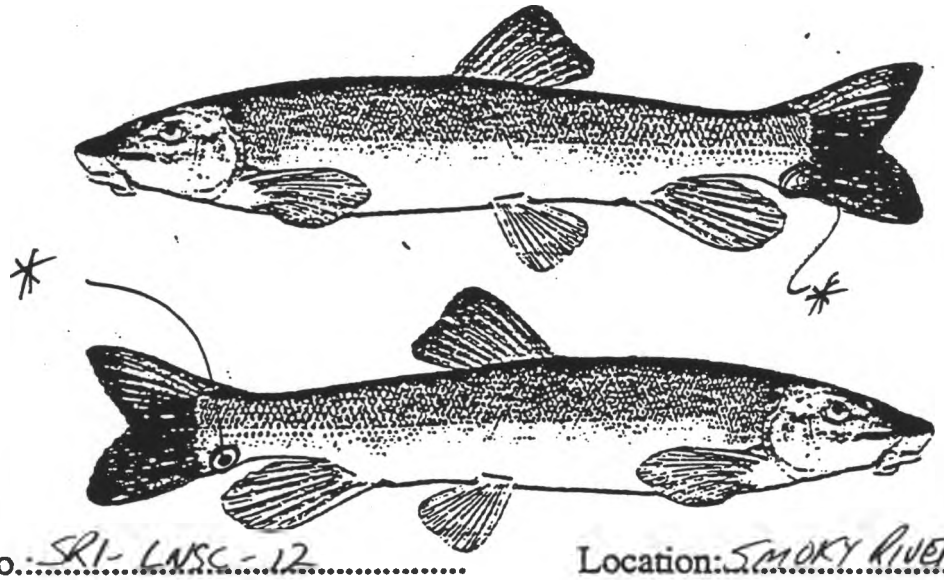
Collection Date: 13/09/94 Collection Time: 1500

Collector (s): BOAG/SHEPARD/DISH Capture Method: EF

Comments:
Numerous small red lesions around base of caudal fin.

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: SRI-LNSC-12 Location: SMOKY RIVER @ WATINO

Collection Date: Collection Time: 1500

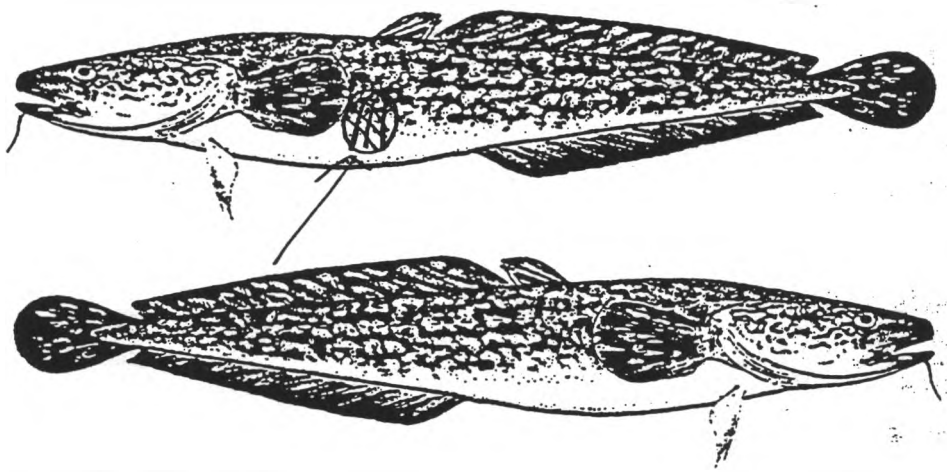
Collector (s): BOAG/SHEPPARD/OOSHI Capture Method: EF

Comments:

* Ulcerous lesion @ base of caudal fin

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

BURBOT



Sample No.: WRI-BURB-2 Location: WAPATI RIVER U/S GRANDE PRAIRIE

Collection Date: 24/09/94 Collection Time:

Collector (s): BOAG / SHEPPARD / ISHI Capture Method: EF

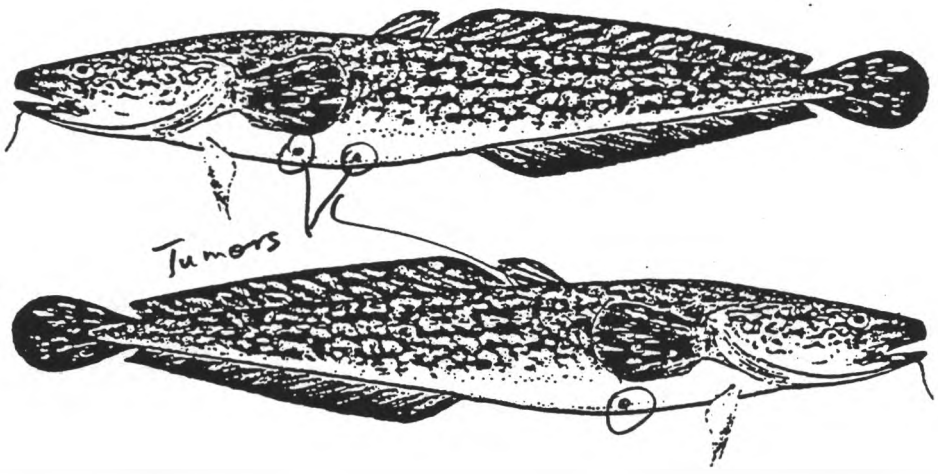
Comments:

- Open lesion on fish's left side. Entire gut & liver hanging outside of burbot, emerging through the open wound

- Intestines red, inflamed, and probably ionic balance is stressed.

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

BURBOT



Sample No.: WR1-BURB-4 Location: WAPATI RIVER u/s GRANDE PRAIRIE

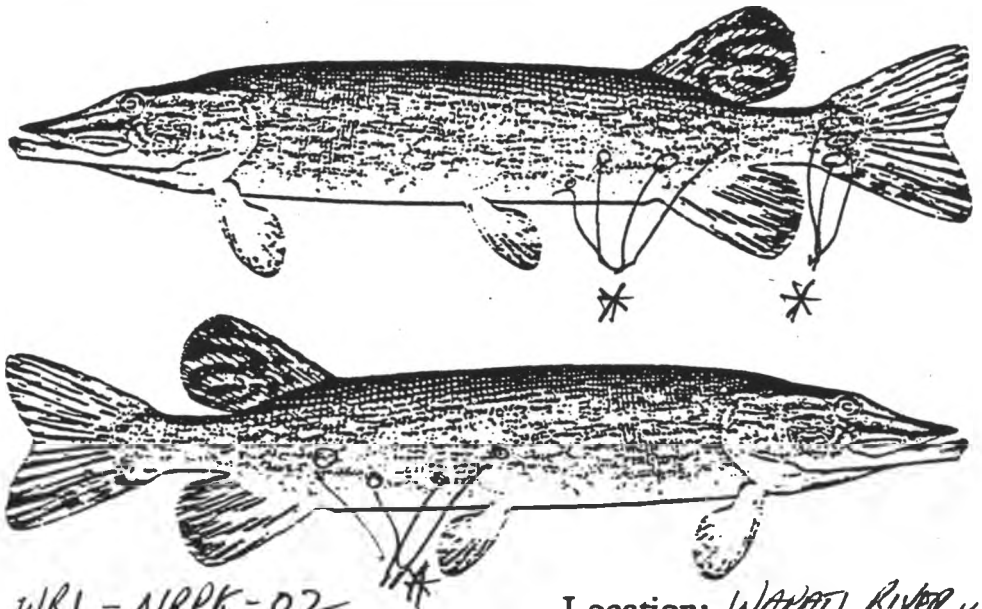
Collection Date: 26/09/94 Collection Time:

Collector (s): BOAG/SHEPPARD/OTSHI Capture Method: EF

Comments:

- Small, dark tumors on ventral surface, anterior to the anal fin

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet
NORTHERN PIKE



Sample No.: WRL-NRPK-02 Location: WRIGHT RIVER u/s GRANDE Rd.

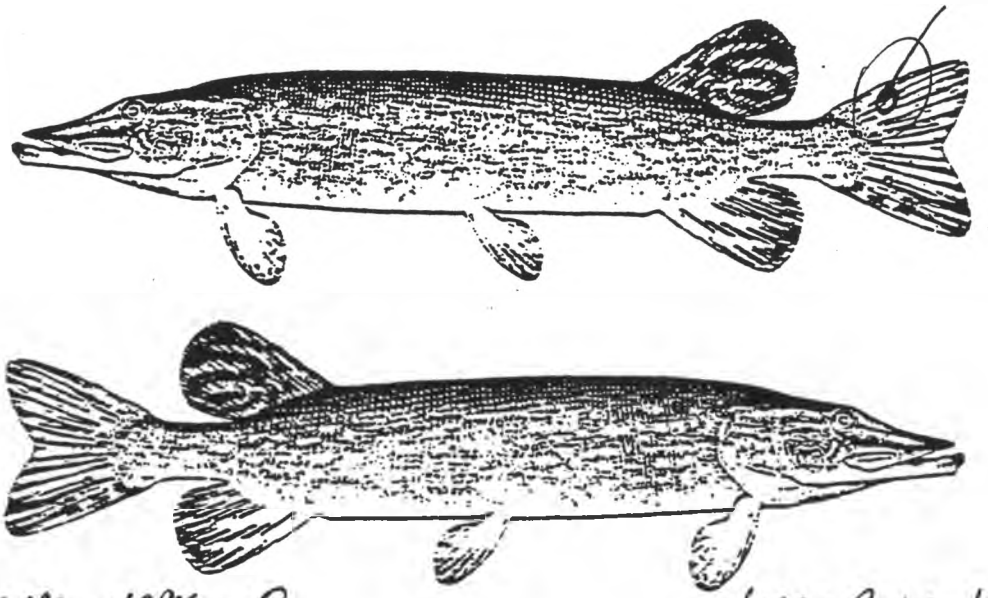
Collection Date: 23/09/94 Collection Time: 1500

Collector (s): BOAG/SHEPPARD/ONSHI Capture Method: EF

Comments:

* Lesions (small, red) around caudal peduncle (+) along each side of fish below lateral line

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet
NORTHERN PIKE



Sample No.: WRI-NRPK-8 Location: WAPITI RIVER u/s GRANDE PRAIRIE

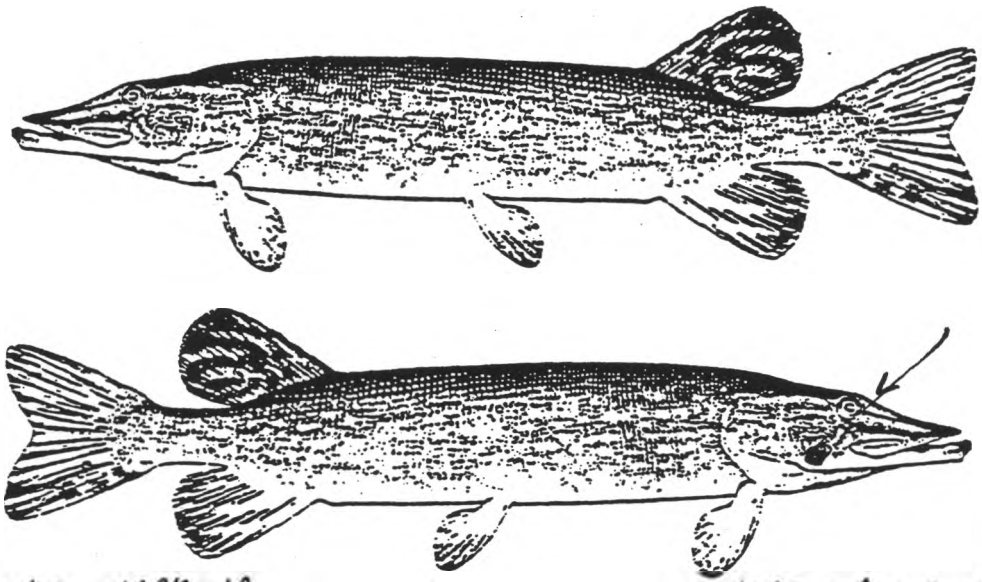
Collection Date: 25/09/94 Collection Time:

Collector (s): BOAG/SHEPPARD/OTSHI Capture Method: EF

Comments:

- GROWTH on upper lobe of caudal fin

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet
NORTHERN PIKE



Sample No.: WRI-NRPK-12 Location: WAPATI RIVER u/s GRANDE PRAIRIE

Collection Date: 26/09/94 Collection Time:

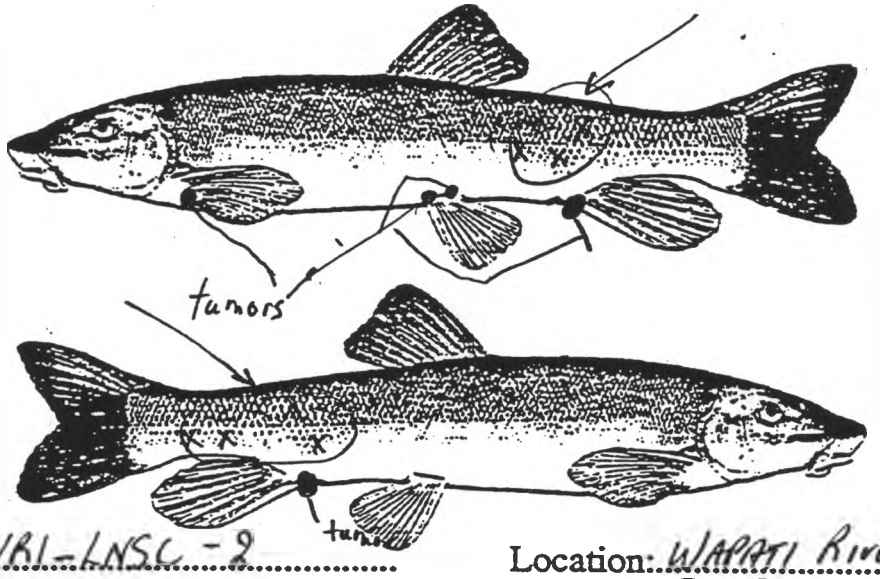
Collector (s): BOAG/SHEPPARD/OISHI Capture Method: E.F.

Comments:

-Tumor on the bottom of the right operculum

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: WRI-LNSC-2 Location: WAPATI RIVER u/s GRANDE PRAIRIE

Collection Date: 23/09/94 Collection Time:

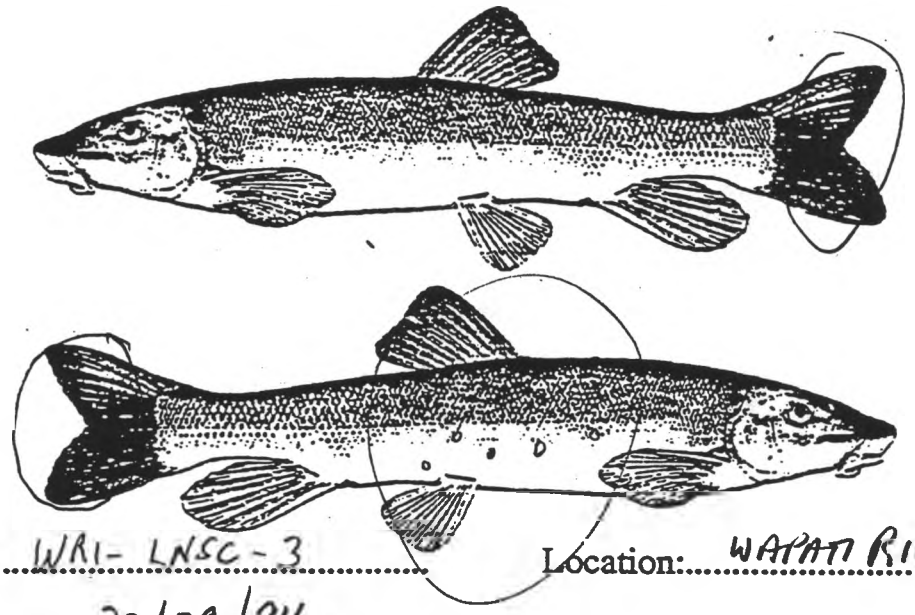
Collector (s): BOAG/SHEPPARD/OLSEN Capture Method: EF

Comments:

- 2 small tumors at base of left pelvic fin
- Tumor at base of anal fin
- Tumor at base of left pectoral fin
- Small, red lesions on both sides of fish below and posterior to dorsal fin

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: WRI-LNSC-3 Location: WAPATI RIVER u/s GRANDE PRAIRIE

Collection Date: 22/09/94 Collection Time:

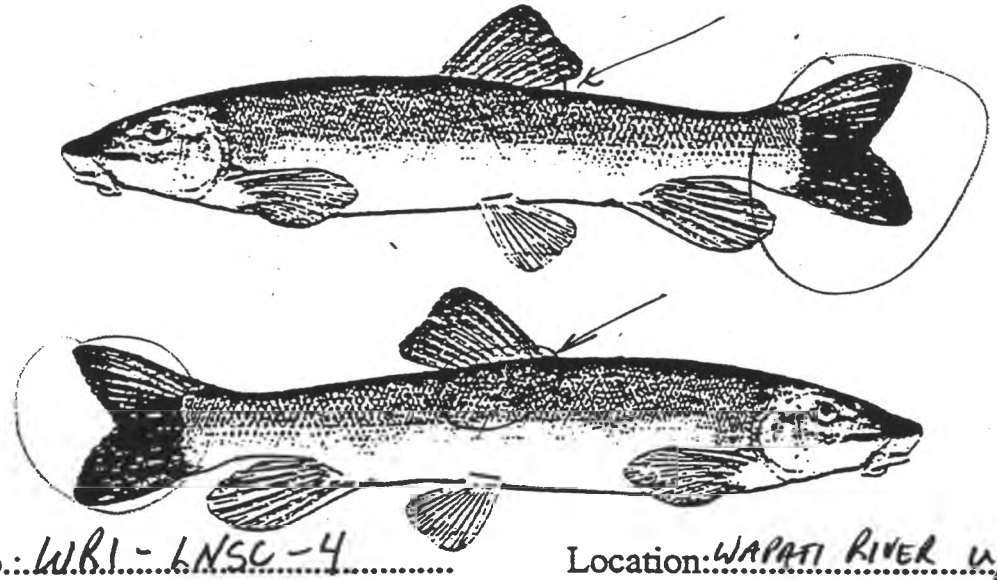
Collector (s) BOAG/SHEPPARD/OISHI Capture Method E.F

Comments:

- Numerous small, red lesions along right side
- Tail is slightly hemmorhagic
- Excessive fat

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: WRI-LNSC-4 Location: WAPATI RIVER U/S GRANDE PRAIRIE

Collection Date: 23/09/94 Collection Time:

Collector (s): BOAG/SHEPPARD/ORSHI Capture Method: EF

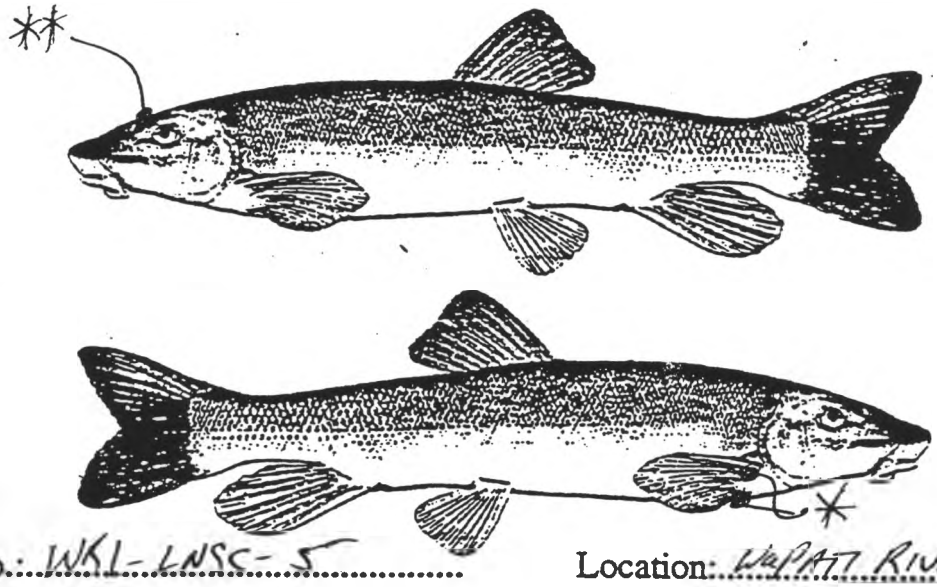
Comments:

- Few small, red lesions below dorsal fin on both right & left sides

- Tail slightly hemmhoragic

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: WK1-LNSC-5 Location: WAPITI RIVER u/s GRANDE PRAIRIE

Collection Date: 23/09/94 Collection Time:

Collector (s): BOAG/SHEPPARD/OTSKI Capture Method: EF

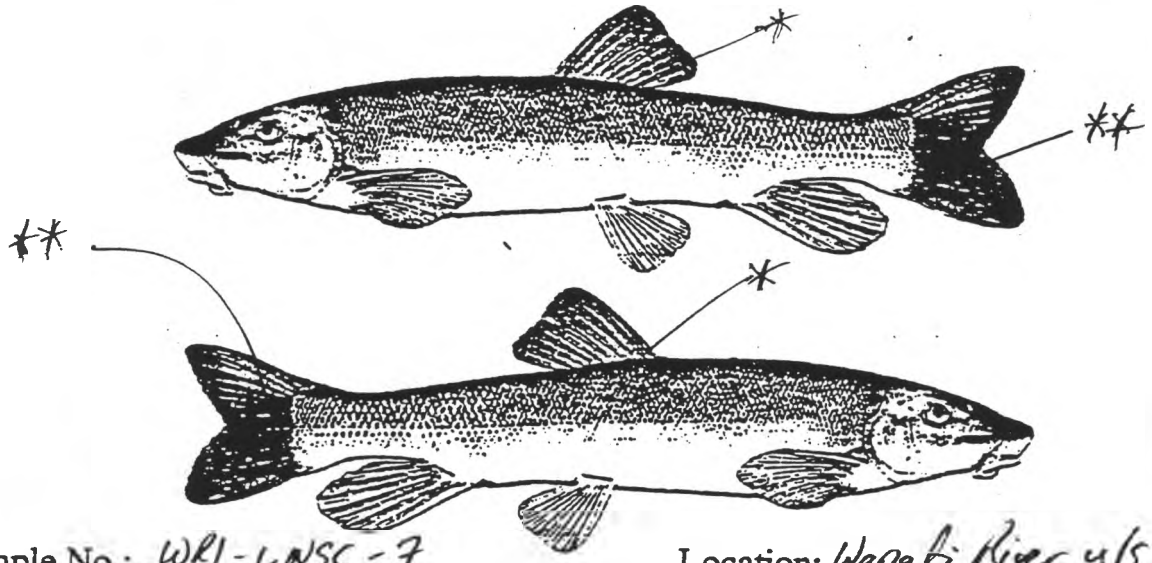
Comments:

* 2 tumors (1 red, 1 white) on right pectoral fin.

** Hole in head, mildly necrotic

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: WRI-LNSC-7 Location: Wapati River u/s GRANDE PRAIRIE

Collection Date: 23/09/94 Collection Time:

Collector (s): BOAG/SHEPPARD/OTSHI Capture Method: EF

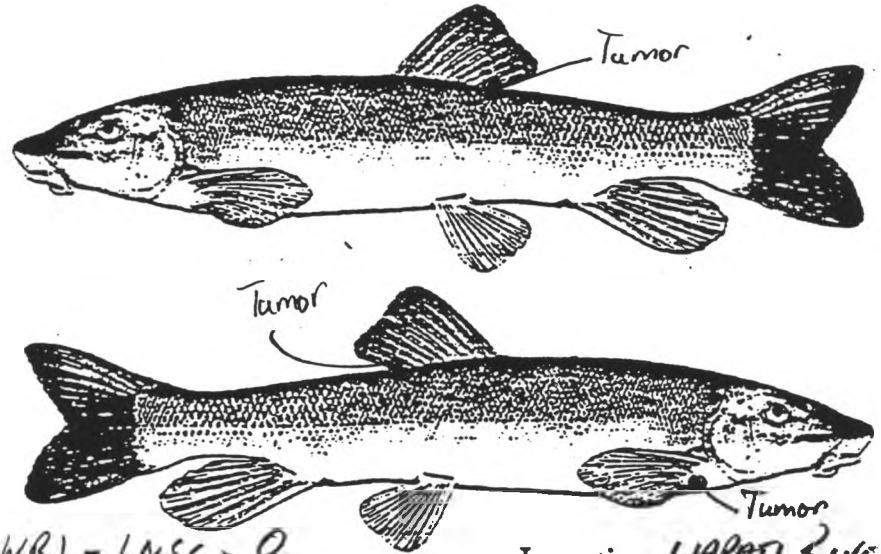
Comments:

* Small, red lesions below dorsal fin, above lateral line.

** Caudal fin hemorrhagic

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: WRI - LNSC - 8

Location: WAPATI RIVER U/S GRANDE PRAIRIE

Collection Date: 23/09/94

Collection Time:

Collector (s): BOAG/SHEPPARD/OISHI

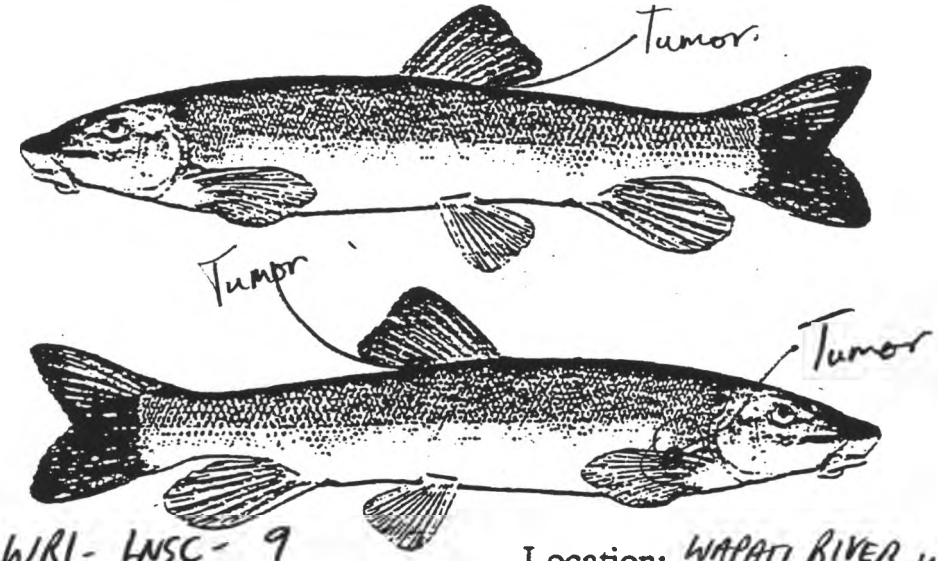
Capture Method: EF

Comments:

- Tumor at base of Right pectoral fin
- Tumor at base of dorsal fin.

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: WRI - LNSC - 9 Location: WAPATI RIVER u/s GRANDE PRAIRIE

Collection Date: 24/09/94 Collection Time:

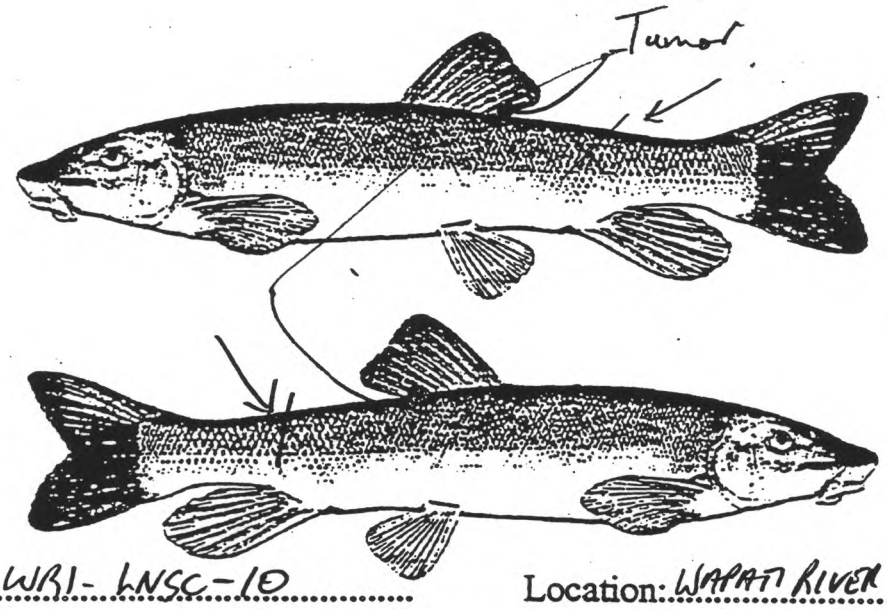
Collector (s): BOAG / SHEPPARD / OTSHI Capture Method: EF

Comments:

- Growth (tumor) on right pectoral fin
- Tumor at base of dorsal fin (1st year)

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No.: WRI-LNSC-10 Location: WAPATI RIVER u/s GRANDE PRAIR

Collection Date: 24/09/94 Collection Time:

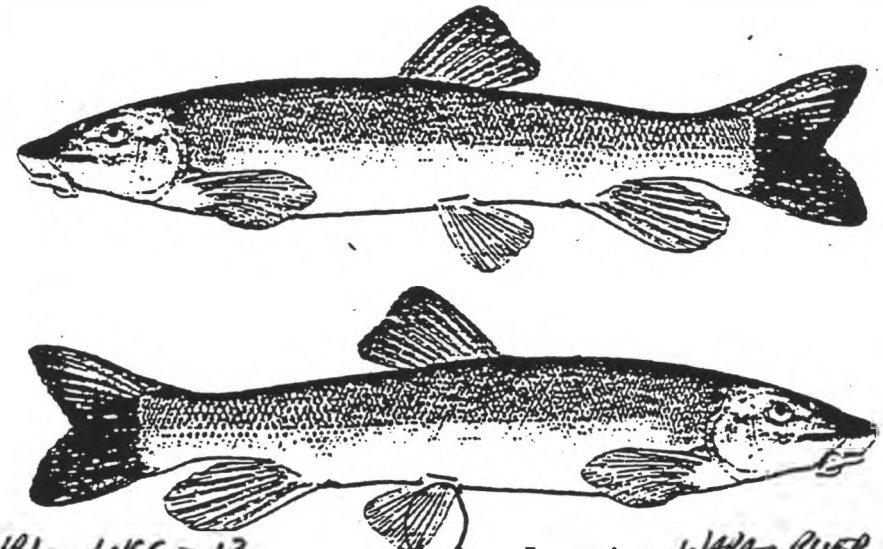
Collector (s): BOAG/SHEPPARD/OISHI Capture Method: EF

Comments:

- Tumor at base of dorsal fin
- Predator scar on either side of Caudal peduncle. Probably Eagle or Osprey wound that has healed

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

LONGNOSE SUCKER



Sample No. WRI - LNSC - 13 Location: WAIHAU RIVER d/s GRANGE MAIKIE

Collection Date: 25/09/94 Collection Time:

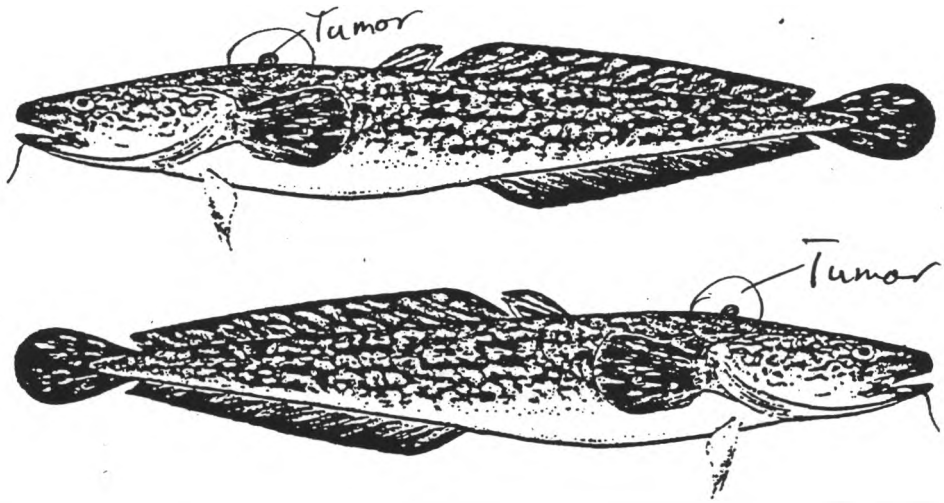
Collector (s) BOAG/SHEPPARD/OTSHI Capture Method EF

Comments:

- Left pelvic fin is frayed and split
- Liver was "granular" and spotted.

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

BURBOT



Sample No.: WR2-BURB-10 Location: WAPITI RIVER u/s ~~GRANDE~~ PRAIRIE

Collection Date: 19/10/94 Collection Time:

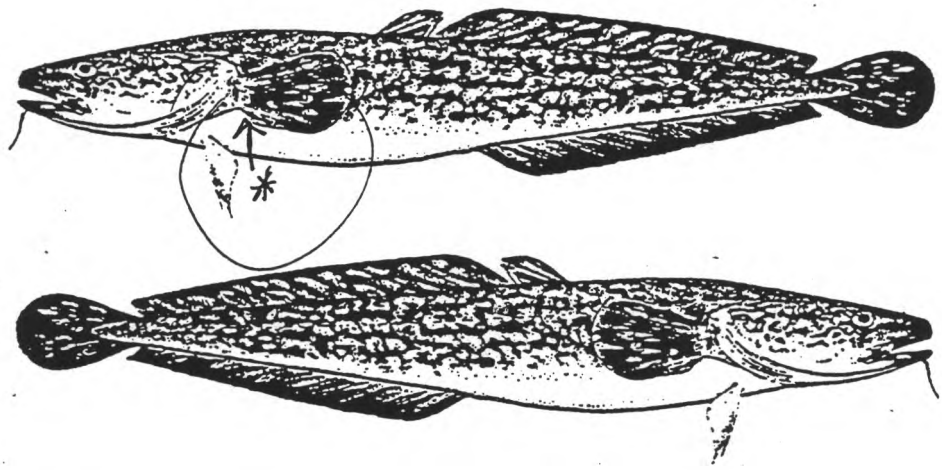
Collector (s): SHERMAN/SCHMELTZER/OISHI Capture Method: SETLINE

Comments:

- Tumor present posterior to skull on dorsal surface, anterior to dorsal fin

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

BURBOT



Sample No.: AI-BURB-1

Location: Athabasca R. d/s WHITECOURT

Collection Date: September 13/94

Collection Time: 1602

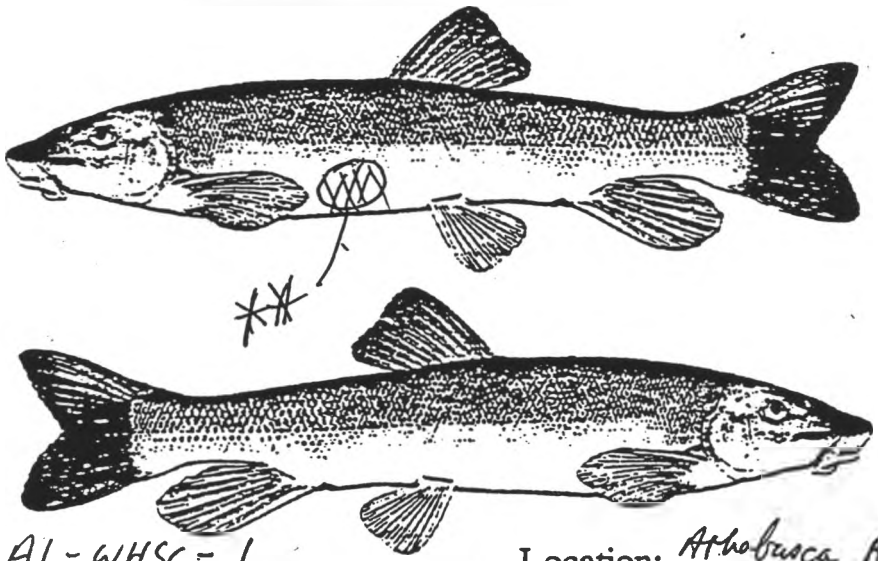
Collector (s): WHITE/BASSO/KLENTCHER

Capture Method: Sn

Comments:

Small lesion behind left pectoral fin.

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet
WHITE ~~LONGNOSE~~ SUCKER



Sample No.: A1-WHSC-1 Location: Athabasca R. d/s Whitecourt

Collection Date: Sept. 15/94 Collection Time: 1300

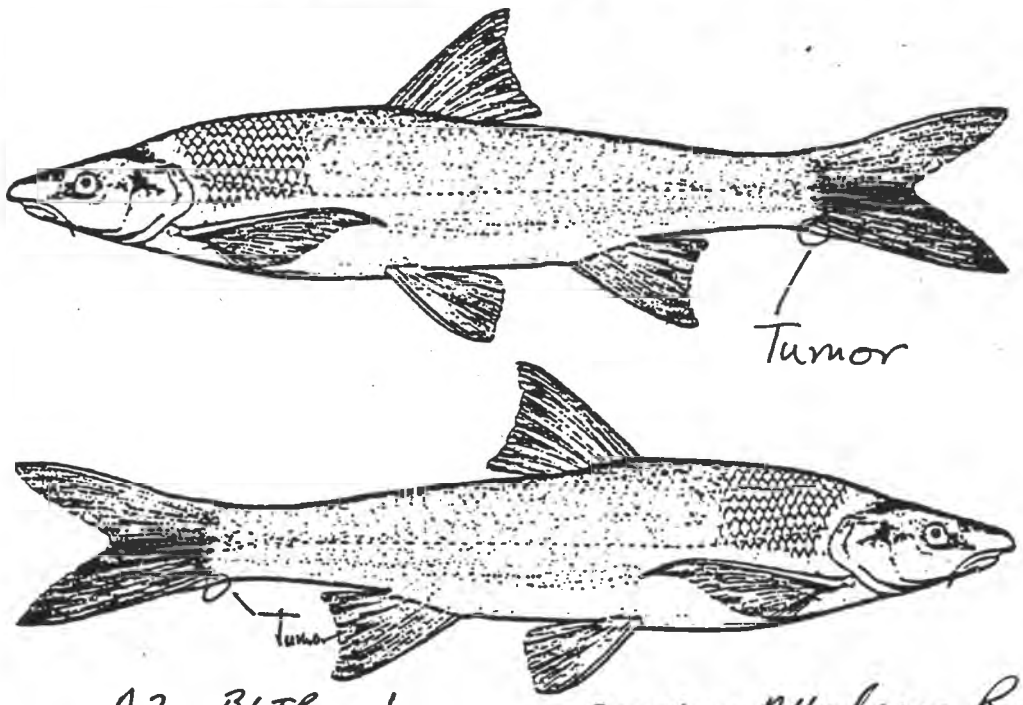
Collector (s): LIGHTLE / BASSO / KOWITCHEK Capture Method: EF

Comments:

Ulcerous lesion on left side, below lateral line.
(No records kept for this fish - oversight).

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

~~FLATHEAD CHUB~~ BULL TROUT



Sample No.: A2 - BLTR - 1

Collection Date: 21 September 94

Collector (s): LIGHTLE / BASSO / KUNTZER

Location: Athabasca R. U/S Hinton

Collection Time: 10:30 AM

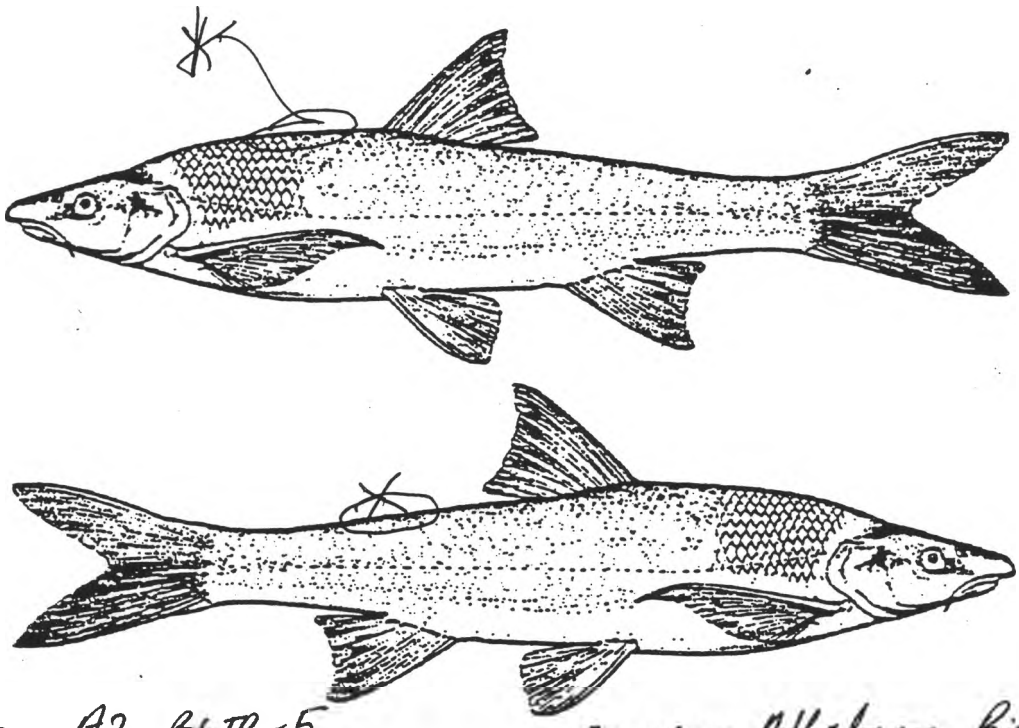
Capture Method: SL

Comments:

Tumor present at base of caudal fin

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

FLATHEAD CHUB



Sample No.: A2-BLTR-5 Location: Athabasca River u/s Hinton

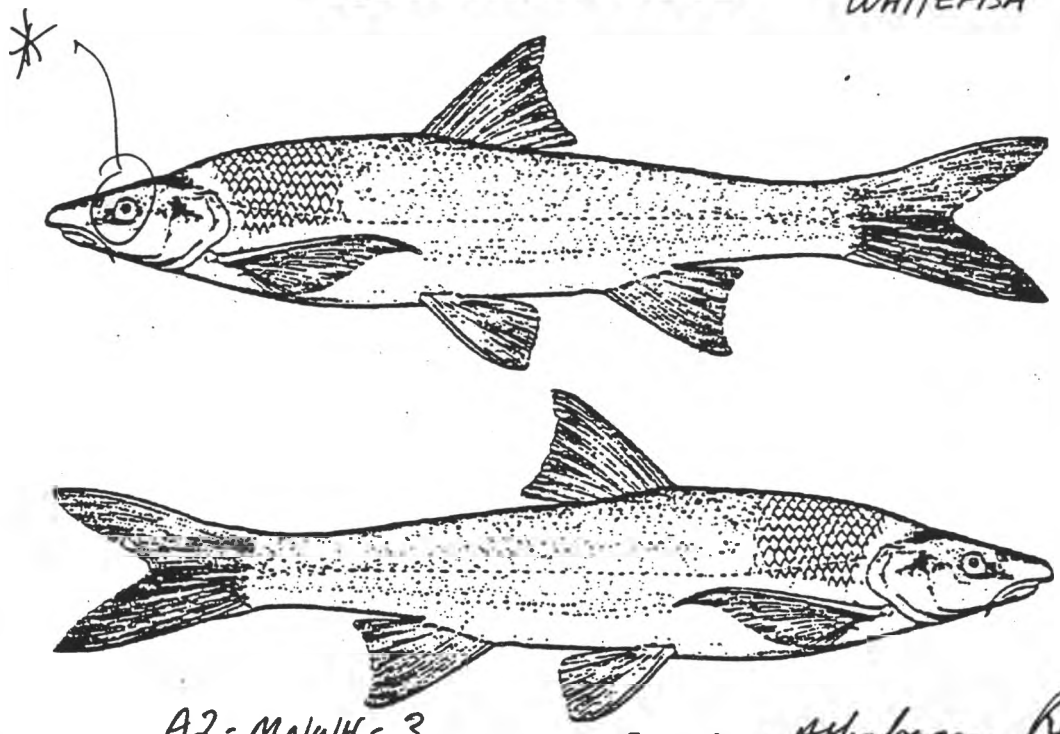
Collection Date: Sept. 21/94 Collection Time: 10:30

Collector (s): LITTLE/BASSO/KUNTCHER Capture Method: SL

Comments: Lesion on back → predator scar?

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

~~FLATHEAD CHUB~~ MOUNTAIN WHITEFISH



Sample No.: A2-MNWH-3

Location: Athabasca River u/s Hinton

Collection Date: 28 Sept. 94

Collection Time: 1530

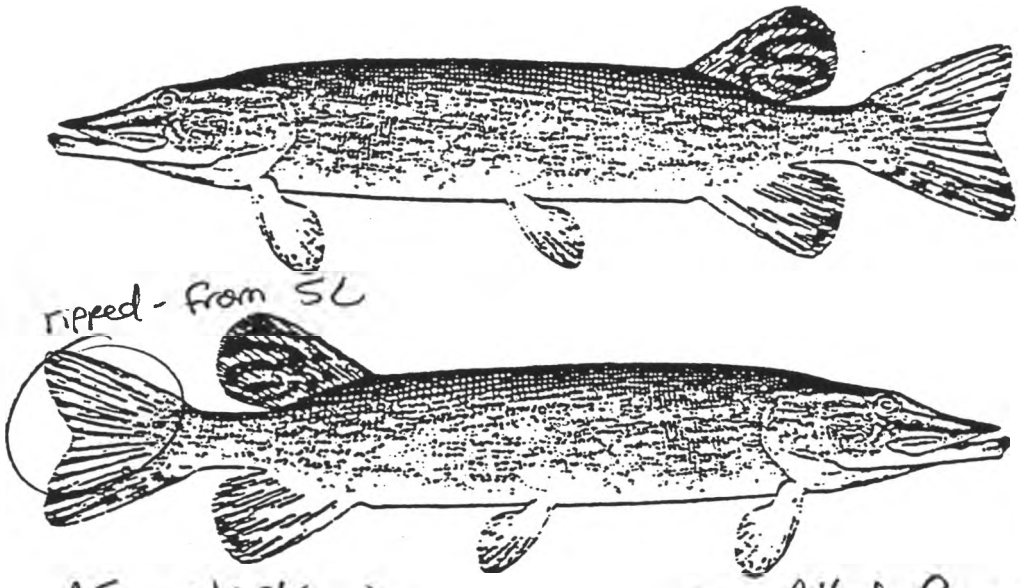
Collector (s): LIGHTLE/BASSO/KUNITCHER

Capture Method: EF

Comments:

Left Eye is haemorrhagic & exophthalmic

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet
NORTHERN PIKE



Sample No.: AS NRPK 1 Location: Athab. R. near Ft. Mackay

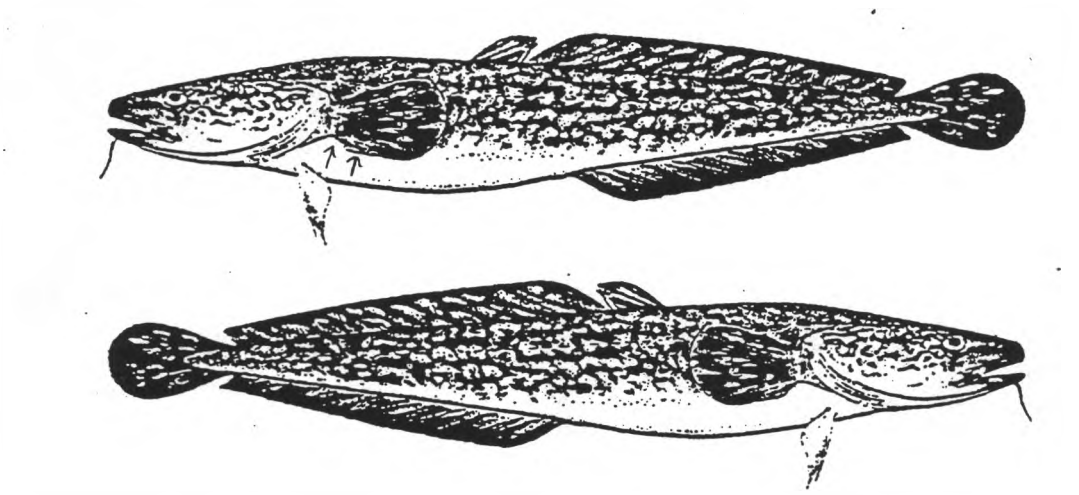
Collection Date: Collection Time:

Collector (s): D.h., D.K., A.B. Capture Method SL

Comments:

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

BURBOT



Sample No.: SRD BURB 4 Location: Slave River

Collection Date: 94.10.15 Collection Time: 1020

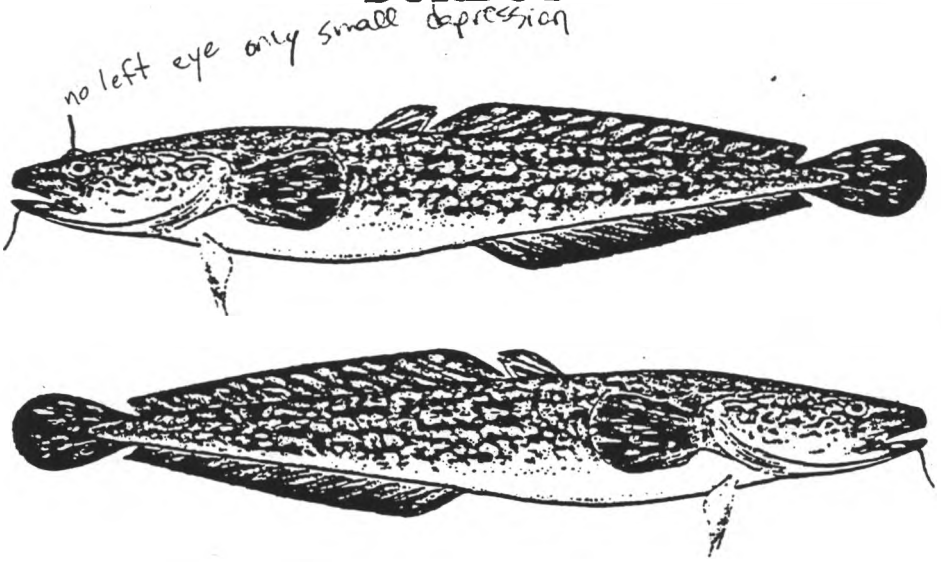
Collector (s): Cashion, Ethier, Jacobson Capture Method: S L

Comments: small round (? ARLM scar) healed slightly depressed

NORTHERN RIVER BASINS STUDY
Gross Pathology Examination Sheet

BURBOT

no left eye only small depression



Sample No.: SRDBURB 17

Collection Date: 94.10.16

Collector (s): T. Ethier, R. Kashino, T. Jacobson

Location: S. Fork River

Collection Time: 1200

Capture Method: SL

Comments:

APPENDIX F. STOMACH CONTENTS OF FISH SAMPLED.

Site	Species	No.	Stomach fullness	Bait	Fish	N	Invertebrates	N	Unidentified	Other
PR1	BURB	2	20							rock
PR1	BURB	3	0							
PR1	BURB	4	100						Chyme	
PR1	BURB	5	0							
PR1	BURB	6	10		spp.?					
PR1	BURB	7	50		spp.?					
PR1	BURB	8	0							
PR1	FLCH	1	0							
PR1	LNSC	1	5						Chyme	
PR1	LNSC	2	0							
PR1	LNSC	3	10						Chyme	
PR1	LNSC	4	8						Chyme	
PR1	LNSC	5	0							
PR1	LNSC	6	8				Corixids		Chyme	
PR1	LNSC	7	0							
PR1	LNSC	8	5				Corixids			
PR1	LNSC	9	0							
PR1	LNSC	10	5						Chyme	
PR1	LNSC	11	0							
PR1	LNSC	12	100				Corixids		Chyme	
PR1	LNSC	13	10						Chyme	
PR1	LNSC	14	5						Chyme	
PR1	LNSC	15	50				Corixids	200		
PR1	LNSC	16	10				Corixids		Chyme	
PR1	LNSC	17	20				Corixids			
PR1	NRPK	1	0							
PR1	NRPK	2	0							
PR1	NRPK	3	100		WHSC	1				
PR1	NRPK	4	100		sucker					
PR2	BURB	1	0							
PR2	BURB	2	0							
PR2	BURB	3	0							
PR2	BURB	4	10		spp?					
PR2	BURB	5	10		minnow					
PR2	BURB	6	25							fluid
PR2	BURB	7	25		minnow					
PR2	BURB	8	5		spp.?					
PR2	BURB	9	0							
PR2	BURB	10	20		minnow	1				
PR2	FLCH	2	10				corixids			
PR2	FLCH	3	0							
PR2	LNSC	1	10						Chyme	
PR2	LNSC	2	15						Chyme	
PR2	LNSC	3	5						Chyme	
PR2	LNSC	4	2						Chyme	
PR2	LNSC	5	20						Chyme	
PR2	LNSC	6	0							
PR2	LNSC	7	100						Chyme	
PR2	LNSC	8	50						Chyme	
PR2	NRPK	1	15		spp.?	1				
PR2	NRPK	2	0							
PR2	NRPK	3	0							
PR3	BURB	2	0							
PR3	BURB	4	5		spp.?					
PR3	BURB	5	20		minnow	4				
PR3	BURB	6	40		GOLD	2				2 cyprinids
PR3	LNSC	1	5						Chyme	
PR3	LNSC	2	10						Chyme	

Site	Species	No.	Stomach fullness	Bait	Fish	N	Invertebrates	N	Unidentified	Other
PR3	LNSC	3	5						Chyme	
PR3	LNSC	4	10							unknown
PR3	LNSC	5	20				corixid		Chyme	
PR3	LNSC	6	20						Chyme	
PR3	LNSC	7	5				corixid			
PR3	LNSC	8	20				corixid		Chyme	
PR3	LNSC	9	35				corixid		Chyme	
PR3	LNSC	10	10						Chyme	
PR3	LNSC	11	2						Chyme	
PR3	LNSC	12	10						Chyme	
PR3	LNSC	13	25				corixid			
PR3	LNSC	14	59				corixid		Chyme	
PR3	LNSC	15	15				corixid		Chyme	
PR3	LNSC	16	5				corixid			
PR3	LNSC	17	10				corixid			
PR3	LNSC	18	20				corixid			
PR3	LNSC	19	5				corixid			
PR3	LNSC	20	20				corixid			
PR3	LNSC	21	20				corixid		Chyme	
PR3	LNSC	23	15				corixid		Chyme	
SR1	BURB	1	0							
SR1	BURB	2	15	smelt						
SR1	BURB	3	0							
SR1	BURB	4	5	smelt						
SR1	BURB	5	10	smelt						
SR1	BURB	6	0							
SR1	BURB	7	0							
SR1	BURB	8	10	smelt						
SR1	BURB	9	10						chyme	
SR1	BURB	10	0							
SR1	BURB	11	0							
SR1	BURB	12	20						chyme	
SR1	BURB	13	0							
SR1	BURB	14	0							
SR1	BURB	15	0							
SR1	BURB	16	0							
SR1	BURB	17	0							
SR1	BURB	18	0							
SR1	BURB	19	0							
SR1	BURB	20	0							
SR1	FLCH	1	0							
SR1	FLCH	2	20						Chyme	
SR1	FLCH	3	5	smelt						
SR1	FLCH	4	0							
SR1	FLCH	5	0							
SR1	FLCH	6	0							
SR1	FLCH	8	0							
SR1	FLCH	9	0							
SR1	FLCH	10	0							
SR1	FLCH	11	0							
SR1	FLCH	12	0							
SR1	LNSC	1	0							
SR1	LNSC	2	0							
SR1	LNSC	4	10						Chyme	
SR1	LNSC	5	0							
SR1	LNSC	6	0							
SR1	LNSC	7	10						Chyme	
SR1	LNSC	8	100						Chyme	

Site	Species	No.	Stomach fullness	Bait	Fish	N	Invertebrates	N	Unidentified	Other
SR1	LNSC	9	0							
SR1	LNSC	11	0							
SR1	LNSC	12	0							
SR1	NRPK	1	0							
SR1	NRPK	2	0							
SR1	NRPK	3	100		FLCH	1				
SR2	BURB	1	50				stoneflies			
SR2	LNSC	1	5				corixid		Chyme	
WR1	BURB	1	5		spp.?					
WR1	BURB	2	0							
WR1	BURB	3	0							
WR1	BURB	4	40		spp.?	3				
WR1	FLCH	1	0							
WR1	FLCH	2	5				spp.?			
WR1	FLCH	3	0							
WR1	FLCH	4	0							
WR1	FLCH	5	0							
WR1	LNSC	1	0							
WR1	LNSC	2	5				Corixids	6		
WR1	LNSC	3	0							
WR1	LNSC	4	5				Corixids		Chyme	
WR1	LNSC	5	5						Chyme	
WR1	LNSC	6	30						Chyme	
WR1	LNSC	7	30				Corixids	150		
WR1	LNSC	8	10				Corixids	30		
WR1	LNSC	9	0							
WR1	LNSC	10	0							
WR1	LNSC	11	0							
WR1	LNSC	12	0							
WR1	LNSC	13	10				Corixid	20		
WR1	NRPK	1	20		GOLD	1				
WR1	NRPK	2	0							
WR1	NRPK	3	0							
WR1	NRPK	4	10		GOLD					
WR1	NRPK	5	0							
WR1	NRPK	6	0							
WR1	NRPK	7	80		FLCH	1				
WR1	NRPK	8	100		sucker	1				1 rodent
WR1	NRPK	9	0							
WR1	NRPK	10	5		spp.?					
WR1	NRPK	11	0							
WR1	NRPK	12	0							
WR2	BURB	1	5		spp.?					
WR2	BURB	2	10		spp.?					
WR2	BURB	3	10		spp.?					
WR2	BURB	4	0							
WR2	BURB	5	0							
WR2	BURB	6	0							
WR2	BURB	7	0							
WR2	BURB	8	0							
WR2	BURB	9	10		spp.?					
WR2	BURB	10	0							
WR2	BURB	11	0							
WR2	BURB	12	0							
WR2	BURB	13	0							
WR2	NRPK	1	5		spp.?					
LSR1	NRPK	1	0							
LSR1	WALL	3	100		LNSC	1				

Site	Species	No.	Stomach fullness	Bait	Fish	N	Invertebrates	N	Unidentified	Other
LSR2	BURB	1	100		FLCH	1				
LSR2	BURB	1	60				mayflies, caddisflies, stoneflies			
LSR2	FLCH	1	0							
LSR2	LNSC	1	0							
LSR2	LNSC	2	50						Chyme	
LSR2	LNSC	3	20						Chyme	
LSR2	LNSC	4	0							
LSR2	LNSC	5	0							
LSR2	LNSC	6	0							
WB1	BURB	1	35				stonefly nymph			
WB1	BURB	2	45				stonefly nymph			
WB1	BURB	3	10				stonefly nymph			
WB1	BURB	4	30				stonefly nymph			
WB1	BURB	5	25				stonefly nymph			
WB1	BURB	6	10				stonefly nymph			
WB1	BURB	7	0							
WB1	BURB	8	30				stonefly nymph			
WB1	BURB	9	40		minnow		stonefly nymph			
WB1	FLCH	1	5						Chyme	
A1	BURB	1	0							
A1	BURB	2	0							
A1	BURB	6	100	bait						
A1	BURB	7	100	bait						
A1	BURB	8	100		sucker	1				
A1	BURB	9	0							
A1	BURB	10	0							
A1	BURB	11	0							
A1	LNSC	1	100						Chyme	
A1	NRPK	1	0							
A1	NRPK	2	0							
A1	NRPK	3	0							
A1	NRPK	4	0							
A2	BLTR		25							
A2	BLTR	4	100		WHSC	1				
A2	BLTR	6	25	smelt			insects			
A2	BLTR	7	100	smelt						
A2	BLTR	8	100	smelt						
A2	BURB	1	100	smelt						
A2	BURB	2	0							
A2	BURB	3	100	smelt	spp.?					
A2	BURB	4	0							
A2	BURB	5	25				stonefly			
A2	BURB	6	0							
A2	BURB	7	100		minnow	3				
A2	BURB	8	100		minnow	3			Chyme	
A2	LNSC	1	100							
A2	LNSC	2	100							
A2	LNSC	3	0							
A2	LNSC	4	0							
A2	LNSC	5	100						Chyme	
A2	MNWH	1	100							
A2	MNWH	2	100							pine needles
A2	MNWH	3	0							
A2	RNTR	1	100							
A2	RNTR	2	100							
A2	RNTR	3	100							
A2	RNTR	4	100							vole
A2	RNTR	5	100		minnow	10				

Site	Species	No.	Stomach fullness	Bait	Fish	N	Invertebrates	N	Unidentified	Other
A2	RNTR	7	25							insects
A2	RNTR	8	100							
A2	RNTR	9	0							
A3	BURB	1	0							
A3	BURB	1	0							
A3	BURB	2	25	smelt						
A3	BURB	3	25				stonefly			
A3	BURB	4	0							
A3	BURB	6	0							
A3	BURB	7	0							
A3	BURB	8	100	smelt						
A3	BURB	9	0							
A3	BURB	10	0							
A3	BURB	11	25		minnow					
A3	BURB	12	25							insect
A3	BURB	13	100							
A3	BURB	14	0							
A3	BURB	15	100		spp.?					
A3	BURB	16	0							
A3	BURB	17	0							
A3	BURB	18	0							
A3	BURB	19	0							
A3	BURB	20	100	smelt						
A3	BURB	21	0							
A3	BURB	22	25							
A3	BURB	23	0							
A4	BURB	1	0							
A4	BURB	2	0							
A4	BURB	3	25	bait						
A4	BURB	4	0							
A4	BURB	5	0							
A4	BURB	6	0							
A4	BURB	7	100	bait			corrigonid			
A4	BURB	8	100	bait						rock
A4	BURB	9	0							
A4	BURB	10	100				stoneflies	4		
A4	BURB	11	100				stoneflies	6		
A4	BURB	12	0							
A4	BURB	13	0							
A4	BURB	14	0							
A4	BURB	15	25		spp.?					
A4	WALL	1	0							
A4	WALL	2	100							
A4	WALL	3	0							
A4	WALL	4	0							
A4	WALL	5	25	bait						
A4	WALL	6	0							
A4	WALL	7	0							
A4	WALL	8	0							
A4	WALL	9	0							
A5	BURB	1	0							
A5	BURB	2	100		spp.?					
A5	BURB	3	0							
A5	BURB	4	0							
A5	BURB	5	0							
A5	BURB	6	100		BRST	1				
A5	BURB	7	100		GOLD	1				1 BRST
A5	BURB	8	100		BRST	47				

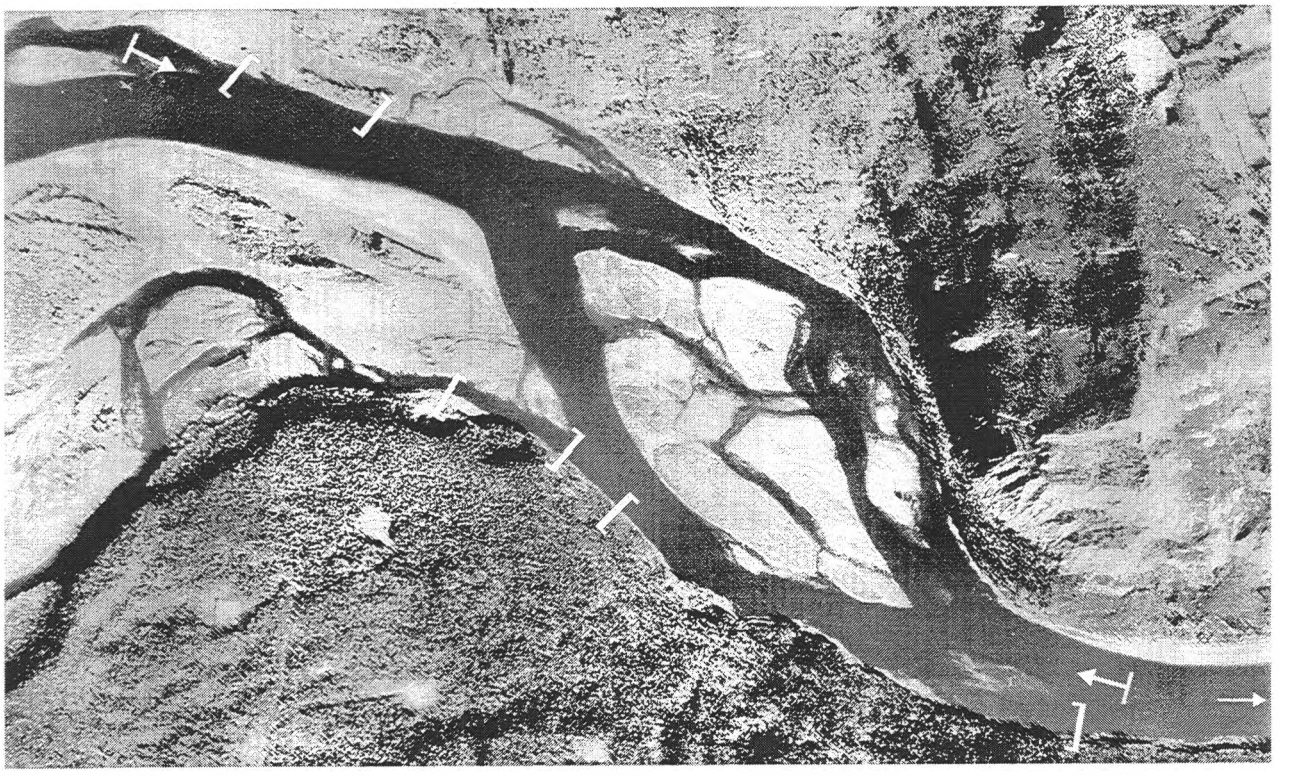
Site	Species	No.	Stomach fullness	Bait	Fish	N	Invertebrates	N	Unidentified	Other
A5	BURB	9	0							
A5	BURB	10	100		BRST	11				1 percid
A5	BURB	11	0							
A5	BURB	12	0							
A5	BURB	13	100		minnow	8				
A5	BURB	14	100				stonefly	1		1 mouse
A5	BURB	15	100		spp.?	1				
A5	BURB	16	0							
A5	BURB	17	0							
A5	BURB	18	100		spp.?	1				
A5	BURB	19	100		spp.?	2				
A5	BURB	20	0							
A5	BURB	21	100	smelt						
A5	GOLD	1	25							pebbles
A5	NRPK	1	100						Chyme	
A5	WALL	1	0							
A5	WALL	2	0							
A5	WALL	3	0							
A5	WALL	4	0							
A5	WALL	5	0							
A5	WALL	6	0							
A5	WALL	7	25						insects	leaves
A5	WALL	8	0							
A5	WALL	9	0							
A5	WALL	10	0							
MR1	BURB	1	100							
MR1	LNSC	1	100							
MR1	NRPK	1	0							
MR1	NRPK	2	0							
MR1	NRPK	3	0							
MR1	NRPK	4	50	smelt						
MR2	BURB	1	90	liver	TRPR	1	caddisflies			
MR2	BURB	2	50	liver			dragonfly			
MR2	BURB	2	0				mayflies			
MR2	BURB	3	0							
MR2	BURB	4	40	liver	TRPR	1	caddisflies, ephemeroptera			
MR2	BURB	5	30	liver						
MR2	BURB	6	50	liver						
MR2	BURB	7	30	liver						
P	BURB	1	25							
P	BURB	2	0							
P	BURB	3	100		spp.?					bivalve spp.?
P	BURB	4	0							
P	BURB	5	100				stoneflies			
P	BURB	6	100				stoneflies			
P	BURB	7								
P	NRPK	1	100						insects	
P	NRPK	2	0							
P	WALL	1	0							
LSV	BURB	1	0							
LSV	BURB	2	0							
LSV	BURB	3	0							
LSV	BURB	4	100	smelt						
LSV	BURB	5	100	smelt			stoneflies			bivalve spp.?
LSV	BURB	6	100		spp.?					
LSV	BURB	7	0							
LSV	BURB	8	0							
LSV	BURB	9	5	smelt						

Site	Species	No.	Stomach fullness	Bait	Fish	N	Invertebrates	N	Unidentified	Other
LSV	BURB	10	0							
LSV	BURB	11	100		spp.?					
LSV	BURB	12	0							
LSV	BURB	13	25	smelt						
LSV	BURB	14	100	smelt			stoneflies			
LSV	BURB	15	25				stoneflies			
LSV	BURB	16	0							
LSV	BURB	17	100				stoneflies	2		
LSV	BURB	18	0							
LSV	BURB	19	0							
LSV	BURB	20	0							
LSV	BURB	21	0							
LSV	WALL	1	25							
CW	BURB	1	100				stoneflies	4		
CW	BURB	2	25				stoneflies			
CW	BURB	3	100	smelt			stoneflies	17		leech, rock
CW	BURB	4	100				stoneflies	5		
CW	BURB	5	100				stoneflies	10		
CW	NRPK	1	100		spp.?	1				
CW	WALL	1	0							
CW	WALL	2	0							
CW	WALL	3	0							
CW	WALL	4	0							
CW	WALL	5	0							
CW	WALL	6	25		spp.?	1				
CW	WALL	7	100		spp.?	1				
JV	NRPK	1	0							
JV	NRPK	2	0							
JV	NRPK	4	0							
JV	NRPK	5	0							
SRD1	BURB	1	50		minnow	1				
SRD1	BURB	2	0							
SRD1	BURB	3	10	bait	minnow	1				
SRD1	BURB	4	0							
SRD2	BURB	5	0							
SRD2	BURB	6	0							
SRD2	BURB	7	50							
SRD2	BURB	8	0							
SRD2	BURB	9	0							
SRD2	BURB	10	0							
SRD2	BURB	11	0							
SRD2	BURB	12	0							
SRD2	BURB	13	0							
SRD2	BURB	14	0							
SRD2	BURB	15	0							
SRD2	BURB	16	10							
SRD2	BURB	17	0							
SRD2	BURB	18	0							
SRD2	BURB	19	0							
SRD2	BURB	20	50		BURB	1				
SRD2	BURB	21	1						unknown	
SRD2	NRPK	1	0							
SRD2	NRPK	2	5						unidentified	
SRD2	NRPK	3	50		BURB	1				

APPENDIX G. SAMPLING SITES.

Table 18. Site locations used for fall and winter 1994 fish collections.

Site	Upstream		Downstream		UTM Coordinates of Block Incorporating Sites				
	Latitude	Longitude	Latitude	Longitude	Zone	Upstream Corner		Downstream (NE) Corner	
PR1	56.288778	119.122778	56.287083	119.118472	11	368602.5785	6240032.1968	368863.2644	6239835.3775
PR2	57.282722	117.090722	57.285389	117.112028	11	494470.1994	6348649.7231	493246.4660	6348948.4503
PR3	58.407556	116.154806	58.406139	116.125055	11	549390.9106	6474196.5205	551131.4731	6474050.9878
SR1	55.714166	117.625139	55.716805	117.623305	11	460723.0378	6174230.4592	460840.9049	6174523.1192
SR2	53.890499	119.164972	53.950361	119.153472	11	357720.2118	5973294.2009	358678.2371	5979929.9916
SR3	54.840167	118.595833	54.840167	118.595833	11	397512.2949	6077957.0886	397512.2949	6077957.0886
WR1	55.042194	119.210167	55.050194	119.114278	11	358774.2004	6101504.3662	364927.2948	6102204.8406
WR2	55.070778	118.803778	55.156083	118.801556	11	384820.5702	6103938.9924	385207.3230	6113426.6530
LSR1	55.597806	117.387167	55.601472	117.390472	11	475602.2594	6161171.4480	475396.2867	6161580.6049
LSR2	55.583347	117.429167	55.583347	117.429167	11	472945.6574	6159577.8618	472945.6574	6159577.8618
WB	57.873472	115.391111	57.875444	155.388583	11	595433.5263	6415547.5116	595578.2313	6415770.5913
A1 a	54.137499	166.641667	54.146417	116.604917	11	523411.8731	5998663.0715	525807.3967	5999668.1122
A1 b	54.007778	116.841111	54.016111	116.841111	11	510413.5233	5984182.2894	510411.4429	5985109.4324
A2	53.363889	117.775000	53.388889	117.661111	11	448426.4553	5912814.2548	456031.0222	5915519.2244
A3	54.307778	114.866389	54.317499	114.784999	11	638818.2535	6019649.5551	644078.9004	6020894.1896
A4	55.096333	112.881167	55.088833	112.881667	12	762775.3676	6113047.7679	762792.7256	6112212.0156
A5	57.091249	111.550000	55.109222	111.593111	12	830073.1097	6340526.3606	844765.7444	6120090.1897
MR1	54.095972	115.820833	54.098111	115.804417	11	577116.9947	5994626.1035	578186.5226	5994882.1030
MR2	53.554167	116.572167	53.554167	116.572167	11	528343.9675	5933788.1585	528343.9675	5933788.1585
P	54.457499	113.985833	54.455556	113.994444	12	695382.3194	6038392.5685	694833.5414	6038152.5933
LSV	55.266667	114.374999	55.266667	114.302778	11	666787.5346	6127392.3378	671375.1456	6127567.5696
CW	56.696667	111.290361	56.697389	111.291999	12	849448.1447	6297979.8042	849341.3258	6298051.6470
JV 1	58.432233	110.911767	58.432233	110.911767	12	855234.3721	6492727.9851	855234.3721	6492727.9851
JV 2	58.447583	111.054017	58.446617	111.047283	12	846796.8162	6493688.7395	847198.4645	6493616.2677
JV1 - GN	58.409017	110.923267	58.409017	110.923267	12	854798.3585	6490088.8360	854798.3585	6490088.8360
SRD 1	61.254167	113.483	61.254167	113.483	12	692681.5198	6796193.1149	692681.5198	6796193.1149
SRD 2	61.255417	113.510950	61.255417	113.510950	12	687136.2760	6796031.7867	687136.2760	6796031.7867



[ ] Set line area

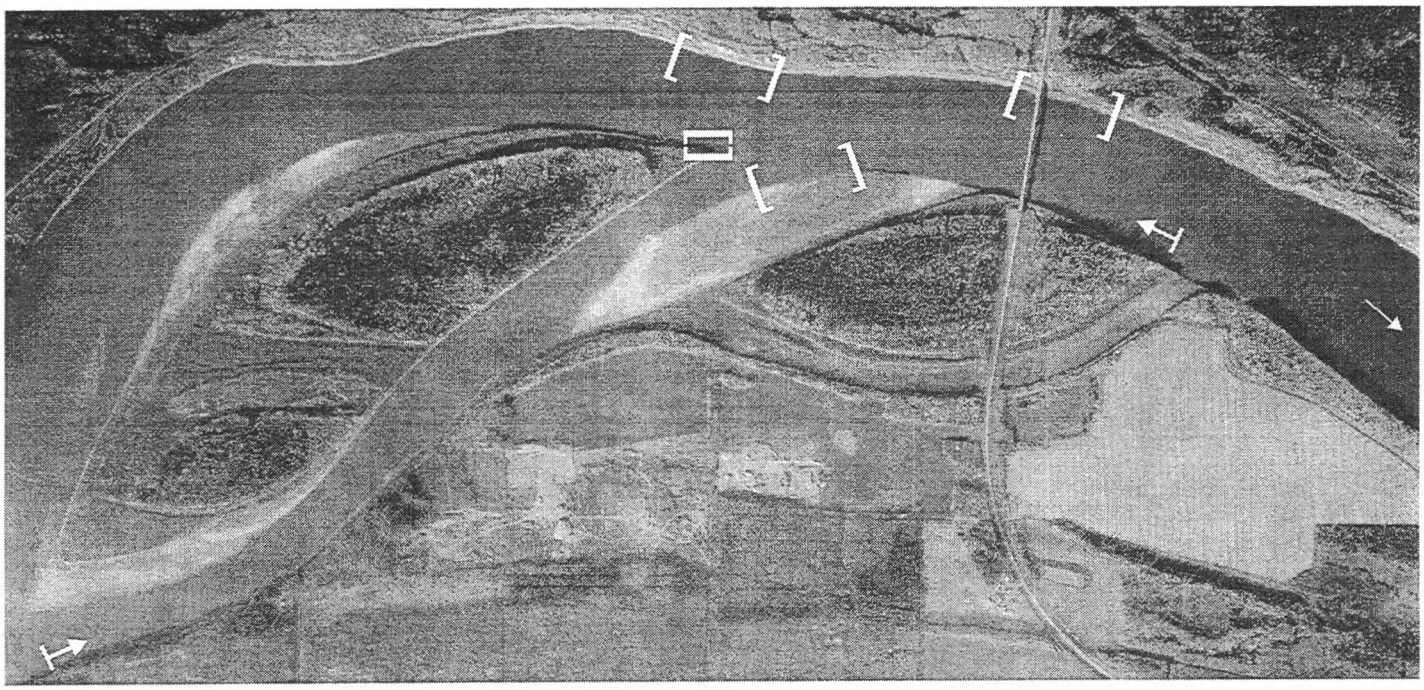
Electrofishing area

Stream flow direction

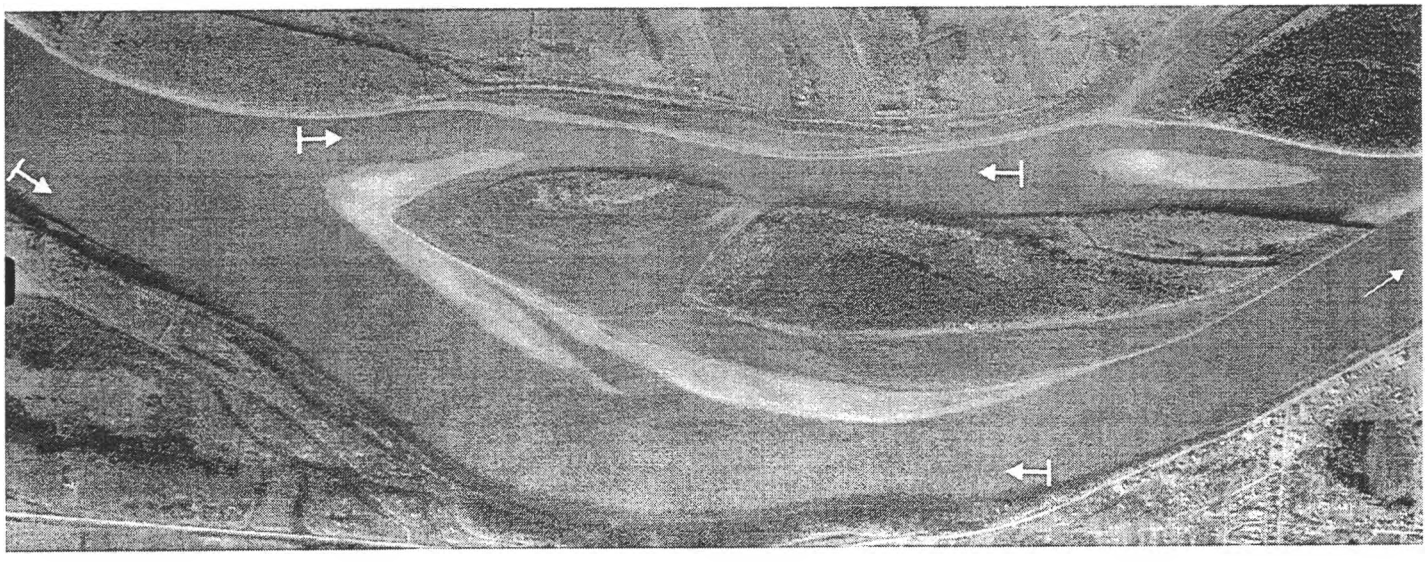
N

Figure 15. Peace River Site PR1 set line and electrofishing locations near Many Islands.

Figure 16. Peace River Site PR2 set line and electrofishing locations near Notikewin River confluence.



Upstream from Highway 88 bridge



Downstream from Highway 88 bridge

[ ] Set line area

Electrofishing area

Stream flow direction

N

Figure 17. Peace River Site PR3 set line and electrofishing locations near Fort Vermilion.

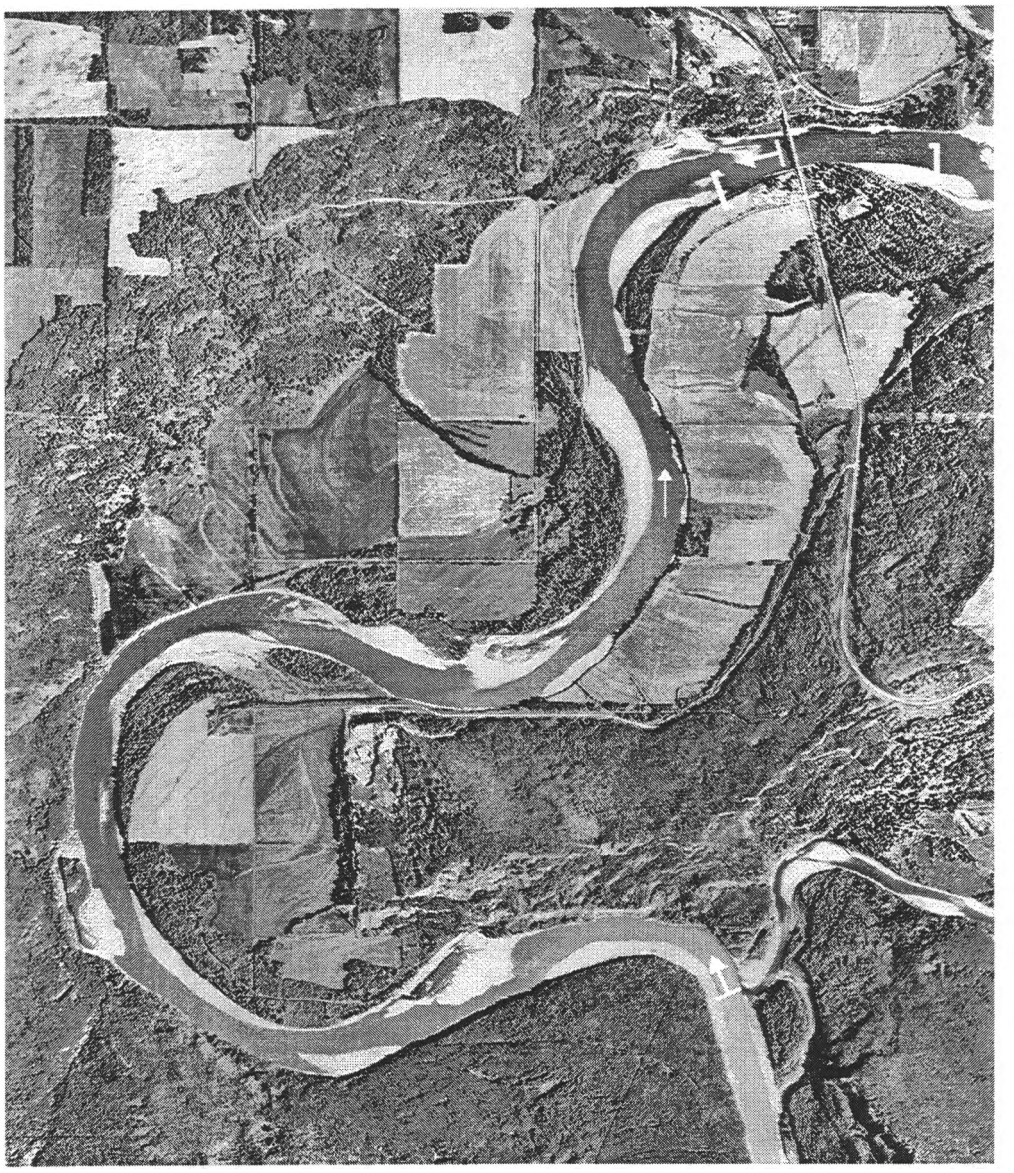


Figure 18. Smoky River Site SR1 set line and electrofishing locations downstream from Wapiti River confluence.

Figure 19. Smoky River Site SR2 set line locations near Grande Cache.

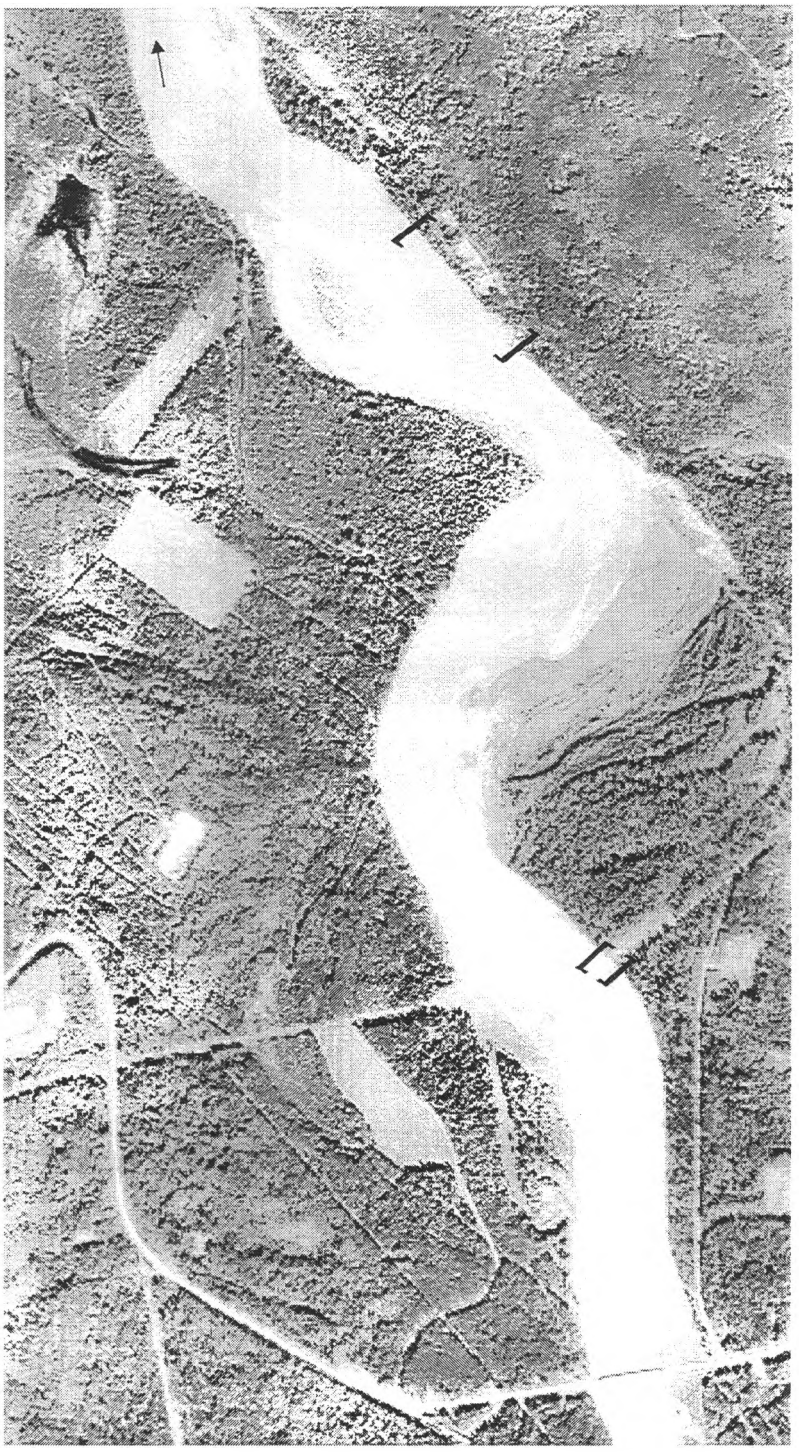
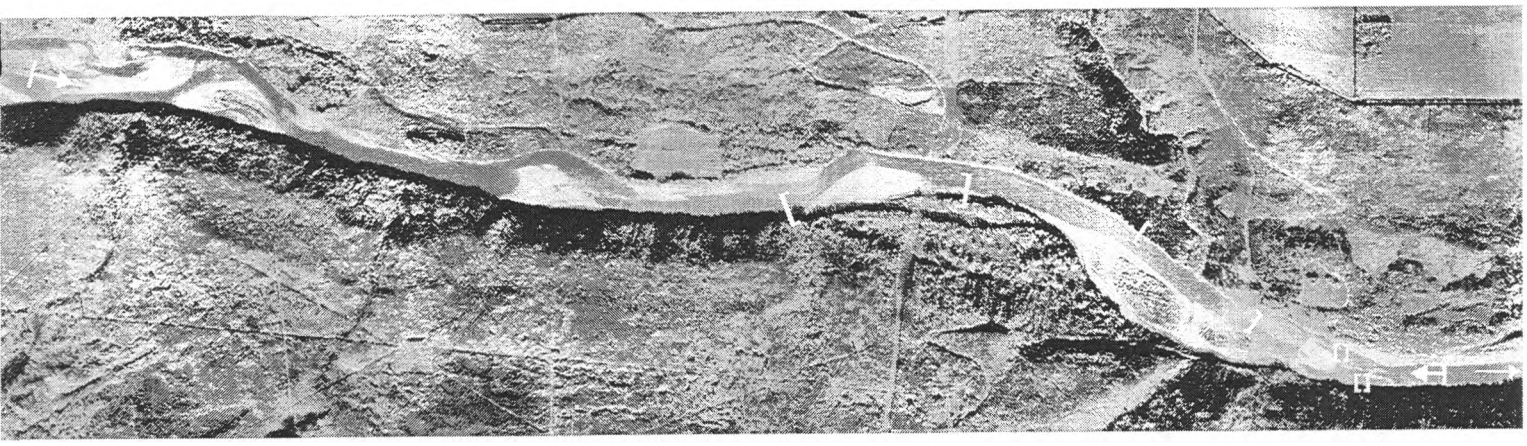
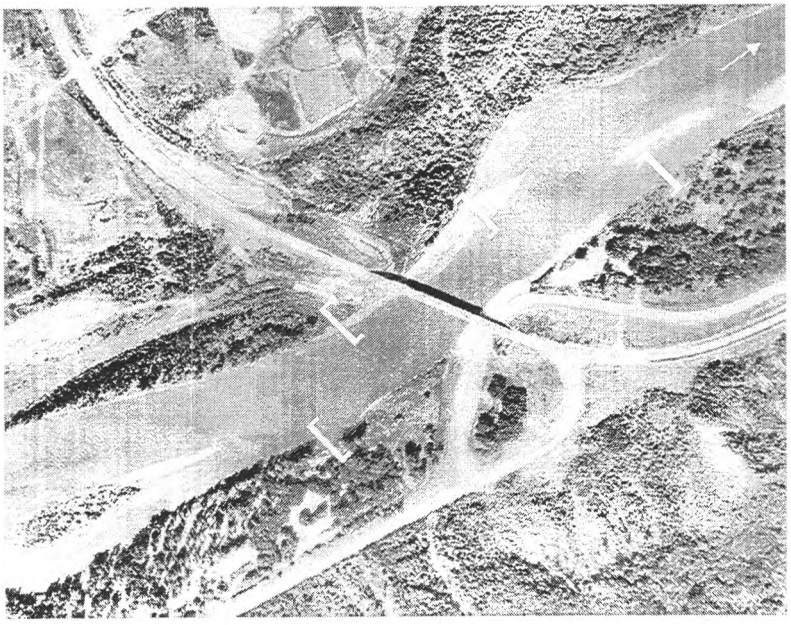


Figure 20. Smoky River Site SR3 (winter) set line locations near Canfor main haul road.



WR1



WR2

[ ] Set line area

Electrofishing area

Stream flow direction

N

Figure 21. Wapiti River Site WR1 set line and electrofishing locations near Pipestone Creek and Site WR2 set line locations near O'Brian Creek Provincial Park.

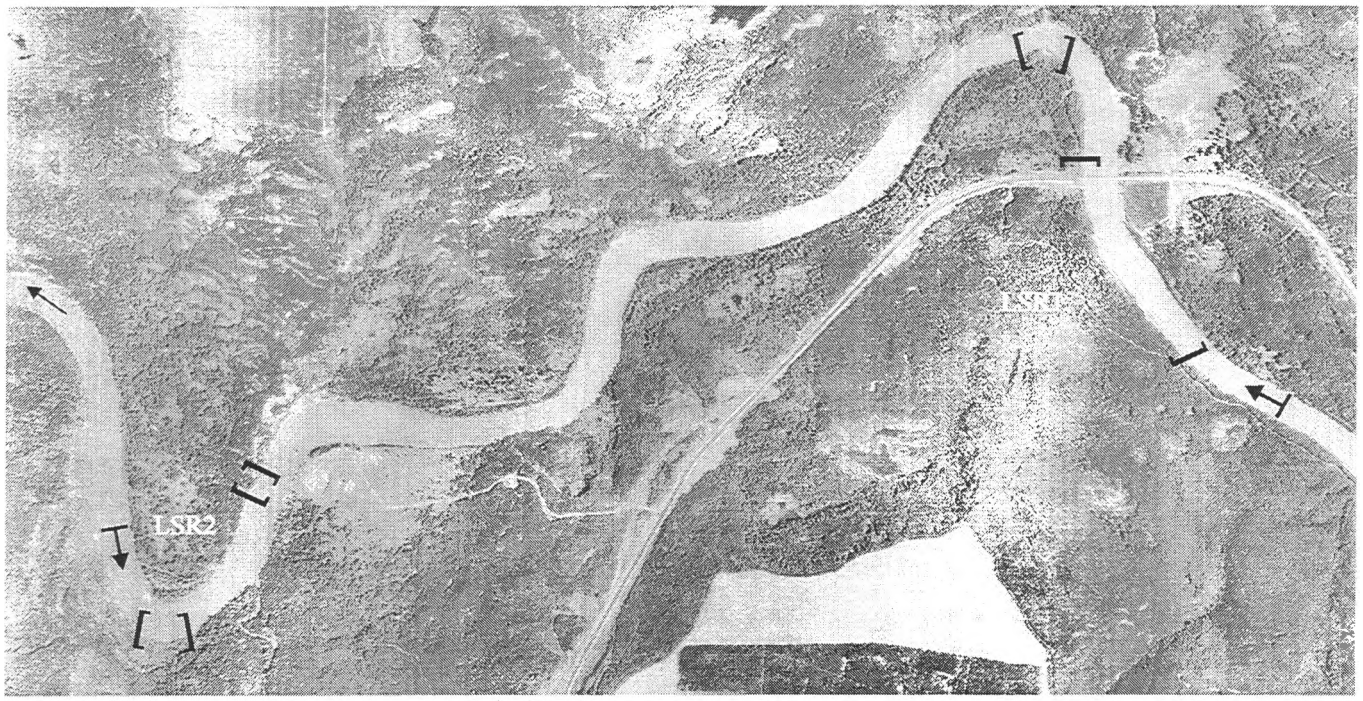


Figure 22. Little Smoky River Site LSR1 fall set line and fall electrofishing locations and Site LSR2 winter set line locations near HWY 744 crossing.

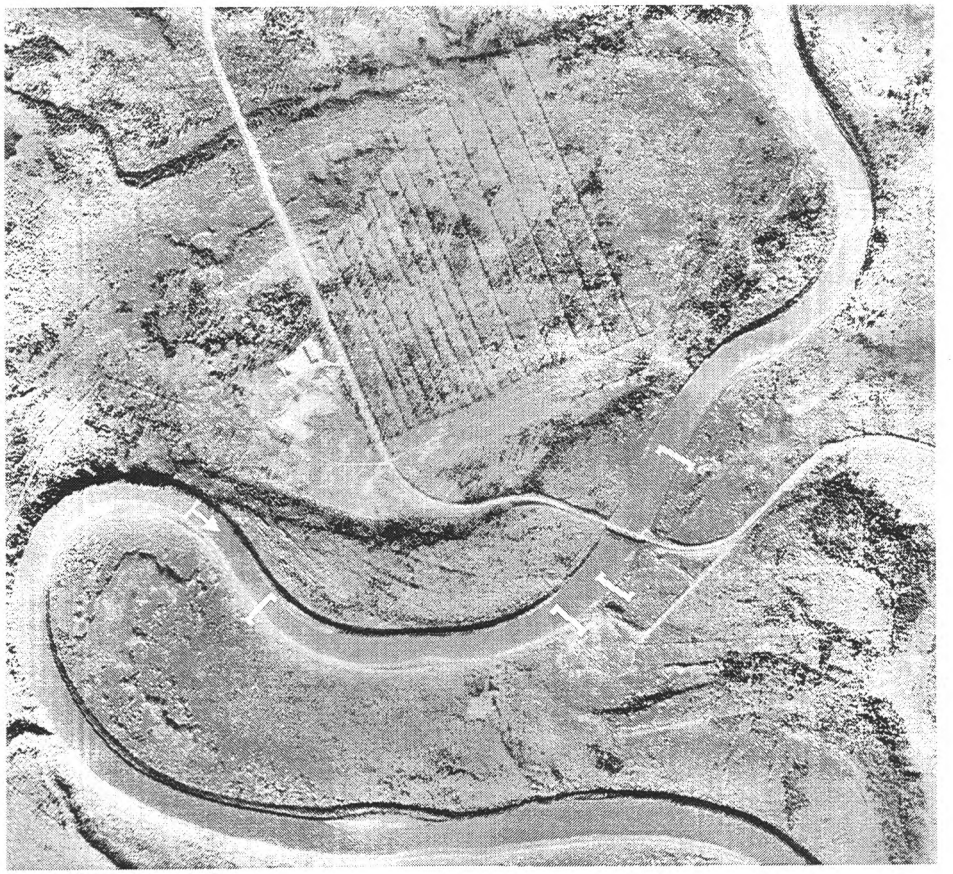


Figure 23. Wabasca River Site WB set line and electrofishing locations near HWY 67 crossing.

A1a

A1b

[ ] Set line area

Electrofishing area

Stream flow direction

N

Figure 24. Athabasca River Site A1a set line and electrofishing locations near HWY 947 crossing. Athabasca River Site A1b set line and electrofishing locations near Berland River confluence.

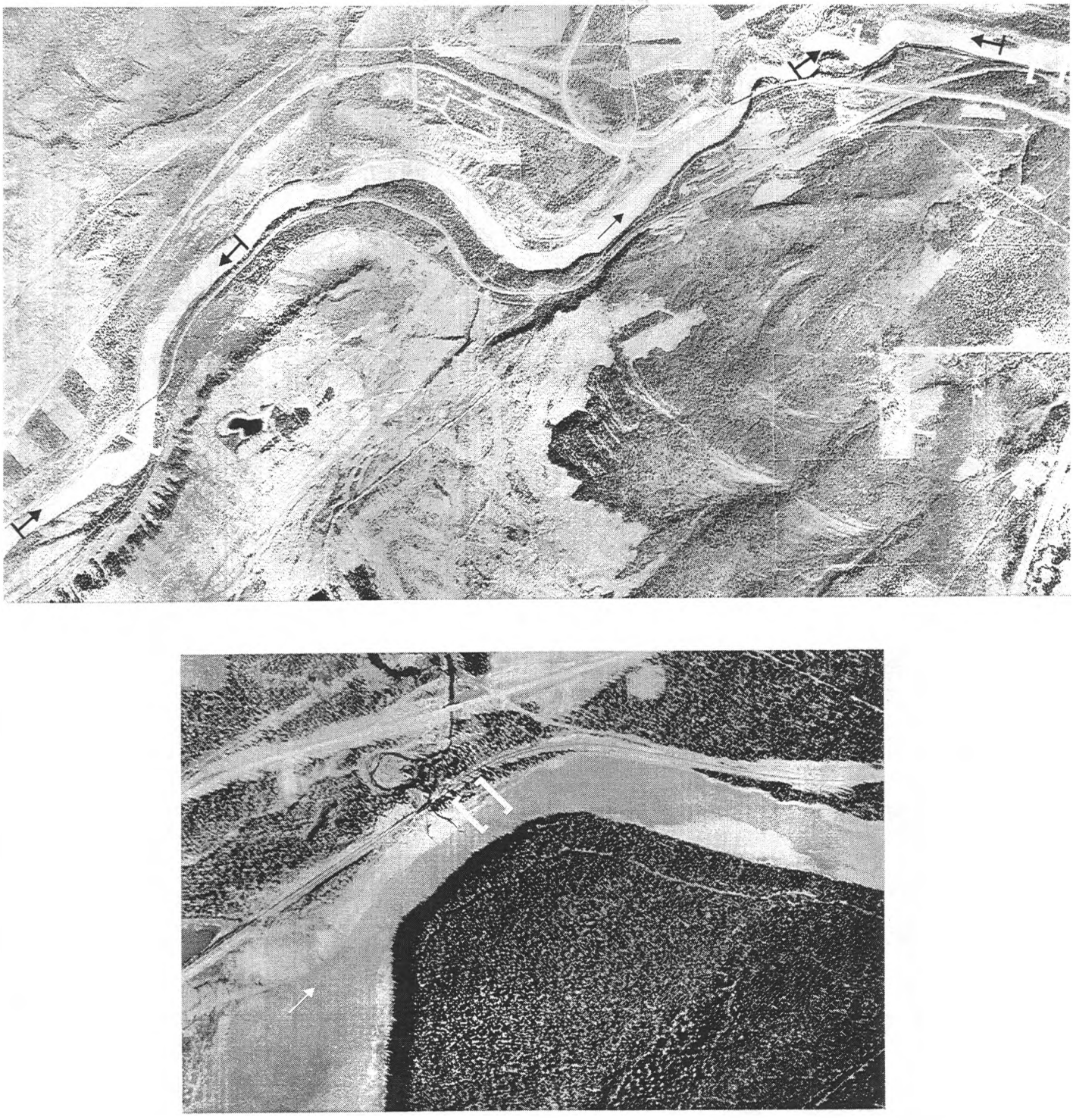


Figure 25. Athabasca River Site A2 set line and electrofishing locations upstream from Hinton.

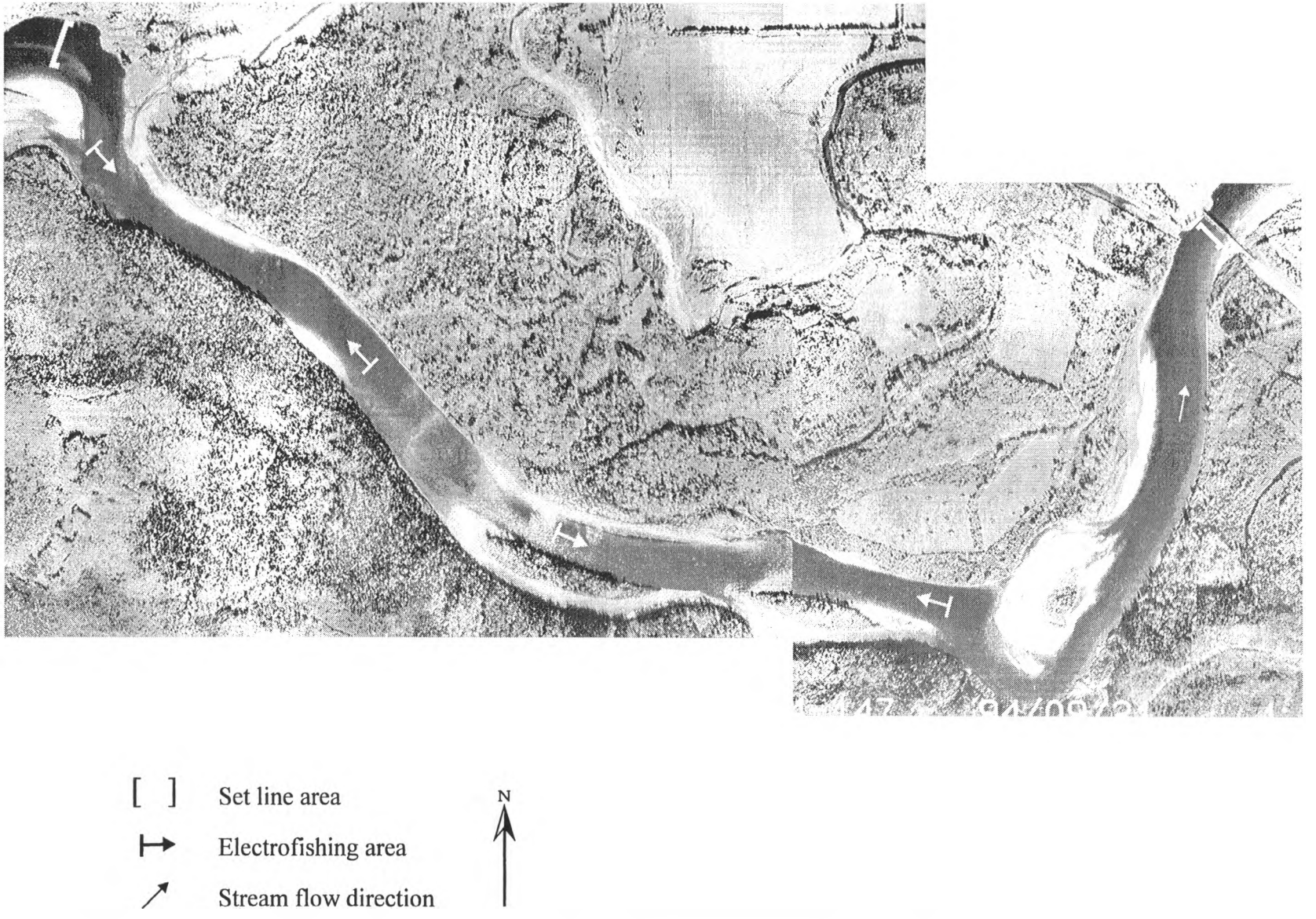


Figure 26. Athabasca River Site A3 set line and electrofishing locations near Fort Assiniboine.

Figure 27. Athabasca River Site A4 set line locations downstream from AlPac near Calling River confluence.

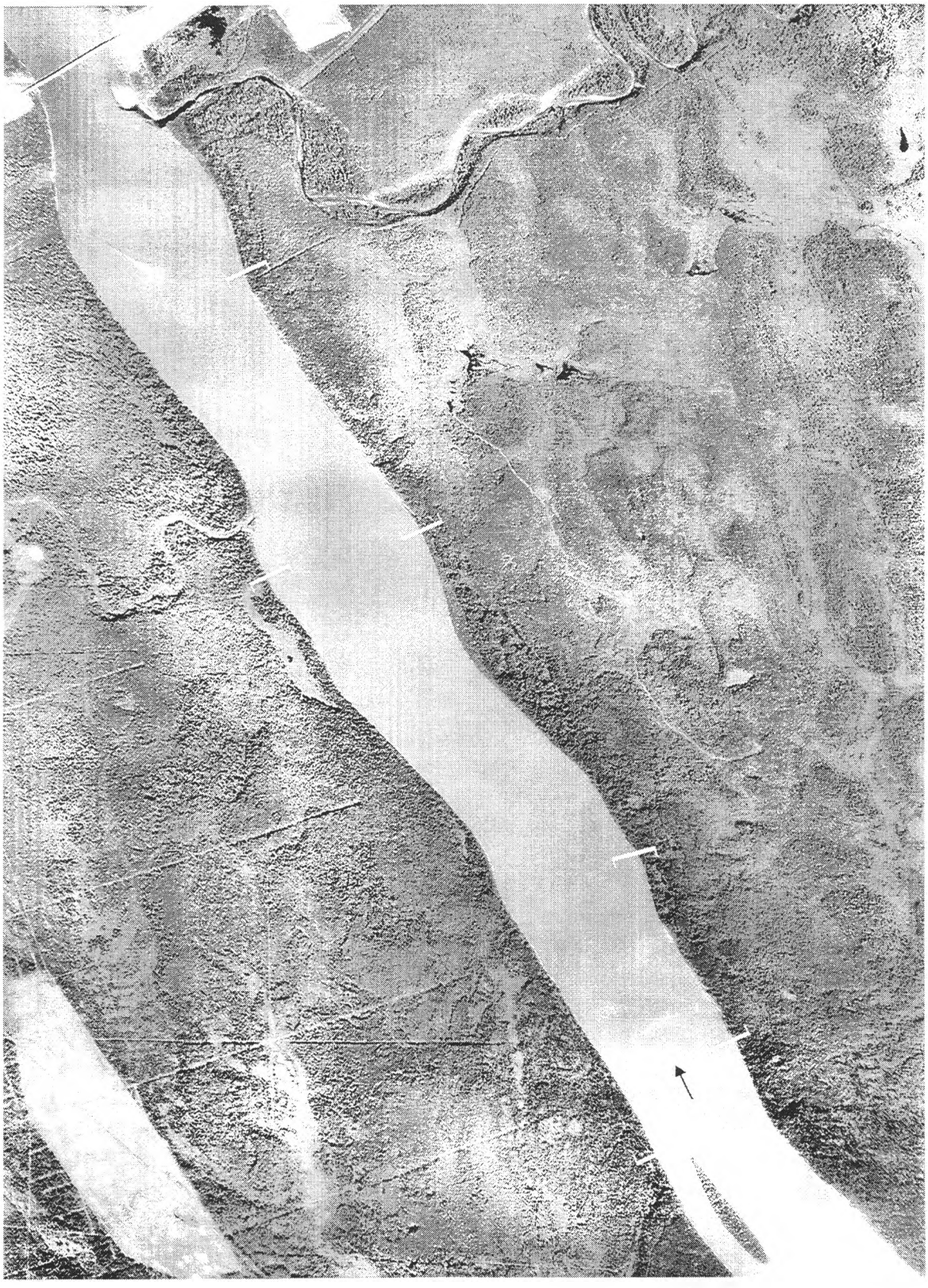


Figure 28. Athabasca River Site A5 set line locations near Fort Mackay.

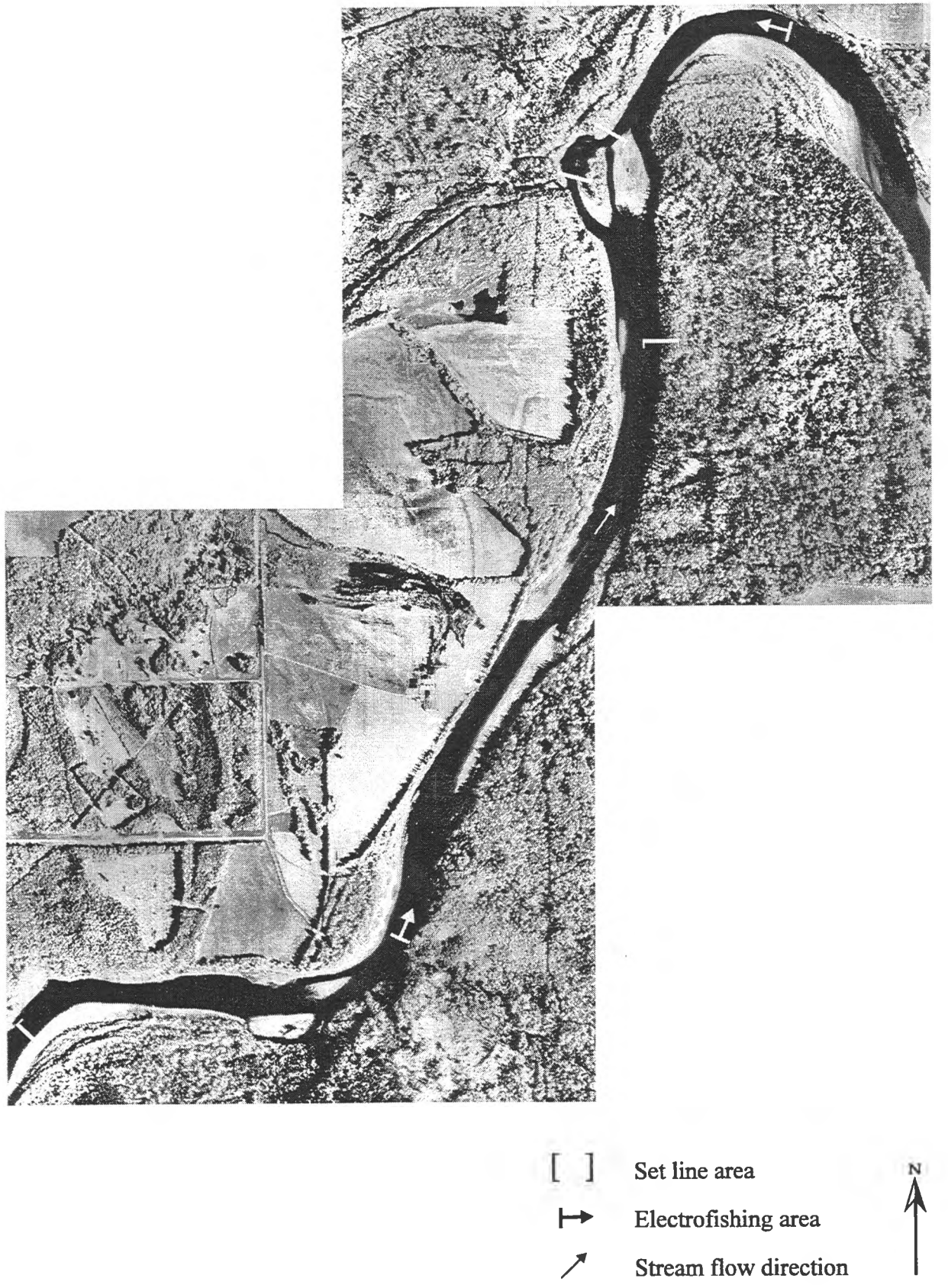


Figure 29. McLeod River Site MR1 set line and electrofishing locations near Eagle Campground.

Figure 30. McLeod River Site MR2 winter set line locations at Big Eddy.

Figure 31. Pembina River Site P set line locations near Jarvie.

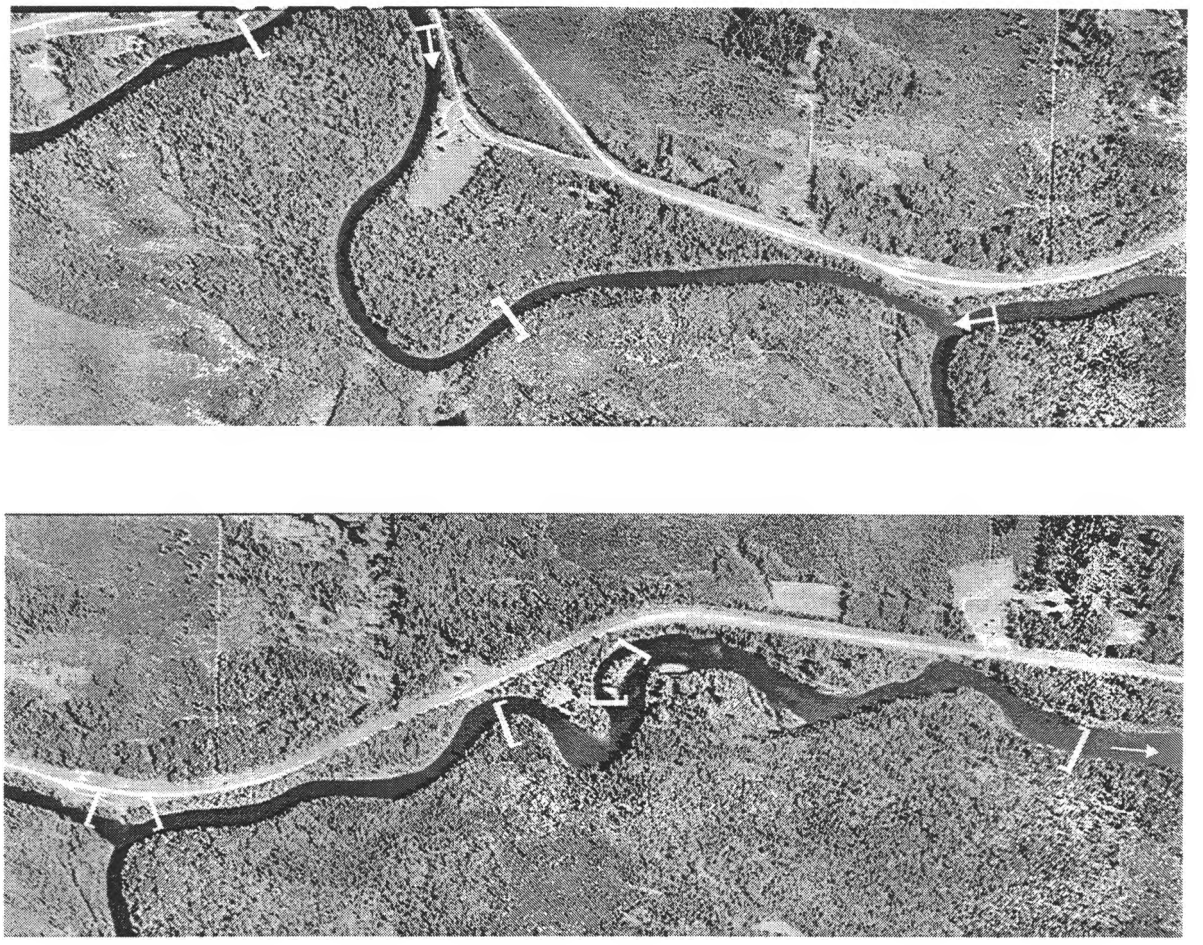
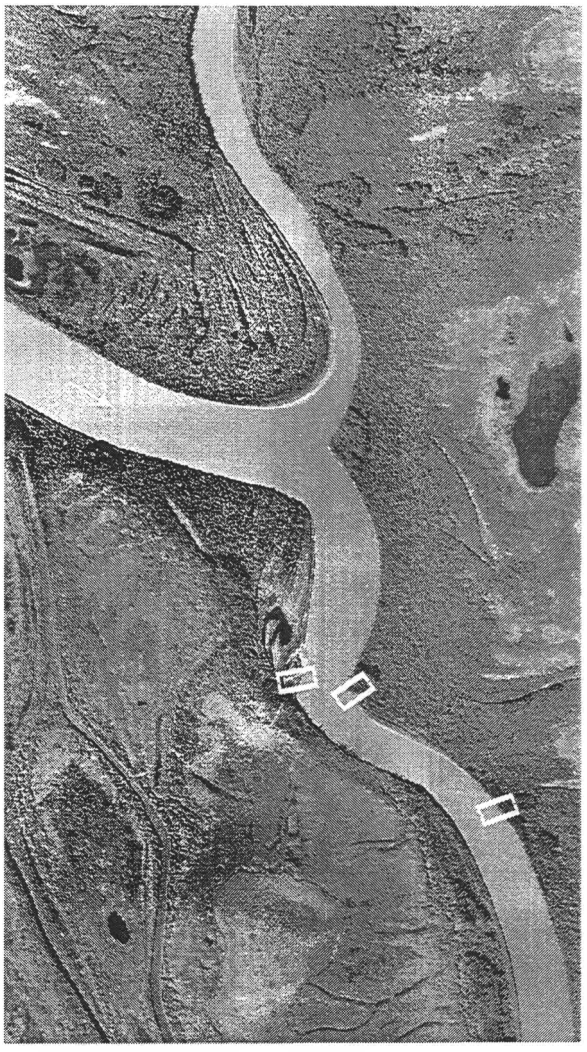


Figure 32. Lesser Slave River Site LSV set line and electrofishing locations downstream of Slave Lake Pulp.

Figure 33. Clearwater River Site CW set line locations upstream from Fort McMurray.

JV1



JV2

[ ] Set line area

GN Gill net location

Stream flow direction

N

Figure 34. Peace-Athabasca Delta Site JV1 set line and gill net locations near Jackfish Village. Peace-Athabasca Delta Site JV2 set line location near Big Eddy Bend.

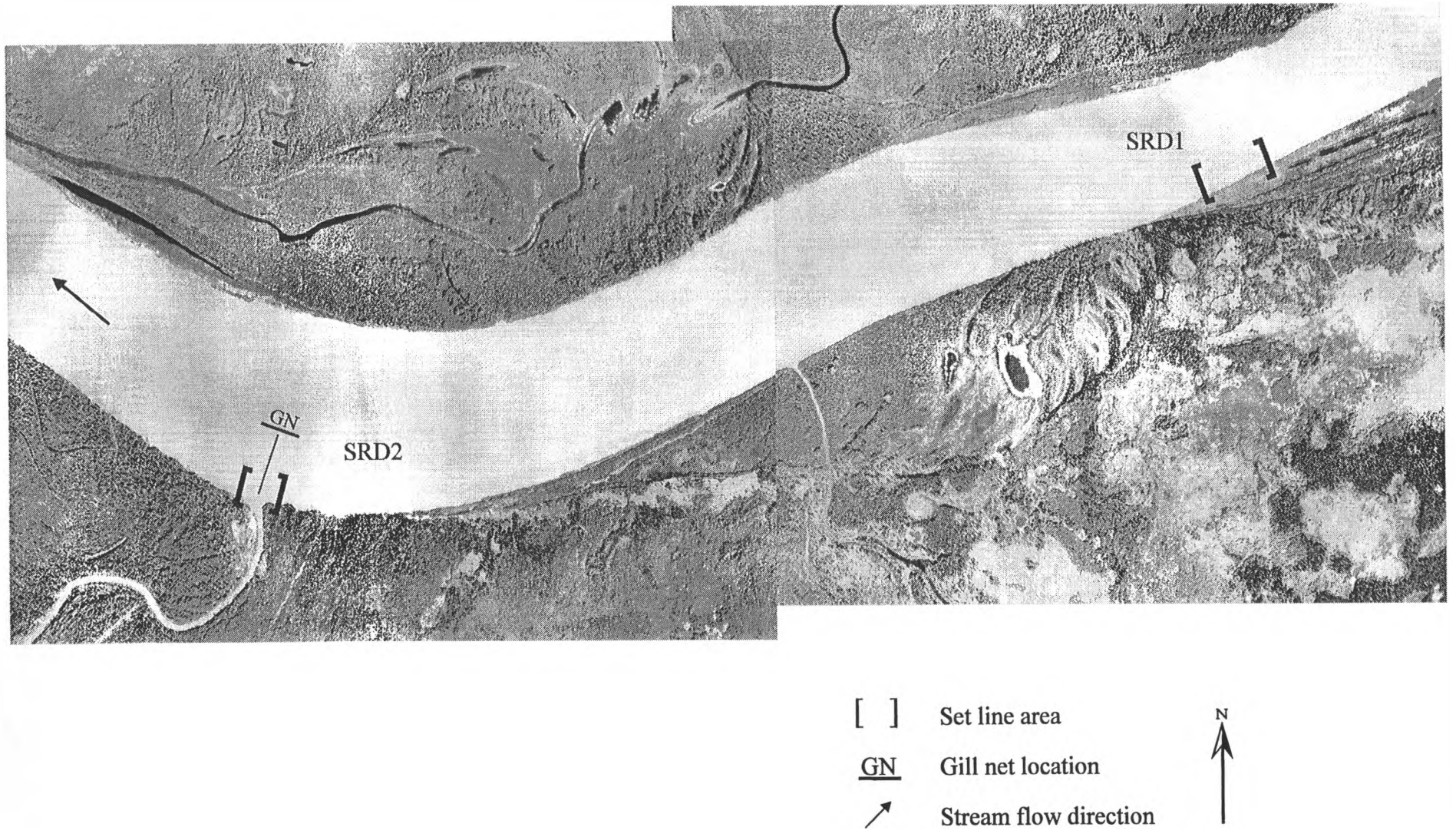


Figure 35. Slave River Delta Site SRD1 set line locations upstream from Nagle Channel and Slave River Delta Site SRD2 set line and gill net locations at mouth of Nagle Channel.