A PRELIMINARY EVALUATION OF FISH HABITAT AND RECREATIONAL FISHERIES VALUES IN THE MAINLAND COAST PLANNING UNIT

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ABSTRACT

The Ministry of Environment, Recreational Fisheries Section is developing a management plan for the Mainland Coast Planning Unit. The first step has been to conduct an inventory of biophysical resources and recreational angling opportunities in major watersheds of the area. Recent interest in recreational fisheries in the Planning Unit, including a rapidly expanding guided fishing industry, have increased the need for improved resource inventory. Construction of Department of Fisheries and Oceans enhancement facilities for salmon and ongoing logging activities in these watersheds have added incentive to conduct these investigations. This preliminary report summarizes the current state of resource knowledge, based on provincial fisheries surveys undertaken between May 1987 and December 1989. Relevant information on fish stocks and stream habitat from DFO surveys and stream summary catalogues is also included. Synopses of information for streams of each major inlet are provided and recreational fisheries and habitat values are discussed. A series of recommendations outlining the most urgent concerns of regional fisheries managers is presented. More recent information, from surveys in May 1990 and July 1990, is appended.

ACKNOWLEDGEMENTS

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INTRODUCTION

The Ministry of Environment, Recreational Fisheries Section is developing a management plan for the Mainland Coast Planning Unit. The area comprises that part of the British Columbia mainland coast adjacent to northern Vancouver Island, extending from the southern end of Loughborough Inlet to Cape Caution in the north, including all the islands from Campbell River northwards and encompasses Management Units 1-15 and 1-14 (Figure 1). This section of coast is characterized by large fjords or inlets (Seymour, Kingcome, Knight, Loughborough) and smaller sounds (Wakeman, Bond, Thompson). Mountain ranges which often exceed 1,500 m in elevation surround the inlets. The streams of these mountainous watersheds are typically steep and fast flowing throughout much of their lengths. The majority of the larger river systems are glacier-fed. They are characterized by high summer flows (Anonymous, 1989) and are extremely turbid or "milky" with fine sediments of glacial origin. The streams fed by snow fields or with lakes in their headwaters are for the most part clearer, warmer and more productive than the glacier-fed streams. The area provides good opportunities for wilderness and semi-wilderness fishing experiences but is largely inaccessible to the average sport angler due to its remote location and lack of road access. At present it is utilised mainly by small numbers of the sparse resident population and by increasingly larger numbers of non-residents on guided fishing expeditions, many of which use helicopters to gain access.

Steelhead populations are generally late-run winter stocks and are most abundant in the clear, medium-sized streams which drain the smaller snow fields. Summer steelhead (less than 100 fish) were identified during field observations on the Clear River (Kingcome drainage) and the Kwalate River (Knight Inlet). These two streams have obstructions in their lower reaches which can be surmounted by summer-run fish but are impassable to fall and winter fish. Both these streams also have populations of summer-run coho. The Atlazi River (Kingcome drainage) and the Ahnuhati River

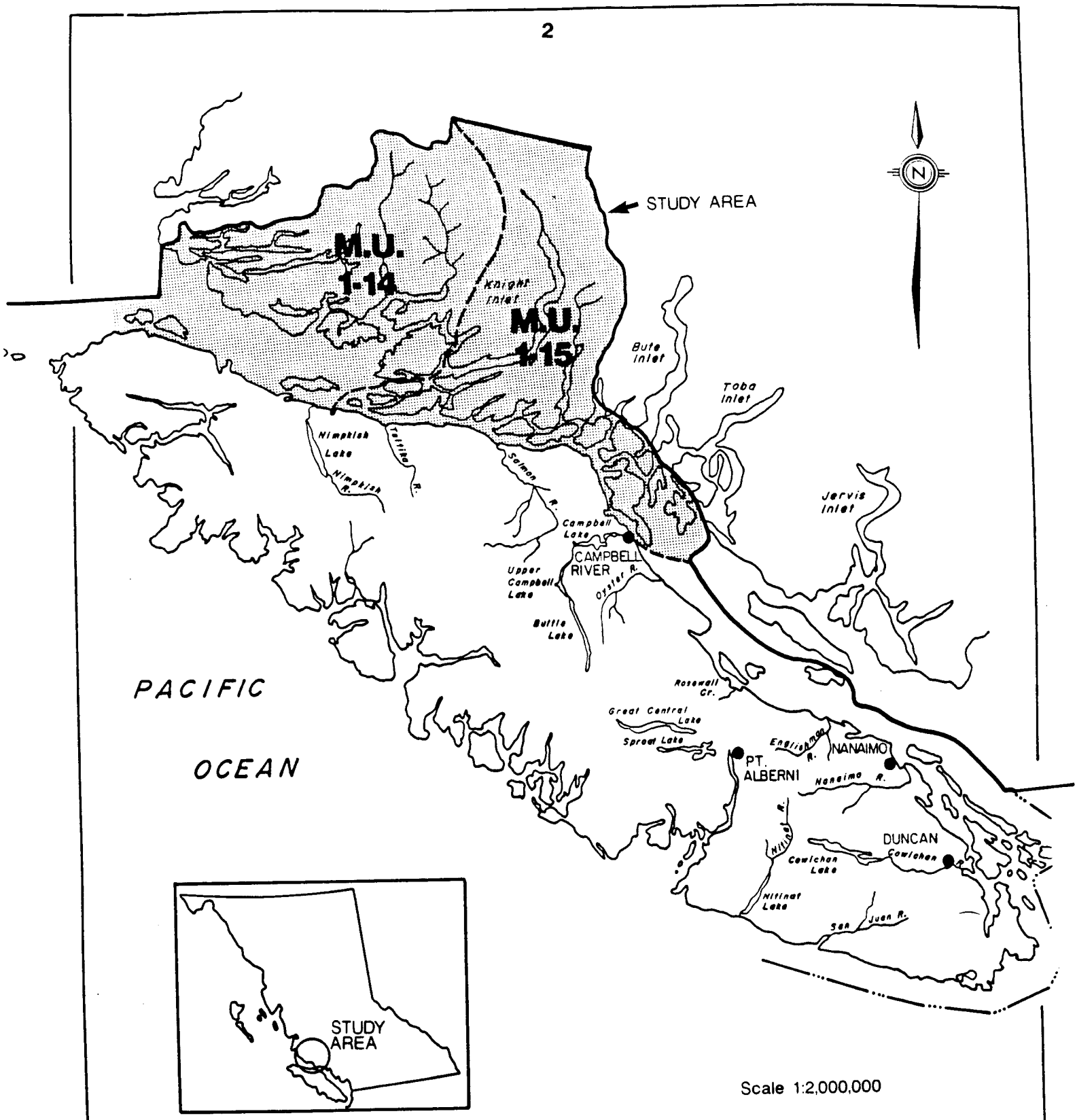

Figure 1. Location of the mainland coast study area.

(Knight Inlet) also appear to contain summer-run steelhead, but only in very small numbers. The Kakweiken River (Thompson Sound) has a few summer steelhead mixed with sea-run cutthroat trout and Dolly Varden char. Cutthroat and Dolly Varden are very abundant in the Glendale, Kakwieken and Wakeman systems. The Kakweiken system is warmer, lake-influenced and more productive than other streams throughout the area.

Snow melt appears to sustain summer flows on all these mainland streams and the low summer flow problems, so typical of Vancouver Island streams, appear less prevalent here. Peak flows on most of the larger streams occur in July and August, while the smaller streams can peak during rain events as well as during summer snow melt. Minimum flows occur during winter freeze-up.

There is a long history of logging in the area and much of the area has been cut over at various times in the past. In some watersheds the logging is being re-activated (Kakweiken and Wakeman Rivers). Unlogged watersheds include the Kwalate, Stafford, Ahnuhati (except the lower 4 km) and upper Kakweiken (above Elbow Creek).

The purpose of these investigations is to evaluate the wild stocks of sport fish and their habitats in order to develop appropriate management plans. Generally, the goal is to maintain the present quality recreational fishery of the area. A management plan will indicate the recreational fisheries potential of streams and lakes within each watershed and will highlight unique fisheries to be found on some streams.

Field observations were made by Recreational Fisheries personnel during a survey in late July, 1987. Most stream flow levels were moderate to high and the glacier-fed streams were in near flood conditions. Thus, while conditions for surveying were good on the smaller streams, they were far from ideal on the larger systems.

Objectives of the 1987 study were to:

(a) evaluate summer steelhead stock size and distribution by snorkel surveys and angling;
(b) summarize the guided angler catch and effort on mainland coast streams;
(c) review DFO reports and summarize existing biophysical information and steelhead, cutthroat and Dolly Varden data;
(d) estimate steelhead production capabilities for selected streams;
(e) recommend regulations to maintain the present quality fishing opportunities and;
(f) identify shortfalls in our existing knowledge of the fisheries.

This study was directed in particular at mainland coast streams where guided fishing effort has increased significantly in recent years. At this time no attempt has been made to assess the smaller streams, of which there are hundreds. In addition, many of the larger islands have lakes and streams, most of which have not been surveyed. Some of these are known to contain abundant fish resources and there may be considerable potential for sport fishing.

METHODS

Reconnaissance of the study area was conducted by aerial survey with a chartered helicopter from Campbell River. Field data on fish distribution were gathered using snorkel surveys in clear water streams and by angling in streams where turbidity made visual observation ineffective. It should be noted that the catchability of sport fish would be reduced by increased turbidity so that angling would tend to underestimate the presence of sport fish. Other field data were obtained from interviews with guides and discussions with staff from federal fisheries and Provincial Ministry of Environment (Conservation Officer Service and Habitat Protection Section).

DFO has conducted substantial inventories, especially for Knight Inlet streams and the Kakweiken system. Much of the baseline habitat data have been derived from these studies and by review of provincial fisheries maps and reports. The limited information for trout has precluded compilation of a more comprehensive report at this time. In order to produce an overall picture of existing fishery values it will be necessary to maintain an ongoing inventory program. The intention will be to progress from the general to site-specific investigations of individual streams or fish stocks. For example, as we discover more about steelhead run size and timing for a particular system, trips can be scheduled to confirm annual escapement levels and distribution within a watershed.

Initial field surveys for this study were conducted over a two day period in July 1987. In the succeeding two years additional field trips have been undertaken as follows:

1988	- Kakweiken, inspect DFO spawning channel site
June 1988	- Wakeman Sound, Wahpeeto Creek snorkel survey
March 1989	- Glendale and Kakweiken, snorkel surveys

May 1989	- Kakweiken, Wakeman and Ahnuhati, evaluate guiding opportunities and assess winter steelhead distribution by angling
September 1989	- Glendale, seining for cutthroat broodstock collection and life history samples.
December 1989	- Glendale and Kakweiken, evaluate guiding opportunities and inspect DFO spawning channels
May 1990	- Apple, Stafford, Heydon, Glendale/Tom Browne, Ahnuhati, Wakeman, Ahta and Kakweiken; aerial reconnaissance, snorkel surveys and angling surveys (see Appendix 2)
July 1990	-Kakweiken Lake and Stafford Lake, lake inventories (see Appendices 3 and 4)

RESULTS

MANAGEMENT UNIT 1-15

Management Unit 1-15 includes Loughborough Inlet, Knight Inlet and Thompson Sound (Figure 2). All the watersheds examined during the initial survey in July 1987 were affected to some extent by glacial runoff. The Apple, Franklin, Klinaklini, Sim and Ahnuhati were all heavily silted with glacial flour. Some of these streams are reportedly never clear except under mid-winter freeze-up conditions. The impacts of glacial runoff are somewhat reduced on some systems by the presence of headwater lakes which intercept and deposit part of the suspended sediment load. Thus the Stafford, Glendale, Devereux and Kakweiken systems were much clearer during the survey than other streams.

1. LOUGHBOROUGH INLET

Apple River

The Apple River is a medium size system, approximately 50-75 m wide and about 20 km long, draining into Cooper Reach at the head of Loughborough Inlet (Figure 3). It is glacier-fed, cold and modertely turbid. During the July 1987 survey, water temperatures were 9°C near the headwaters and 11.5°C in the lower reach. Visibility was 1-2 m. The water was a milky-green colour. Two sets of falls were noted. The lower, at 12.5 km upstream of the mouth, consisted of a series of small chutes with considerable rapids over a distance of several hundred meters. This section is probably accessible to summer steelhead and possibly other salmonids. The second falls, 16 km upstream from the mouth, had several vertical drops (maximum approximately 3 m) and chutes. These upper falls would likely be impassable to most

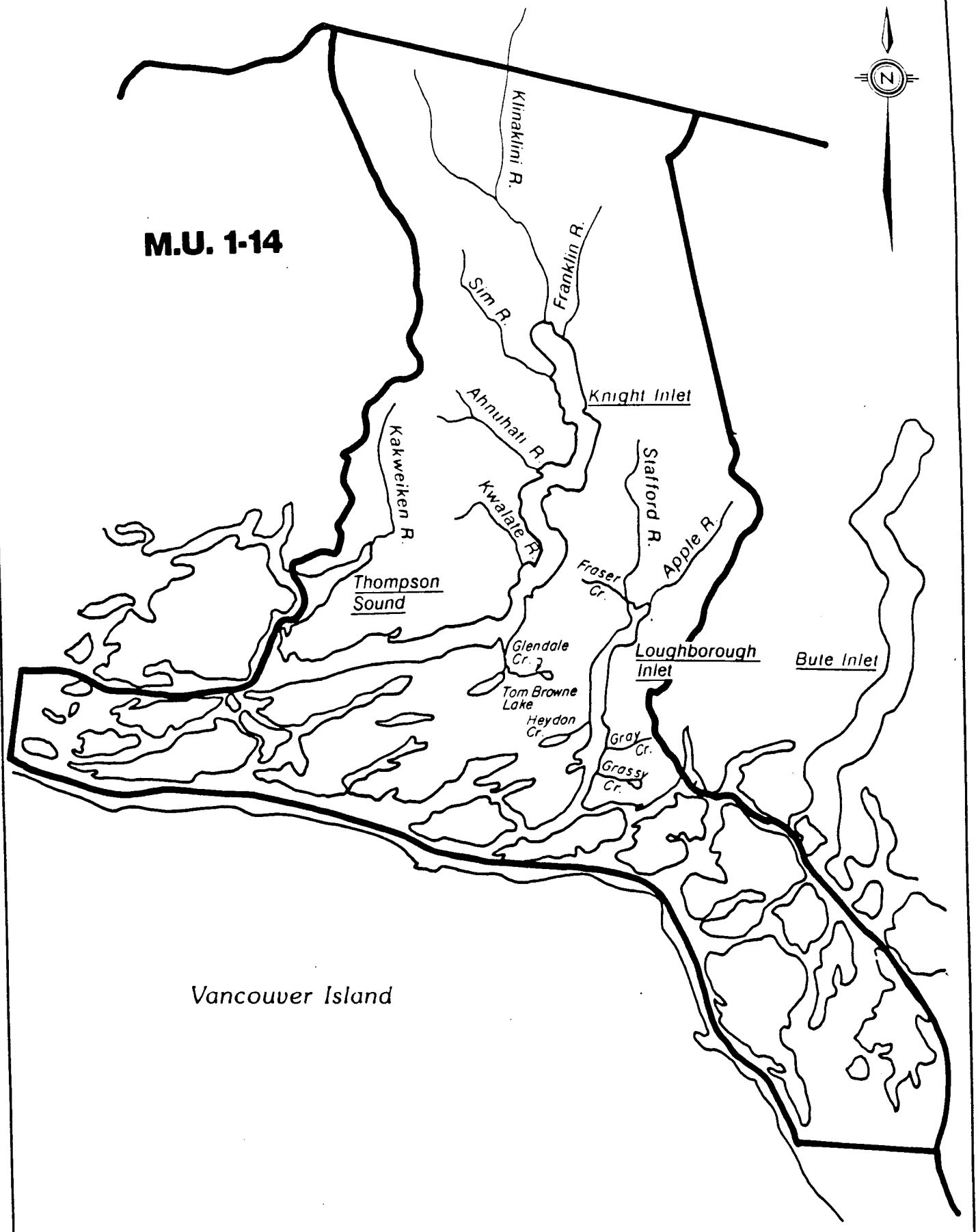

Figure 2. Management Unit 1-15.

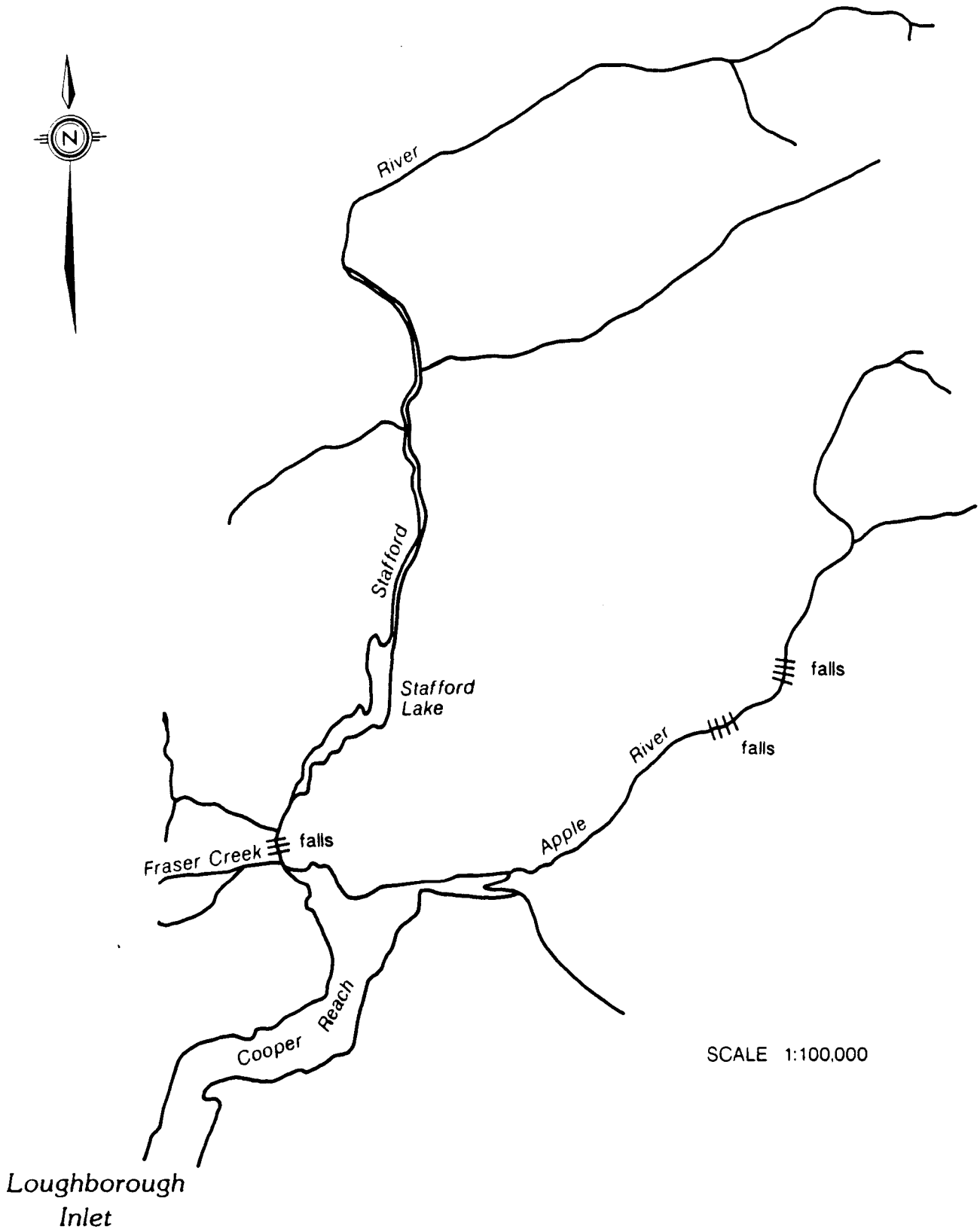

Figure 3. Major streams draining into Loughborough Inlet.

fish; however, DFO escapement records indicate salmon (possibly summer steelhead) above this site.

Apple River fish habitat can be described in 4 reaches:

(1) estuary to 5 km - low gradient (<1%) with channel braiding, meandering and sand accumulations;

(2) 5 km to 12.5 km (1st falls) - steeper gradient (1-2%) with gravelly substrate;

(3) 12.5 km to 16 km (2nd falls) - very steep gradient with cobble and boulder substrate;

(4) 16 km to headwaters - two main forks with moderate to steep gradients, substrate mostly gravel and cobble. Glaciers at higher elevations sustain stream flows.

Extensive logging in the 1960's has contributed to the substantial sediment load and debris observed along banks in lower reaches of the river. Substrate in the lower 2-3 km has a very high percentage of fines.

Access for anglers is poor as the original logging road has completely overgrown. Several helicopter landing sites adjacent to fishable water are present in the lower reaches.

A snorkel survey was conducted at a helicopter landing site on the lower reach during the July 1987 survey. Juvenile steelhead, Dolly Varden and coho were observed. Angling in this reach yielded adult summer chinook. Sea-run cutthroat were not observed, but likely utilize this system.

Mean salmon escapements to the Apple River for the 10-year period 1977-86 (with maximum recorded escapements in brackets) are: pink 8,756 (50,000); chum 4,871 (20,000); coho 396 (3,500); chinook 317 (1,500); sockeye 517 (2,500) (Salmon

Escapement Data System Information for Subdistrict 13, 1990).

Habitat in the first 5 km of the lower reach appeared suitable for pink and chum spawning and rearing. The lower reach between 5 km and the first falls contained a few good holding pools. The reach between first and second falls contained some good holding and spawning habitat for steelhead. Reaches above the second falls have good habitat for resident fish but are likely not accessible to anadromous fish. A steelhead production capability model estimates a potential adult run size of 150 (Appendix 1).

Overall fish productivity of the Apple River is limited by cold water temperatures, high sediment loads, obstructed access for anadromous fish and suspected low dissolved nutrients. This, combined with limited angler access means the system is a minor contributor to the stream fisheries of Loughborough Inlet.

Habitat descriptions, accessibility and fishery assesments for the Apple River were updated during the May 1990 survey. See Appendix 2 for more recent information.

Stafford River

Stafford River is a medium sized stream which flows into Cooper Reach at the head of Loughborough Inlet through a narrow, steep-sided valley and has a lake in its lower reaches approximately 5 km upstream from the mouth (Figure 3). The water was clear during the July 87 survey. Several waterfalls downstream of the lake limit access for anadromous fish to the lower 1.5 to 2 km. The valley upstream of the lake has not been logged. The lake is accessible to anglers by float plane or helicopter.

The lower reach of Stafford River, below the falls, is utilized by chinook, coho,

chum and pink (Marshall et al., 1977a) and likely cutthroat (angler reports). Numbers of fish are relatively small due to the short acessible length of stream. Mean salmon escapements to the Stafford River for the 10-year period 1977-86 (with maximum recorded escapements in brackets) are: chinook 51 (200); coho 96 (750); chum 468 (3,500); pink 3,579 (35,000) (Salmon Escapement Data System Information for Subdistrict 13, 1990).

Stafford Lake reportedly has a reasonable trout population which utilizes the inlet stream for recruitment. No data are available on the Stafford Lake fishery, but discussions with anglers suggested good fishing in June near the inlet stream for large resident trout. An inventory of Stafford Lake was conducted in July 1990 (see Appendix 3).

Other Small Streams of Loughborough Inlet

Grassy Creek - A small lake-headed stream located on the southwest end of the inlet (Figure 2) with good access for fish into the lakes. DFO escapement records indicate a good run of pink salmon (25,000 to 200,000 in even years) and small runs (<1,000 fish) of coho and chum salmon (Marshall et al., 1977a). There are no recent escapement data available. Habitat and gradient appeared suitable for anadromous cutthroat trout.

Gray Creek - A small stream on the east side of the inlet (Figure 2) with small runs of coho, chum and pink salmon. Pinks are the largest component and utilize the lower portions of the stream. (Marshall et al., 1977a).

Mean salmon escapements to Gray Creek for the 10-year period 1977-86 (with maximum recorded escapements in brackets) are: pink 597 (7,500); chum 13 (400);

coho 62 (750) (Salmon Escapement Data System Information for Subdistrict 13, 1990).

Fraser Creek - A small stream draining into the Stafford River estuary (Figure 2). Access to anadromous fish is limited to the lower 2.4 km.

Mean salmon escapements to Fraser Creek for the 10-year period 1978-87 (with maximum recorded escapements in brackets) are: pink 2,689 (20,000); chum 154 (1,500); coho 8 (200); sockeye 1 (25) (Salmon Escapement Data System Information for Subdistrict 13, 1990).

Heydon Creek - A short stream on the western side of the inlet with a relatively large lake in its headwaters (Figure 2). The stream gradient and lake influence appear conducive to sea-run cutthroat production. The potential sport fishery of this system warrants further evaluation.

Mean salmon escapements to Heydon Creek for the 10-year period 1977-86 (with maximum recorded escapements in brackets) are: pink 764 (35,000); chum 9,670 (75,000); coho 438 (3,500); sockeye 2,167 (7,500) (Salmon Escapement Data System Information for Subdistrict 13, 1990).

LOUGHBOROUGH INLET SYNOPSIS

The production potential for sport fish here, as in the rest of the Mainland Coast Planning Unit, is limited by the biophysical constraints which will be discussed later. Recreational stream fishing opportunities in Loughborough Inlet are limited by the small number of streams, small stream size and difficulty of access. The main candidate for angling, the Apple River, has some potential for steelhead and salmon heli-fishing. The Stafford is a larger stream, but a falls in the lower reaches severely

restricts its potential for anadromous fish.

Several large lakes in the area may have the potential to diversify the recreational fishing experience, but many have not been surveyed. These include Stokes and Ricardo Lakes, which drain into Grassy Creek, but whose fisheries values are presently unknown. Heydon Lake, the largest in the area, is another unknown at this time. An inventory of Stafford Lake in July, 1990 indicated good trout fishing potential.

The islands south of Loughborough Inlet also contain a number of unsurveyed lakes which could contribute to a recreational fishery involving resort-based fly-in operations. East Thurlow Island has eight small lakes and Sonora Island has another seven. Northwest of Loughborough Inlet there may be further potential in Seabird Lake, Lapan Lake, Fulmore Lake and several other, smaller lakes for which there are no current inventories.

2. KNIGHT INLET

Knight Inlet and its tributaries comprise the largest drainage basin of the study area. Several major watersheds containing large river systems drain an area of 7,800 km^2. The area is characterized by high mountains (1200-1800 m) sloping steeply to the inlet shores. During July 1987 the waters of the inlet were clouded with glacial flour from Hoeya Sound to the mouth of the Klinaklini River. The main contrubutors of glacial runoff were the Klinaklini, Franklin, Wahkash and Sim Rivers.

Glendale and Tom Browne Creeks

Glendale Creek is a small lake-headed system unaffected by glacial runoff. It merges with Tom Browne Creek about 1 km above tidewater (Figure 4). Tom Browne Creek is a short (9.6 km) stream with a lake, Tom Brown Lake (4.9 km^2), situated 1.5 km above tidewater. There is a falls barrier at the lake outlet; therefore, only the short section of Tom Browne Creek (<0.5 km) upstream of the confluence with Glendale Creek may be accessible to anadromous fish. There are, however, reports of cutthroat navigating the falls (Black and Birch, 1982; and T. Slaney, pers. comm.). The Glendale Creek mainstem is approximately 7.5 km long and flows out of Glendale Lake. Both streams are low gradient (<1%) throughout all reaches. A summary of the physical habitats of both creeks is given in Table 1. DFO has done extensive studies on the Glendale/Tom Browne system from the perspective of potential enhancement of commercial salmon stocks. The results of those studies are summarised in 4 reports:

Black and Birch (1982) - gives baseline biological, chemical and physical information for Tom Browne Lake;
Fielden and Slaney (1982) - gives biophysical data for selected Knight Inlet streams, spawning escapement summaries, water quality and habitat descriptions;
Whelen and Morgan (1984) - gives adult salmonid distribution for selected Knight Inlet streams,
Fielden et al. (1985) - gives juvenile salmonid distribution for selected Knight Inlet streams and potential juvenile stocking sites.

A spawning channel for pink salmon was constructed on Tom Browne Creek below the Glendale confluence in 1988. It utilizes water drawn from Tom Browne Lake.

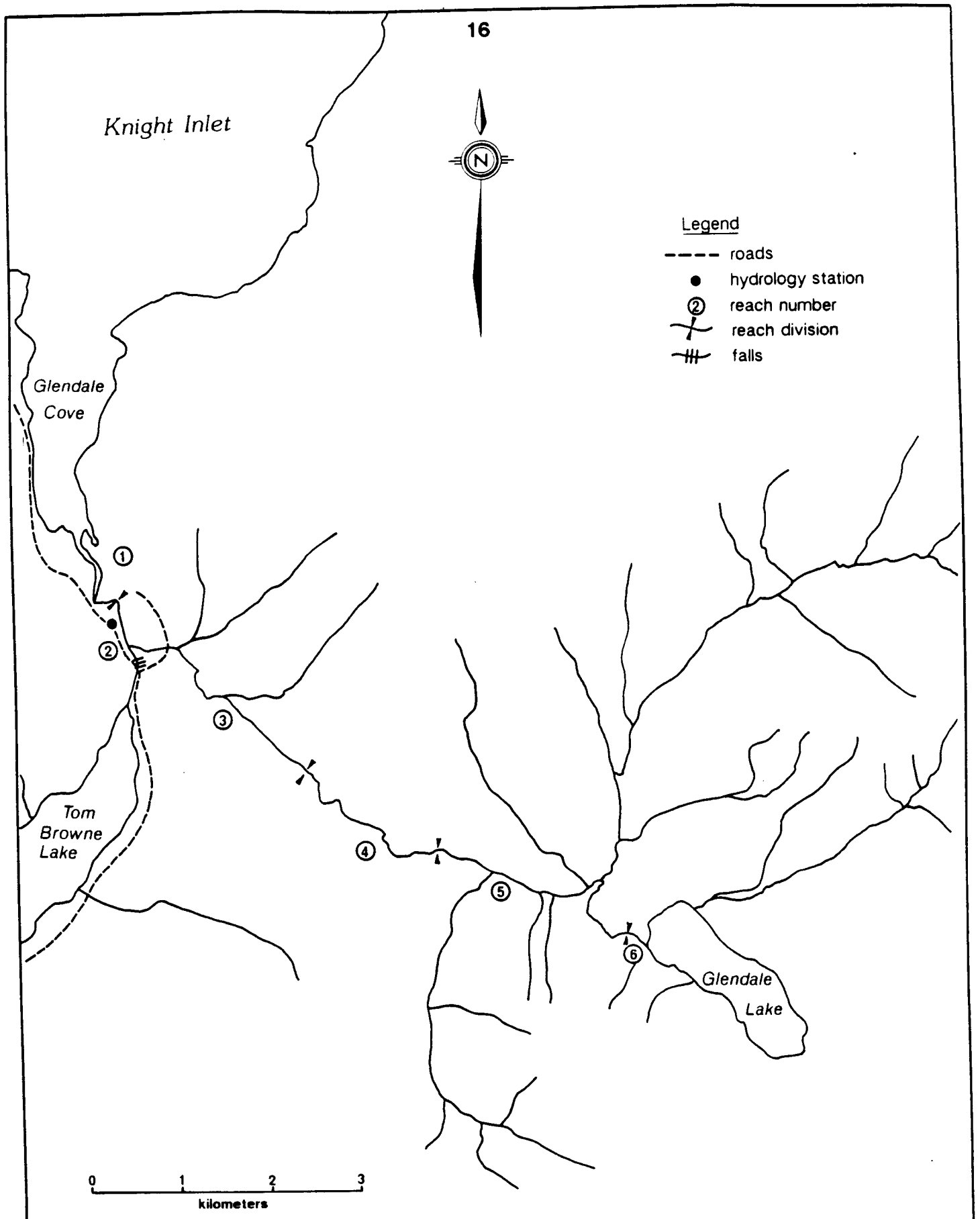

Figure 4. Glendale Creek drainage system (from Fielden and Slaney, 1982).

REACH NO.	REACH GRADIENT	REACH LENGTH (km)	WETTED WIDTH (m)	CHANNEL WIDTH (m)	AVERAGE DEPTH (m)	SURFACE VELOCITY (m/sec)	FLOW CHARACTER (%)				SUBSTRATE COMPOSITION (%)						SIDE CHANNELS (% AREA)	% OVERSTREAM CHANNEL COVER	HOLDING POOLS	MIGRATION BARRIERS
							POOL	GLIDE	RIFFLE	RAPIDS	FINES (0.0-0.1 cm)	SMALL GRAVEL (0.1-4 cm)	LARGE GRAVEL (4-10 cm)	COBBLE (10-30 cm)	BOULDERS (> 30 cm)	BEDROCK				
1	0.1	1.5	18.0	18.0	0.4	0.4-0.6	10	65	25		10	30	45	15	<1		30	10	3 major	
2	0.8	1.0	20.0	20.0	0.3	0.5	20	55	25		10	25	30	30	5			40	2 major, numerous small	falls at Tom Browne Lake outlet
3	0.3	3.0	12.5	17.5	0.7	0.5	25	40	35		5	40	20	30	5		15	40	5 major, numerous small	4 passable log jams
4	0.6	2.0	10.0	15.0	0.5	0.8	15	25	60		5	15	20	35	25			25	2 major, numerous moderate	
5	0.3	2.0	8.0	12.0	0.4	0.6	20	45	35		5	25	35	30	5		5	40	numerous small to moderate	
6	0.1	0.5	20.0	20.0	0.7	0.3	40	60			75	15	5	5	<1			10	few large, numerous moderate	

TABLE 1. PHYSICAL HABITAT SUMMARY OF THE GLENDALE/TOM BROWNE SYSTEM (FROM WHELEN AND MORGAN, 1984)

Logging occurred in the area around Glendale Lake and the upper reaches of Glendale Creek in the 1950's. The middle and lower reaches of Glendale Creek and the area around Tom Browne Lake were logged in the 1980's and logging continues in many of those areas.

Access for anglers is available from tidewater by logging roads which run virtually the full length of both systems, including the headwater lakes. Tom Browne and Glendale Lakes are both accessible by floatplane.

A snorkel survey in March 1989 in the spawning channel and adjacent Tom Browne Creek revealed 6 cutthroat in the channel and none in the stream. A fine mesh seine net was used in the holding area at the top of the spawning channel in October 1989 to obtain cutthroat broodstock. Total catch for 2 net sets was as follows: 800 cutthroat (size range 18.5-38.5 cm), 30 sockeye, 5 coho jacks, 6 coho juveniles and 1 rainbow juvenile. An estimated 2500-3000 adult cutthroat were observed in the spawning channel following enumeration of the fall 1989 salmon run (Harry Genoe, pers. comm.).

Steelhead are reported to be late winter-run fish. Shepherd (1984), reports observing 5 adults in the lower reaches of Glendale Creek during April. Gerry Blackman (pers. comm.) reported catching steelhead regularly during April 1989. Fish captured were unspawned and had recently arrived in fresh water.

Cutthroat abundance in Tom Browne Lake was relatively high. Two gill net sets in July 1981 captured 105 cutthroat (Black and Birch, 1982). An average catch for a natural, unstocked coastal lake would be in the order of 15-20 fish per set (G. Reid, pers. comm.). These cutthroat were large and silvery, suggesting they may have been sea-runs or possibly piscivorous lake residents.

Most of the anadromous fish production comes from Glendale Creek, as Tom Browne Creek is very short. Pink salmon runs are reputed to peak in odd years; however, figures in the DFO escapement records (Marshall et al., 1977b) contradict that generalization and no clear pattern is evident. Pink runs up to 200,000 have been recorded. Chum runs range between a few hundred and 55,000. Coho and sockeye runs are small with less than 100 recorded in most years (Anonymous, 1988).

It has been suggested that coho production could be enhanced by stocking fry into the headwater lakes (Fielden et al., 1985); however, this plan should be reviewed carefully before being implemented, with special regard given to potential adverse effects on the as-yet lightly-utilized cutthroat fishery.

Franklin River

The Franklin River is a small system, heavily affected by glaciers, draining into the head of Knight Inlet (Figure 2). Turbidity is high and temperatures are reported to remain below 6°C year-round with August and September mean temperatures of 2.6° and 2.7°C respectively (Fielden and Slaney, 1982). Small runs of coho and chum are reported for recent years. Most recent 10-year mean escapements are <1 and 100 respectively (Anonymous, 1988). Fielden and Slaney (1982) did not observe fish in their spawning survey which was conducted to the end of October 1981. This stream has very limited fish values and no known angling opportunities. All tributary streams (Crevice, Fissure and Stanton Creeks) are glacier-fed and have characteristics similar to the mainstem.

Klinaklini River

The Klinaklini is the largest river system in the Mainland Coast Planning Unit. It extends approximately 150 km, with headwaters in the Cariboo Region (M.U. 5-6). The lower reaches, extending approximately 30 km, are extremely braided with a multitude of sand and gravel bars, meanders, oxbows and side channels (Figure 5). A canyon 35-40 km long, with numerous rapids and chutes throughout, apparently limits access for anadromous fish to the lower 33 km of river (Anonymous, 1988). Whelen and Morgan (1984) reported no anadromous salmonid adults or juveniles in the canyon reach. Upstream of the canyon the gradient is flatter for approximately 30 km. The river then branches with a northwest fork entering Tweedsmuir Park and a northeast fork draining a portion of the Chilcotin Plateau. The lower river is extremely turbid and remains cold throughout the year. It is the main contributor of glacial flour to Knight Inlet.

High water and extreme turbidity during the July 1987 survey made it impossible to determine sport fishing values. The only clear water tributary observed was Devereux (Mussel) Creek where a large school of adult chinook was holding in a pool just above the Klinaklini confluence. Steelhead Harvest Analysis data indicate that steelhead are present in the Kliniklini system. There is no information available on cutthroat or Dolly Varden in the lower reaches, but it is likely they are present. Fielden et al. (1985) observed 7 species of fish in the upper Klinaklini River. They included cutthroat, Dolly Varden, mountain whitefish, prickly sculpin, redside shiner, longnose sucker and lamprey ammocetes. They found trout densities were low in most of the upper river habitat and highest ($0.05/m^2$) in the clear water ponds adjacent to the mainstem.

DFO escapement records (Anonymous, 1988) indicate that salmon utilization of this system is relatively low for its size. Mean escapements to the Klinikini River for

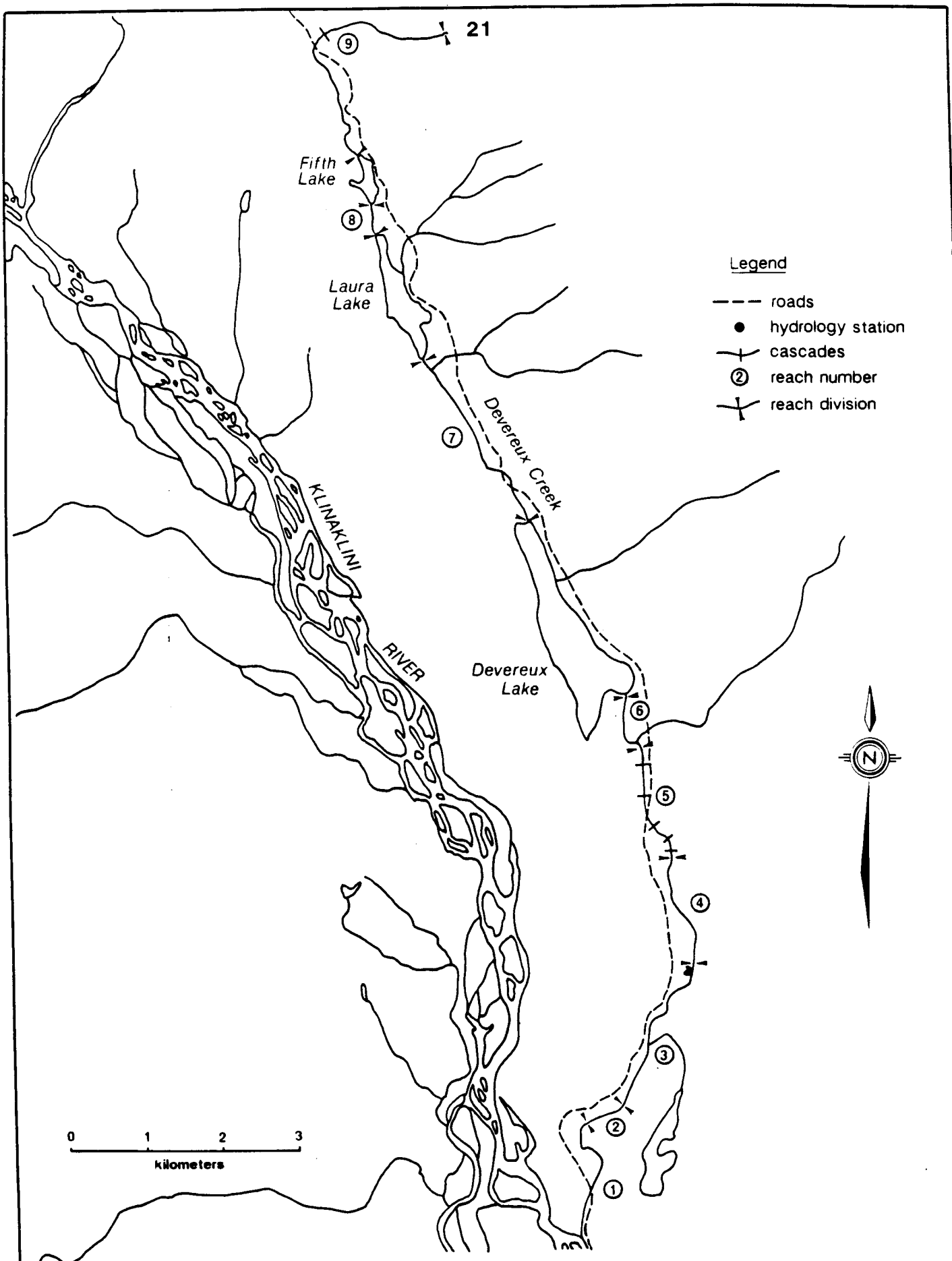

Figure 5. Devereux Creek drainage system (from Fielden and Slaney, 1982).

the 10 year period 1976-85 (with maximum recorded escapements in brackets) are: pink 83 (300); chum 3084 (20,000); coho 944 (3,500); chinook 2097 (7,500) and sockeye 202 (800). Runs of all species have declined in recent years from historical levels (Fielden and Slaney, 1982).

Angling opportunities on the Klinaklini River are extremely limited, being mainly at the confluences with clear-water tributaries such as Devereux Creek and in the relatively clear side channels and oxbows. There are no published records of sport fish catches on the mainstem; however, employees at the Fletcher Challenge logging camp reported catches of large Dolly Varden in clear side channels.

Devereux Creek (Mussel Creek)

Devereux Creek is a small system which runs into the Klinaklini River about 8 km upstream from its mouth (Figure 5). It drains a watershed of 74 km^2, is 19 km long and incorporates three lakes. The water is relatively clear year-round although several small headwater feeder streams drain icefields and contribute some turbidity in warmer weather. Stream temperatures are relatively high. Recordings taken between July 20 and October 30, 1981 (Fielden and Slaney, 1982) showed a summer maximum of 21.5°C on August 19, 1981 and a low of 7.5°C on October 23. Maximum runoff occurs in summer in response to melting snow and icefields. Flows are relatively stable due to the stabilizing influence of the lakes. A series of rapids below Mussel Lake drop 120 m over a distance of 1.75 km and constitute a barrier to pink, chum, chinook and some sockeye. Coho have been observed above this reach and steelhead, cutthroat and Dolly Vardon likely navigate this section as well. Detailed habitat descriptions of each reach are given in Fielden and Slaney, 1982. A summary of physical characteristics for each reach of Devereux Creek is given in Table 2.

REACH NO.	REACH GRADIENT	REACH LENGTH (km)	WETTED WIDTH (m)	CHANNEL WIDTH (m)	AVERAGE DEPTH (m)	SURFACE VELOCITY (m/sec)	FLOW CHARACTER (%)				SUBSTRATE COMPOSITION (%)						SIDE CHANNELS (% AREA)	% OVERSTREAM CHANNEL COVER	HOLDING POOLS	MIGRATION BARRIERS
							POOL	GLIDE	RIFFLE	RAPIDS	FINES (0.0-0.1 cm)	SMALL GRAVEL (0.1-4 cm)	LARGE GRAVEL (4-10 cm)	COBBLE (10-30 cm)	BOULDERS (> 30 cm)	BEDROCK				
1	0.5	1.2	20.0	20.0	1.20	0.5	40	58	2		85	10	5					5	1 major, numerous moderate	2 passable beaver dams
2	2.0	0.7	12.0	12.0	1.00	1.0	45	10	45		5	35	30	30			20	25	numerous small to large	numerous passable log jams
3	3.0	2.0	13.0	13.0	0.50	1.5	10	5	35	50	10	10	20	30	30		2	70	few large, numerous small	passable cascades
4	2.0	1.5	12.0	12.0	0.50	1.0	20	30	40	10	15	20	30	30	5		15	60	3 major, numerous small	numerous passable log jams
5	6.5	1.5	5.0	5.0	0.40	1.7	2	2	11	85	5	5	10	25	55			70	few small	passable cascades
6	0.8	0.8	15.0	15.0	1.00	0.7	25	75			40	35	20	5				20	4 large, few small	numerous passable log jams
7	1.5	3.0	8.0	8.0	0.50	0.7	15	25	50	10	25	25	30	15	5		25	60	numerous small to moderate	numerous passable log jams
8	1.0	0.5	5.0	7.5	0.50	0.30	15	60	15		20	45	20	15	<1	<2		40	few small/ moderate	few passable log jams
9	1.5	2.0	4.0	5.0	0.50	0.30	25	70	5		40	50	10	<2			10	5	few small	impassable cascades at 2.0 km

TABLE 2. PHYSICAL HABITAT SUMMARY OF DEVEREUX CREEK (FROM WHELAN AND MORGAN, 1984)

DFO built a small experimental hatchery for chinook below the Devereux Lake outlet in 1984, but it was removed in 1986 when the pilot project proved unsuccessful. Reasons given for abandoning the hatchery included poor water quality and a concern about endemic viral disease in the lake's kokanee population (J. Lewis, pers. comm.)

Logging has been extensive throughout the Devereux Creek watershed and the lower areas surrounding the creek have been cut during the past 20 years. Logging continues at higher elevations in the watershed.

Access for anglers is available on logging roads which run the full length of the system and are well maintained. The lakes provide access for float planes.

Snorkeling and angling surveys were not carried out on Devereux Creek.

Fielden, Slaney and Birch (1985) reported trapping 1,900 adult sea-run cutthroat, mostly in the 30-40 cm fork length size range, outmigrating from Devereux Creek between April and June 1984. Peak emigration occurred on May 14 and 15 when 276 and 282 cutthroat entered the fence trap. Several of these fish were dissected to examine gonads and stomach contents. Most females contained a few loose eggs in the abdominal cavity, indicating they were kelts. None were found with fry in their stomachs. Scales of 11 cutthroat were examined and of these, 2 were age 4+, 8 were 3+ and 1 was 2+.

A total of 12 steelhead kelts passed downstream through the fence. In addition, 138 steelhead smolts were captured at the fence trap between May 14 and 28, 1984. Before that date some additional steelhead smolts were caught but were included with the sea-run cutthroat. The peak catch of 33 steelhead smolts occurred on May 20. Scales of 25 steelhead smolts were aged and of these, 20 were 2+ and 5 were 3+.

Fish data are not available for the lakes in this system. Fielden and Slaney reported only cutthroat and kokanee spawning upstream of Devereux Lake.

A more complete evaluation of lake and stream sport fish in this system should be considered a matter of priority as fishing values appear to have good potential here. Sea-run cutthroat give indications of being one of the best populations in the study area. Coho fry outplanting in Devereux Creek should receive critical review before proceeding, as expanding the present distribution of coho within this system could have significant impacts on trout production.

Sim River

Sim River is a medium size, glacier-fed system with high summer flows of cold turbid water draining directly into Knight Inlet on the northwestern shore (Figure 2). A white-water chute approximately 3 km upstream of the mouth constitutes a fish barrier and limits salmon production. A few hundred pink and chum utilize the lower 2 km and a few coho have also been reported below the barrier (Anonymous, 1988). Some steelhead production would be possible assuming they could navigate the obstruction; however, there are no reports of steelhead above the barrier.

During the July 1987 survey in the lower reaches, the flow was estimated at 19.8-22.6 m^3/s and visibility was <30 cm. Most of the glacial sediment was coming from mainstem runoff. The McMyn Creek tributary was relatively clear. Angling in McMyn Creek and the lower mainstem produced no fish. No juvenile fish of any species were observed. More detailed evaluation during low flow conditions in April-May would be required to verify the presence of steelhead in this system.

Ahnuhati River

The Anuhati River is a medium size system which drains a watershed of 178 km^2 and flows into northwestern Knight Inlet (Figure 6). It lies in a steep, narrow valley and is fed by snow melt and numerous small icefields. It is 23 km long and there are 6 small, high altitude lakes in the tributaries (but none on the mainstem). Water levels have been observed to rise to flood conditions after 2 days of heavy rain and recede again after another 2 days (Fielden and Slaney, 1982). Spring and summer flows often exceed 14.1 m^3/s. The river could not be waded during surveys in July 1987 and May 1989. Water temperatures from July through October 1981 ranged between a maximum of 13.0°C on August 10 and a minimum of 7.5°C on October 20 and were similar in 1983 (Whelen and Morgan, 1984). The water is relatively clear, being slightly affected by glacial flour during warm weather; however, it can become quite turbid during freshets. Stream habitats are described in detail by Fielden and Slaney, 1982. Stream gradients are relatively steep (see Table 3 for a summary of physical habitat) but there are no barriers impassable to fish in the mainstem of the river for a distance of approximately 17.6 km upstream, at which point there is a 2 m waterfall. There is also an impassable falls on Tanockteuch Creek, just upstream of its confluence with the Ahnuhati.

Logging of the lower 4 km of watershed commenced in 1978 and is now completed. A 10 m wide strip of vegetation was left along the streambanks. The stream, during the July 1987 survey, showed no obvious impact of logging. The upper regions of the valley remain unlogged in early 1990; however, they are included in Fletcher Challenge Canada's 5-year development plan tabled in 1990. In 1993 the company intends to commence road building and by 1994, clearcutting of a 65 Ha block in the lower watershed. Regional Habitat Protection staff have emphasized the high fishery, wildlife and wilderness recreation values of this watershed and recommend deferral of logging plans until proposals to deal with the 10% reduction in

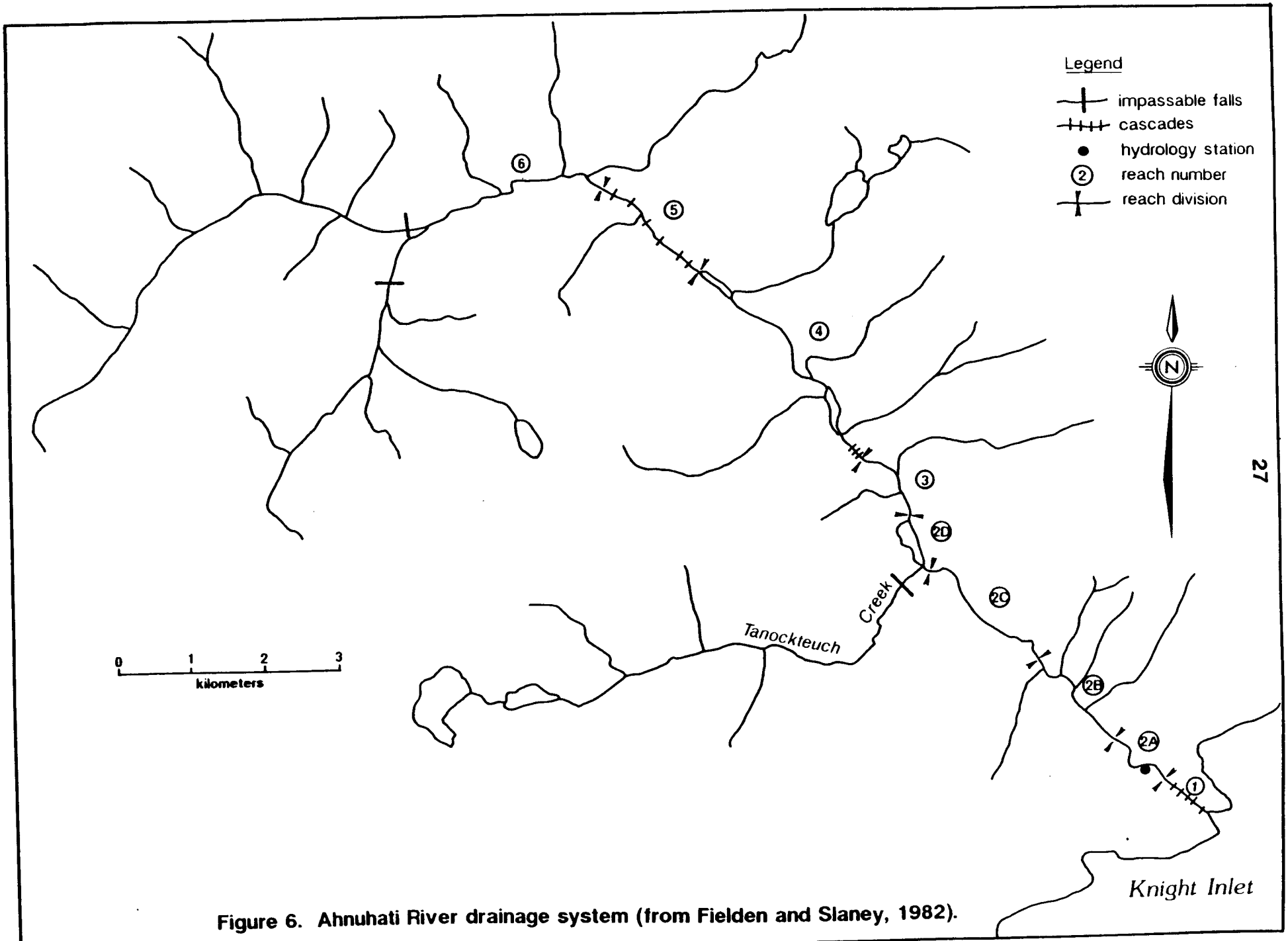

Figure 6. Ahnuhati River drainage system (from Fielden and Slaney, 1982).

REACH NO.	REACH GRADIENT	REACH LENGTH (km)	WETTED WIDTH (m)	CHANNEL WIDTH (m)	AVERAGE DEPTH (m)	SURFACE VELOCITY (m/sec)	FLOW CHARACTER (%)				SUBSTRATE COMPOSITION (%)						SIDE CHANNELS (% AREA)	% OVERSTREAM CHANNEL COVER	HOLDING POOLS	MIGRATION BARRIERS
							POOL	GLIDE	RIFFLE	RAPIDS	FINES (0.0-0.1 cm)	SMALL GRAVEL (0.1-4 cm)	LARGE GRAVEL (4-10 cm)	COBBLE (10-30 cm)	BOULDERS (> 30 cm)	BEDROCK				
1	1.0	1.0	20.0	20.0	1.3	1.5	10	25	20	45	10	10	10	35	25	10		30	2 major, numerous moderate	passable cascades
2a	0.3	1.2	25.0	30.0	1.0	0.8	30	50	20		15	60	20	5	<1		<1	10	1 major, numerous moderate	
2b	0.5	1.5	25.0	35.0	1.0	0.8	25	40	35		5	50	35	10	<1		5	5	few large, numerous moderate	passable log jams
2c	0.5	2.3	25.0	35.0	0.8	0.8	40	40	20		5	30	40	20	5		15	15	numerous large	passable log jams
2d	0.7	1.0	25.0	30.0	0.7	1.0	10	75	15		15	30	45	10	<1		30	10	numerous moderate	passable log jams
3	3.0	1.2	15.0	25.0	1.0	1.5	25	15	15	45	5	10	20	30	35		15	20	few moderate to small	passable log jams and cascades
4	1.2	4.0	12.5	22.5	1.3	1.0	15	50	25	10	5	10	20	50	15		5	15	5 large, numerous moderate	
5	4.8	2.0	10.0	15.0	1.5	1.8	40	5	5	50	10	10	10	10	60			<5	numerous small	passable cascades
6	0.9	3.5	12.5	20.0	1.0	0.7	15	60	20	5	10	30	35	25	<5		<5	<5	2 major, numerous moderate	impassable (7.0 m) falls

TABLE 3. PHYSICAL HABITAT SUMMARY OF THE AHNUHATI RIVER (FROM WHELEN AND MORGAN, 1984)

the A.A.C. as mandated by the Ministry of Forests, have been considered. Options for the area include retention in the TFL harvesting plan, inclusion in the Small Business Forest Enterprise Program, or designation as forest wilderness.

Angler access to the lower reaches is available by foot along 4 km of old logging road. There are a number of sites suitable for helicopter landing.

The July 1987 snorkel survey of the headwaters indicated no salmonid presence above the cascades at 11-12 km. There appeared to be no summer steelhead in the system. Absence of angler catches of summer steelhead in guide reports (1987, 1988, 1989) support this observation. Substantial winter runs of steelhead with a timing of February through April were apparent from samples caught by angling in the middle reaches during May 1989. Preliminary production model estimates indicate a potential population of 400 adult winter-run steelhead (Appendix, Table 1).

Angling during the July 1987 survey yielded several jack and adult chinook. These were silver fish and ranged from approximately 2 kg to over 14 kg.

Mean salmon escapements for the 10 year period 1976-85 (with maximum recorded escapements in brackets) are: coho 706 (21,000); chinook 88 (350); chum 5,000 (12,000) and pink 73,300 (340,000). (Anonymous, 1988) Pink runs are strong in even years. A summer run of extremely large (8-10 kg) chum salmon has been reported in the river's lower reaches (A. Gould, DFO, pers. comm.).

Most steelhead rearing potential is in reaches 3 and 4. Access to the upper reaches is restricted, although there appears to be suitable rearing habitat there. None of the tributaries provide suitable fish habitat due to steep gradients.

Angling opportunities on the Ahnuhati are quite high. Heli-fishing for pink

salmon has occasionally yielded daily catches in excess of 100 fish. Guide reports indicate catches of cutthroat, rainbow and Dolly Varden have declined over the past 3 years. During this same period the salmon catch (mostly pinks) showed a steady increase. The strong even-year pink escapements are reflected in these catches.

Kwalate Creek

Kwalate Creek is a small stream, 16 km long, draining into the middle of Knight Inlet on the west side (Figure 7). It is fed by snow fields and is reported to rise dramatically after heavy rain. The flow in July 1987 was approximately 4.25m^3/s. Stream gradients range from 1% to 4%. The water is extremely clear and the substrate is free of fines. A series of cascades from 400 to 500 m upstream from the mouth, with a 2.5 m falls at the top end, excludes chum and pink from the reaches above, but is navigable by summer steelhead, summer coho, a few chinook and cutthroat (Hooton et al., Regional Fisheries file data, 1985). Ideal spawning and rearing habitat exists throughout most of the 11.5 km upstream of the lower cascades and falls.

Kwalate Creek fish habitat may be summarised in 4 reaches:

(1) mouth to 400 m - fast flowing, straight channel with boulder substrate including patches of gravel and cobble;

(2) 400 m to 500 m - cascades with bedrock substrate and 2.5 m falls at top;

(3) 500 m to 12 km - irregular channel with cobble-gravel substrate and an average gradient of 2%, numerous riffles, runs and pools;

(4) 12 km to headwaters - stream divides into 2 branches, both branches obstructed to fish passage by impassable falls.

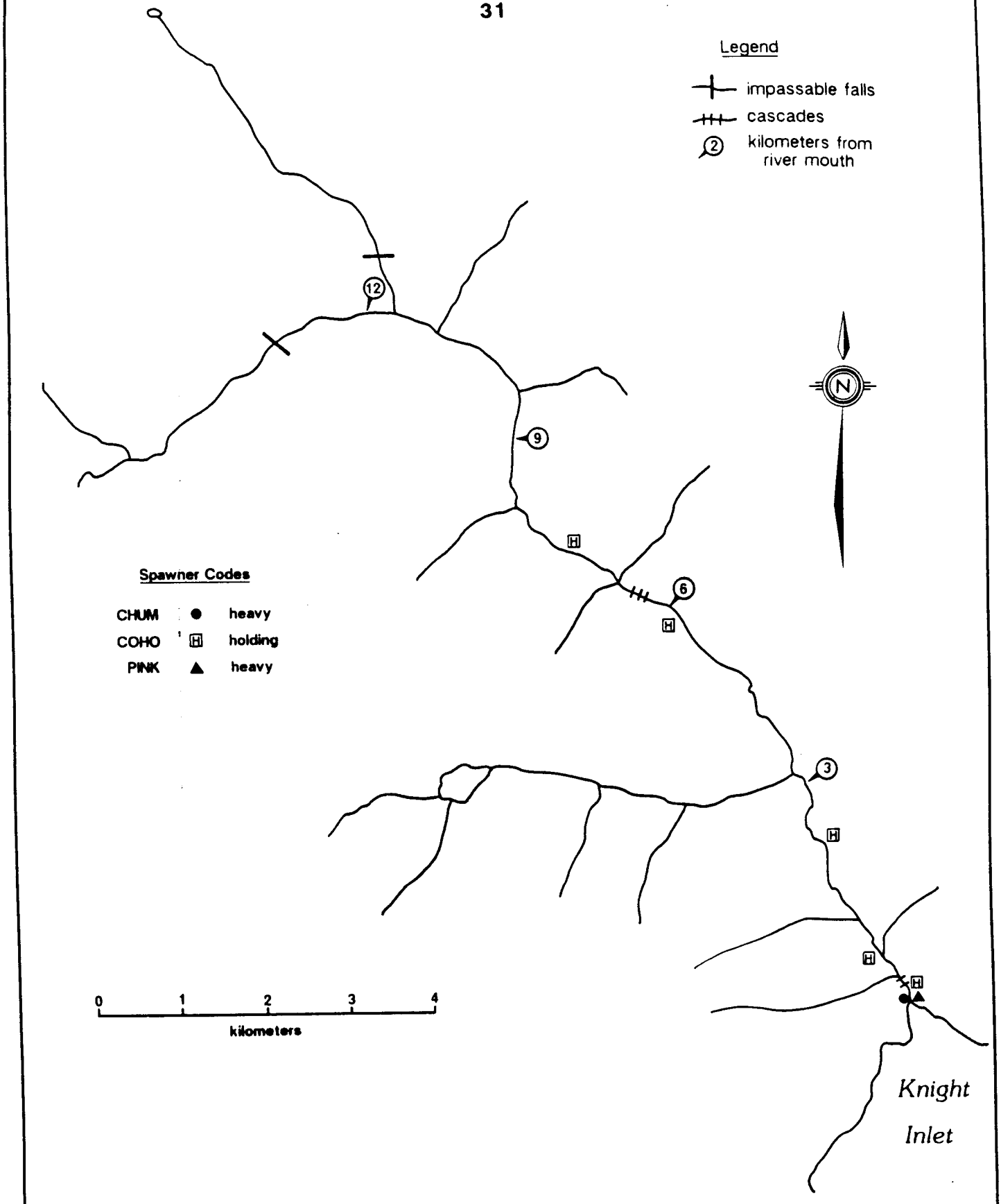

Figure 7. Kwalate Creek drainage system (from Fielden and Slaney, 1982).

Logging has not yet been initiated in any part of this watershed. It remains as a pristine wilderness area in early 1990. However, Fletcher Challenge Canada has included this watershed in their 5-year development plan for 1990. In 1992 they intend to commence road building and clearcutting 6 blocks totalling 110 ha in the lower and middle areas of the watershed, including Deflateur Creek as well as the mainstem Kwalate. A further 90 Ha is scheduled for cutting in 1993. Regional Habitat Protection staff have emphasized the high fishery, wildlife and wilderness recreation values of this watershed and recommend deferral of logging plans until proposals to deal with the 10% reduction in the A.A.C. as mandated by the Ministry of Forests, have been considered. Options for the area include retention in the TFL harvesting plan, inclusion in the Small Business Forest Enterprise Program or designation as forest wilderness.

Angler access is limited. The lower reaches are accessible by boat from Knight Inlet and some evidence of angler use downstream of the falls was noted in July 1987. Local angling guides are active on this stream.

A snorkel survey was conducted in July 1987 from a helicopter landing site approximately 100 m upstream of the canyon and falls, to the mouth. The fish counts were: 12 summer steelhead, 3 cutthroat, 2 Dolly Varden, 40 coho and 5 chinook. Only steelhead, cutthroat and coho were observed above the falls.

An angling survey in July 1987 yielded 2 fresh run summer steelhead (3.6 kg) below the falls and 1 cutthroat (35 cm) above the falls.

Mean salmon escapements to Kwalate Creek for the 10-year period 1978-87 (with maximum recorded escapements in brackets) are: pink 963 (3,500); chum 109 (750); coho 593 (3.500) (Salmon Escapement Data System Information for Subdistrict 13, 1990).

KNIGHT INLET SYNOPSIS

Knight Inlet has a number of streams with relatively healthy populations of steelhead, cutthroat and salmon. At present these are only lightly exploited, mainly by fly-in or helifishing operators and by salt water guides using freshwater fishing as an optional experience for their clients. Present fishing effort in the area is mainly focussed on the Ahnuhati River and is targetted on pink, coho and steelhead. It appears that Glendale, Kwalate, Devereux and Ahnuhati Rivers have the potential to support more angler days for anadromous fish than at present. However, stream resident fish are not abundant and are likely vulnerable to overharvesting, so conservative regulations will continue to be used where warranted.

3. THOMPSON SOUND

Thompson Sound is a relatively small inlet with one major stream, the Kakweiken River. The inlet is surrounded by 1,300 m high mountains. McAlister Creek and other small drainages to the sound, including many Kakweiken tributaries, have steep gradients and little or no recreational fishing values.

Kakweiken River

The Kakweiken is a large river draining a watershed of 310 km2 and flowing into the head of Thompson Sound (Figure 8). It is surrounded by steep terrain with many peaks over 1,525 m. There are 3 lakes on the mainstem and several others on tributary streams. An inventory of Kakweiken Lake was conducted in July 1990 (see Appendix 4). The system is fed mainly by snow melt and in spite of the influence of the lakes, wide fluctuations in flow are reported. Flashflooding and bedload transport

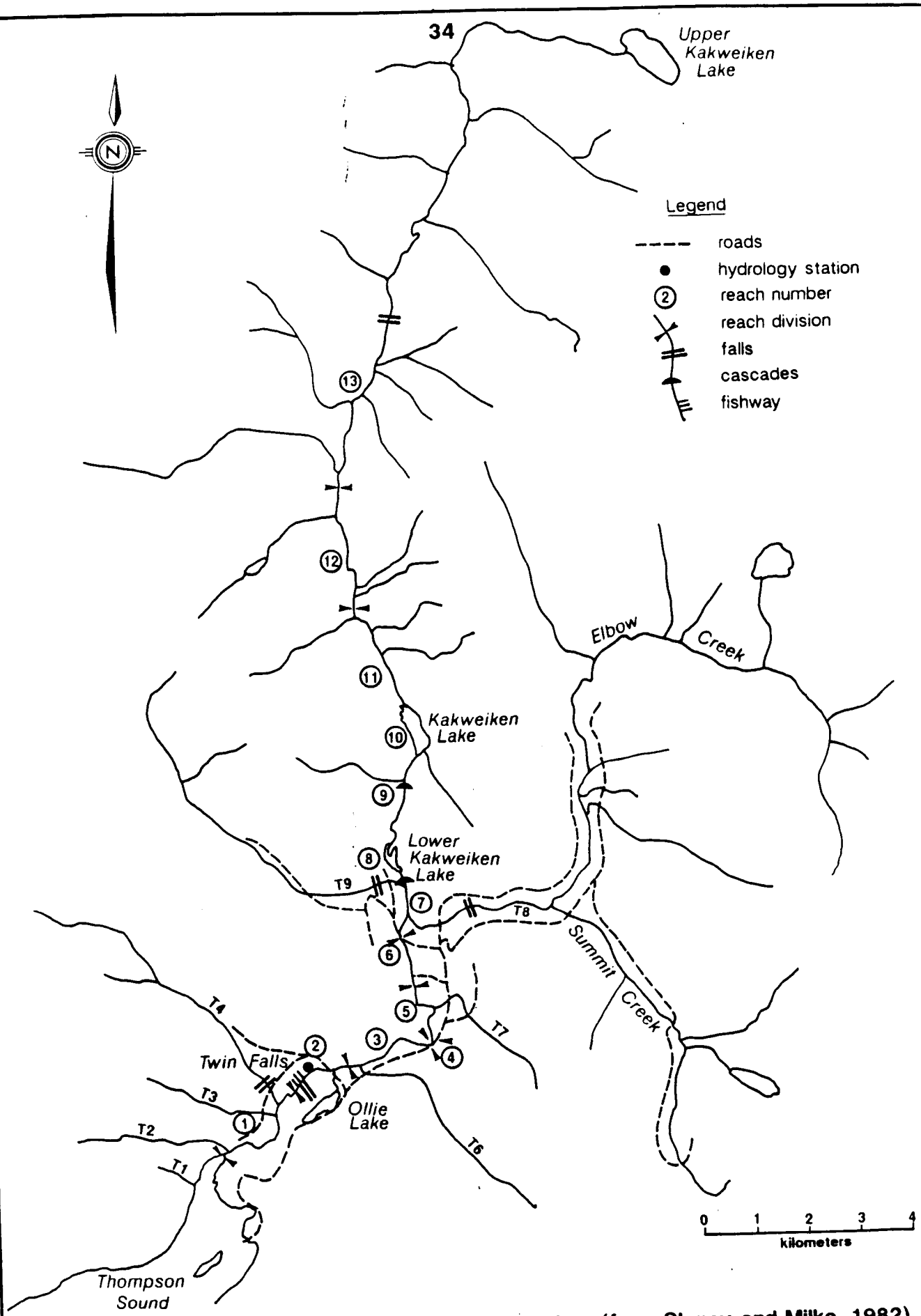

Figure 8. Kakweiken River drainage system (from Slaney and Milko, 1982).

are reported to occur in response to heavy rainfall (Wilson et al., 1979; Slaney and Milko, 1982). Temperatures from mid-July to early September in 1981 ranged between 10° and 17°C (Slaney and Milko, 1982). Observations made during provincial surveys in May, June and July, from 1987 to 1989, indicate the stream generally remains clear year-round (except during flood events). Two waterfalls (Twin Falls) located 2.7 km upstream of the river mouth constitute a barrier to fish movements; however, a fishway, originally constructed in 1964 and replaced in 1979, provides anadromous fish with access to upstream reaches. A series of cascades approximately 22 km upstream of the mouth appear to be the upper limit of anadromous fish distribution. Detailed habitat descriptions for the stream can be found in Slaney and Milko, 1982.

Kakweiken River fish habitat can be summarized in 13 reaches (Figure 8) as follows:

(1) estuary to falls at 2.7 km - low gradient, numerous shallow runs with gravel substrate <7.5 cm diameter, short section of steeper gradient with boulder and bedrock substrate from falls to first tributary downstream and deep, turbulent pool below falls;

(2) 2.7 km to 3.1 km - low gradient, series of deep pools with thin layer of small gravel over bedrock substrate;

(3) 3.1 km to 5.1 km - low gradient, approximately 35% riffles and 65% runs, substrate of 7 cm gravel throughout;

(4) 5.1 km to 5.3 km - low gradient, deep (6-8 m) pool with gravel substrate, some sand and silt in shallow areas;

(5) 5.3 km to 6.3 km - slightly steeper gradient, approximately 50% riffles and 50% runs, substrate of small (2.5-5 cm) gravel;

(6) 6.3 km to 7.5 km (six mile bridge site) - low gradient, approximately 30% riffles, 65% runs and several deep pools, substrate mainly 4-8 cm gravel with scattered boulders;

(7) 7.5 km to 8.8 km (Lower Kakweiken Lake outlet) - low gradient, approximately

20% riffles and 80% runs, substrate of small (<4 cm) gravel;

(8) 8.8 km to 9.5 km - Lower Kakweiken Lake - approximately 8 hectares, shallow (<6 m), substrate of fine silt and organic material;

(9) 9.5 km to 12.5 km (Kakweiken Lake outlet) - four distinct subsections in this reach; the first 1 km above the lower lake flows through a swamp and is a low gradient shallow and braided channel with sand and silt substrate and numerous debris jams; the second subsection comprises a short, broad pool with small (3.5-6 cm) gravel substrate; the third subsection is approximately 1.5 km of steeper gradient with a series of rapids over boulder and bedrock substrate; the fourth subsection is 0.6 km at lower gradient with shallow runs connected by fast, shallow riffles with bedrock streambanks;

(10) 12.5 km to 13.7 km - Kakweiken Lake - approximately 31 hectares, is a deep lake and has shallow bars of sand and silt at inlet and outlet;

(11) 13.7 km to 16.3 km - low gradient, swampy, meandering channel, substrate of small gravel, sand and mud;

(12) 16.3 km to 18.3 km - slightly steeper gradient, mostly runs with a short series of cascades in the middle and at the top which do not affect fish passage, gravel substrate with scattered boulders;

(13) 16.3 km to 21.7 km - steeper gradient, narrow channel, boulder substrate with gravel patches. The large cascades at the head of this reach (shown as falls in Figure 8) appear to constitute a barrier to upstream movement of salmon but may be navigable by cutthroat and summer steelhead. The mainstem above this reach (approximately 8.5 km) flows out of Upper Kakweiken Lake and has not been surveyed.

Logging activity in the lower valley began in 1973 and by 1980 the valley-bottom had been logged upstream as far as Elbow Creek. Logging was reactivated in 1988 with the reconstruction of roads. Many roads were washed out by floods during November 1989 and are currently in need of re-building.

Fishway construction to bypass the Twin Falls barrier was first attempted (unsuccessfully) in the 1920's. An aluminum steep-pass fishway was installed in 1964, but was only partially successful, being utilized only by odd-year pink runs. It was replaced with a concrete slot orifice fishway in 1979, which has proved successful in substantially increasing pink returns. A spawning channel for pink salmon was constructed by DFO during 1988-89, adjacent to reach 6 (just downstream of the Elbow Creek confluence).

Angler access and fishability were assessed in May and December of 1989. Access is available from tidewater by logging road at several points from the mouth to Elbow Creek. This section can easily be drifted by raft and is considered to have the highest angling potential in the system. It would provide a quality, semi-wilderness experience for guided or non-guided anglers. From Elbow Creek upstream access would be easiest by helicopter. The upper watershed regions, where logging has not yet occurred, would also provide a quality wilderness experience.

A snorkel survey in July 1987 on the Kakweiken mainstem revealed 2 summer steelhead, 35 cutthroat, 100 Dolly Varden, 20 chinook and 1 sockeye. Moderate densities of juvenile trout were also observed in the mainstem. Elbow Creek had moderate densities of steelhead parr (somewhat more than the mainstem) but no adult fish were observed there. A snorkel survey of the mainstem in March 1989 revealed 44 adult steelhead and no cutthroat or Dolly Varden. Other snorkel surveys (by DFO personnel: Genoe, Beggs and Campbell) saw 13 steelhead in the entire length of the river in late June 1987 and 5 steelhead in July 1987. Wilson et al. (1979) report no steelhead observed in 14 snorkel surveys on the Kakweiken between July 23 and September 5, 1977.

In their June 1987 survey, the DFO crew reported "many" cutthroat in reaches 7 and 9 (Figure 8) above and below Lower Kakweiken Lake. There were several

hundred cutthroat in each of these reaches but exact numbers could not be assessed due to large aggregations in pools where they were mixed with Dolly Varden (H. Genoe, pers. comm.). The heaviest concentration was near the Elbow Creek confluence. Reaches 1 through 6 had fewer than 100 cutthroat per reach. In July 1987, the same DFO crew reported only 6 cutthroat in reach 9 and "many" (several hundred) in reaches 7 and 3. Reaches 2,4,5 and 6 had "few" (<100) per reach. The 35 cutthroat seen during the provincial snorkel survey on July 22, 1987 were all in reach 7, indicating a decline in numbers in this reach at that time. A provincial survey in March 1989 of reaches 1 through 7 saw no cutthroat.

Angling in the lower mainstem during the July 1987 survey produced a catch of cutthroat which were all kelts with clam glochidia (larvae) attached, indicating seaward movement after an extended freshwarter residence. Angling in May 1989 yielded several bright steelhead in the lower reaches of the mainstem below the fishway.

A trap was operated in the fishway at Twin Falls between July 20 and September 12, 1981 (Slaney and Milko, 1982) to enumerate adult salmonids moving upstream. A total of 843 Dolly Varden were counted over the period and 1 steelhead (in July). Not all fish were counted, as some ascended the falls, making the fishway trap counts conservative.

Mean salmon escapements to the Kakweiken River for the 10-year period 1978-87 (with maximum recorded escapements in brackets) are: pink 300,200 (800,000); chum 3,260 (35,000); coho 7,900 (55,000); chinook 316 (750); sockeye 308 (7,500) (Salmon Escapement Data System Information for Subdistrict 13, 1990).

Downstream traps operated for DFO to enumerate outmigrant juveniles (Wilson et al., 1979) indicate that cutthroat and Dolly Varden utilize the small tributaries for

rearing; however, our surveys indicate Kakweiken Lake and mainstem reaches 7 and 9 provide the largest portion of juvenile rearing habitat.

Numbers of summer steelhead in the system are very limited. The winter steelhead are more numerous and their run likely peaks in April with most spawning in May. A steelhead production capability model estimates a potential adult run size of 600 (Appendix 1). Indications from snorkel surveys, angling surveys and trapping at the fishway suggest that the trout and char in this system, including Kakweiken Lake, are mostly anadromous. The timing of the cutthroat run appears to be April-May with spawning activity peaking in June. Adult Dolly Varden are most abundant in the river during summer and fall and appear to emigrate downstream after spawning in the fall and may either return to the sea or overwinter in the main lake.

THOMPSON SOUND SYNOPSIS

Kakweiken River and Lake are well known for their abundance of cutthroat, steelhead, Dolly Varden and salmon. They now sustain a moderately high level of angler use. Preliminary evidence suggests that trout in this system are mainly anadromous, rather than lake or stream resident, but stock status remains unclear at this time. Trout stocks in Kakweiken Lake are of special regional significance and will be more intensively evaluated in the next year.

MANAGEMENT UNIT 1-14

Management Unit 1-14 includes Kingcome Inlet, Seymour Inlet and Belize Inlet (Figure 9). The general watershed characteristics for this region are basically the same as Management Unit 1-15, that is they are surrounded by mountains and are fed mainly by glacier and snowfield meltwater. The Belize Inlet area does not contain any streams of significant size and has not been surveyed for the purposes of this study.

1. KINGCOME INLET

Kingcome Inlet (Figure 9) receives the flows of two major river systems; the Kingcome River, which drains into the head of the inlet, and the Wakeman River, which runs into Wakeman Sound, on the north side of Kingcome Inlet. Biophysical and fisheries data for these systems are sparse. The mainstems of both these rivers are strongly affected by glacial sediments and consequently the main recreational fishing values lie in the clearer trubutaries, ie., the Atlatzi and Clear Rivers of the Kingcome system and the Atwaykellesse River and Wahpeeto Creek of the Wakeman system.

Kingcome River

The Kingcome River (Figure 10) is a large, glacier fed system with a mainstem length of 32 km and a watershed area of 900 km^2. There are no sizeable lakes in the system. Discharge is mainly meltwater and flow increases in response to warmer weather. Water temperatures are generally low and turbidity high. Data on streambed gradients, substrates and barriers to migration in the mainstem are not available. Topographic maps indicate most of the mainstem is of low gradient with a broad,

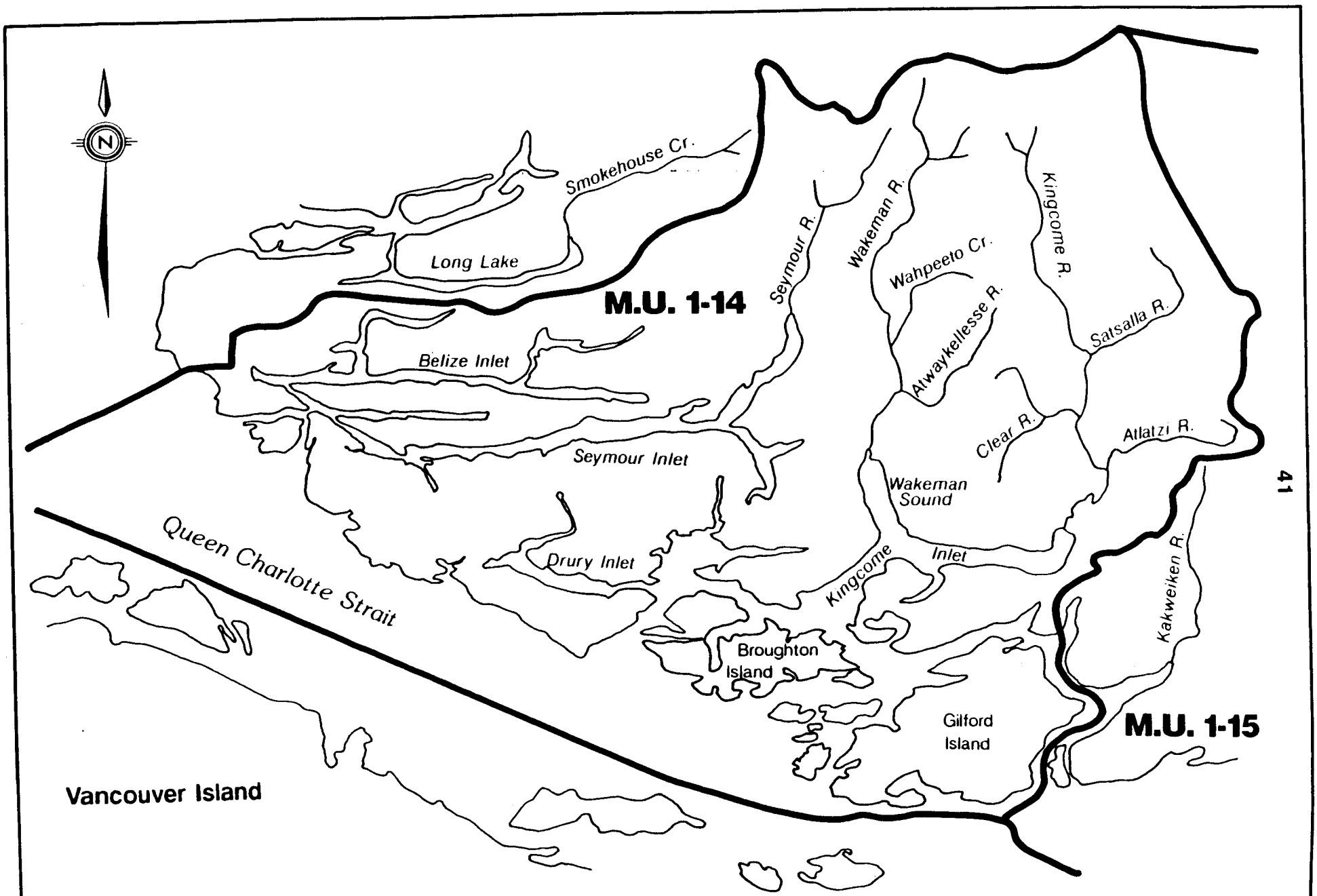

Figure 9. Management Unit 1-14.

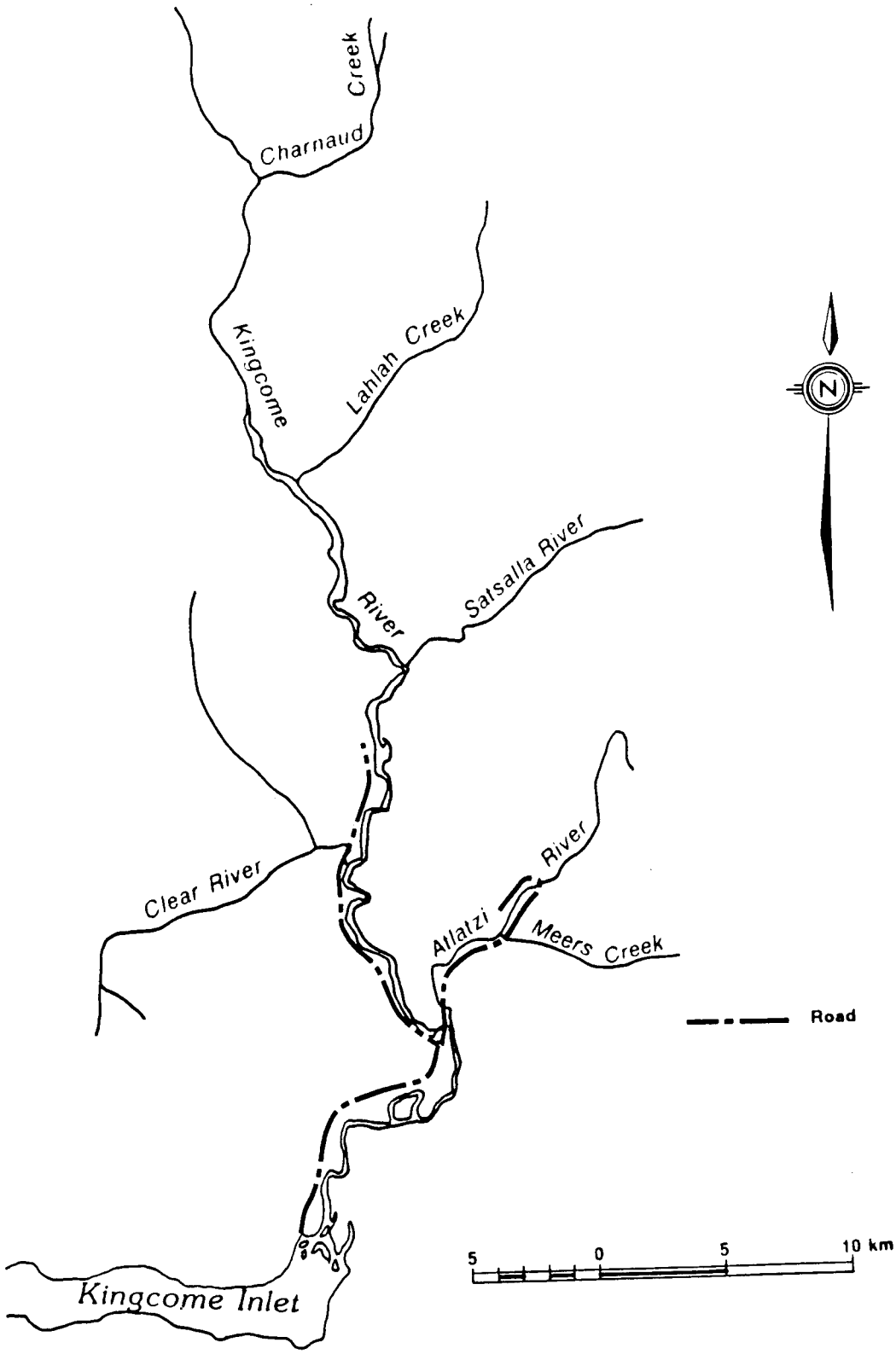

Figure 10. Kingcome River and major tributaries.

braided channel. Logging has taken place in the lower watershed from approximately Satsalla River downstream. Operations commenced in 1912 and the second growth is currently being cut.

A large Indian reserve and permanent community are located near the river mouth. Their access is by boat or aircraft only.

Angler access to the main river is available via logging roads as far upstream as the Satsalla River.

Escapement records do not differentiate runs of fish utilizing the mainstem from tributary runs (including the Atlatzi and Clear Rivers, which will be discussed below). Mean salmon escapements to the whole Kingcome River system for the 10-year period 1978-87 (with maximum recorded escapements in brackets) are: pink 13,035 (275,000); chum 4,397 (50,000); coho 1,335 (75,000); chinook 388 (7,500); sockeye 7 (3,500) (Salmon Escapement Data System Information for Subdistrict 13, 1990).

Fishing values on the mainstem Kingcome are generally low with the exception of some back-channels and tributary confluences. These areas are also important juvenile habitats, where utilization is especially high by young-of-the-year salmon (chinook, chum, pink, and coho).

Atlatzi River

The Atlatzi River is a tributary to the Kingcome with its confluence approximately 13 km upstream from tidewater (Figure 10). It is a medium size stream, approximately 20 km long, 25 m wide and has a drainage area of about 161 km^2. Water temperature in July 1987 was 11°C and discharge was estimated at 11.3 m^3/s.

The water remains clear year-round.

The lower reaches (confluence to 5.3 km) are characterized by a low gradient (<1%) and braided channel with gravel substrate. The gradient increases (1-2%) from 5.3 km upstream, the channel becomes more confined and substrate size increases to predominantly coarse gravel and cobble with scattered boulders. There is a falls barrier at 7 km. The reach above the falls for a distance of approximately 10 km has a gradient of 2-4 % and a cobble and boulder substrate.

A fish ladder was constructed on Atlatzi Falls in 1970 and was renovated in 1985. It provides access for all anadromous species.

Access for anglers is available by road from the mouth of Kingcome River which branches at the Atlatzi confluence and continues approximately 10 km up the Atlatzi valley. Sport fishing opportunities are best in the lower reaches, downstream of the falls.

A snorkel survey was conducted in July 1987, during moderate flows and visibility >10 m. High densities of coho fry and juvenile trout were seen upstream of the falls fishway. Several resident trout and a few Dolly Varden were seen above and below the falls. A group of 21 chinook with 6 summer coho were seen in the pool below the falls. An earlier snorkel survey was conducted in May 1976 under conditions of moderate flow and visibility of 1.5 - 3 m, from mile 9 (15 km) to lower bridge, approximately 2.5 km downstream. Fish observed were 4 steelhead and 1 Dolly Varden. No juvenile fish or cutthroat were observed. The habitat in that reach was described as alternating sections of long slow runs with sandy bedload and pool-riffle sections with excellent gravel substrate. Two anglers were checked the same day and had a catch of one cutthroat (30 cm) and one Dolly Varden (40 cm), caught near mile 10 (17 km).

Pink, chum and chinook spawn in the lower reaches (Anonymous, 1988), while steelhead, cutthroat Dolly Varden and coho utilize the entire accessible length of the stream. The accessible length extends to an elevation of 150 m (approximately 15 km upstream of the confluence). The best steelhead habitat for spawning and rearing is in the reaches above and below the falls (approximately 5 km to 15 km upstream of the confluence).

Steelhead run timing for winter fish appears to be March through May. There are small numbers of summer run steelhead as well. A habitat capability model estimates a total steelhead run size of 300 adults (Appendix 1).

Clear River

The Clear River is a tributary to the Kingcome with its confluence approximately 22 km upstream from tidewater (Figure 10). It is a medium stream, approximately 15 km long. The volume is approximately 10 m^3/s and estimated maximum discharge is approximately 50 m^3/s. The water remains clear year-round. A small falls (1.6 m high) and series of bedrock chutes limit access for most salmon and winter steelhead to the lower 2.75 km. The gradient downstream of the falls is <1% and the substrate is predominantly small gravel. The mean gradient above the chutes is approximately 2% and the substrate is cobble and boulders. The headwaters have a gradient of 6-8% and a predominantly boulder substrate.

A snorkel survey was conducted in July 1987 under moderately high flows and visibility >10 m. From the upper falls to "lower logging bridge", a total of 35 summer steelhead (20 in falls pool), 30 summer coho (in pools between bedrock chutes) and 3 large chinook were seen. Juvenile densities were medium to low (sparse throughout

the reach with falls and chutes).

Escapement data are not available, but distribution of salmon in the watershed (Anonymous, 1988) is as follows: coho to 6 km, chinook to 6 km, pink to 2.75 km and chum to 2.75 km. Steelhead, cutthroat and Dolly Varden are recorded as present but no distribution limits are given. It is likely they utilize at least the lower 6 km, where the moderate gradient, coarse substrate and confined channel provide ideal spawning and rearing habitat. A habitat capability model estimated a potential steelhead run size of 180 adults (Appendix 1).

Satsalla River

The Satsalla River is a relatively large glacier-fed tributary to the Kingcome River, with its confluence approximately 32 km upstream from tidewater (Figure 10). There is a steep canyon in the lower reaches which may constitute a velocity barrier for anadromous fish (local logging camp employees, pers. comm.). The gradient and streambed configuration above the canyon section appeared suitable for fish production; however, high turbidity made this impossible to assess from the air during the July 1987 survey. There are no snorkel or angling surveys currently available for this system. In addition, no DFO escapement records are available.

Wakeman River

Slightly [illegible], 4m visibility on Mar 15/01 during snorkel survey from Wahpeeto to tidewater by Lough

The Wakeman River is a large, glacial-influenced system, approximately 50 km long, draining into the head of Wakeman Sound (Figure 11). Discharge is mainly meltwater and flow increases in response to warm weather. Water temperatures are

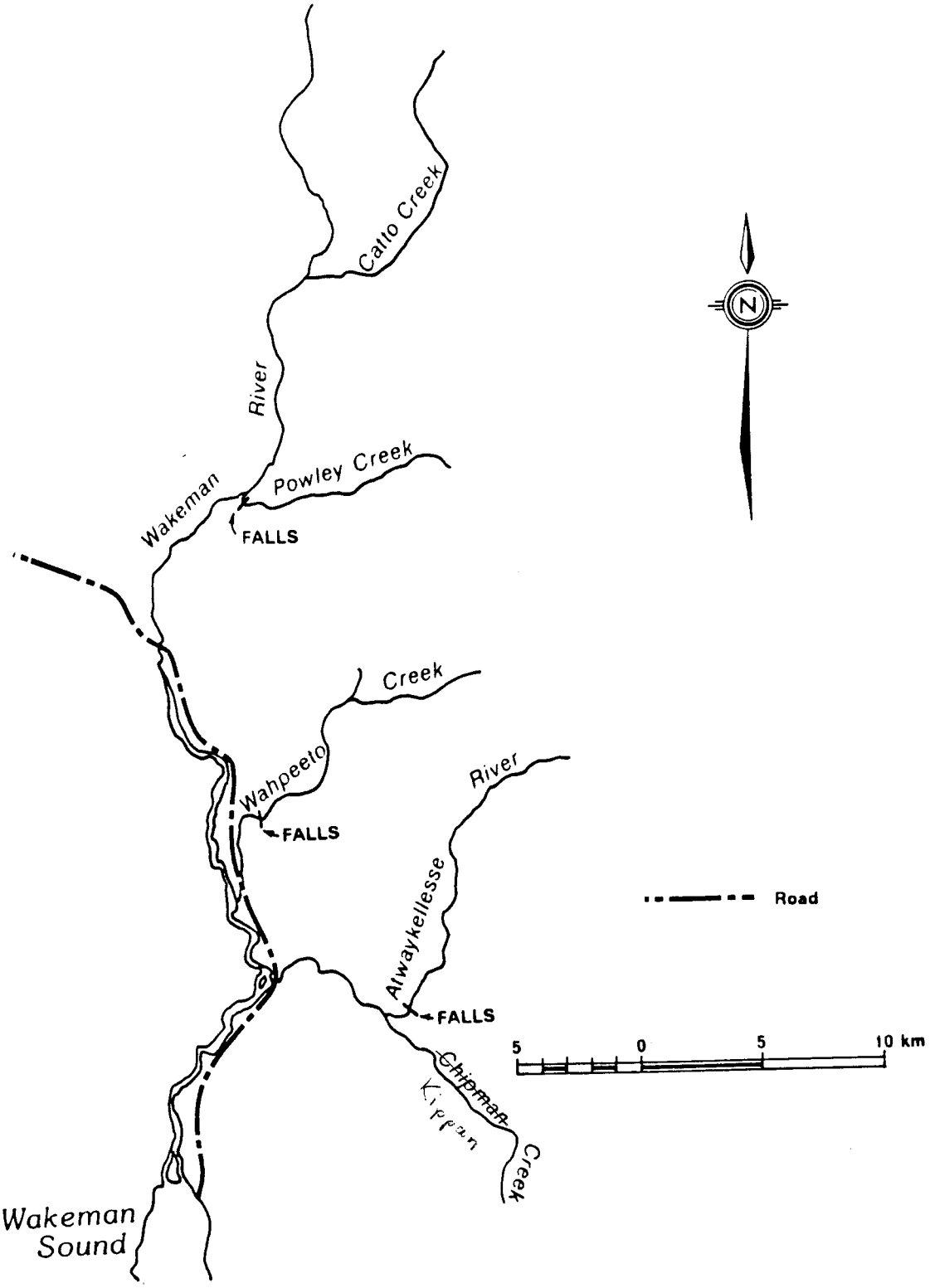

Figure 11. Wakeman River and major tributaries.

generally low. Turbidity is high in the mainstem from May to October (S. Vesely, pers. comm.). There are no barriers to anadromous fish on the mainstem; however, many of the tributaries are obstructed with falls, velocity barriers and debris accumulations (anonymous, 1988). Data on streambed characteristics and gradients are not available. The watershed has been logged in the past and logging is ongoing.

Information on angler access suggests most sport fishing occurs on the lower 20 km of the mainstem and in two large tributaries, the Wahpeeto and Atwaykellesse.

Snorkelling and angling surveys were not conducted during the July 1987 survey due to the high turbidity. There is a lack of quantitative data on escapement, distribution or abundance of adult or juvenile trout and char in the Wakeman system.

Salmon escapement records (Anonymous, 1988) only partially differentiate runs in the Wakeman from those in its tributaries. Pink, chum, coho and chinook are reported throughout the Wakeman mainstem. Both pink and chum are also reported in the Atwaykellesse and Wahpeeto, while the only tributary where chinook are reported is the Atwaykellesse. Mean escapements to the Wakeman system for the period 1978-87 (with maximum recorded escapements in brackets) are: pink, 61,200 (700,000); chum, 1,312 (20,000); coho, 1,178 (15,000); chinook, 366 (3,500) (Salmon Escapement Data System Information for Subdistrict 13, 1990).

Angling opportunities in the mainstem tend to be limited, by high turbidity, to the clear tributary confluence pools of the Atwaykellesse River and Wahpeeto Creek in spring and fall. Summer turbidity levels are too high to promote angling success. Bright steelhead (>4.5 kg) were taken from these confluence pools during an angling survey in May 1989. When the Wakeman is clearer in April and May, steelhead angling can be excellent (guide reports), especially in the lower river near the Atwaykellesse confluence. Steelhead have been reported caught as far as 25 km

upstream in the Wakeman mainstem (K. Bertram, DFO Alert Bay, pers. comm.).

Atwaykellesse River

low + tannic (3m vis.) Mar 15/01

The Atwaykellesse River (Figure 11) is the largest tributary of the Wakeman River. Its confluence is approximately 11 km upstream from tidewater, it is approximately 35 km long and 35 m wide. It is fed by snow fields and runs clear throughout the year. Temperature in July 1987 was 13.5°C and discharge was estimated at approximately 14 m^3/s.

The gradient is moderately steep with long stretches of fast water over boulder substrate, suggesting productive steelhead rearing habitat. There is an impassable falls several hundred meters upstream of the Chipman Creek confluence (Figure 11). Chipman Creek has a lower gradient with a predominantly gravel and cobble substrate. It is accessible to anadromous fish and contains good spawning and rearing habitat.

Logging has been extensive throughout the lower reaches of the Atwaykellesse watershed since the early 1970's, by BCFP (now Fletcher Challenge). Logging is currently active in the area. Most of the upper watershed remains timbered.

Angler access is limited as the logging road is not maintained and there are few suitable helicopter landing sites.

A snorkel survey was conducted in July 1987 under moderate flows and good visibility. From 1 km above the confluence with Chipman Creek to approximately 0.6 km downstream of the confluence, the following fish were observed: 1 summer steelhead, <10 Dolly Varden, moderate densities of resident trout, 25 chinook and 10 coho. In addition, abundant trout fry and parr and moderate-high densities of coho fry were observed over the length of stream snorkelled.

Salmon escapement data are not available, but coho, chinook, pink and chum all utilize the Atwaykellesse system. A habitat capability model estimates a total steelhead run size of 300 adults (Appendix 1).

Angling opportunities are limited by access, but the lower river, between the bridge and the Wakeman confluence is popular for steelhead, trout, Dolly Varden and salmon. Guide reports indicate steelhead run timing is April-May.

Wahpeeto Creek low + tannic w/ 4m [illegible] Mar 15/01 (Lough)

Wahpeeto Creek is a medium size tributary to the Wakeman River with its confluence approximately 15 km upstream from tidewater (Figure 11). It is approximately 20 km long. Data on discharge volume and temperature are not available. It is smaller than the Atwaykellesse but probably has similar temperature and discharge characteristics. It runs clear year-round.

There is an impassable barrier 4 km upstream from the Wakeman confluence. The reach between the confluence and the barrier has low gradient and predominantly gravel substrate suitable for salmonid spawning and rearing. The lower 2 km of this reach has an unconfined, braided channel with abundant large organic debris and side channels providing good habitat for juvenile salmonids.

Logging has been extensive throughout the lower reaches of the Wahpeeto watershed since the early 1970's, by BCFP (now Fletcher Challenge). Logging is currently active in the area. Most of the upper watershed remains timbered.

Information on angler access is not available, although a recognized poaching problem occurred in the falls pool immediately downstream of the anadromous barrier.

This area has now been closed by sport fishing regulation. A snorkel survey in June 1988 revealed steelhead spawning just below the falls.

Salmon escapement data are not available, but pink, chum and coho are reported spawning in accessible reaches of Wahpeeto Creek. In November 1989 a run of large "northern" coho was observed spawning throughout the lower reaches.

Angling opportunities are best in the reach between the falls and the bridge. This section can be drifted and contains several good holding pools.

KINGCOME INLET SYNOPSIS

The Kingcome River sustains a Native food fishery and some consumptive sport fishing in the lower mainstem by residents of the Interfor logging camp (L. Johnston, C.O., pers. comm.), but is otherwise not presently fished very heavily. The mainstem's large size and glacial flour load create conditions less than favourable for fish production and recreational fishing. The Atlatzi River is the main fish producing tributary in this system, but because angler access is difficult, it experiences relatively low fishing pressure. The Clear River has a small summer steelhead run and currently experiences low angler use.

The Wakeman River has become widely known in recent years for its April-May steelhead run. It is experiencing increasingly heavy guided fishing pressure on this stock. Most of the anadromous fish production appears to be from clear tributaries, notably the Atwaykellesse and Wahpeeto.

2. SEYMOUR INLET

Seymour Inlet is a large water body (Figure 9), but the streams feeding into it are all relatively small and consequently it has low potential for recreational fishing. The largest stream, Seymour River, has an impassable falls just 2 km upstream from tidewater. Two other smaller streams, Taaltz Creek, flowing into Salmon Arm and Rainbow Creek, flowing into the north side of Seymour Inlet, provide some fish production but have not been surveyed to date.

Seymour River

Seymour River flows into the head of Seymour Inlet. It is a medium size system, approximately 30 km long. Saghalie Creek, the main tributary, has its junction above the falls (Figure 12), so does not contribute to anadromous fish production. Biophysical data and watershed characteristics are not available for this system. A cursory examination in July 1987 revealed a good holding pool below the falls with the downstream reach containing suitable spawning substrate, good bank cover and several side channels providing juvenile rearing habitat.

Logging has been extensive throughout the mainstem drainage since the 1950's, with most activity carried out by Whonnock (now Interfor), since the early 1970's. Some of the upper mainstem and most of the side drainages remain timbered, due to difficulty of terrain for roadbuilding. Current activity in the area is limited to "specialty logging" and small blocks on the upper mainstem and tributaries are being harvested by helicopter and balloon.

There are no recent escapement records for this system, but the lower 2 km are reputedly utilized by pink, chum and coho. Run sizes are probably small, due to

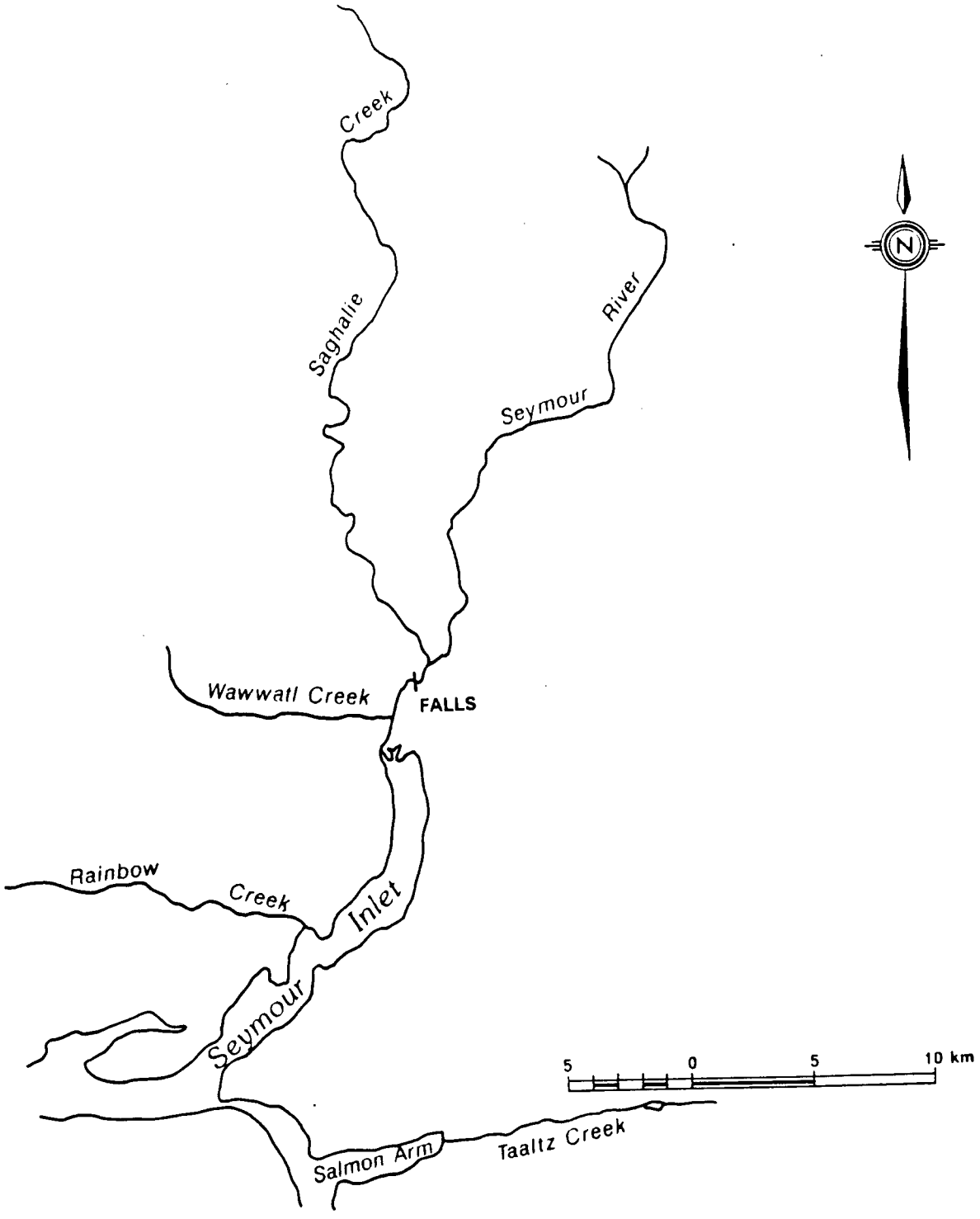

Figure 12. Major streams draining into Seymour Inlet.

the short section of accessible stream. DFO escapement records prior to 1976 indicate highly variable escapements of coho (200 to 2,500) and chum (450 to 35,000) and an unknown escapement of pink salmon (Marshall et al., 1977c).

Small numbers of steelhead and cutthroat likely utilize the stream, but there are no records to confirm this.

Angling opportunities are limited. There is a helicopter landing site available at the falls pool. Coho fishing is reported to be excellent in that pool, as the entire run aggregates there during the September-October spawning migration.

SEYMOUR INLET SYNOPSIS

Recreational fishing values are low in the Seymour Inlet area, due to the short accessible length of the Seymour River and small size of the other streams. The only known fishery of any note is for coho in the falls pool of the Seymour River. Concern for reduced coho escapements in recent years resulted in DFO imposing more restrictive daily catch and possession limits (1 per day, 2 in possession) on coho in the 1990-91 licence year.

DISCUSSION

Biophysical constraints including cold thermal regimes, low dissolved nutrient levels, glacial silt loading, short growing seasons and limited productive stream lengths due to barriers are applicable in some degree to all the systems of the Mainland Coast Planning Unit. In addition, periodic flood events with associated problems of bank erosion, substrate instability, sand and silt deposition and debris torrents provide further constraints. Those factors combine to limit the productivity of these systems for sport fish and it is this innately low productive capability that will dictate direction and scope of management strategies for the area. While the quality of recreational fishing is good in many of these systems, it must be recognized that their ability to sustain a high level of fishing pressure is limited. These systems are particularly vulnerable to localized overharvest of resident and anadromous fish stocks (eg., in the proximity of seasonal logging camps or from increased exposure in sport fishing circles where media publicity or word of mouth result in increased angling pressure from guides and resident anglers). As a result, the status of fish stocks and angler effort need to be monitored and carefully regulated if opportunities for high quality fishing experiences are to be maintained.

Logging activities within the Mainland Coast Planning Unit have obvious potential impacts on stream habitat quality. Besides direct habitat perturbations which occur, the increased or extended road access into pristine habitats with unfished or lightly fished populations can create conservation concerns. Also of importance is the potential impact on aesthetic values associated with the wilderness recreational fishing experience. This is particularly true for licenced angling guide operations, especially on the designated Class II streams. (A Class II stream is one where the level of guided use, and of non-Canadian, non-guided use, is restricted. There is no restriction on B.C. residents.) Opportunities for resident and non-resident anglers to experience quality fishing in undisturbed wilderness are already limited and logging has the

potential to further reduce the remaining pristine watersheds. Considerable revenue is generated by the newly developing resort-based guided fishing industry and it depends heavily on preservation of these remaining wilderness areas. Nearly all the watersheds in the Planning Unit have been logged to some extent in the past and logging is ongoing in many of the areas. There are a few watersheds such as the Ahnuhati and Kwalate, which have been identified as potential provincial wilderness reserves by the Ministry's Wildlife Branch. The logging companies concerned have agreed in principle with the concept of removing these areas from the TFL to establish wilderness reserves, but it remains to be seen if Ministry of Forests will approve such a recommendation.

Another potential threat to the recreational fisheries of the Mainland Coast Planning Unit is development of salmon enhancement facilities, especially spawning channels for pink and chum salmon. A number of concerns have been generated by these developments including:

(a) loading of stream substrates with fines as a result of construction activities and later from channel scarification as part of routine maintenance, which can severely degrade spawning and rearing habitat in the natural stream;

(b) diversion of water into enhancement facilities which reduces flow in the adjacent natural channel, impacting rearing habitat and detracting from fishability;

(c) diversion of migrating trout into spawning channels (as observed at the Glendale channel) which may delay or impede movement to critical over-wintering and spawning areas;

(d) diversion of migrant juvenile trout into water intakes for enhancement facilities which may reduce recruitment to natural rearing habitats;

(e) the obtrusive appearance of spawning channels and attendant facilities which impact on the natural aesthetics and detract from the wilderness angling experience; and

(f) enhancement of salmon stocks which promotes commercial net fishery effort, potentially increasing the interception of non-target species. These mixed-stock

fishery effects would likely impact most strongly upon summer steelhead, but coho and chinook may be affected as well.

Salmon enhancement may also include development of hatcheries for coho and chinook, which should also be regarded cautiously. Outplanting of coho fry, if poorly planned and done unilaterally, could lead to competition with trout for limited rearing habitat, particularly in small lakes. There is a need to accelerate the pace of lake and stream inventory where salmon outplanting programs are planned.

RECOMMENDATIONS

Low natural productivity, as well as logging impacts and potential problems associated with salmon enhancement, all combine to limit the habitat capability for sport fish production in many of the mainland coast streams. This reduces the ability of sport fish stocks to recover quickly following heavy exploitation and necessitates conservative management strategies. Regulations such as catch and release for steelhead and trout, reduced bag limits, species closures, year-round bait bans and closed areas are already in effect on many mainland coast streams to reduce sportfish exploitation where the need is recognized. Continued vigilance is required to monitor stock status and prescribe management actions as they are needed. It is already recognized that fishing pressure on the designated Class II streams has reached optimal levels and that illegal guiding and poaching problems are occuring in some instances (L. Johnston, C.O., pers. comm.). Surveillance on these systems is essential if regulations are to be effectively enforced and stocks maintained at healthy levels. This will help ensure preservation of the quality angling experience. The following recommendations address the most urgent concerns of regional fisheries managers:

1. The presence of licenced guides and legitimate fishermen may, to some extent, provide a "watchdog" service to monitor certain detrimental activities in the watersheds such as careless logging or mining practices or even poaching and illegal guiding. However, while the presence of guides and legitimate fishermen may serve as a partial deterrent to some of those practices, there is an obvious need for more frequent surveillance by the Ministry's Conservation Officers.

2. The mandatory requirement that guides provide catch and effort data for waters where they operate, as part of their planning and reporting for licencing purposes, should be continued as it provides a readily accessed and useful source of information for monitoring the state of stocks and recreational fishery usage on most of the fishing

streams in the mainland coast Management Units.

3. Initiatives to establish wilderness reserves on systems such as the Ahnuhati and Kwalate should be strongly endorsed by our Ministry so that part of this magnificent wilderness with its associated quality sport fishery can be retained in its pristine state.

4. Freshwater angling for commercial net species (pink, chum and sockeye) should be seriously considered in streams where harvestable surpluses are known to exist. This practice may be particularly relevant for systems with spawning channels. Pinks especially are becoming an increasingly popular sport fish in streams and are readily caught on the fly. They are abundant in many of the mainland coast streams and should withstand a conservative sport fishery harvest, thus relieving some pressure on other, less productive species such as as cutthroat and Dolly Varden.

5. Cutthroat and Dolly Varden stream populations are vulnerable to over harvest and are usually among the first stocks to seriously decline under intense angling pressure. Catch and release regulations already apply to wild steelhead year-round and to cutthroat from October 1 to May 31. Special restrictions on trout and char have been introduced for specific mainland coast streams and lakes in the 1990-1992 Regulations Synopsis. A close watch on the effectiveness of these restrictions should be maintained so that timely remedial action can be implemented if necessary.

6. Salmon enhancement projects such as the Glendale and Kakweiken pink spawning channels need to be carefully watched and good liason maintained with DFO to keep abreast of current and proposed activities. Channel scarification requires special attention and on-site monitoring at the time of implementation is strongly recommended in order to monitor operations and minimize impact of downstream effects. Other concerns with spawning channels should be monitored on an ongoing basis.

7. Guidelines should be established for steering outplantings of coho away from lakes and streams where native trout and char may be impacted. DFO's ongoing plans for outplanting fry should be monitored so that timely recommendations can be made where conflicts of interest might occur. For example, more complete evaluation of lake and stream sport fish in the Devereux Creek system and review of DFO's outplanting plans for that system should be considered a matter of priority as recreational fishing values appear to have good potential there. Sea-run cutthroat give indications of being one of the best populations in the study area. Expanding the present distribution of coho within this system could have significant impacts on trout production. Similar attention should be afforded to proposed coho fry outplantings on the Glendale/Tom Browne system.

8. Biophysical inventory of mainland coast streams should continue in order to address obvious gaps in our resource knowledge. In the face of rapidly developing guide operations on five major river systems (Ahnuhati, Kakweiken, Kingcome, Seymour and Wakeman) improved knowledge of habitat and fish populations is required. With growing angler interest in mainland coast streams it is inevitable that angling guides (in particular) will expand operations to include streams not currently utilized and those not yet inventoried. Ongoing resource evaluation should be designed to update information on high priority waters and those where angler interest is just starting to flourish (ie. Stafford, Glendale and Kwalate). Snorkel surveys, habitat capability assessment, angling and review of guide reports should continue to be major tools in this regard.

Priorities for more intensive biophysical inventory as presently conceived would be:

1. Wakeman River and tributaries
2. Kakweiken River and tributaries
3. Glendale/Tom Browne system, including lakes
4. Ahnuhati River
5. Clear and Atlatzi Rivers (Kingcome watershed)
6. Kwalate Creek
7. Seymour River
8. Apple River
9. Ahta River
10. Devereux Creek and lake (Kliniklini watershed)
11. Stafford River
12. Waump Creek

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APPENDICES

APPENDIX 1.

Table 1. Physical habitat and steelhead production capability estimates for selected mainland coast streams

Stream	Total Area (km^2)	Anadromous Area (km^2)	Producing Length (km)	Potential Steelhead Production * Smolts	Adults
Ahnuhati	189	150	10	2800	400
Kakweiken	317	210	20	4000	600
Atlatzi	161	100	10	2000	300
Clear	139	65	10	1200	180
Atwaykellesse	177	100	10	2000	300
Seymour	420	-	3	-	-
Wakeman	765	-	-	-	-
Apple	176	-	5 **	1000	150

* Based on F.I.U. Victoria model:

smolt yield = .916 + 1.383 log drainage area(D.A.) - .1 (log D.A.)^2

smolt to adult survival of 15%

** Winter run

APPENDIX 2.
MAINLAND COAST STREAMS INVENTORY
MAY 1 - 2, 1990

OBJECTIVES and PROCEDURES:

As part of the ongoing cataloging of inventory data for the Mainland Coast Streams in Management Units 1-14 and 1-15, to conduct a two day helicopter survey of the following streams:

Day 1,

Apple River
Stafford River including Stafford Lake
Heydon Creek
Glendale/Tom Browne Creeks
Ahnuhati River

Day 2,

Wakeman River including Wahpeeto Creek and Atwaykellesse River
Ahta River
Kakweiken River including Kakweiken Lake

The specific objectives for each stream were to:

1) determine presence or absence of steelhead and other sport fish and estimate their abundance and distribution by snorkelling and angling;
2) assess steelhead run timing by examining colour and condition of fish observed and caught;
3) determine age of sampled fish by scale examination;
4) locate spawning areas by low altitude, slow overflight and by snorkelling;

5) make general assessments of stream habitat on video tape and through 35 mm SLR photographs; and

6) make visual assessments of the effects of logging, spawning channel development and the November 1989 flood event on stream habitats.

OBSERVATIONS:

Day 1

Apple River

Overall channel width approximately 50-75 m, flow approximately 150 cfs, temp 6.0°C at 0850 h, water relatively clear (underwater visibility approximately 3-4 m).

Overflight indicated stream habitat can be divided into five main reaches (distances are rough approximations only):

(1) mouth to 5 km - low gradient, sand substrate (lower 2 km) and gravel (upper 3 km), channel braiding, abundant LOD and instream cover in the lower and middle sections, several holding pools in the upper section, good habitat for pink and chum spawning and for juvenile coho in the lower and middle portions of this reach grading into suitable steelhead habitat in the upper part

(2) 5 km to 7 km - moderate gradient, gravel and cobble substrate, more confined banks and less LOD, good streamside vegetation cover, good steelhead habitat with riffle, run and pool sections

(3) 7 km to 9 km - steep gradient, large cobble and boulder substrate, confined channel, several falls (approximately 2-3 m high), bedrock chutes and broken water throughout with no apparent holding water, may constitute barrier to upstream movement of most anadromous fish

(4) 9 km to 14 km - moderate gradient, gravel and cobble substrate, side channels and flooded meadows adjacent to stream, several large pools in addition to good

riffles and runs, habitat appears good for steelhead (if they can access it)

(5) 14 km to headwaters - steep gradient, large boulder substrate, lots of broken water, very little suitable fish habitat, stream forks into 2 branches.

There is no recent logging activity in this watershed; however, it has been logged in the past and much of the lower valley appears to have regenerated naturally with mixed deciduous trees, mostly alder, and clumps of conifers, mainly spruce. Two bridge crossings were observed near the lower and upper ends of reach 3, but neither of these old logging road bridges appeared in sound condition. The roads are completely overgrown, thus making foot access from the estuary difficult.

There are at least 12 suitable helicopter landing sites near fishable water on reaches 1, 2 and 4.

The aftermath of last November's flood event is obvious with severe scouring in most of the small tributaries and several debris torrents on the slopes feeding the Apple River. Large amounts of fresh trees, other woody debris and sand have washed into the river channel. There were several obvious channel changes in the lower river.

Spawning fish were not observed at tail-outs during overflight.

We landed at 3 sites to conduct angling and snorkel surveys: near the upper end of reach 1 just below a washout, reach 2
beside a riffle-pool-run stretch and above a pool in the lower region of reach 4, just upstream from the barrier section. Angling yielded one 3 kg male steelhead in a dark condition in reach 1, a 4.5 kg female steelhead kelt in reach 2 and no fish in reach 4. Spot swims (approximately 0.5 km of stream length) at each landing site revealed 6 steelhead in spawning condition in reach 1 and 4 steelhead plus evidence of two

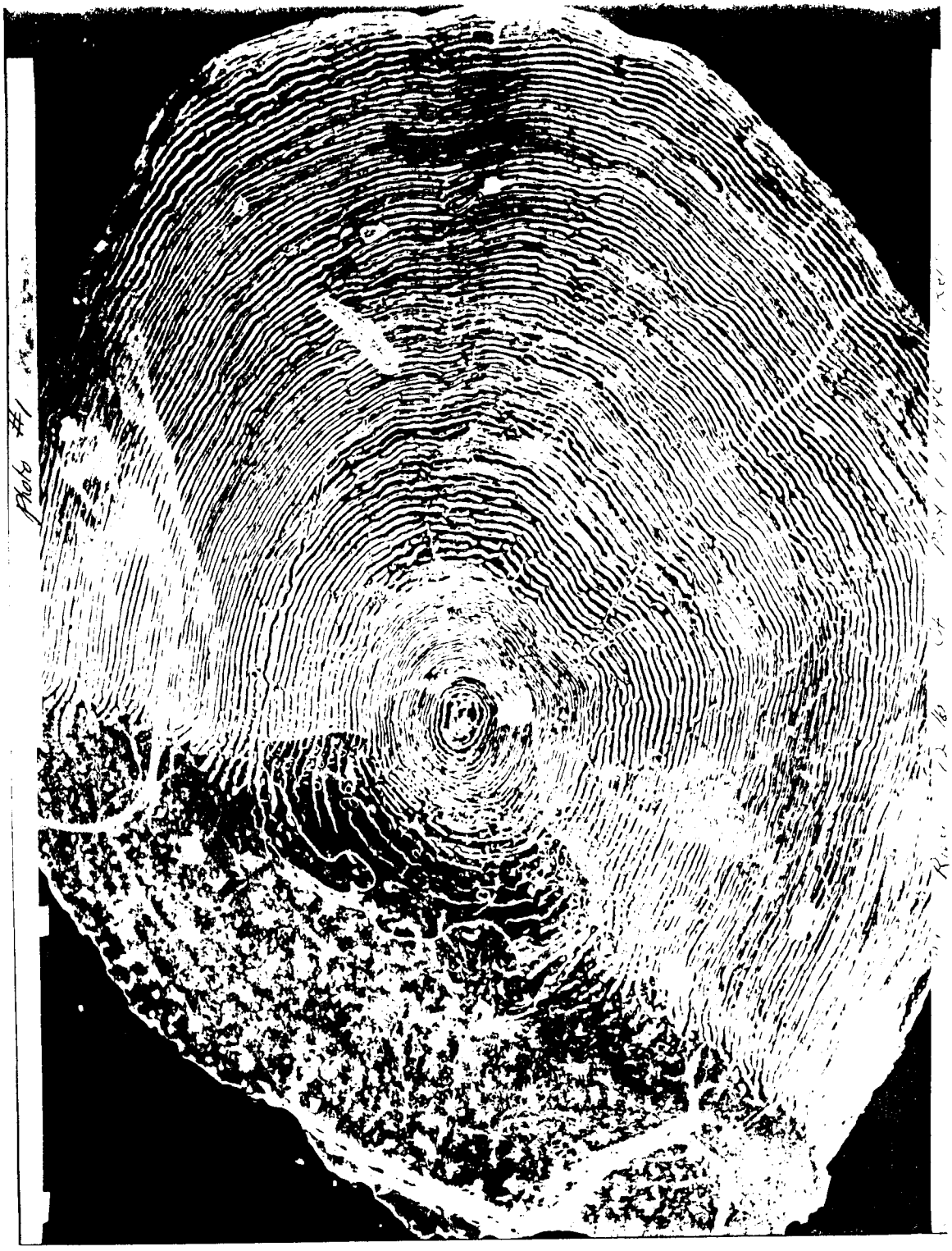

Photo 1. Scale from Apple River steelhead (female, approximately 4.7 kg, kelt) taken by angling May 1, 1990 in reach 1. Age 3.3

or three redds and a sculpin in reach 2. No fish or redds were seen in reach 4. No juvenile fish were seen at any of the sites.

Colour and condition of the steelhead observed would be consistent with a run timing of February to April. Scales sampled from the 4.7 kg female steelhead angled from reach 1 indicated an age of 3.3 (Photo #1). The freshwater growth circuli were very light, indicating slow growth in a relatively cold, sterile environment.

Stafford River

Good size stream with flow approximately 700-800 cfs, temperature 7.5°C at 1145 h, water relatively clear.

Overflight revealed only a short length of stream accessible to anadromous fish (approximately 1 km). Spawning habitat is severely limited as most of the substrate above tidewater is largely cobble, boulder and bedrock with a moderately steep gradient. The barrier is a canyon with steep bedrock chutes and a high waterfall at the downstream end. Fraser Creek, a small tributary with a flow of approximately 30-50 cfs enters the river in the tidal region. This tributary has suitable spawning habitat in the lower region we observed from the ground.

The watershed downstream from the lake, including the north side of the lake, was logged in the 1950's and 60's and has regenerated naturally with mixed deciduous and conifers.

One helicopter landing site is available adjacent to fishable water on a rocky bar near the river mouth, at the Fraser Creek confluence.

Angling and snorkelling at the landing site on the lower river yielded no fish.

Stafford Lake inlet has a low gradient, sand and small gravel substrate with abundant LOD, including lots of fresh woody debris from the flood last November. The channel is braided and has evidence of channel changes from the flood. Approximately 5 km upstream from the lake the gradient increases, substrate becomes predominantly cobble and boulder and the channel is more confined.

The steep, rocky slope on the south side of the lake and the watershed above the lake have not been logged.

We landed on the extensive sandbar at the lake inlet and angled on the drop-off. The catch was 5 small rainbow trout. The two largest (approximately 25 and 30 cm) were scale sampled (Photos 2 and 3). They appeared to be slow growing and quite old (5 and 8 years respectively) for their size.

Footprints in the sandbar indicated other anglers had recently been in the area, likely using floatplane access as no evidence of helicopter landing was seen in the sand. Foot access from the estuary would be exceedingly difficult.

Heydon Creek

We landed briefly at the mouth of Heydon Creek to refuel. It is a small stream with a low gradient and a flow of approximately 75 cfs. The watershed has been logged in the past and has regenerated with deciduous trees only. A resident of the logging camp there said it has good runs of sockeye, coho, chum and cutthroat. There is a large lake in the system which looks very productive, with shoal areas and good spawning reported in the inlet and outlet streams (logging camp resident, pers. comm.).

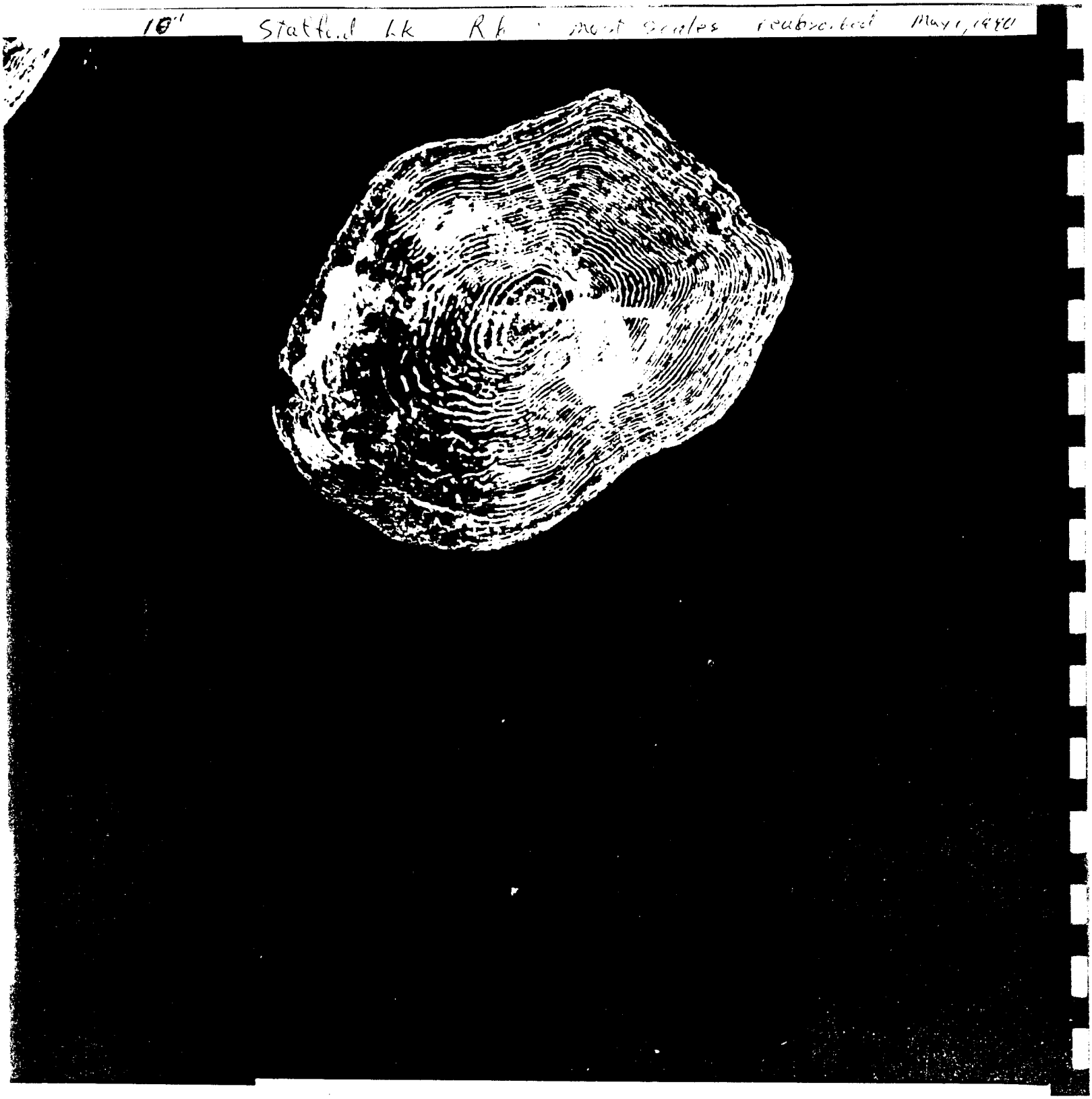

Photo 2. Scale from Stafford Lake rainbow trout (approximately 25 cm FL) taken by angling May 1, 1990 at lake inlet. Estimated age 5 years.

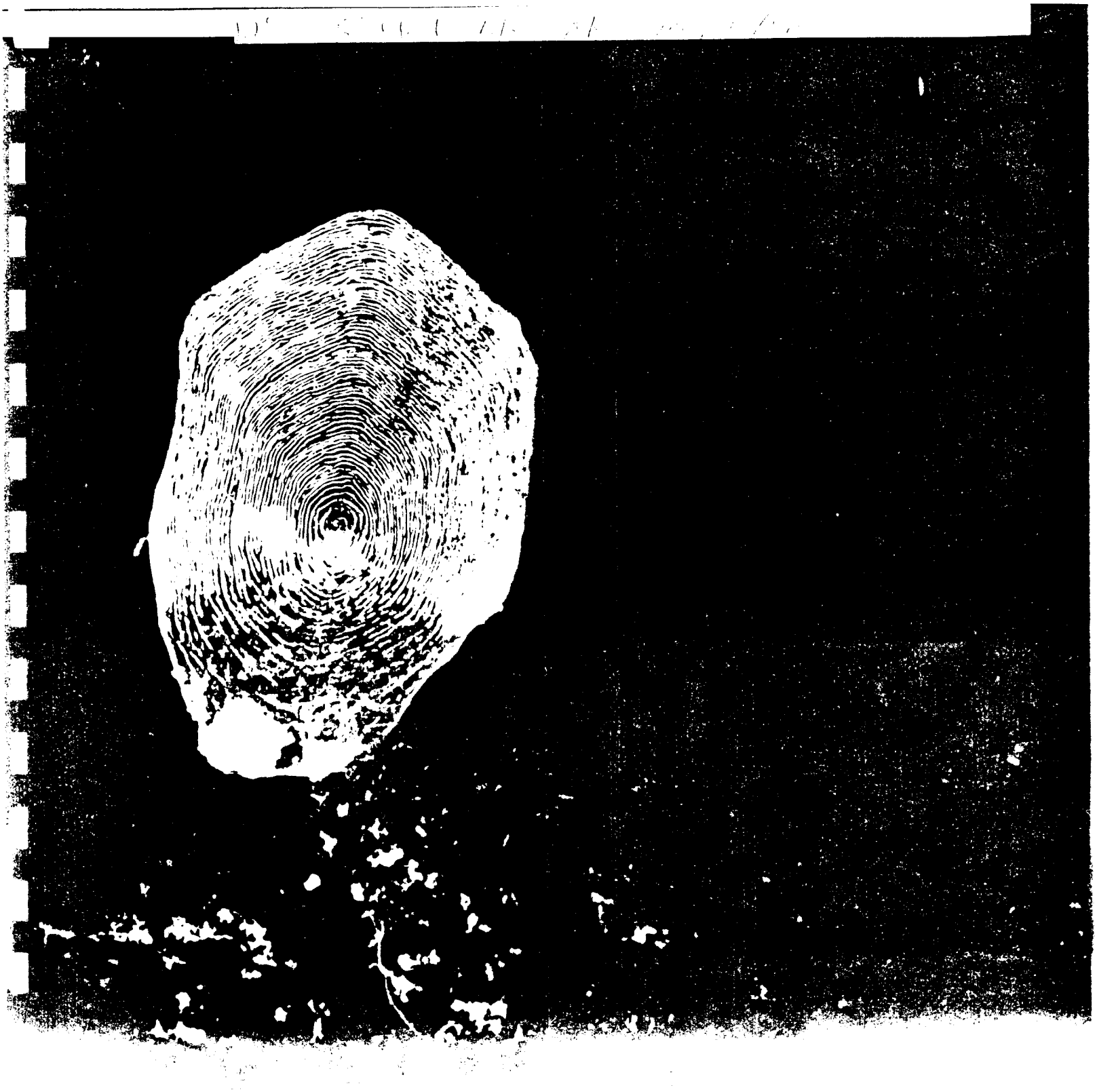

Photo 3. Scale from Stafford Lake rainbow trout (approximately 30 cm FL) taken by angling May 1, 1990 at lake inlet. Estimated age 8 years.

Glendale/Tom Browne Creeks

Glendale Creek.

Estimated flow was 50-60 cfs, temperature 8.5°C at 1555 h and water clear but tea colored. There appeared to be little damage from the November, 1989 flood.

Snorkelling in the pool at the head of the spawning channel revealed no adult fish there. Snorkelling in Glendale Creek adjacent to the spawning channel revealed approximately 100 adult cutthroat in two pools and two steelhead (one male was approximately 6.5 kg). Most of the cutthroat were kelts. Steelhead colour and condition were consistent with a March-April run timing. Coho and steelhead smolts were also seen in the stream here.

Angling yielded four or five cutthroat, all kelts. Juvenile coho, steelhead and cutthroat were feeding aggressively in the stream, pecking at the roe baits during the angling survey.

The "bear bangers" were tested here and made impressively loud noises. Although no bears were present to confirm it, the concensus was that the noise would have deterred any.

Tom Browne Creek.

Temperature in the Tom Browne Channel was 11.5°C at 1555 h. The substrate in the spawning channel appeared to be free of fine sediments. There was a vigorous algal growth on the channel substrate. Coho fry were observed along the edges of the channel.

A spot swim was done in the pool at the spawning channel inlet and no adult cutthroat were seen there. Snorkelling in the forebay to the outlet at Tom Browne Lake revealed no fish above the weir. Below the weir, 15-20 cutthroat (mainly juveniles) and 2 Dolly Varden were seen in the plunge pool below the first small falls (just below the first bridge crossing). These cutthroat were highly colored with conspicuous spotting and broken black adipose margins. It is noteworthy that these fish were upstream of the main falls and downstream of the small falls at the bridge. Their colouration and location suggest these cutthroat were lake residents moving downstream. The swim was abandoned at this point because of a torn dry suit.

Ahnuhati River

Water temperature was 7.5°C in late afternoon and water was relatively clear.

Overflight from estuary to headwaters revealed good steelhead habitat in this stream. No spawning fish were seen on tail-outs.

The lower 4 km of the watershed was logged post-1978 and is regenerating naturally with mixed deciduous and conifers. Most of the watershed remains in a pristine condition and exhibits a spectacular natural beauty.

Evidence of the November, 1989 flood is present in the form of trees and other woody debris in the stream channel and high up on the banks. The banks are stable and there is little evidence of erosion or channel changes. The substrate did not appear substantially affected by fines.

We landed below the "boulder run" and angled for about 1 hour. Four steelhead were hooked and two were landed, a dark male and a female kelt. All four of these

fish were a good size, in the 90 cm, 6.5 kg range. The color and condition of the steelhead was consistent with a January - March run timing.

Day 2

Wakeman River

Wahpeeto Creek.

Estimated flow 400-500 cfs, temperature 6.0°C at 1030 h, water relatively clear (underwater visibility 3-4 m).

Snorkel survey was conducted from falls pool to first bridge crossing (approximately 1.5 km) with 2 swimmers. Fish seen were: 45 steelhead, 1 rainbow trout, 1 Dolly Varden. Approximately 75-80% of the steelhead were .3 ocean fish (several males were in the 9+ kg range). The dark colouration of most of the steelhead was indicative of March - early April run timing; however, several bright does were seen as well, indicating some fish may come in later.

Angling at the falls pool did not produce any fish.

Wakeman mainstem.

Water temperature was 6.5°C at 1030 h and water was turbid with glacial flour. Flows were relatively high in response to rainfall the previous day.

Angling at the confluence of Wahpeeto Creek, along the clear edge, produced one large steelhead (9+ kg range) which was hooked but not landed.

Angling from a bar opposite and slightly downstream of the Atwaykellesse confluence yielded a female steelhead kelt, approximately 9.5 kg.

Atwaykellesse River.

Estimated flow was 1200-1500 cfs, water temperature 6.5°at 1300 h and water was relatively clear (underwater visibility approximately 3-4 m).

Snorkel survey was done on section of bouldery rapids just above the gradient transition zone (from island to big rock, approximately 0.8 km). Conditions were difficult for snorkelling due to high volume and velocity of flow. Saw only 2 steelhead, both large .3 ocean fish.

Angling at the "spring hole", upstream of the long white water section, yielded no adult fish. One unidentified parr was hooked. One juvenile fish (possibly coho fry) was seen along the stream edge. A spot swim through the same run revealed no fish. The lack of winter steelhead here gives credence to the supposition that the white water section limits their upstream migration. Summer coho, summer chinook and the occasional summer steelhead surmount the white water section on declining flows.

Ahta River

Estimated flow 100 cfs, water temperature 7.0°C during mid-afternoon and water relatively clear (underwater visibility 4-5 m).

Snorkel survey from falls to estuary revealed 5 steelhead and 1 cutthroat.

Overflight at low altitude revealed a productive looking estuary and good looking trout habitat, especially downstream of the falls. The waterfall constitutes a barrier to upstream fish movement, consequently the anadromous section of stream is rather short (<0.5 km). One helicopter landing site was identified downstream from the falls in addition to a site on the estuary. Several seals were observed just off the river mouth.

Logging has not yet affected this watershed, although current logging activity is approaching. The stream, its estuary and an area of marsh ajacent to the estuary would make an attractive recreational area if it was preserved. Development of a spawning channel on this system would be restricted by the small area of land available and detrimental to the recreational value. Given proposed logging plans and uncertainty about late summer-early fall flows, the development of a costly pink spawning channel may be ill advised. We do not want to see another "Kakweiken facility" built which is subject to annual maintenance/operation problems.

Kakweiken River

Estimated flow 4,000 cfs, water temperature 8.0°C at 1630 h and water clear (underwater visibility 5-6 m).

Overflight revealed conspicuous evidence of flood damage, especially near the Elbow Creek confluence. A steep mountainside across the river from Elbow Creek was the site of an extensive landslide and a number of the small, steep feeder streams in this watershed were affected with debris torrents. The logging road bridge just upstream of the falls and fishway was washed out by the November 1989 flood event and was being reconstructed at the time of this survey. Logging operations are currently active in this watershed.

The spawning channel was wetted, but flow was very low. There was a deposition of sediment several feet thick at the channel intake as a result of the flood last November. Cleanup of this material could create silting problems. The channel substrate was covered by a blanket of reddish brown algae. Several sets of tracks, likely grizzly bear, were observed in the channel from the air. These tracks, on later examination from the ground, appeared to be several weeks old. Most of the flow into the channel was coming from Elbow Creek water. Water temperature at the top end was 8°C. Coho fry were observed in the channel.

We landed at the Kakweiken Lake inlet and angled for trout in the lake without success. Several fish were seen jumping offshore, but there appeared to be more juveniles than catchable size fish.

The second landing site was at Elbow Creek confluence, where angling and snorkel surveys were done. No fish were caught, but 6 steelhead were observed from shore, just downstream of the
Elbow Creek confluence. Redds were seen adjacent to the spawning channel inlet and below the old bridge crossing.

A snorkel survey of the Kakweiken mainstem, from Elbow Creek to the downstream end of the spawning channel, revealed 4 steelhead, 3 cutthroat and 3 Dolly Varden. Fry were observed along the edges of the river. The high flows and broad area of wetted riverbed made it difficult to observe the whole river, thus the snorkel count should be regarded as conservative. A third swimmer would be useful in these flow conditions.

The third landing site was just downstream of the falls and fishway. Angling here yielded no fish, although a dead steelhead (male, approximately 5.4 kg) was recovered on the bank and a scale sample was taken. It appeared to have been dragged

up the bank and partially eaten by an eagle. Later examination of the scales showed they were all regenerated and unreadable.

A snorkel survey from the fishway to approximately 700 m downstream, through a bouldery riffle and rapids section, was difficult under the high flow conditions and only the edge of the river could be observed. The count was 7 cutthroat and 1 steelhead parr.

The trash rack on the upstream end of the fishway was completely obstructed with debris. We cleaned about 50% of the obstruction to allow passage of fish.