

### SKAGIT RIVER AND ROSS RESERVOIR

FISHERIES MANAGEMENT PLAN

by H. R. Neuman

British Columbia Ministry of Environment

Fish and Wildlife Management

Surrey, B. C.

Regional Fisheries Report No. LM150

1988

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#### **B.C. ENVIRONMENT**

The following plan outlines fisheries management objectives, strategies and activities for the Skagit River and Ross Reservoir for the next three to five years. These are consistent with the objectives of B.C. Environment, the Fisheries Program and the Lower Mainland Region.

Implementation of specific activities that require financial and human resources are contingent upon resource availability and Ministry, Program and Regional priorities at the time.

#### **APPROVED:**

Director Fisheries Branch B.C. Environment

Date:

Difector

Lower Mainland Region B.C. Environment

Date

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#### SUMMARY

#### Neuman, H.R. 1988. Skagit River and Ross Reservoir Fisheries Management Plan. B.C. Ministry of Environment. Fish and Wildlife Management. Reg. Fish. Rept. No. LM150. 40p

This management plan outlines fisheries management objectives, strategies and activities for the Skagit River and Ross Reservoir for the next five years. The recent international agreement not to flood the Skagit Valley and the establishment of an endowment fund administered by the Skagit Environmental Endowment Commission has secured recreational development in the valley. Recreational use is expected to increase considerably over the next five to ten years and if uncontrolled poses a threat to the Skagit River fishery. For this reason fisheries management objectives and strategies must be clearly identified and activities planned to achieve them.

The primary objective of this plan is to maintain the quality angling experience on the Skagit River and protect and enhance wild fish stocks. Strategies concentrate on managing angler use by controlling physical access, enhancing fish stocks, reducing reservoir harvest, assessing habitat improvement opportunities, and stocking the Sumallo River.

Fisheries management must be coordinated with the Washington Department of Wildlife. The fish stocks common to the Skagit River and Ross Reservoir and the international fishery on the reservoir require that the system be managed cooperatively for the benefit of both Canadians and Americans.

Funding assistance is required from the Skagit Environmental Endowment Commission for successful management of the Skagit River and Ross Reservoir fisheries.

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#### ACKNOWLEDGEMENTS

I wish to thank the following people and groups:

Pat Slaney, Allan Martin, Peter Caverhill, Tom Burgess, Vic Swiatkiewicz, Rob Knight, Brian Clark, Poul Bech, Bruce Usher, Dale Sebastian, Don Cadden, Jim Rissling, Kay Keding, Rick Simmons and Jack DeLair for reviewing the plan in its draft form.

The Osprey Flyfishers, Totem Flyfishers and the B. C. Federation of Flyfishers for reviewing the plan and providing comments on how they would like to see the Skagit River fishery managed.

Jim Johnston of the Washington Department of Wildlife for consultation and a spirit of cooperative management.

Members of the Skagit Environmental Endowment Commission for funding many of the background studies necessary to the plan and for fostering cooperative international management of the Ross Reservoir watershed.

Carol Davison for word processing and Howie Chan for drafting the figures.

#### INTRODUCTION

The Skagit River is one of the most important non-anadromous trout streams in British Columbia and is gaining international recognition as one of the better trout streams in western North America. Similarly, Ross Reservoir is one of the most popular fishing lakes in the Lower Mainland and has one of the highest catch rates. Both these fisheries are dependent on a single stock of fish.

The attraction of the Skagit River fishery stems from the quality and special nature of the angling experience. It is easily accessable to Vancouver and over half the population of the Province, yet, it is still relatively quiet and uncrowded. This very attractive river is located in a beautiful natural setting which contains high wildlife and scenic values. Angling success and the size of fish in the catch are good. The river has wild fish which anglers value highly in a world that is becoming more and more hatchery oriented. Also, because of its moderate size, the Skagit is easily fished and offers excellent flyfishing opportunities. The Skaqit also offers a unique or special There are numerous, varied opportunities to fish experience. lakes or anadromous rivers in southwest mainland British Columbia. The Skaqit, on the other hand, is the only quality non-anadromous trout stream in the Lower Mainland - an experience that is in short supply in British Columbia.

Fisheries management on the Skagit is not simply a matter of meeting demands for fish and for angling opportunity. The challenge will be to preserve and improve the quality experience that the Skagit provides. This will be more difficult as recreational use in the valley increases. Management of Ross Reservoir is complicated by an international fishery on the lake.

The two major fisheries management issues on the Skagit/Ross system are increasing angler use on the river and overharvest on the U.S. portion of Ross Reservoir. The key to maintaining a

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quality experience on the Skagit River is to keep angler use moderate. High use will alter the character of the fishery, reduce success and could cause a decline in fish supply. Harvest on the U.S. portion of the reservoir impacts on both the river and reservoir fisheries in Canada. Cooperative fisheries management with the Washington Department of Wildlife is essential to protect and enhance this valuable fishery and to ensure equitable distribution of fish and angling opportunity to citizens of both countries.

The purpose of this plan is to outline fisheries management objectives, strategies and activities for the Skagit River and Ross Reservoir over the next five years. It also summarizes information on the system and provides a rationale for management objectives and strategies. The direction of this plan is consistent with the goal of the Provincial recreational fisheries program which is to provide economic, cultural, recreational and scientific benefits through conservation and management of freshwater fisheries. To satisfy this goal five objectives have been developed for the Lower Mainland Region (Swiatkiewicz 1984). This plan meets three of these objectives (the other two deal with urban and non-salmonid fisheries):

- 1. Maintain the genetic integrity of the fisheries resource through the protection of wild stocks.
- 2. Accommmodate increasing recreational angling demand and maintain the success rate at or above current levels through the implementation of a variety of fisheries management activites including habitat protection, enhancement, angler regulation, research, inventory and enforcement.

3. Provide a variety of angling opportunities and experiences.

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#### BACKGROUND

The Canadian portion of the Skagit River is located approximately 150 kilometers east of Vancouver between the main ranges of the Coast Mountains (Fig. 1). For its entire length the mainstem Skagit flows through Manning Park and the Skagit Valley Recreation Area. The river enters Ross Reservoir approximately 1.5km north of the international border at full storage or, at low storage, more than 10km south of the border. The American portion of the river flows into the Pacific Ocean at Mount Vernon, Washington. The Canadian river is approximatley 55km long and has two major tributaries, the Sumallo and Klesilkwa Rivers.

Ross Reservoir is a hydro electric reservoir operated by the City of Seattle. Surface area varies between 4,700ha at full storage and 1,800ha at low storage. At full storage approximately 2km<sup>2</sup> of the Canadian Skaqit Valley are flooded. The dam was built in stages between 1937 and 1949. A 1942 International Joint Commission (IJC) Order of Approval authorized Seattle's proposal to raise the dam an additional 37 metres. This would have flooded a further 21km<sup>2</sup> of the Skagit Valley in Canada including 16km of the river. The approval was contingent upon British Columbia and Seattle reaching an agreement for compensation. After a lengthy series of negotiations, an agreement was signed in 1967. However, because of subsequent public and political protest the governments . of Canada and the United States asked the IJC to re-examine the case. Public hearings were held and a major controversy occurred through the 1970s and early 1980s over the High Ross proposal. The dispute was finally resolved in 1983 when an agreement between the Province and the City of Seattle decided that High Ross would not be constructed and that B.C. Hydro would sell power to Seattle City Light in compensation for the lost generating capability of High Ross.

In 1984 the Skagit Environmental Endowment Commission (SEEC) was established under the Skagit Environmental Enhancement Act. A five million dollar (U.S.) Skagit Environmental Endowment Fund was



set up to be administered by the SEEC. The purpose of the Fund is to protect and conserve wilderness and wildife habitat and enhance recreational opportunities in the Skagit River watershed upstream of Ross dam. The Fund will provide expenditures of approximately \$400,000 (U.S.) per year until the year 2066. Since 1985 the SEEC has partially funded one third of the fisheries studies conducted in the Canadian Skagit Valley (Appendix I).

A number of British Columbia government agencies have a management role within the Canadian portion of the Skagit River watershed. The Ministry of Parks has overall responsibility within the Skaqit Valley Recreation Area and Manning Park. The Ministry of Environment manages the fish and wildlife resource in cooperation with the Ministry of Parks. Lands outside the Recreation Area and Manning Park, yet within the watershed (the upper reaches of the Sumallo and Klesilkwa Rivers), are administered by the Ministry of Forests. Fish and wildlife resources in these areas are managed by the Ministry of Environment. The Ministry of Transportation and Highways is responsible for construction and maintenance of the Hope-Princeton Highway and the Silver-Skagit Road. The Ministry of Energy, Mines and Petroleum Resources is responsible for mining claims within the Recreation Area.

In the State of Washington, the U.S. National Parks Service administers the North Cascades National Park and the Ross Lake National Recreation Area. The Washington Department of Wildlife manages fish and wildlife resources. Water levels in Ross Reservoir are controlled by Seattle City Light.

Both the river and the reservoir have been popular angling destinations for decades. Prior to construction of the Silver-Skagit Road in 1946 anglers accessed the area on horseback. There are rumours of large numbers of rainbow trout to 2kg prior to the 1960s. These anecdotal stories could well be true at a time when the river was relatively pristine and received very little angling pressure. However, as access improved and angler use increased, catch rates and fish size in both the river and reservoir probably declined. By the early 1970s the average catch success in both the river and reservoir was about two fish per day and rainbow trout averaged 30 to 35cm in length (Anon 1974). Currently, success on the river and reservoir is about 1.5 fish per day (Scott and Peterson 1986, Scott and Lewynsky 1987) and fish size is about the same as the early 1970s. Angler days expended on the river in 1986 were 3,575 (13,157 hours) with a catch and harvest of 5,722 and 1,030 rainbow trout respectively.

Before 1982, the Skaqit River and Ross Reservoir received little management effort other than a spring closure to protect rainbow trout spawners (see Appendix II for a history of angling regulations). In 1982 the Recreational Fisheries Branch initiated studies as part of an intensified management program to protect this valuable fishery. Studies began with a two year biophysical assessment and annual monitoring of fish abundance with underwater enumeration by snorkle floating. Numerous fisheries studies have been conducted since 1982 including biophysical assessment, fish enumerations, tagging studies, and creel surveys (Appendix I). In 1985, restrictive catch and gear regulations were introduced to increase fish populations by protecting fish until they had spawned at least once and by reducing harvest. These regulations did not become law until 1986. Preliminary indications are that this strategy has been successful and the numbers of catchable size fish in the river have been maintained or increased.

These studies have identified two pressing management concerns in the Skagit/Ross system. First is the necessity for cooperative international management of the fishery. The Skagit River fishery is dependent on migratory rainbow from Ross Reservoir and is vulnerable to harvest on the reservoir (90% of the harvest is by U.S. anglers). Also, there are perceived inequities in reservoir regulations of both countries and Canadian reservoir anglers are frequently disadvantaged during the first few weeks of the fishery (when most of the catch occurs) as a result of low reservoir levels and little or no flooding in Canada. Secondly, it has become obvious that the Skagit River requires intensive management to protect and enhance this valuable sport fishery. The vulnerability of the fishery to overexploitation in the United States portion of the reservoir and increasing angler demand threaten the quality of this fragile resource.

#### FISHERIES RESOURCE

#### **1.** RESOURCE BASE

#### Physical Characteristics of the Skagit River

The Canadian portion of the Skagit River has a watershed area of  $1,000 \text{km}^2$ , and is a medium size stream with a mean annual discharge of  $28 \text{m}^3/\text{s}$ . Freshet occurs in May and June and is fed mostly by snow melt. Peak flows average  $85 \text{m}^3/\text{s}$ . Low flows (5-6m<sup>3</sup>/s) occur in September. Average summer flows are approximately  $15 \text{m}^3/\text{s}$ .

The river has four reaches based on physical characteristics (Griffith and Greiner 1983) (Fig. 2 and Table 1). The uppermost reach flows 16 km from the source, near Allison Pass, to a set of barrier falls below Skagit Bluffs. This reach is swift-flowing and bouldery with a mean wetted width of 10m.

The middle river contains two reaches and flows from the barrier falls to Twenty-six Mile Bridge on the Silver-Skagit Road. It is approximately 18km long and averages 20m wetted width during summer. It is characterized by numerous pools and riffles with periodic log jams. Some bouldery rapids are present. The Sumallo River, the largest tributary, enters the Skagit three kilometers below the barrier falls. With the exception of the upper reaches, the Sumallo meanders through a riffle-pool sequence for 17km before meeting the Skagit. Late summer wetted width is 15m.



STREAM	SECTION	REACH NO+	DOWNSTREAM LIMIT	UPSTREAM LIMIT	LENGTH (km)	MEAN WIDTH (m)	GRADIENT (%)
Skagit R.	Lower	1	Ross Reservoir	26 Mile Bridge	18	30	0•24
	Middle	2	26 Mile Bidge	Sumallo R. confluence	14.5	20	0.53
	Middle	3	Sumallo R. confluence	Barrier falls (Skagit Bluffs)	3.2	15	3.3
	Upper	4	Barrier Falls	source (Allison Pass)	16	10	3.1
Klesiikwa R	•	1	Skagit R. confluence	Klesilkwa/ Silverhope swamp	14.6	15	0.21
Sumatio R.		1	Skagit R.	Tashme (barrier)	17.0	15	0.26

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Table 1. Physical Characteristics of the Skagit, Klesilkwa and Sumalio Rivers

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The lower Skagit (below Twenty-six Mile Bridge) meanders through a wide, glaciated valley for 18km before entering Ross Reservoir. The stream averages 30m wetted width (summer) and contains several intermittent side channels. Hydraulic habitat is 11% pool, 63% riffle and 26% glide. Large organic debris (LOD) is common and a number of large stable log jams are present. The Klesilkwa River flows from the west and enters the Skagit a few hundred meters downstream of Twenty-six Mile bridge. It is a low gradient, slow flowing system and wanders extensively through marshy terrain. Debris accumulations are frequent. Late summer wetted width is approximately 15m.

The mainstem Skagit River has 12 tributaries (Fig. 2). Most are less than 5m wetted width and have high gradient (5-10%). Seven have short (0.5 to 2km) low gradient reaches near their confluence with the Skagit that likely contribute to juvenile rainbow production.

#### Physical Charateristics of Ross Reservoir

Table 2 gives some physical and chemical characteristics of Ross Reservoir. Ross reservoir is 35km in length and has a watershed area of 2,600km<sup>2</sup>. Surface area varies from 18km<sup>2</sup> at low storage to 47km<sup>2</sup> at full storage. Approximately 5% of the reservoir (at full storage) is in Canada. Surface area in Canada varies from zero to approximately 2km<sup>2</sup>. Full storage elevation for the reservoir is 488.4m above mean sea level (ms1). Water starts to enter Canada in June at an approximate elevation of 481.6m ms1. Maximum permissable drawdown is to 449.6m ms1. Maximum water depth in Canada is about 6.8m.

The reservoir is fed by six major tributaries and numerous minor ones. Of the major streams, the Skagit is by far the largest, having more than twice the watershed area of the next largest tributary and almost half of the total drainage area of the reservoir. The Skagit is also the most important tributary from a fisheries standpoint, and is estimated to contribute about half of the fish recruitment to the reservoir (Anon 1974).

#### Table 2: Physical and Chemical Characteristics of Ross Reservoir (information from Anon 1972)

#### Physical Characteristics

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Watershed area: 2,600 square kilometers

	Maximum	Minimum
	Storage	Storage
Reservoir elevation (m)	488.4	449.6
Surface area (km <sup>2</sup> )	47	18
Surface area in Canada (km <sup>2</sup> )	2	0
Reservoir volume (dam <sup>3</sup> )*	1,163,000	334,000
Shoreline Perimeter (km)	104	60
Mean depth (m)	37.3	28.5
Maximum depth (m)	107	
Maximum depth in Canada (m)	6.8	
-		
<pre>* cubic decameters</pre>		
Water Chemistry [at North En	d (depth 7.6m)]	
•••••		
TDS (mg/1) 9		
рН 7.	3	
$NO_2(mg/1)$ <0.	05	
$PO_{A}$ (mg/1) .	03	
Secch Disc $(m)$ 4.	3	
	~	

#### Fish Habitat in the Skagit River

Fish habitat in the Skagit is generally good. Substrate is predominated by gravel with areas of cobble and boulder. Spawning habitat in the mainstem is high quality, however, gravels in the Sumallo and Klesilkwa often contain high concentrations of sand and silt. Good gravel is found in many of the smaller tributaries.

Fish cover consists mainly of large organic debris (LOD) (often associated with pools) and overhanging vegetation. Undercut banks, boulder cover and surface turbulence are also important. LOD is extremely important fish habitat on the Skagit and over 65% of fish >20cm in length are associated with debris (Neuman 1985). Log jams also contain high concentrations of juvenile fish. Some sections of the Sumallo and, possibly, the middle Skagit lack instream cover and adult holding habitat.

#### Fish Habitat in Ross Reservoir

Fish habitat in the Canadian portion of Ross Reservoir is transitory due to fluctuations in water level which limit both physical space for fish and fish food producton (insects). The reservoir is at or near full storage for only about three months of the year (late June or early July to September). Insects and aquatic plants are limited by the prolonged dewatering of the Canadian side each year. The stumps left over from logging prior to the initial flooding in 1953, provide important fish cover and substrate for insects.

#### Fish Distribution

Only three fish species are found in the Skagit River and Ross Reservoir. Rainbow trout is the primary sport fish and constitutes 96% and 90% of catch in the Skagit River and Ross Reservoir respectively. Dolly Varden char comprise 4% and 9% of the river and reservoir catch respectively. Brook trout make up the remaining 1%. Cutthroat trout were present at one time but have not been confirmed from the river in over 15 years.

Trout (presumably rainbow) were first recorded from the Skaqit River (near the international boundary) in 1859 (Anon 1972). Anadromous salmonids are not believed to have ever reached more than 2km upstream of the town of Newhalem, Washington (approximately 18km downstream from Ross dam) due to a series of falls and rapids through this section of the Skaqit River (Anon 1972). Rainbow, cutthroat, steelhead, Golden trout and Eastern Brook have been stocked by the U.S.A. into Skaqit River tributaries, upstream of the Ross Dam site (prior to dam construction) or into the Ross Reservoir drainage since 1916 (Appendix III). Ross Reservoir itself was stocked with cutthroat between 1952 and 1954 (Appendix III). High elevation lakes in the drainage are regularly stocked with a hatchery strain of rainbow trout (Mt. Whitney, Calif.) and westslope cutthroat (Twin Lakes). There is no record of stocking on the Canadian side of the border. There is no record of Dolly Varden stocking and they are believed to be native. Brook trout were introduced into the Ross Reservoir drainage in 1933 (Appendix III).

Most rainbow in the Skagit River are migratory and move seasonally between the river and the reservoir. Griffith and Greiner (1983) estimated that 20% of rainbow in the river during late summer were true river residents based on scale analysis. However, a 1986 test fishery found only 7% (12 fish) of a sample of 181 fish that did not show reservoir growth based on scale analysis (Neuman and Scott in prep). Of these, only one fish was older than two years, indicating that most adult fish reside in the reservoir. Snorkle float data (on file) indicates low numbers of resident fish in the river, the river is virtually barren of adult fish from late October to the spring spawning run.

Rainbow begin entering the river to spawn in early April. Spawning occurs between early May and the end of July with the peak in early June (Anon 1974). Spawning occurs during freshet when the river is high and turbid and it is very difficult to determine timing, location and size of the run. A crude estimate, based on snorkle float enumeration, placed the size of the run at 13,000 spawners (Neuman 1986). Downstream fry trapping indicated that 60% of spawning occurred below Twenty-six Mile bridge (in the mainstem) and the lower reaches of tributaries (Anon 1974). The Klesilkwa River provided 20% of Skagit fry production with the remaining 20% derived from upstream of Twenty-six Mile bridge (Anon 1974). It appears that the vast majority of recruits enter reservoir as fry or fall fingerlings (Griffith 1985, Neuman and Scott in prep.).

After spawning, the majority of adult rainbow return to the reservoir where they are exposed to the Canadian and American sport fisheries. A portion of the run remains in the river and contributes to the summer fishery before moving back to the reservoir in September. There is also evidence of a summer "feeding migration" into the river. Thirty-five percent of fish in the river during the summer showed reservoir growth (scale analysis), but had not spawned that spring (Neuman and Scott, in prep.). Therefore, it appears that one third of adult trout in the river during the summer are non-spawning migrants from the reservoir, while two thirds of the fish are holdovers from the spawning run.

Dolly Varden and Eastern brook trout spawn from late September through October. It is unknown if Skagit brook trout spend any time in the reservoir but there is probably some movement between the river and the reservoir. There appears to be more than one distinct population of Dolly Varden in the system. The fish seen in the river during the summer (up to about 35cm in length) are likely fluvial and adfluvial. There is also evidence of a stunted population in the Klesilkwa River (Griffith 1985). Finally, a run of large (ca. 5kg) Dolly Varden begin entering the river in August to spawn in the fall. These are reservoir fish.

#### Fish Supply

The number and distribution of rainbow trout >20cm in the Skagit River varies from year to year but is generally low, particularly in the Sumallo River. Late summer holding habitat is under utilized and is estimated to be at 38% of theoretical capacity (Appendix IV). In the early 1980's approximately 1800 catchable size fish were in the river during late summer. However, in 1986 and 1987 numbers increased to 5,500 fish (data on file). The theoretical capacity, based on habitat capability models, is 13,000 fish >20cm (40kg/ha) (Griffith 1985). It is too soon to tell if recent increases are part of a natural cycle or a reduced harvest resulting from more conservative regulations initiated in 1985. Approximately 60% of catchable size fish in the river are legal size (>30cm; data on file).

The supply of rainbow in the reservoir is unknown but an estimated exploitation rate of 40 - 60% (Parkinson, pers. comm.) and a harvest of 18,000 fish (Scott and Peterson 1986) place estimates at 30,000 to 45,000 adult fish.

Dolly Varden and Eastern brook trout are approximately five and one percent respectively of the total catch in both the river and reservoir.

#### Factors Influencing Supply

Angling regulations are the major management activity that affect the supply of trout and char in the Skagit/Ross system. Between 1982 and 1985, regulations were introduced on the river to protect fish until first spawning, reduce harvest and reduce mortality of released fish: 2 fish per day catch limit, 30cm minimum size limit, single barbless hook, and bait ban (Appendix II). These regulations may have resulted in a three fold increase in the late summer standing stock of catchable size trout. The regulations on Ross Reservoir (British Columbia: four fish per day, two day possession limit, no minimum size limit; Washington: eight fish per day, no more than three over 14", one day possession limit, no minimum size limit) influence the supply of fish in both the reservoir and the river by influencing angling mortality on subadult and adult fish.

Other factors influencing fish supply include seasonal movements of rainbow between the river and reservoir and reservoir water levels. The Canadian portion of the reservoir is typically dewatered for seven months of the year. Often little or no flooding occurs in Canada during the first few weeks of the angling season. Fish availability in Canada at this time is reduced or nonexistant.

It is anticipated that logging and mining within the Recreation Area will probably not reduce fish supply greatly. The Ministry of Parks plans to acquire all mining claims withi the Recreation Area. Timber harvesting is planned for a numbe of tributary drainages. Impacts are expected to be minimal and limited to water quality and aesthetics. Logging within n the Skagit Provincial Forest could affect water quality in ther upper reaches of the Klesilkwa and Sumallo Rivers as well as tributaries to the Sumallo, Klesilkwa and upper Skagit.

Widening and maintenance on the Hope-Princeton Highway and the Silver-Skagit Road could affect fish supply through habitat alteration and water quality by encroachment on the river and its tributaries. Also, residential and recreational development at Tashme (Sunshine Valley Estates) could affect water quality in the Sumallo River.

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#### 2. USE OF THE FISHERY RESOURCE

Skagit River

(a) Angler Use

The Skagit River fishery opens each year on the third Saturday in June. The river is usually high and colored at time, and angling effort is low until the water has dropped and cleared, usually by mid-July. Most angling occurs from mid-July to early September. Fishing effort drops off through September and is essentially finished by the end of October, by which time virtually all subadult and adult fish have returned to overwinter in the resevoir.

Angler effort on the Skagit River is approximately 3,600 days per year (Scott and Lewynsky 1987), equivalent to 30 days/ha, or 68 days/km. Seventy percent of this occurs below Twenty-six Mile Bridge; 20% in the middle river, accessed from the Hope-Princeton Highway; and 10% on the Sumallo. Use is highest in the lower river at 45 days/ha or 136 days/km. This is considered a moderate level of angler use compared to other similar sized North American streams (Slaney et. al. 1984). Angler use upstream of the barrier falls is minimal. Angler survey data is scanty prior to 1985 and angler effort estimates do not exist.

Angler use on the Skagit River will increase in future. The population of Greater Vancouver and the Fraser Valley is expected to increase dramatically over the next 10 years resulting in an increasing demand for outdoor recreation. Also, the current expansion of recreational facilities in the Skagit Valley will attract more recreatists including more anglers. Finally, the growing reputation of the Skagit as a quality trout stream is drawing more anglers each year. Without regulation, angler use may rise sharply over the next five to ten years resulting in unacceptable levels of crowding. Over use is the biggest threat to the quality of the fishery.

Angler use on the Skagit River is affected by access, regulations and catch success. Access Management will be instrumental in keeping angler use at moderate levels. The lower river, which receives 70% of total effort, is accessed by forty plus kilometers of gravel road, with spur road access to the river itself. Access on the upper river is by trail only. This limited access has, so far, kept use at moderate levels. If, at some future time the Silver-Skagit Road is paved, improved access to the valley would result in an enormous increase in angling and other recreational activities. This would have serious consequences for the Skagit River fishery (see also Ross Reservoir, Angler Use).

Restrictive regulations, introduced in 1985, are believed to have caused a small and temporal reduction in angler use (Keding, pers. comm.). The change in regulations also resulted in a change in the type of fishery on the river from a consumptive bait fishery to a catch and release fishery. In the early 1970s, 85% of anglers used bait, while only 11% fly-fished. Bait use remained popular on the river until outlawed by the regulations. Currently, more than 60% of anglers fly fish, and only 5% illegally use bait. The remaining 35% fish with lures. Over 80% of fish caught are voluntarily released.

Catch rates also affect use. Recent increases in catch success will almost certainly contribute to increased angler use once the angling public becomes informed. Fish supply will have an indirect effect on use by influencing angler success. The absolute supply of fish is less important on the Skagit, however, because over 80% of the catch is recycled by catch and release.

#### (b) Catch and Harvest

Total annual catch varies according to the number of fish in the river, angler effort, and the rate of catch and release. Estimated catch during 1986 was 5,722 rainbow trout (Scott and Lewynsky 1987). This is 50 fish/ha or 108 fish/km. Of these, 82% were released for an estimated harvest of 1,030 fish (9 fish/ha or 19 fish/km).

#### (c) Catch Success

Catch success on the river in 1986 was 1.6 fish per day; the harvest rate was 0.3 fish per day. Catch rate has decreased only slightly since the early 1970s rate of two fish per day. However, in the 1970s most of the catch >20cm in length was probably harvested.

#### (d) Other Users

Angling is by far the major recreational attraction to the Skagit River. Other uses of the river corridor include canoeing, hiking, camping, nature study and an ecological reserve. Canoeists are likely to conflict with anglers in the future. Canoeing on the river is presently low (less than 50 canoes per year) and promotion by the Ministry of Parks is minimal (a sign in the valley and mention in Parks brochures). If canoeing increases in popularity, conflicts with anglers may occur. Increased use by canoeists might also result in public pressure to remove log jams and sweepers from the river for safety considerations. Since most fish in the river are associated with debris (Neuman 1985), its removal would seriously reduce fish habitat.

#### Ross Reservoir

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#### (a) Angler Use

Both the Canadian and American portions of Ross Reservoir open to angling on the third Saturday in June. Opening weekend is very popular and angling effort is high for the first few weeks. However, angling in Canada is often restricted due to low or no flooding on the Canadian side. Many Canadians view this as a hardship and feel that U.S. anglers have an unfair advantage. After the first few weeks, angler effort drops off to a steady level to the end of September, with little use in October. The U.S. fishery differs in that roughly half the use occurs between opening day and the July 4th holiday.

Angler use on the Canadian portion of Ross Reservoir is about 1,700 days from the June opening to the end of September (Scott and Peterson 1986). Use during October probably brings the annual total to about 2,000 angler days, or 10 angler days/ha. Canadian effort is 14% of total Ross Reservoir effort, which is approximately 14,550 angler days/year (Scott and Peterson 1986). Use on Ross Reservoir is expected to increase with recreational development in the valley and as human populations increase in British Columbia and Washington State.

Angler use on Ross Reservoir is influenced by access, water levels, fish supply, regulations and catch success. Access to the reservoir is via the Silver-Skagit Road. The majority of American anglers also access the reservoir through Canada by the Silver-Skagit Road. Less than 5% of American anglers gain access at the south end of the reservoir along a 3km trail from Highway 20 to the Ross Lake Resort. Any improved access, by either upgrading or paving the Silver-Skagit Road, or by constructing a road to the south end of the reservoir in Washington State, would result in a substantial increase in angler use on the reservoir. Construction of a road to the south end of the reservoir is of particular concern. This would mean that American anglers would no longer have to drive up through Canada and could be at the lake in a relatively short period of time. Such easy access would result in a considerable increase in effort by American anglers.

Water levels in Ross Reservoir have a considerable influence on use by Canadian anglers. As already noted, low water levels during the first few weeks of the fishery often mean there is no fishable water on the Canadian side.

#### b) Catch and harvest

An estimated 21,979 rainbow trout were caught on Ross Reservoir in 1985 (Scott and Peterson 1986). Eighty-three percent (18,200) of these fish were harvested. Only 8% (1,450 fish) of the rainbow harvest was in Canada which has 14% of the angler use on the reservoir. Rainbow harvest in Canada and the U.S. is approximatley 7 fish/ha and 4 fish/ha respectively.

The 1985 estimated catch for Dolly Varden and brook trout on the entire reservoir was 2,065 and 421 respectively (Scott and Peterson 1986). Ninty-eight percent of Dolly Varden and 100% of brook trout were harvested. Thirty-five percent (710 fish, 4 fish/ha) of the harvest was in Canadian waters.

#### c) Catch Success

Catch success for all species on the entire reservoir and the Canadian portion only, for 1985, was 1.7 fish per day and 1.6 fish per day respectively (Scott and Peterson 1986). Harvest success was the same on both the Canadian and American portions of the reservoir (1.4 fish/day).

#### d) Other Users

Other uses of Ross Reservoir include electrical power generation, camping, boating, swimming and an angling resort at the south end. Water level manipulation by Seattle City Light for the purpose of generating electricity is the major conflicting use with angling. The effects of fluctuating water levels on the fishery have already been discussed (see Angler Use). Some conflict with the Ross Lake Resort may occur if the Resort opposes recommended changes to regulations on the reservoir (see Ross Reservoir Strategies).

#### ANALYSIS OF SUPPLY AND DEMAND

#### Skagit River

Based on recent studies (two years of angler survey and seven years of adult enumeration), it appears that the current angler effort on the mainstem Skagit River is not overexploiting the population due to its nonconsumptive nature. Angler expectations on the Skaqit are not harvest oriented. Average catch success is 1.6 fish per angler day and mean size in the catch is approximately 35cm, 82% of the catch is voluntarily released. However, the balance of supply and demand in the Skaqit is fragile and requires further study, particularly with respect to the impact of the reservoir fishery. We have only two years of angler survey data, the first of which is preliminary. It is uncertain if data on angler use, catch, harvest and success are accurate. Further, adult enumeration surveys (snorkle float surveys) have indicated a three fold increase in the numbers of fish >20cm in 1986 and 1987 while counts in 1988 are down slightly. Any decrease in fish abundance in the river or increase of angler use and harvest could result in overharvest. Consistent trend data is required to monitor the fishery on both the river and reservoir.

The Sumallo River is overexploited. Angler success is half that of the lower Skagit River (0.89 fish/day compared to 1.74 fish/day; Scott and Lewynsky 1987). Consequently, anglers fish elsewhere in the system. The Sumallo, which has easy access along the Hope- Princeton Highway, contains almost one third of the fishable length of the system yet receives less than 7% of total angler effort. Catchable fish populations in the Sumallo are low (Griffith and Greiner 1983, snorkle float data on file) probably due to over exploitation of remnant river residents and reduced migrations from the reservoir due to high reservoir harvest.

Recent data suggests that adult rainbow in the Skagit River are not over harvested. Twenty-two percent of late summer standing crop in kg of rainbow trout >20cm was harvested in 1986 (Appendix IV). Twenty-five percent of late summer standing crop is the recommended maximum allowable harvest for unstocked resident trout and char fisheries in British Columbia (Slaney et However, this is not directly applicable to the Skaqit al 1984). River due to the adfluvial nature of the stock. Slaney et al (1984) also assume a stream resident population that is at or near carrying capacity. The Skagit is at 38% of carrying capacity (Appendix IV) for stream residents. The management of Skagit River rainbow must be conducted on the basis of their adfluvial nature and not in isolation from the river or reservoir fisheries.

The fact that the number of adult fish that migrate into the river from the reservoir is affected by harvest levels in Ross Reservoir, makes it difficult to determine a maximum allowable harvest for the Skagit River. Until the Skagit stocks are better understood, a maximum allowable harvest of 25% of the late summer river migrant standing crop is recommended for the Skagit River. Rainbow harvest is presently near this level. However, any increase in harvest, due either to an increase in angler use on the river or a shift to a more harvest oriented river fishery could result in overharvest.

The extent to which fish stocks in the Skagit River are affected by harvest in Ross Reservoir is believed high due to the relative numbers of fish caught in the two fisheries. The annual harvest of Skagit origin fish in the reservoir is estimated at 8,200 fish or eight times the river harvest of 1030 fish: 18,200 reservoir rainbow harvest (Scott and Peterson 1986) x 0.45 (Skagit contribution to reservoir rainbow population (Anon 1974) = 8,200 rainbow. It is clear that maintenance of the Skagit fishery is dependent on harvest levels in the reservoir and the Skagit fishery would be enhanced by a reduction in reservoir harvest.

There is little opportunity to enhance the river fishery by a regulated reduction in river harvest because 82% of the catch is already voluntarily released. For example, a catch and release regulation on the river would increase fish supply by approximately 1,000 fish. In contrast, it would require only a 12% reduction in reservoir harvest to reduce the kill of Skagit origin fish by 1,000. These 1,000 unharvested fish could potentially return to the Skagit resulting in an almost 20% increase in fish supply in the river (based on an estimated late summer supply of 5,500 fish).

Catch estimates and fish counts in the middle Skagit and the Sumallo River indicate that reservoir harvest may be too high. The Skagit River system is underutilized by adult fish (Appendix IV, Griffith and Greiner 1983) particularily in the Sumallo where fish numbers and catch success are low. A reduced harvest on the reservoir may increase the numbers of fish migrating into the river and more fully utilize available adult and sub-adult habitat. On the other hand, the lack of fish in these areas may be a result of the migratory behaviour of the stock. This can only be tested by increasing escapement to the system.

Dolly Varden harvest in the river is approximately 13% of estimated late summer Dolly Varden standing crop (Appendix IV). This is well below the recommended maximum allowable harvest of 25% (Staney et al 1984). With the exception of a fall spawning migration of large fish from the reservoir, most of the Dolly Varden are believed to be river residents (non migratory).

Brook trout harvest is very low. Brook trout only constitute approximately 1% of fish in the river.

The present supply of fish in the Skagit River is capable of meeting only a small increase in demand prior to the introduction of a catch and release regulation. The Skagit is already at or near the recommended maximum allowable harvest. An increase in angler use would increase harvest of late summer standing crop above allowable levels. Also, any increase in harvest would reduce catch success and fish size as larger fish are cropped off. Catch success and fish size are dependent on a high rate of release and recycling of fish.

#### Ross Reservoir

At the writing of this plan it is difficult to determine the status of the fishery and fish stocks in Ross Reservoir. Approximately 90% of the fishery (angler catch and use) is in Washington State and most of the data has been collected on the American side. Very little data exists for British Columbia. The Washington Department of Wildlife plans to collate and analyse some 40 years of data within the next year. Until that time, supply and demand analysis for the Reservoir is speculation. It appears, however, that the reservoir fishery is declining. Catch per angler day decreased steadily from the 1940s (>10 fish/day) to 1970 (3.6 fish/day) (Anon 1972). Angler success in 1985 was 1.5 fish per angler day (Scott and Peterson 1986). Historical data is not available at this time on angler use, catch, or fish size and age structure.

#### MANAGEMENT OBJECTIVES AND STATEGIES

#### Skagit River

Management objectives for the Skagit River fishery are:

- 1. Maintain the quality of the angling experience.
- 2. Protect and enhance "wild" fish stocks
- 3. Achieve, within a 5-10 year time frame, the following goals:

- a) Angler use Remain unchanged at approximately 3600 angler days per year. However, if fish supply increases accordingly it is speculated that a 50% increase in effort could be accommodated without a major decline in the quality of the angling experience due to overcrowding.
- b) Fish supply Increase fish supply to fully utilize adult holding habitat (approximately 13,000 fish >20cm).
- c) Harvest Remain unchanged at approximately 1,000 fish per year.
- d) Angler Success Increase to 1 fish per hour (3.7 fish per day).

Listed below, not in order of priority but grouped according to type ie. regulations, habitat protection etc. are management strategies for the Skagit River.

- 1. Maintain current regulations designed to protect rainbow spawners, minimize harvest and reduce release mortality.
- Extend the spring angling closure to June 30 to increase protection of rainbow spawners. This regulation should be the same on the reservoir and must be coordinated with Washington State regulations on the reservoir (see Ross Reservoir strategies).
- Consider a catch and release regulation on Dolly Varden from August 1 to October 31 to protect the spawning migration from the reservoir.
- 4. Consider a catch and release regulation for rainbow trout if harvest levels increase.
- 5. Do not licence angling guides on the river. Guides will encourage increased use and contribute to overcrowding.

- Protect fish habitat, particularly large organic debris in the river. Minimize impacts from multiple resource use (logging, mining, road building and maintenance).
- 7. Examine the potential for habitat improvement in sections of the Sumallo and Skagit Rivers that are deficient in instream cover and adult holding habitat.
- 8. Limit angler access to maintain the quality of the experience and to protect and enhance fish populations.
- 9. Develop a resident (non migratory) rainbow trout fishery in the Sumallo River by stocking with progeny from Skagit River brood stock.
- 10. Monitor angler use, catch, harvest, success, fish size in the catch and angler satisfaction to determine the current status of the fishery and to detect changes as recreational use in the valley increases. Creel surveys chould be conducted every second year until a baseline is obtained after which every three to five years should be adequate.
- 11. Monitor the status of adult fish stocks by sampling fish size and age every second year and an annual snorkle float census of fish numbers.

#### Ross Reservoir

Management objectives for Ross Reservoir are:

- 1. Protect and enhance "wild" fish stocks.
- Manage the Ross Reservoir fishery cooperatively with the Washington Department of Wildlife to ensure that rainbow trout stocks are not overharvested and to increase fish supply in the Skagit River.

Listed below, not in order of priority but grouped according to type ie. regulations, habitat protection etc. are management strategies for Ross Reservoir.

- Introduce a catch quota of four fish per day with a one day possession limit to reduce harvest of rainbow trout in the reservoir. This regulation must be the same on the American side.
- Extend the spring angling closure to June 30 to increase protection of rainbow spawners and allow reservoir levels on the Canadian side to rise before the fishery opens. This regulation must be the same on the American side.
- 3. Establish, on a trial basis, a river/reservoir angling boundary near the mouth of the Skagit River at full reservoir storage to simplify enforcement and provide a Canadian "reservoir" fishery in the early season when reservoir levels are low. This will require an earlier spring closure to protect congregating spawners (see 4. below).
- 4. Close the fishery on October 31 to coordinate with Washington Department of Wildlife regulations on the reservoir and protect the spring spawning run that gathers off the mouth of or in the lower Skagit River in March prior to the present April 1 closure.
- 5. Protect fish habitat especially stumps in the drawdown area.
- 6. Initiate discussions with Seattle City Light to increase reservoir levels in Canada in mid June.
- 7. Monitor angler use, catch, harvest, success, fish size in the catch and angler satisfaction to determine the current status of the fishery and detect changes as recreational use in the valley increases. Creel surveys should be conducted every second year until a baseline is determined after which every three to five years should be adequate.

#### COST OF MANAGEMENT ACTIVITIES

Activities and estimated costs (in Canadian dollars) for managing the Skagit River and Ross Reservoir sport fisheries for the next five years are provided in Table 3. Costs for each year are broken down into that required from the Skaqit Environmental Endownment Commission (SEEC) and that provided by the Ministry of Env; ironment (MOE). MOE costs include salaries fixed at 1988 levels. It must be emphasized that MOE budgets are not capable of funding all of the required activities. SEEC funding will be required. In accordance with SEEC funding guidelines, the proposed activities are not part of a regular Ministry program and would not normally be undertaken. The required activities are part of a special management program that is required to protect a valuable and fragile fishery resource; a resource that will be impacted by increased recreational use resulting from SEEC funded recreational development in the Skaqit Valley.

Additional activities and costs for Ross Reservoir will likely be identified after the Washington Department of Wildlife has analysed and interpreted data for the American portion of the reservoir and a coordinated management scheme for the reservoir is developed.

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		19	989	199	0	199	91	199	92	19	93
	ACTIVITY	SEEC	MOE	SEEC	MOE	SEEC	MOE	SEEC	MOE	SEEC	MOE
1.	Creel Survey-Skagit River and Ross Reservoir	42 <sup>1</sup>	2	25 <sup>2</sup>	2	60	3			60	3
2.	Skagit River Rainbow Sampling	7	3			7	3			7	3
3.	Snorkle Float Enumeration		4		4		4		4		4
4.	Sumallo Fishery Development	22	11	22	11	22	11	22	11	22	11
5.	Habitat Improvement Assessment			10	5	10	5				
6.	Habitat Improvement Implementation (If required)							unkno	nwo	unkn	own
7.	Evaluate River/Reservoir Boundary		2		2						
Ann	ual Costs: SEEC MOE TOTAL	71 ,( <u>22 ,(</u> 93 ,(	000 000 000	57,00 24,00 81,00	00 00 00	99,( 	000 000 000	22,00 <u>15,00</u> 37,000	00 00 00 Jus	89,0 <u>21,0</u> 110,0	00 00 00ptus

# Table 3. Cost of Management Activities for the Skagit River and Ross Reservoir Cost (000s of 1988 Canadian dollars)

<sup>1</sup>Skagit River only

<sup>2</sup>Ross Reservoir only

#### REFERENCES

- Anon. 1972. The aquatic environment, fishes and fishery. Ross Lake and the Canadian Skagit River. Volume 1. City of Seattle. Department of Lighting. 282p.
- Anon. 1974. The aquatic environment, fishes and fishery. Ross Lake and the Canadian Skagit River. Interim Rept. No. 3. Volume 1. City of Seattle. Department of Lighting. 297p.
- Bech, P. 1984. Skagit River rainbow trout tagging study, 1983. B.C. Ministry of Environment. Fish and Wild. Program. Rept. No. LM021.
- Bech, P. in prep. Skagit River rainbow sampling, 1987 and 1988. B.C. Ministry of Environ. Fish and Wildl. Program.
- Griffith, R.P. 1985. Assessment of existing and potential fisheries values in the Canadian Skagit River drainage: II Inventory of juvenile fish populations and final management recommendations, 1983. B.C. Ministry of Environ. Fisheries Branch.
- Griffith, R.P. and D.L. Greiner. 1983. Assessment of existing and potential fisheries values of the Canadian Skagit River drainage: Inventory of existing stream population of catchable - sized fish and general assessment of enhancement potential, 1982. B.C. Ministry of Environ. Fisheries Br. 88p
- Hickey, D.G. and I.W. Whyte. 1987. 1987 Canadian Skagit River rainbow trout sampling program. B.C. Ministry of Environ. and Parks. Fish and Wildl. Program. Rept. No. LM135. by Hickey, Whyte and Assoc. Ltd.
- Keding, K. pers. comm. Conservation Officer. B.C. Min. of Environ.
- Neuman, H.R. 1985. Skagit River snorkle float Debris evalation. Memo to file (1985-10-10). B.C. Min. of Environ. 3p.

- Neuman, H.R. 1986. Skagit River spawner survey; May 1986. Memo to file (1986-07-25). B.C. Min. of Environ. 2p.
- Neuman, H.R. in prep. Skagit River snorkle float evaluation study. B.C. Min. of Environ. Fish and Wildl. Program.
- Neuman, H.R. and K.J. Scott. in prep. Aspects of Skagit River rainbow trout life history based on 1986 tagging and test fishing studies and scale analysis. B.C. Min. of Environ. Fish and Wildl. Program.
- Parkinson, E. pers. comm. Research Biologist. B.C. Min. of Environ.
- Scott, K.J. 1986. A data report of rainbow trout tagging and test fishing studies in the Canadian Skagit River, 1986. B.C. Min. of Environ. and Parks. Fish and Wildl. Program. Rept. No. LM114. by Scott Resources Services. 68p.
- Scott, K.J. and V.A. Lewynsky. 1987. Creel survey of the Canadian Skagit River, 1986. B.C. Min. of Environ. and Parks. Fish and Wildl. Program. Rept. No. LM115. by Scott Resource Services. 45p.
  - Scott, K.J and G.R. Peterson. 1986. Angler catch and use survey of Ross Reservoir and the Canadian Skagit River, 1985. B.C. Min. of Environ. Fish and Wildl. Program. Rept. No. LM102. by Howard Paish and Assoc. Ltd. 35p.
  - Slaney, P.A., M.L. Rosenau, A.D. Martin, G.D. Taylor, G.E. Reid and D.H.G. Ableson. 1984. Yield, effort and catch characteristics of resident trout and char fisheries on streams. B.C. Min. of Environ. Fisheries Br. Fish. Tech. Circ. No.65. 10p.
  - Swiatkiewicz, V.J. 1984. Lower Mainland Region fisheries management statement (1984). B.C. Min. of Environ. Fish and Wildl. Program. Rept. No. LM140. 94p.

- Usher, J.B. 1986. Skagit River rainbow trout (<u>Salmo gairdneri</u>) tagging study, 1984. B.C. Min. of Environ. Fish and Wildl. Program. Rept. No. LM101. 28p.
- Usher, J.B. 1987. Methods report: Skagit scale samples 1986. B.C. Min. of Environ. Fish and Wildl. Program. Report No. LM141. 14p.

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#### APPENDIX 1

#### Fisheries Studies Conducted on the Skagit River and the Canadian Portion of Ross Reservoir Between 1982 and 1988

Date	Study Description	Funding Agency	Report Reference
1982	Skagit River Fisheries Assesment Part I	MOE	Griffith Greiner 1983
1983	Skagit River Fisheries Assesment Part II	MOE	Griffith 1985
1983	Skagit River Tagging Study	MOE	Bech 1984
1984	Skagit River Snorkle Assessment	MOE	data on file
1984	Skagit River Tagging Study	MOE	Usher 1986
1985	Skagit River Snorkle Assessment	MOE	data on file
1985	Skagit River Tagging Study	MOE	Scott & Peterson 1986
1985	Skagit River/Ross Reservoir Creel Study	SEEC	Scott & Peterson 1986
1985	Snorkel Float Evaluation Study	MOE	Neuman, In. prep.
1986	Skagit River Snorkie Assessment	MOE	data on file
1986	Skagit River Creel Survey	SEEC	Scott and Lewynsky 1987
1986	Skagit River Tagging Study and Test Fishery	SEEC/ MOE	Scott 1986, Usher 1987, Neuman & Scott in prep.
1987	Skagit River Snorkie Assessment	MOE	data on file
1987	Sumailo River Experimental Stocking	MOE/ SEEC	study in progress
1987	Rainbow Trout Length and Age Sampling	SEEC/ MOE	Hichey & Whyte 1987 Bech, in prep.
1988	Skagit River Snorkle Assessment	MOE	data on file
1988	Sumallo Stocking Experiment, con'd	MOE	study in progress
1988	Rainbow Trout Length and Age Sampling	MOE	Bech in prep.

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#### APPENDIX II Angling Regulations on the Skagit River and the Canadian Portion of Ross Reservoir 1931-1988

Year	Regulation Type	Skagit River and Tributaries	Ross Reservoir
1931	Catch Quota	15 fish/day	15 fish/day
1946	Catch Quota	15 fish/day, maximum of 25 pounds plus 1 fish	15 fish/day, maximum of 25 pounds plus 1 fish
1949 to 1953	Closure	closed below bridge on Sliver-Skagit Road including Klesiikwa River	(No closure?)
	Catch Quota	no change, 3 day possession limit	no change, 3 day possesion
1954	Closure	(area closure presumably lifted)	)
	Catch & Possession	12 fish/day, max. 251b plus 1 fish, 3 day possession limit	12 fish/day, max. 251b plus 1 fish, 3 day possesion limit
1955	Closure	March 1-June 30, Sumalio River	March 1-June 30
1961	Catch & Possession	No change	No change
1962	Closure	No time or area closure	No time or area closure
1963	Catch & Possession	12 fish/day, 36 fish possession	12 fish/day, 36 fish possesion
1964	Closure	April 1-June 25, Sumallo River	April 1-June 25
1966	Catch & Possession	12 fish/day, only 2>20", 36 fish possession	12 fish/day, only 2>20", 36 fish possession
1967	Closure	April 1-June 24	April 1-June 24
	Catch & Possession	No change	No change
1968	Closure	No change	No change
	Catch & Possession	8 fish/day, 24 fish possession	8 fish/day, 24 possession

Year	Regulation Type 1	Skagit River and Tributaries	Ross Reservolr
1969 and	Closure	April 1-June 21	April 1-June 21
1970	Catch & Possession Minimum size	No change 8 <sup>11</sup>	No change No minimum size
1971	Closure	April 1-June 18	April 1-June 18
	Catch & Possession	No change	No change
	Minimum Size	No change	No minimum size
1972 and	Closure	April-June 16	April 1 - June 16
1973	Catch & Possession	No change	No change
	Minimum Size	No change	No minimum size
1974	Closure	April 1-June 14	April 1-June 14
	Catch & Possession	No change, only 1 flsh > 20"	No change, only 1 fish>20"
	Minimum Size	No change	No minimum size
1975	Closure	April 1 to Friday Immediately preceding the 3rd Saturday In June	April 1 to Friday Immediately preceding the 3rd Saturday in June
	Catch & Possession	8 fish/day, only 1 fish>20", 8 fish possession	8 fish/day, only 1 fish>20", 8 fish possession
	Minimum Size	No change	No minimum size
1976	Closure	April 1-June 18	April 1-June 18
	Catch & Possession	No change	No change
	Minimum Size	No change	No minimum size
1977	Closure	April 1-June 17	April 1-June 17
	Catch & Possession	No change	No change
	Minimum Size	No change	No minimum size
1978	Closure	April 1-June 16	April 1-June 16
	Catch & Possession	No change, only 2 fish>50cm	No change, only 2 flsh>50cm
	Minimum Size	No change	No minimum size

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Year	Regulatio	оп Туре	Above & Including Skaist Cr.	Below Skalst Ck.	Ross Reservoir
1979	Closure		No closure	April 1-June 15	April 1-June 15
	Catch & I	Possession	No change	No change	No change
	Minimun	Size	No minimum size	No change	No minimum size
1980	Closure		No closure	April 1-June 20	April 1-June 20
	Catch & I	Possess Ion	No change	No change	No change
	Minimum	Size	No minimum size	No change	No minimum size
1981	Closure		No closure	April 1-June 19	April 1-June 19
	Catch & I	Possession	No change	No change	No change
	Minimum	Size	No minimum size	No change	No minimum size
1982	Closure		No closure	April 1-June 18	April 1-June 18
	Catch & I	Possession	2 fish/day, only 2 fish>50cm, 4 fish possession	2 fish/day, only 2 fish > 50cm, 4 fish possession	2 fish/day, only 2 fish > 50cm, 4 fish possession
	Minimum	Size	No minimum size	No change	No minimum size
1983	Closure		No closure	April 1-June 17	April 1-June 17
	Catch & I	Possess Ion	No change	No change	8 fish/day, only 2 fish
	Minimum	Size	No minimum size	No change	> 50cm, 16 fish possession No minimum size
1984	Closure		No closure	No Change	No change
	Catch & I	Possession	No change, only 1 flsh > 50cm	No change, only 1 flsh > 50cm	No change only 1 fish > 50cm
	Min Imum	Size	No minimum size	No change	No minimum size

Skagit River and Tributaries

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		Skagit River an		
Year	Regulation Type	Above & Including Skaist Cr.	Below Skalst Ck+	Ross Reservoir
1985	Closure	No closure	April 1-June 14	April 1-June 14
	Catch & Possession	No change	No change	4 fish/day, only 1 fish > 50cm, 8 fish possession
	Minimum Size	No minimum size	30 cm	No minimum size
	Single Barbless Hoo	k Yes	Yes	No
	Balt Ban	No	Yes	No
1986	Closure	No closure	April 1-June 13	April 1-June 13
-		All other	regulations same as	1985
1987	Closure	No closure	April 1-June 19	April 1-June 19
		All other	regulations same as	1985
1988	Closure	No closure	April 1-June 17	April 1-June 17
		All other	regulations same as	1985

#### APPENDIX III

# Fish Introductions to Ross Reservoir Drainage (Washington Department of Wildlife Records)

Year	Water	Stock	Species	Number
1916	Big Beaver Creek		cutthroat	27,000
	Beaver Creek		cutthroat	20,000
1919	Big Beaver Creek		rainbow	10,000
1920	Hozomeen Lake <sup>1</sup>		steelhead	40,000
1933	Sourdough Lake		Eastern Brook	unknown
1935	Slate Creek <sup>2</sup>		rainbow	10,000
1936	Ruby Creek		rainbow	2,000
	Slate Creek <sup>2</sup>		rainbow	2,000
	Slate Creek, South Fork <sup>2</sup>		rainbow	2,000
1938	Slate Creek, South Fork <sup>2</sup>		rainbow	5,000
	Slate Creek, North Fork <sup>2</sup>		rainbow	5,000
1952	Ross Lake	Twin Lakes	cutthroat	25,104
1953	Ross Lake	Twin Lakes	cutthroat	25,761
1954	Ross Lake	Twin Lakes	cutthroat	50,861
1960	Willow Lake <sup>3</sup>	Tokal Creek	cutthroat	7,200
1961	Willow Lake <sup>3</sup>		cutthroat	5,000
	Silver Lake (Glacier Lake)	4	Golden Trout	5,000
1967	Willow Lake <sup>3</sup>		cutthroat	2,250
	Jerry Lakes (upper) <sup>5</sup>		cutthroat	3,450
	Jerry Lakes (lower) <sup>5</sup>		cutthroat	3,450
	Skymo Lake	Twin Lakes	cutthroat	unknown
_ <b>*</b>	Firn		rainbow	unknown
	Middle Lakes		rainbow	unknown
	East Lakes		rainbow	unknown
1975	Ridley Lake	Mt. Whitney	rainbow	1,200
1978	No Name Lake	Cape Cod	rainbow	515
	Willow Lake	Mt. Whitney	rainbow	1,519
1982	Ridley Lake	Mt. Whitney	rainbow	999
1985	Willow Lake	Twin Lakes	cutthroat	2,800
1988	Willow Lake	Twin Lake	cutthroat	1,300
	Ridley Lake	Mt. Whitney	rainbow	1,200
l <sub>Hozo</sub>	meen Creek Drainage	<sup>2</sup> Ruby Creek Drai	Inage	

- <sup>3</sup> Lightning Creek Drainage 5 Devils Creek Drainage 4 Silver Creek Drainage

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 $\{ e_{i}, e_{i}$ 

#### APPENDIX IV

## Calculation of Harvest and Utilization Rates for Rainbow Trout and Dolly Varden Char in the Skagit River

1.	Standing Crop for 1986.	5
	<pre>- estimated rainbow harvest (Scott &amp; Lewynsky 1987) - estimated mean weight - estimated harvest in kg - estimated late summer standing crop (on file)</pre>	1030 0.4kg 412kg
	- rainbow harvest as % of standing crop	1870kg 22%
2.	Late Summer Standing Crop as a Percentage of Carryin Capacity	ng
	<ul> <li>estimated standing crop capability for trout and char &gt;20cm below barrier falls including Sumallo and Klesilkwa (Griffith and Griener 1983) 130 ha at 40 kg/ha</li> <li>rainbow trout late summer standing crop</li> <li>char late summer standing crop (5% of fish in the river are char - most are Dolly Varden)</li> <li>total estimated standing crop (trout and char)</li> <li>standing crop as % of carrying capacity</li> </ul>	5200kg 1870kg 100kg 1970kg 38%
3.	Dolly Varden Harvest as a Percentage of Late Summer Crop for 1986	Standing
	<ul> <li>estimated DV harvest (Scott and Lewynsky 1987)</li> <li>estimated mean weight</li> <li>estimated harvest in kg</li> <li>estimated late summer standing crop (from</li> <li>above - for this calculation brook trout</li> </ul>	43 0.3kg 13kg
	<ul> <li>have been ignored since are few in number)</li> <li>DV harvest as % of standing crop</li> </ul>	100kg 13%



