HQ1617

Parsnip
Nation
Osilinka
Omineca
Finlay
Residual
Ingenika
Ospika.
Mesilinka
peace reach
crookedfac
Manson.
(all but Dinosaur

PEACE/WILLISTON
FISH & WILDLIFE
COMPENSATION
PROGRAM

BChydro
BC Environment

Williston Watershed Aerial Kokanee (*Oncorhynchus nerka*) Spawning Survey 1990

? inventory

Williston Watershed Aerial Kokanee (*Oncorhynchus nerka*) Spawning Survey 1990

A.R. McLean[1] and B.G. Blackman[1]

[1]Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave.
3rd Floor, Prince George, B.C. V2L 3H9

December 1991

Citation: McLean, A.R. and B.G. Blackman. 1991. Williston watershed aerial kokanee (*Oncorhynchus nerka*) spawning survey 1990. Peace/Williston Fish and Wildlife Compensation Program Report No. 62. 10pp plus appendicies.

This report has been approved by the Peace/Williston Fish and Wildlife Compensation Program Fish Technical Committee.

ABSTRACT

An aerial survey for spawning kokanee was undertaken between October 16, 1990 to November 1, 1990 on selected Williston Reservoir tributaries. Key sections of eighteen selected rivers (totaling 1303 km) were surveyed during the investigation. Kokanee (approx. 10,300) were only found in the Finlay River. The kokanee holding in the Finlay River tended to be located in side channel pools with no flow and a depth of 1-2 m. No kokanee were observed spawning, however, test redds were present and limited digging behaviour was observed. The cooler weather may have delayed the maturation process, thereby off-setting spawning timing, until sometime after the survey was completed (after ice-up).

TABLE OF CONTENTS

LIST OF TABLES

pg

LIST OF FIGURES

pg

1.0 INTRODUCTION

Williston Reservoir is the largest body of fresh water in British Columbia. It was formed in 1968 by the completion of B.C. Hydro's W.A.C. Bennett Dam on the Peace River.

Kokanee, a landlocked sockeye salmon, provide public angling opportunities and are forage for other fish species. Their numbers within the reservoir have apparently increased between 1975 and 1988, but they are not present in sufficient numbers to provide a sport fishery. The Williston Lake Fisheries Compensation Program Management Plan states that kokanee will play a central role in Williston Reservoir fisheries.

Kokanee were captured in all three reaches of Williston Reservoir during the 1988 gillnetting studies. Native populations are present in both Arctic (head waters of the Parsnip R.) and Thutade Lakes (head waters of the Finlay R.). Historically, reports by early explorers indicated "silver salmon" in the Finlay River (R.M. Patterson, 1968). During recent years there have been unconfirmed reports of kokanee in the Clearwater, Cut thumb, Parsnip, Nation, Ospika, Finlay and Akie Rivers.

A kokanee spawning survey was conducted in the lower 60 km of the Finlay River between October 10-13, 1989 by the Williston Fisheries Compensation Program. The survey found 3000-6000 adult kokanee in sloughs and side channels of the main river.

Prior to the current study, spawning activity had only been observed in the Finlay River. As a result of this, an aerial survey was undertaken in 1990. Key sections of eighteen selected rivers (totalling approx. 1303 km) draining into the Williston Reservoir were surveyed from October 16, 1990 to November 1, 1990. The primary objectives of the survey were to:

1. Determine the timing and distribution of spawning kokanee.

2. Estimate the numbers of kokanee spawning.

3. Determine the type of habitat utilized by spawning kokanee.

2.0 METHODS

Key sections of eighteen selected rivers (totalling approx. 1303 km) draining into the Williston Reservoir were surveyed from October 16, 1990 to November 1, 1990 (Fig. 1 ; Table 1). Each river was surveyed by helicopter in an upstream or downstream direction at tree top level, between 25 and 30 mph. Three observers participated in each survey. If kokanee were observed, their locations were recorded using the latitude/longitude co-ordinates from the helicopter's loran and geographical landmarks (if possible). A spawning survey data sheet was completed for each river (See Appendix 1).

Rivers surveyed for kokanee met one or more of the following criteria:

- large and stable;
- reliable sources indicated kokanee or potential kokanee spawning habitat present;
- kokanee documented in head water lake;
- net-work of side channels present, (kokanee were observed in side channels on the Finlay River in the fall of 1989).

Note: The Davis and Mesilinka Rivers were surveyed in order to help confirm the absence of wild kokanee, as kokanee may be stocked in these systems in the future.

Visibility

For the purposes of this survey, visibility is a measure of water visibility. Example- good visibility generally indicated nothing obstructed visibility to river bottom.

With the exception of the Akie, Ospika, Pack and Finlay Rivers (Nov. 7), visibility was generally good.

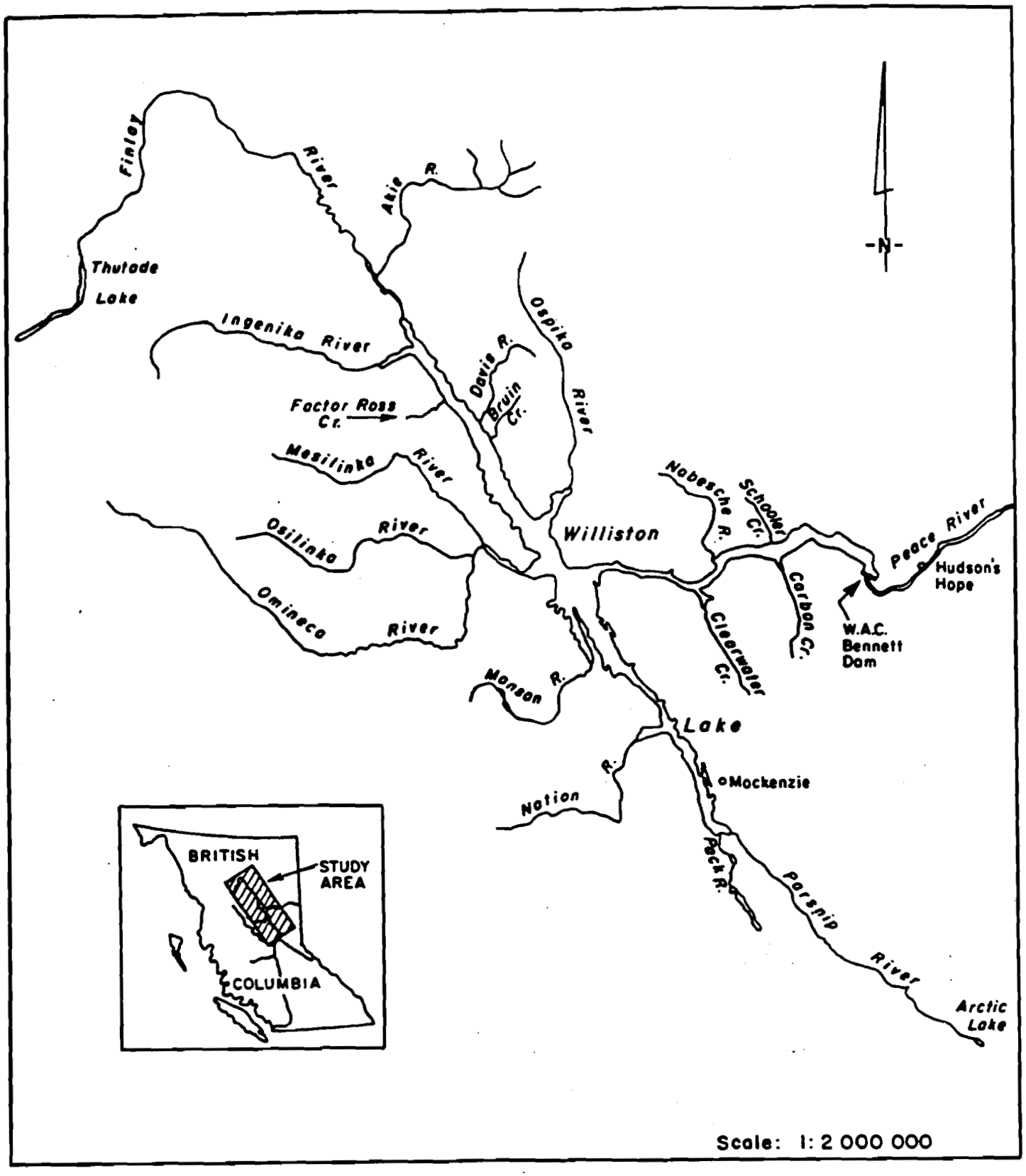


Figure 1 Study area location - Williston Lake.

TABLE 1 RIVERS SURVEYED

DATE	RIVER SURVEYED	RIVER(KM) LENGTH	*LENGTH(KM) SURVEYED	VISIBILITY	# KOKANEE OBSERVED	COMMENTS
OCT. 16	PARSNIP	175	89	GOOD	0	
OCT. 16	NATION	126	45	GOOD	0	
OCT. 16	MANSON	83	60	GOOD	0	
OCT. 16	OSILINKA	114	66	GOOD	0	
OCT. 16	OMINECA	219	4	GOOD	0	
OCT. 17	FINLAY	278	97	GOOD	5100	(1)
OCT. 17	AKIE	90	25	POOR	0	
OCT. 17	INGENIKA	119	15	GOOD	0	
OCT. 19	OSPIKA	111	49	POOR	0	
OCT. 19	DAVIS	54	54	GOOD	0	
OCT. 19	BRUIN	26	19	GOOD	0	
OCT. 19	MESILINKA	144	62	GOOD	0	(2)
OCT. 23	CLEARWATER	50	50	GOOD	0	(3)
OCT. 23	NABESCHE	50	6	GOOD	0	(4)
OCT. 23	SCHOOLER	27	13	GOOD	0	
OCT. 23	CARBON	46	46	GOOD	0	
OCT. 24	PARSNIP	175	175	GOOD	0	(5)
OCT. 24	PACK	12	12	POOR	0	
OCT. 25	FACTOR R.	17	6	GOOD	0	
OCT. 25	FINLAY	278	170	GOOD	8200	(1)
NOV. 1	FINLAY	278	278	POOR	3000	(1)
TOTAL		2,472	1,303			

(1) Kokanee in very tight schools.

(2) Schools of whitefish present, up to 45/school.

(3) Spawning habitat in upper Clearwater R. only.

(4) Surveyed to falls, approximately 6 km.

(5) Limited spawning potential in mainstem upstream of Anzac C.

* from river mouth

3.0 RESULTS

Weather

Air temperatures during the study were generally cooler than the temperatures recorded at Ingenika Point over the 20 year standard time period 1961 to 1980 (Atmospheric Environment Service) (Table 2). Mean air temperatures from October 13 to 31, 1990 averaged 2.5°C. below the 20 year average for the month of October, while air temperatures from November 1 to 7, 1990 averaged 7.0°C below the 20 year average. (Fielden 1991; Table 3).

Table 2

Adjusted Average Total Monthly Precipitation and Mean Daily Air Temperatures at Ingenika Point.

	Temperature (C)			
Month	Mean Maximum	Mean Minimum	Mean	Precip. (mm)
Sept.	13.8	3.5	8.6	41.5
Oct.	7.1	-1.2	3.0	34.8
Nov.	-2.2	-5.8	-2.3	37.2
Dec.	-10.0	-18.2	-14.1	64.6
Jan.	-12.9	-22.7	-17.8	47.5

20 year standard time period 1961 to 1980 (Atmospheric Environment Service).

Table 3

Mean Monthly Air Temperatures - Lower Finlay River 1990

	Temperature (C)		
Month	Mean Maximum	Mean Minimum	Mean
Oct.	3.8	-2.3	0.5
Nov.	-3.4	-11.9	-9.3

The temperature data represents the data collected October 13 to November 7, 1990, at the lower Finlay River (Fielden 1991).

Kokanee Distribution and Timing

Approximately 10,300 kokanee were observed at 8 locations in side channels and the main stem of the Finlay River during the 1990 investigation (Table 1; Figure 1). The kokanee holding in the Finlay River tended to be located in side channel pools with no flow and a depth of 1-2 m (Table 4). No kokanee were observed spawning, however, test redds were present and limited digging behaviour was observed at Location # 1.

Table 4

Finlay River
Kokanee Timing and Distribution - 1991

Map Loc.#	Date	Habitat Type	# of Kokanee	UTM
1	* Oct. 17	Side channel	3000	10.3685.63282
2	Oct. 17	Side channel	2000	10.3665.63306
3	Oct. 17	Side channel	100	10.3639.63371
3	Oct. 25	Side channel	500	10.3639.63371
4	Oct. 25	Mainstem	1000	10.3436.63670
5	Oct. 25	Slough	700	10.3391.63683
6	Oct. 25	Mainstem	3000	10.6473.63755
1	* Oct. 25	Side channel	3000	10.3685.63282
1	* Nov. 1	Side channel	3000	10.3685.63282

* Same groups of kokanee suspected

Location #1

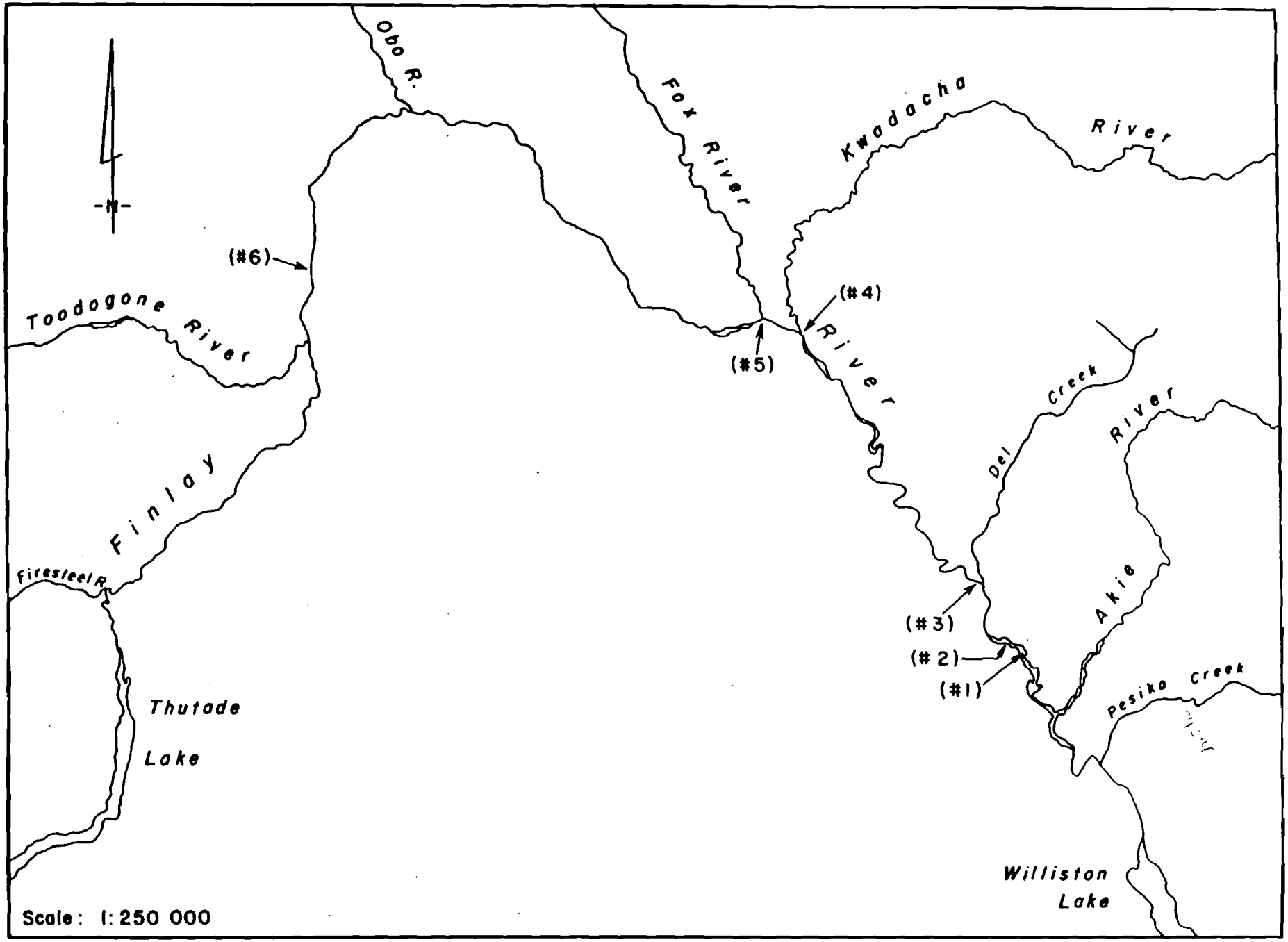
Located ~32 km upstream from the mouth, this side channel (no flow) pool had an approximate depth and visibility of 0.7 m. Test redds were present at this site.
Kokanee holding.

Location #2

Located ~38 km upstream from the mouth, this side channel (no flow) pool had an approximate depth and visibility of 1.2 m.
Kokanee holding.

Location #3

This side channel pool was located ~54 km from the mouth (near Del C).
Kokanee holding.



Kokanee locations (#1-6)

Figure 2 Finlay River.

Location #4

Located ~93 km from the mouth (near Kwadacha R), this main stem glide had an approximate depth and visibility of 2.0 m. Kokanee migrating.

Location #5

Located ~97 km from the mouth (near Fox Creek), this side channel pool had an approximate depth and visibility of 2.0 m. Kokanee holding.

Location #6

Located ~170 km from the mouth (near Fishing Lakes), this main stem glide had an approximate depth and visibility of 1.5 m. Kokanee migrating/holding.

4.0 DISCUSSIONS

Aquatic Resources was commissioned by the Ministry of Environment to conducted a kokanee spawning survey in the lower Finlay River between October 10, 1990 and November 7, 1990. Their survey indicated that slough and back channel habitat were the only areas where concentrations of kokanee (approx. 6,573) were observed in the lower Finlay River. It was also indicated that the gravel in many of these areas did not appear to be as suitable for spawning (high fines content) as the gravel in the mainstem glides.

It appears that the only concentrations of kokanee were in the Finlay River. Rough calculations using 1988 gill netting data (Blackman 1992) and hydroacoustic data (Johnson and Yesak, 1989) suggests that there should be significantly more spawners than were observed.

The selectiveness of the stock to the Finlay River suggests that the Williston stock of kokanee may have originated from Thutade Lake, located at the headwaters of the Finlay River. Initially it was assumed that the Williston kokanee had originated from the Arctic Lake stocks at the headwaters of the Parsnip River. There have been reports of kokanee in the Parsnip River and some have been captured in Tudyah Lake (tributary to the Parsnip reach). If there are kokanee utilizing the Parsnip System, the run timing must be different as no fish were observed in the river during the survey period.

Only the lower 60 km of the Mesilinka and Ospika Rivers were surveyed, however these areas had more than adequate kokanee spawning habitat. It is therefore doubtful kokanee were present in the upper reaches of the two rivers.

Visibility was poor in the Akie and Ospika Rivers due to the glacial nature of the systems. Visibility was also poor in the Pack River due to the dark coloration of the water. It is therefore feasible that kokanee may have been present, but not observed in these systems.

The Kwadacha River (tributary of the Finlay River) is a glacial system which was not surveyed during the 1990 investigation. However, unconfirmed reports, indicating the presence of kokanee, were received after the 1990 investigation was completed.

Surveys of the Ominica and Ingenika Rivers were curtailed due to darkness and weather conditions. Insufficient habitat was checked to speculate as to the presence or absence of kokanee.

Local sources had indicated the presence of kokanee in Clearwater, Nation and Cut thumb Rivers. However, time constraints, or the possibility their spawning timing may not have coincided with the investigation are all possible reasons that none were observed. This combined with the immense size of the watershed made it difficult to cover all potential kokanee systems.

The cooler weather may have offset spawning times, until sometime after the survey was complete (after ice-up). The warmer water temperatures in the side channels (up to 5 oC warmer than mainstem) and the instability of the main stem may have prompted spawning in slough and back-channels. Numerous investigations (Lister et al, 1980; King and Young, 1986;1986b; Bonnel, 1990; and Sheng et al, 1990) have found that ground water fed side channels are more productive and have higher egg to fry survival rates than mainstem areas. The timing of spawning in ground water fed side-channels is often later than stocks that spawn in the main river because of warmer sub-gravel temperatures.

5.0 RECOMMENDATIONS

The potential importance to the fisheries of the watershed and the level of enhancement activities that may be directed towards this species makes it important to gather biological background data.

A radio tagging program could be used to determine spawning timing and distribution of kokanee in the Finlay River. Once the kokanee are located, scuba divers could be used to examine their condition.

A public information campaign could also be initiated to gather additional information on timing and distribution.

LITERATURE CITED

Blackman, B.G. 1992. Fisheries Resources of Williston Reservoir Twenty Years After Impoundment. Unpub. data. B.C. Environment, Prince George, B.C..

Bonnell, R.G. 1990. Construction, operation and evaluation of groundwater-fed side channels for chum salmon in British Columbia. In Proceedings of the Fisheries Bio-engineering Symposium, October 1988. Publ.by Am.Fish.Soc.

Fielden, R.G. 1990. Finlay River Kokanee (Oncorhynchus nerka) Spawning Survey. Aquatic Resources Ltd., Van., B.C.. 9p

Johnson, R.,D. Yesak. 1989. Hydroacoustics surveys of Williston Reservoir (June, Sept, and Oct. 1988).

King,D.and R. Young.1986a. An evaluation of three groundwater-fed side channels of the East Fork Satsop River, Spring 1984 outmigrants. Wash.Dept.Fish.,Tech. Rep.No.89:47 p.

King,D.and R. Young.1986b. An evaluation of four groundwater-fed side channels of the East Fork Satsop River, Spring 1985 outmigrants. Wash.Dept.Fish.,Tech. Rep.No.90:73 p.

Lister, D.B., D.E. Marshall and D.G. Hickey. 1980. Chum salmon survival and production at seven improved groundwater-fed spawning areas. Can. MS Rept.Fish.Aquat.Sci.1595:58 p.

Patterson, R.M.. Finlay's River (Macmillan of Canada, Toronto, 1968). 28 p.

Sheng, M., M. Foy and A.Y. Fedorenko. 1990. Coho salmon enhancement in British Columbia using improved groundwater-fed side channels. Can. MS Rep. Fish. Aquat.Sci.No.2071 :81p.

APPENDICIES

APPENDIX 1

Spawning Survey Form

KOKANEE SPAWNING SURVEY '90

Date: River: Crew:

SITE	HLD/SP	T	D	V	MORTS	LIVE	COMMENTS

RIVER - Name of river studied.

SITE - Main or side-channel.

HLD/SP - Holding, spawning, or migrating.

T - Type of habitat being utilized (Pool, riffle, run , glide).

D (m) - Water depth the Kokanee are in.

V (m) - Water depth visibility.

MORTS - Number of dead Kokanee.

LIVE - Number of live Kokanee.

COMMENTS -

PWFWCP REPORT SERIES

Copies of Peace/Williston Fish and Wildlife Compensation Program Reports can be obtained, depending on supply, from the Peace/Williston Fish and Wildlife Compensation Program, 1011 Fourth Ave., 3rd floor, Prince George, B.C. V2L 3H9.

No. 1 Moose winter distribution and habitat use in the southern Williston Reservoir area, British Columbia, 1989. D.F. Hatler. April 1989. 25pp plus appendices.

No. 2 Ungulate census of north shore and adjacent areas, Peace Arm, Williston Reservoir, March 1989. S.M. Hirst. March 1990. 10pp plus appendices.

No. 3 Wildlife distribution and habitat use in the northern Williston Reservoir area, British Columbia, winter 1990. D.F. Hatler. April 1990. 17pp plus appendices.

No. 4 Wetland enhancement blasting trials, 1990. R. Dawson. November 1990. 2pp plus appendices.

No. 5 Williston Wildlife Compensation Program Management Plan, 1990. P.W. Davidson and R. Dawson. December 1990. 44pp.

No. 6 Report, vegetation map, ungulate capability map and habitat enhancement plan for Dunlevy Inlet (Block A, D.L. 754 Williston Lake, B.C.). M.V. Ketcheson and E. McKenzie. January 1991. 12pp plus appendices.

No. 7 Wildlife distribution and habitat use south of the Peace Reach of Williston Reservoir, February 1991. R.J. Backmeyer. March 1991. 19pp.

No. 8 Waterfowl and aquatic furbearer inventory and assessment of Tutu and Mugaha Bay wetlands, Mackenzie, B.C. F.B. Corbould. August 1991. 30pp plus appendices.

No. 9 Public Consultation Report 1990/91. D.J. Read. September 1991. 16pp plus appendices.

No. 10 Wetlands enhancement, Tutu/Mugaha nesting islands, 1991. F.B. Corbould. September 1991. 2pp.

No. 11 Wildlife Program Annual Report, 1990/91. R. Dawson and M.D. Wood. 1991. 5pp.

No. 12 Wildlife Program Annual Report 1991/92. M.D. Wood. July 1992. 10pp.

No. 13 Cavity Nester Habitat Selection Project, Phase 1 report: Snag deterioration. L.J. Murray. July 1992. 11pp.

No. 14 South Peace Arm Stone's sheep inventory, June 1992. M.D. Wood. July 1992. 5pp.

No. 15 Waterfowl inventory and wetlands enhancement summary 1992. T. Martin. August 1992. 22pp plus appendices.

No. 16 Wildlife tree maintenance and creation in managed ESSF forests in the Mackenzie District. Working Plan. R. Dawson, L.J. Murray, and M.D. Wood. August 1992. 13pp plus appendices.

No. 17 Public Consultation Report 1991/92. G.K. Becker. August 1992. 12pp plus appendices.

No. 18 Wetlands enhancements 1992. F.B. Corbould. September 1992. 4pp.

No. 19 Donna Creek Biodiversity Project (cavity nester habitat selection), Progress report 1992/93. M.D. Wood. October 1992. 8pp plus appendices.

No. 20 Cavity Nester Habitat Selection Project, Phase 3 report: Map preparation and transect layout. L.J. Murray. November 1992. 8pp plus appendices.

No. 21 Upland furbearer problem analysis. D.Q. Becker. November 1992. 35pp plus appendices.

No. 22 Biophysical habitat classes for the Peace Arm of the Williston Reservoir study area. C.E. Thompson and L.E.H. Lacelle. 1992. 81pp.

No. 23 South Peace Arm Stone's sheep inventory, December 1992. M.D. Wood. January 1993. 3pp plus appendices.

No. 24 Omineca biophysical mapping project: Maps and legend. E. McKenzie. March 1993. 125pp.

No. 25 Wolverine Range woodland caribou inventory, February 1993. M.D. Wood. March 1993. 2pp plus appendices.

No. 26 Chase Mtn/Butler Range caribou inventory, March 1993. F.B. Corbould. April 1993. 3pp plus appendices.

No. 27 Public Consultation Report 1992/93. C. Bemister. August 1993. 23pp plus appendices.

No. 28 Wildlife Program Annual Report 1992/93. F.B. Corbould. September 1993. 12pp plus appendices.

No. 29 Dina Lakes wetlands enhancement and Parsnip nestbox monitoring. F.B. Corbould. September 1993. 4pp.

No. 30 Ingenika River elk transplant proposal. M.D. Wood. November 1993. 5pp plus appendices.

No. 31 Mugaha marsh and pond wildlife viewing sign. F.B. Corbould. November 1993. 3pp plus appendices.

No. 32 Muskwa Range (east of Finlay River) winter ungulate inventory, March 1994. M.D. Wood. March 1994. 6pp.

No. 33 Peace Arm Williston Lake wildlife capability ratings. R.J. Backmeyer. March 1994. 52pp.

No. 34 Wolverine Range woodland caribou calf survey, June 1994. M.D. Wood. June 1994. 3pp plus appendices.

No. 35 Dunlevy wildlife viewing sign. F.B. Corbould. July 1994. 3pp plus appendices.

No. 36 Snow depth survey January - March 1990. T. Martin. August 1994. 7pp plus appendices.

No. 37 Donna Creek Biodiversity Project: Progress report, 1993/94 and 1994/95. M.D. Wood. October 1994. 7pp.

No. 38 Tutu/Mugaha aspen girdling project. T. Martin. October 1994. 5pp plus appendices.

No. 39 Seasonal habitat use and movements of woodland caribou in the Omineca Mountains, north central British Columbia, 1991-1993. M.D. Wood. November 1994. 23pp.

No. 40 Wildlife Program Annual Report 1993/94. F.B. Corbould and M.D. Wood. November 1994. 12pp.

No. 41 Donna Creek Biodiversity Project: Preliminary breeding bird surveys 1993. L.W. Gyug and K. Summers. March 1995. 45pp plus appendices.

No. 42 Effects of habitat manipulation projects on non-target wildlife species in the Williston watershed. Working Plan. P.A. Giroux. March 1995. 28pp.

No. 43 Williston and Dinosaur Reservoirs raptor survey 1995: Survey 1, Raptor nest locations. R.J. Zemlak, M.D. Wood, and F.B. Corbould. March 1995. 8pp plus appendices.

No. 44 Donna Creek Biodiversity Project: Spring 1995 breeding bird surveys. Summary Report. J. Joy and R. van den Driessche. July 1995. 4pp plus appendices.

No. 45 Wildlife Program Annual Report 1994/95. F.B. Corbould and M.D. Wood. August 1995. 12pp.

No. 46 Donna Creek Biodiversity Project: Progress report 1995/96. M.D. Wood. November 1995. 7pp.

No. 47 Mt. Frank Roy Stone's sheep transplant, March 1993. M.D. Wood. November 1995. 2pp plus appendices.

No. 48 South Peace Arm Stone's sheep and woodland caribou inventory, March 1994. M.D. Wood. November 1995. 3pp.

No. 49 South Peace Arm Stone's sheep and woodland caribou inventory, March 1995. M.D. Wood. November 1995. 9 pp.

No. 50 Branham Slide 1993 prescribed burn. M.D. Wood. January 1996. 5pp.

No. 51 Pelly Lake 1993 prescribed burn. M.D. Wood. January 1996. 5pp.

No. 52 Branham Slide 1995 prescribed burn. M.D. Wood. February 1996. 5pp.

No. 53 Donna Creek Forestry/Biodiversity Project: Breeding bird point counts 1995. L.W. Gyug. March 1996. 30pp plus appendices.

No. 54 Donna Creek Biodiversity Project: Habitat use of cavity nesting birds in the Donna Creek study area 1995. J. Joy and R. van den Driessche. March 1995. 26pp plus appendices.

No. 55 Wildlife Program Annual Report 1995/96. M.D. Wood and F.B. Corbould. November 1996. 12pp.

No. 56 Spawning and rearing habitat assessment of Williston Reservoir tributaries. C.M. Retzer. January 1989. 35pp.

No. 57 Hydroacoustic surveys of Williston Reservoir (June, September, and October, 1988). R.L. Johnson and I. Yesaki. November 1989. 35pp plus appendicies A through G.

No. 58 Williston Lake fisheries compensation program management plan. B.G. Blackman, D. Jesson, D. Ableson, and T. Down. August 1990. 38pp.

No. 59 Finlay River kokanee (*Oncorhynchus nerka*) spawning survey 1990. R.J. Fielden. January 1991. 40pp plus appendices.

No. 60 Walleye feasibility study: Moberly and Gwillim Lakes. T.L. Slaney and V.A. Lewynsky. July 1991. 76pp plus appendicies.

No. 61 Small lake inventory and enhancement program preliminary progress and enhancement report on 1991 field activities. A.R. Langston, A.R. McLean, and B.G. Blackman. November 1991. 20pp.

No. 62 Williston Watershed aerial kokanee (*Oncorhynchus nerka*) spawning survey 1990. A.R. McLean and B.G. Blackman. December 1991. 10pp plus appendicies.

No. 63 Finlay River kokanee(*Oncorhynchus nerka*) spawning survey, 1991. R.J. Fielden. March 1992. 27pp plus appendices.

No. 64 Bull Trout (*Salvelinus confluentus*) survey in Scott Creek and Weston Creeks conducted by the Lheit-Lit'en Nation August to September, 1991. T. Slaney. March 1992. 24pp plus appendices.

No. 65 Small Lake program summary 1989-1992. A.R. McLean and A.R. Langston. October 1992. 19pp.

No. 66 Stream fertilization feasibility study 1991 data report. A.R. Langston. November 1992. 56pp plus appendices.

No. 67 Stream surveys of the west (Upper) Moberly River Watershed (Summer, 1992). H. Hohndorf, G. Hopcraft, and T. Down. February 1993. 17pp plus appendicies.

No. 68 Current status and potential enhancement projects of selected small lakes in the Omineca/Peace region 1992. A.R. McLean and A.R. Langston. March 1993. 26pp.

No. 69 Embayment enhancement feasibility study Williston Reservoir. R.J. Fielden, T. Slaney, and A.W. Wood. March 1993. 28pp plus appendicies.

No. 70 Fisheries resources and enhancement potentials of selected tributaries of the Williston Reservoir. Volume II. A.R. Langston and B.G. Blackman. April 1993. 185pp plus appendicies.

No. 71 Creel survey of the winter 1992/93 Gantahaz Lake ice fishery. A.R. Langston. April 1993. 15pp plus appendices.

No. 72 Fisheries enhancement options for Dinosaur Lake, A Review. R. Pattenden and G. Ash. April 1993. 38pp plus appendicies.

No. 73 Dinosaur Lake summer creel surveys, Results of the 1988 program and a five year review (1984 - 1988). R. Pattenden and G. Ash. April 1993. 26pp plus appendices.

No. 74 Water temperatures of the Nation and Mesilinka River systems 1992. A.R. Langston. November 1993. 29pp.

No. 75 Water temperatures of the Nation and Mesilinka River systems 1993. A.R. Langston. November 1993. 46pp.

No. 76 Summary of the 1994 fish trapping operations on Suschona and Sylvester Creeks. A.R. Langston and R.J. Zemlak. March 1997. 12pp plus appendicies.

No. 77 Firth Creek habitat enhancement project 1993. A. R. Langston. December 1993. 9pp plus appendicies.

No. 78 A review of management and enhancement options for the Arctic grayling (*Thymallus arcticus*) with special reference to the Williston Reservoir Watershed in British Columbia. T.G. Northcote. 1993. 69pp.

No. 79 Water temperatures of the Nation and Mesilinka River systems 1994. A.R. Langston and R.J. Zemlak. November 1994. 22pp.

No. 80 Finlay River lake trout spawning investigation. R.J. Zemlak and A.R. Langston. December 1994. 6pp plus appendices.

No. 81 Carbon Creek spawning/rearing channel preliminary design. M.R. Morgan. April 1995. 24pp plus appendicies.

No. 82 Development of a premier northern river fishery: Mesilinka River pre-fertilization progress 1992-93. C.W. Koning, K.I. Ashley, P.A. Slaney, R.W. Land, and P.W. Davidson. November 1995. 37pp plus appendicies.

No. 83 Water temperatures of the Nation and Mesilinka River systems 1995. A.R. Langston. November 1995. 22pp.

No. 84 Water temperatures of the Nation and Mesilinka River systems 1996. A.R. Langston. October 1996. 14pp.

No. 85 Development of a premier northern river fishery: Mesilinka River, the first year of fertilization (1994). A.J. Paul, C.W. Koning, K.I. Ashley, P.A. Slaney, P.W. Davidson, and R.W. Land. December 1996. 48pp plus appendicies.

No. 86 A reconnaissance survey of Bruce Lake. D.A. Jesson. 1989. 18pp plus appendices.

No. 87 A reconnaissance survey of Canty Lake. D.A. Jesson. 1990. 22pp plus appendices.

No. 88 A reconnaissance survey of Curve Lake. D.A Jesson. 1989. 18pp plus appendices.

No. 89 A reconnaissance survey of Dunlevy Lake. D.A. Jesson. 1989. 18pp plus appendices.

No. 90 A reconnaissance survey of Heather Lake. A.R. McLean. 1989. 21pp plus appendices.

No. 91 A reconnaissance survey of McIntyre Lake. D.A. Jesson. 1989. 19pp plus appendices.

No. 92 A reconnaissance survey of Pothole Lake No. 1. D.A. Jesson. 1989. 19pp plus appendices.

No. 93 A reconnaissance survey of Robinson Lake. D.A. Jesson. 1989. 18pp plus appendices.

No. 94 A reconnaissance survey of Royer Lake. D.A. Jesson. 1989. 21pp plus appendices.

No. 95 A reconnaissance survey of Tobin Lake. A.R. McLean. 1990. 21pp.

No. 96 A reconnaissance survey of Upper Lions Lake. D.A. Jesson. 1990. 20pp plus appendices.

No. 97 A reconnaissance survey of Windy Point Lake. A.R. McLean. 1989. 18pp plus appendices.

No. 98 A reconnaissance survey of Blackwater Lake. D.A. Jesson. 1991. 22pp plus appendices.

No. 99 A reconnaissance survey of Butternut Lake. D.A. Jesson. 1990. 21pp plus appendices.

No. 100 A reconnaissance survey of Finger Lake. D.A. Jesson. 1990. 22pp plus appendices.

No. 101 A reconnaissance survey of Grayling Lake. A.R. McLean and D.A. Jesson. 1990. 26pp plus appendices.

No. 102 A reconnaissance survey of Wright Lake. A.R. McLean and D.A. Jesson. 1990. 20pp plus appendices.

No. 103 A reconnaissance survey of Clearwater Lake. A.R. McLean. 1991. 25pp plus appendices.

No. 104 A reconnaissance survey of Dina Lake (#5). A.R. McLean. 1991. 25pp plus appendices.

No. 105 A reconnaissance survey of Dina Lake (#7). A.R. McLean. 1991. 21pp plus appendices.

No. 106 A reconnaissance survey of Gataiga Lake. A.R. McLean. 1991. 22pp plus appendices.

No. 107 A reconnaissance survey of Le Moray Lake (#1). A.R. McLean. 1991. 22pp plus appendices.

No. 108 A reconnaissance survey of Little Carbon Lake. A.R. McLean. 1991. 20pp plus appendices.

No. 109 A reconnaissance survey of Shoal Lake (#2). A.R. McLean. 1991. 21pp plus appendices.

No. 110 A reconnaissance survey of Simpson Lake. A.R. Langston and A.R. McLean. 1991. 22pp plus appendices.

No. 111 A reconnaissance survey of Dina Lake (#3). A.R. McLean. 1992. 22pp plus appendices.

No. 112 A reconnaissance survey of Little Calais Lake. A.R. McLean. 1992. 23pp plus appendices.

No. 113 A reconnaissance survey of Dina Lake (#6). A.R. Langston. 1993. 23pp plus appendices.

No. 114 A reconnaissance survey of Lost Lake. A.R. McLean. 1993. 20pp plus appendices.

No. 115 Fish habitat enhancement potential and stocking assessment of Sabai Lake. D.A. Jesson. 1990. 12pp plus appendices.

No. 116 Fish habitat enhancement potential and stocking assessment of Burden Lake. A.R. McLean. 1991. 12pp plus appendices.

No. 117 Fish habitat enhancement potential and stocking assessment of Dina Lake (#1). A.R. McLean. 1991. 13pp plus appendices.

No. 118 Fish habitat enhancement potential and stocking assessment of Dina Lake (#2). A.R. McLean and A.R. Langston. 1991. 13pp plus appendices.

No. 119 Fish habitat enhancement potential and stocking assessment of Gantahaz Lake. A.R. McLean. 1991. 11pp plus appendices.

No. 120 Fish habitat enhancement potential and stocking assessment of Lower Manson Lake. A.R. McLean. 1991. 12pp plus appendices.

No. 121 Fish habitat enhancement potential and stocking assessment of Upper Manson Lake. A.R. McLean. 1991. 12pp plus appendices.

No. 122 Fish habitat enhancement potential and stocking assessment of Morfee Lake. A.R. McLean. 1991. 14pp plus appendices.

No. 123 Fish habitat enhancement potential and stocking assessment of Bruce Lake. R.J. Zemlak and A.R. Langston. 1994. 12pp plus appendices.

No. 124 Fish habitat enhancement potential and stocking assessment of Canty Lake. R.J. Zemlak and A.R. Langston. 1994. 13pp plus appendices.