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STUDIES OF CUTTHROAT AND STEELHEAD IN SOUTHEAST ALASKA

AFS 42-10-A Darwin E. Jones
AFS 42-10-B Darwin E. Jones

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STATE OF ALASKA

Jay S. Hammond, Governor

Annual Performance Report for

DEVELOPMENT OF TECHNIQUES FOR ENHANCEMENT AND MANAGEMENT OF STEELHEAD TROUT IN SOUTHEASTERN ALASKA

by

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ALASKA DEPARTMENT OF FISH AND GAME

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DIVISION OF SPORT FISH

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Volume 23 Project AFS-42-2

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ABSTRACT

Presented herein is the final report on 6 years of study in the development of techniques for the enhancement and management of steelhead trout, *Salmo gairdneri* Richardson, in southeast Alaska.

A continuing program has been underway since 1976 to survey selected steelhead systems throughout southeast Alaska. During this time, 30 streams scattered throughout southeast Alaska have been surveyed for their populations of spring-run steelhead. Surveys for adult summer-run steelhead were limited to the Plotnikof River system on Baranof Island, as this is the only known island in southeast Alaska to have a summer-run of steelhead.

The enhancement of spring-run steelhead with hatchery produced smolts is in the early stages of development. During 1976 and 1977, nine streams scattered throughout southeast were surveyed to assess their potential for plants of hatchery reared steelhead. A steelhead management plan for southeast Alaska was prepared in 1978 and has been updated on an annual basis. Steelhead brood stock development in southeast Alaska utilizing native brood stocks was begun in 1974 at Crystal Lake Hatchery and has been expanded to the Deer Mountain and Klawock River Hatcheries. The evaluation of streams enhanced with hatchery produced steelhead began in 1978 at Petersburg Creek and has been expanded to include four additional streams.

KEY WORDS

Southeast Alaska, Steelhead trout, *Salmo gairdneri*, surveys for hatchery enhancement, population assessments.

BACKGROUND

Basic life history research on spring-run steelhead in Petersburg Creek was conducted from 1971 through 1975. This research provided important data regarding spring-run steelhead in a typical lake-stream system in southeast Alaska.

It was determined that any given run of spawners is comprised of many age groups of adults, with as high as 45% of the total returning to spawn for the second, third, fourth, or fifth time. Initial spawners are comprised of adults that return to spawn after spending 2 or 3 years at sea and are usually 5 and 6 years of age.

Steelhead abundance may be directly related to rearing habitat. In a rich habitat, more smolt are produced annually. During the 1930's and 1940's, sockeye salmon, Oncorhynchus nerka (Walbaum), were abundant, with large annual escapements. These large escapements may have been the key to providing the enrichment necessary to produce large numbers of steelhead. Steelhead have not been subjected to intensive commercial fishing, so their decline is related to other factors. It may be possible that steelhead are cyclic in abundance, as are other salmonid species that rear for any length of time in fresh water. If indeed this is the case, the declines noted at Petersburg Creek may have reached a low and may turn upward in the near future.

Comphrehensive data on the majority of the steelhead systems in southeast Alaska are not presently available. Increasing angler interest for steelhead demonstrated that good background data will be necessary to properly manage steelhead stocks. At present, most of the angling pressure is concentrated on the better known steelhead systems within easy reach of the population centers. With improved access due to the expansion of logging roads, the development of mining, and oil exploration, fishing pressure will expand to areas where only light or no angling occurred 10 to 15 years ago. Increased pressure on some systems will make it difficult to sustain viable populations in those systems.

Present bag limits are quite restrictive (one per day) and do not leave much room for further reductions. Partial stream closures may be necessary on some systems to maintain adequate numbers of spawners.

Southeast Alaska contains numerous stream systems that support fall-run steelhead and three or four systems with summer-run steelhead. The run timing of these two races of steelhead make them attractive to the angling public. Development work on obtaining a brood stock of fall-run steelhead was started in 1976 without much success. Even though this initial attempt was mostly unsuccessful, much valuable data was gathered on the techniques necessary to successfully collect a brood stock of fall-run steelhead. Work on summer-run steelhead is in the planning stage and will await developments of the spring- and fall-run brood stock programs.

Hatchery expansion in southeast Alaska is just a matter of time. As these additional hatcheries become operational, more room will be created in which to raise salmonids. Allocation of space by species has yet to be determined; however, it is hoped that there will be room to raise significant numbers of steelhead smolt in the future.

A comprehensive plan for the management and enhancement of southeast Alaska steelhead was completed in 1978 (Jones, 1978). This plan has been upgraded on an annual basis and has been used to set guidelines for the regulatory management of wild steelhead populations and as the background for making recommendations for hatchery steelhead enhancment.

Enhancement of steelhead in southeast Alaska with hatchery production began in 1974, when the first wild steelhead eggs were obtained from Petersburg Creek and Falls Creek. Crystal Lake Hatchery, located just south of Petersburg, was selected to begin raising spring-run steelhead on an experimental basis. The use of heated, recirculated water at Crystal Lake Hatchery resulted in steelhead fry reaching smolt size in less than 12 months.

A total of 9,500 steelhead smolt were released into Crystal Creek and 8,000 into Petersburg Creek during the spring of 1975 (Zorich, 1979). Eggs collected from wild steelhead at Falls Creek in 1975 suffered a higher than normal hatchery mortality, resulting in the 1976 release of only 1,600 smolt at Crystal Creek, 6,500 at Montana Creek, 6,500 at Petersburg Creek, and 2,000 at Falls Creek.

Adult returns from these plants began to appear in the fishery in 1978 and were complete in 1979. The returns of initial spawners ranged from good at Crystal Creek, Falls Creek, and Petersburg Creek, to very poor at Montana Creek.

The steelhead brood stock development at Crystal Lake Hatchery was suspended in the summer of 1978 when the facility was closed down to eradicate diseases identified in resident salmon. The disinfection of the facility resulted in the loss of all fish on hand. Steelhead fry in residence at the time were destroyed. Adult steelhead returning in 1979 were not used as brood stock as they were suspected as carriers of Infectious Hematopoietic Necrosis Virus (IHNV) and Bacterial Kidney Disease (BKD).

The Deer Mountain Hatchery, near Ketchikan, has started production of spring-run steelhead on a small scale. Eggs have been collected from Ketchikan Creek on an annual basis since 1978 and the first smolt were released in Ward Creek and Ketchikan Creek in 1980. The first adults from this plant are expected to begin contributing to the sport fishery and hatchery in 1982. Until that time, wild steelhead will continue to be trapped in Ketchikan Creek for brood eggs.

The development of a fall-run (September-December) steelhead brood stock for enhancement work on Prince of Wales Island began at the Klawock Hatchery during the winter of 1978. A small number of eggs were obtained from six wild steelhead and were reared to smolt size by the spring of 1980. This program has continued and expanded on an annual basis; the 1981 egg take totaled over 45,000. The first hatchery produced adults should enter Klawock River during the winter of 1981-1982. These fish will contribute to the area's sport fishing and also provide brood stock to continue the program.

A continuing program has been underway since 1975 to identify streams in southeast Alaska that are suited for enhancement with hatchery produced steelhead. Eleven streams have been cataloged to date. These streams include: Indian River and Salmon Creek in the Sitka area; Fish, Montana, Kowee, and Peterson Creeks in the Juneau area; Pats Creek in the Wrangell area; Mahoney, Bakewell, and Ward Creeks in the Ketchikan area; Black Bear Creek in the Klawock area; and Ohmer, Falls, and Petersburg Creeks in the Petersburg area. Of these streams, only Montana, Petersburg, Falls, and Ward Creeks have received plants of hatchery produced steelhead smolt.

Stream systems have been surveyed throughout southeast Alaska since 1976, looking for possible sources for steelhead brood stock. Peterson Creek, in the Juneau area, has been surveyed as a possible source for steelhead for use in northern southeast Alaska. Petersburg Creek and Falls Creek have been developed as sources of spring-run steelhead for the Crystal Lake Hatchery. Ketchikan Creek has been developed as a source of spring-run steelhead production for the Deer Mountain Hatchery. Klawock River has provided adults for the development of fall-run steelhead at the Klawock Hatchery. The Plotnikof River has been surveyed as a possible source of summer-run steelhead, however, no fish have been taken from there to date.

A continuing program has been underway since 1975 to survey the steelhead systems throughout Southeast. These surveys have provided background data on the numbers and run timing of wild steelhead stocks. This information has been used to evaluate the potential impact that various land use activities would have on these streams. In addition, this data has been used by management to formulate regulatory measures aimed at perpetuating the resource.

A list of common names, scientific names, and abbreviations of all species mentioned in this report is presented in Table 1.

RECOMMENDATIONS

Management

1. Reestablish a brood stock of spring-run steelhead at the Crystal Lake Hatchery. The first full cycle of steelhead adults (2- and 3-ocean) returned to the Crystal Lake Hatchery during 1978 and 1979. Survival from smolt to adult was 9.2%. This brood stock was lost when it became necessary to shut down the Crystal Lake Hatchery for disease eradication measures. Steelhead eggs were again taken in 1980 and 1981 from the few remaining repeat spawning survivors of the former run. To fully reestablish the brood stock at Crystal Lake, it may be necessary to go back to wild fish from Falls Creek to meet the egg take requirements.

2. Continue the development of the spring-run steelhead at the Deer Mountain Hatchery. Spring-run steelhead eggs have been collected from Ketchikan Creek on an annual basis since 1978 and the first smolts

Table 1. List of common names, scientific names, and abbreviations.

Common Name	Scientific Names & Authors	Abbreviations
Steelhead trout	Salmo gairdneri Richardson	SH
Cutthroat trout	Salmon clarki Richardson	CT
Coho salmon	Oncorhynchus kisutch (Walbaum)	SS
Chinook salmon	Oncorhynchus tshawytscha (Walbaum)	KS
Rainbow trout	Salmo gairdneri Richardson	RT
Dolly Varden	Salvelinus malma (Walbaum)	DV

were released during the spring of 1980. As this program expands, spring-run steelhead smolts will be available for enhancement of other fisheries in the Ketchikan area.

3. Develop a brood stock of spring-run steelhead at the Snettisham Hatchery. At present, there is not a brood source of steelhead available for enhancement of the Juneau area streams. Work on this program should begin as soon as a disease free wild brood source is identified and space is available at the Snettisham Hatchery.

4. Continue the development of the fall-run steelhead brood stock at the Klawock Hatchery. Eggs have been collected from wild fall-run steelhead in the Klawock River annually since 1978. The first smolts were released into the Klawock River during the spring of 1980. As this brood stock program expands, fall-run steelhead smolt will become available for release in the Prince of Wales area.

5. It is recommended that areas already developed, or planned for development, be monitored by creel census, escapement counts, or other survey techniques. The ever increasing mileage of logging roads throughout southeast Alaska, together with an annual increase in the number of anglers, will put increasing fishing pressure on the steelhead resource.

Research

1. Continue to gather background data on steelhead streams in southeast Alaska. Additional steelhead streams in southeast Alaska should be surveyed on an annual basis. These surveys should proceed to determine adult steelhead abundance, run timing, distribution, and angler harvest. Surveys of spawning and rearing habitat will be necessary in order to afford reasonable protection from various land use activities.

2. Evaluate adult returns to streams that have been stocked with hatchery steelhead.

   The evaluation of systems that have been stocked with hatchery-reared steelhead will provide the background data necessary to formulate stocking levels. In addition, this evaluation will gather data on the contribution of hatchery fish to the sport fishery.

3. Continue the evaluation of brood stocks for use in the various hatcheries in southeast Alaska.

   Research needs to be continued on the selection of brood stocks of steelhead for hatchery use. This research should include run timing, average size, age at migration, and habitat preference.

   Investigations of diseases of wild steelhead must be undertaken before those stocks can be used for hatchery brood.

4. Investigate possible sources of summer-run steelhead for future brood stock development.

   Summer-run steelhead have been recorded in only one location on the islands of southeast Alaska. Development of this population for brood stock will be both time consuming and expensive. Runs of summer steelhead ascend the larger mainland rivers of southeast Alaska; however, their spawning grounds are located in Canada. Development of these populations would require negotiations with Canadian officials.

   Summer-run steelhead occur on Kodiak Island, and even though they are geographically far removed, they may be desirable for brood stock use in southeast Alaska.

5. Research the ecological relationships between steelhead, cutthroat, *Salmo clarki* Richardson, Dolly Varden char, *Salvelinus malma* (Walbaum), and coho salmon, *Oncorhynchus kisutch* (Walbaum).

   The competition among various salmonids for rearing habitat and food will need to be better understood for southeast Alaska before large-scale enhancement of any species can begin. The enhancement of one or more species may have undesirable effects on the other rearing species.

OBJECTIVES

1. Evaluate adult steelhead returns to streams that have been stocked with hatchery reared steelhead smolts.

2. Determine the distribution and abundance of adult steelhead throughout southeast Alaska.

3. Evaluate stream systems throughout southeast Alaska for possible enhancement with hatchery reared steelhead smolts.

TECHNIQUES USED

Foot surveys, hook and line, boat, and aircraft were used to determine the location and general abundance of adult steelhead in selected stream systems in southeast Alaska. Adult steelhead were captured, measured, sexed, and a scale sample was removed before they were released at the point of their capture.

Minnow traps, baited with cured salmon eggs, were used to determine the presence and distribution of rearing steelhead in selected streams in southeast Alaska. Rearing steelhead were anesthetized with Tricaine Methanesulfonate (MS-222) and their fork length was measured. These steelhead were allowed to recover before releasing them at the capture site.

Baited minnow traps and foot surveys were used to evaluate the streams selected for enhancement with hatchery-reared steelhead. Rearing fish captured in the minnow traps were enumerated by species before release at the point of capture. Maps of the streams were drawn noting various physical features.

Evaluations of adult steelhead returns to streams enhance with hatchery smolts were accomplished by the following means:

1. A creel census was conducted on Petersburg Creek between April 1 and June 15, 1978 and 1979, on a 7-day per week basis.

2. All adult steelhead censused at Petersburg Creek were examined for fin clips, and lengths and scale samples were collected.

3. Foot surveys and rod and reel sampling were conducted to determine the distribution of returning hatchery steelhead to the Petersburg Creek systems.

4. Periodic fisherman contacts and foot surveys were conducted at Montana Creek to determine the return of adult steelhead to the system.

5. Weir counts were monitored at Crystal Creek to determine the return of hatchery produced steelhead to Blind Slough.

6. Periodic angler contacts were conducted in the Blind Slough area to determine the harvest of adult steelhead bound for the Crystal Lake Hatchery.

7. The weir counts at Crystal Creek were monitored to determine the number of steelhead returning to the hatchery.

8. Foot surveys were conducted on Ketchikan Creek to determine the return of hatchery steelhead to the Deer Mountain Hatchery.

Evaluations of selected streams for enhancement with hatchery produced steelhead smolts were accomplished by:

1. Conducting foot surveys, noting access points, steelhead holding water, and other physical characteristics.

2. Noting the abundance and distribution of adult steelhead (if any) and preparing a stream map.

Evaluations of adult steelhead returns to streams stocked with hatchery smolt were accomplished by the following means:

1. Periodic angler contacts were conducted in the Blind Slough area to determine the harvest of adult steelhead bound for Crystal Lake Hatchery.

2. The weir counts at Crystal Creek were monitored to determine the number of returns to the hatchery.

3. Foot surveys were conducted on Ketchikan Creek to determine the return of hatchery steelhead to the Deer Mountain Hatchery.

Adult Spring-run Steelhead Surveys

During the 6 years of this project, a total of 25 streams, scattered throughout southeast Alaska, have been surveyed for their runs of spring steelhead. The names and locations of the 25 streams surveyed are presented in Table 2. A comprehensive description of the streams surveyed from 1976 through 1980 can be found by reviewing the annual reports of progress by Jones (1976; 1977; 1978; 1979; 1980 and 1981). Descriptions of streams surveyed in 1981 are found in Appendix A.

Summer-Run Steelhead Survey

The Plotnikof Lake and River system, located near Port Banks on the west coast of Baranof Island, supports the only known run of summer steelhead on an island in southeast Alaska.

Physical surveys of the Plotnikof River and the two inlets to Plotnikof Lake were conducted in July, 1976. Impassable falls occur on both inlets streams a short distance above Plotnikof Lake. The inlets are of a fairly steep gradient with only limited pools and a few riffles that could be considered as good spawning area.

The Plotnikof River has one of the steepest gradients known to be passable to anadromous fish. The area below the lake is a series of low falls 1- to 2-m high, connected by rough rapids. The middle section of Plotnikof River is a 2-km section of lower gradient, with many deep pools and many excellent spawning riffles. The last 0.75-km of Plotnikof River is composed of several low falls and rapids and terminates in a 5-m falls at tidewater in Port Banks.

The numbers of summer-run steelhead entering the Plotnikof system each year is difficult to determine. The physical size of the stream, with its many deep pools, make visual observations difficult, and once the steelhead reach Plotnikof Lake they disappear into the deep water.

Steelhead Enhancement Surveys

The enhancement of spring-run steelhead with hatchery-produced smolt is in the early stages of development in southeast Alaska. The Crystal Lake Hatchery, located at Petersburg, has the capability of producint smolt-size steelhead in a little less than 2 years. In an effort to utilize this production, investigations were carried out in 1976 and 1977 to determine what streams would be most suitable for these plants.

Four stream systems were surveyed during 1976 and five streams were surveyed during 1977 to determine their suitability for plants of hatchery-reared steelhead smolt. Two streams were in the Juneau area, two were adjacent to Sitka, one was adjacent to Wrangell, and the remaining four were in the Ketchikan area.

Table 2. Spring-run steelhead streams surveyed, 1976-1981.

Stream	Location	Average Escapement
Kadake Cr.	North Kuiu Is.	300
Hamilton R.	W. Kupreanof Is.	150
Sitkoh Cr.	SE Chichagof Is.	500
Chuck R.	Windham Bay-Mainland	50
Keta R.	Boca De Quadra-Mainland	50
Peterson Cr.	N of Juneau-Mainland	30
Admiralty Cr.	North Admiralty Is.	100
Plotnikof R.	W. Baranof Is.	200
Summer Cr.	S. Mitkof Is.	100
Manhattan Cr.	Dall Is.	0
Devil Cr.	Dall Is.	50
White R.	Revillagigedo Is.	250
Pleasant Bay Cr.	Pleasant Bay- Admiralty	100
Ward Cr.	N of Ketchikan-Revillagigedo Is.	150
Thomas Cr.	Wrangell Is.	100
Martin Cr.	Bradfield Canal	400
Franks Cr.	Bradfield Canal	50
Tom Cr.	Bradfield Canal	50
Harding R.	Bradfield Canal	50
Eagle R.	Bradfield Canal	150
Anan Cr.	Bradfield Canal	150
Harris R.	E. Prince of Wales Is.	250
Black Bear Cr.	Prince of Wales Is.	100
Steelhead Cr.	Big Salt Lk.-Prince of Wales Is.	150
Bakewell Cr.	Smeaton Bay-Mainland	50

Surveys of these nine streams were conducted to assess their potential for plants of hatchery-reared steelhead. Fisherman accessibility, steelhead holding water, and rearing species were the primary criteria.

The names and locations of the nine streams surveyed are present in Table 3. Additional comprehensive descriptions of these systems can be found by reviewing the annual reports of progress by Jones (1976 and 1977).

STEELHEAD MANAGEMENT AND ENHANCEMENT PLAN FOR SOUTHEAST ALASKA

A comprehensive plan for the management and enhancement of southeast Alaska steelhead was completed in 1978. This plan has been upgraded on an annual basis and has been used to set guidelines for the regulatory management of wild steelhead populations and as the background for making recommendations for hatchery steelhead enhancement. The completed plan can be found by reviewing the annual report of progress by Jones (1978).

Steelhead Brood Stock Development

The Department policy of not allowing the importation of trout or salmon eggs into the State has made it necessary to develop brood stocks from native Alaskan steelhead.

The first eggs for brood stock development were obtained from spring-run fish at Petersburg Creek in the spring of 1974. Subsequently, eggs were obtained from Falls Creek, Petersburg Creek, and Crystal Creek. The development of a hatchery brood stock of spring-run steelhead started with the release of 9,500 smolts in Crystal Creek in 1975. This hatchery program has continued to date.

The Klawock River Hatchery became operational in the summer of 1978 and is considered the prime facility for the development of a fall-run steelhead brood stock. Klawock River receives a run of steelhead in the fall, i.e., during October and November. During coho salmon egg-take operations at the Klawock Hatchery in November, 1978, 16 fall-run steelhead were captured. The holding mortality was high; less than 5,000 eggs were obtained.

In addition to the above work, surveys were conducted on an annual basis on various streams throughout southeast Alaska in search for additional wild stocks of steelhead for use in the various hatchery facilities. The streams surveyed are listed in Table 4. Additional information on these systems can found in annual reports of progress by Jones (1976; 1977; 1978; 1979; and 1980). Information gathered during 1981 can be found in Appendix A of this report.

Steelhead Enhancement Evaluation

Petersburg Creek:

The enhancement of spring-run steelhead systems with smolt produced at the Crystal Lake Hatchery was initiated in 1975 with the release of 8,000 smolts in Petersburg Creek. A second plant of 6,500 smolts was conducted during the spring of 1976.

Table 3. Streams surveyed for potential enhancement with steelhead smolt 1976-1981.

Name	Location	Recommended Action
Cowie Creek	Juneau Road System	Not recommended at this time
Montana Creek	Juneau Road System	Recommended release of spring-run steelhead smolt
Indian River	Sitka Road System	Not recommended at this time
Salmon Creek	Silver Bay	Not recommended at this time
Pats Creek	Wrangell Road System	Recommended for enhancement when fish are available
Mahoney Creek	George Inlet	Not recommended at this time
Ward Creek	Ketchikan Road System	Recommended for release of steelhead smolt
Peterson Creek	Juneau Road System	Recommended for release of steelhead smolt
Fish Creek	Juneau Road System	Not recommended at this time

Table 4. Steelhead Streams Investigated for Broodstock, 1976-1980.

Name	Location	Steelhead Race
Plotnikof River	W. Baranof Island	Summer-run
Eagle Creek	E. Prince of Wales Island	Fall-run
Naha River	Revillagigedo Island	Fall-run
Kah Sheets Creek	S.E. Kupreanof Island	Spring-run
Peterson Creek	Juneau Road System	Spring-run

The evaluation of these plants continued during the spring of 1979 to determine the contribution of these hatchery smolts to the steelhead run in Petersburg Creek. Budgeting and other factors ruled out the use of a counting weir in 1979. Evaluation methods were limited to a daily creel census of steelhead fishermen, hook and line sampling by the field crew, and foot surveys of the system. These forms of evaluation serve only as indicators of hatchery contribution. A counting weir remains the best tool for assessing total figures.

Census of anglers fishing Petersburg Creek began on April 4, 1979, and continued on a daily basis through June 7, 1979. A census taker was stationed at the old weir cabin and contacted steelhead anglers as they left the creek.

A comparison of the hatchery steelhead contribution to the sport angler at petersburg Creek for 1978 and 1979 is presented in Table 5.

In addition to the above creel census, the field crew at Petersburg Creek undertook a rod and reel sampling program to determine the contribution of hatchery steelhead to the 1979 run. Periodic sampling throughout the system from mid-April to mid-July resulted in the capture of 41 additional steelhead. Of these 41 additional steelhead sampled, 17 (41%) were of hatchery origin.

During 1978, the sampling by the field crew produced 56 steelhead of which 32% were of hatchery origin (Jones, 1979). The difference in percentages of hatchery steelhead taken by the public and by the sampling crew is significant, however, no ready explanation was apparent. The general public fished the same water during the same time frame.

All steelhead checked during the creel census and sampling program were examined for fin clips given the steelhead smolts before they were liberated from the Crystal Lake Hatchery. Examination revealed that 31% of all steelhead caught in Petersburg Creek in 1979 were of hatchery origin. Examination of 25 hatchery steelhead and 80 wild steelhead at Petersburg Creek showed very little difference in overall size (Table 6). Of the fish measured, wild steelhead averaged 60 mm larger than hatchery steelhead.

Foot surveys of Petersburg Creek and its major tributaries during May and early June 1979, determined that hatchery steelhead were distributed throughout all available and/or preferred spawning habitat. There was a tendency for hatchery fish to school near the release site below Shakey Franks Creek. This area is prime spawning habitat and was used by both wild and hatchery fish.

The evaluation of the initial hatchery plants in the Petersburg Creek system is now complete, as 1979 marked the final year initial hatchery produced spawners would enter Petersburg Creek. All hatchery fish returning in 1980 and the future will be repeat spawners and will contribute to a lesser extent to the overall fishery.

Table 5. Petersburg Creek Creel Census 1978-1979.

Dates of Census	No. of Anglers	Angler Hours	No. SH	% Hatchery SH
4/7-6/9-1978	136	471	39	25
4/4-6/7-1979	115	301	39	21

Table 6. Petersburg Creek Steelhead, 1979

Type	No.	Length Range mm	Average Length mm
Hatchery Steelhead	25	610-850	800
Wild Steelhead	80	650-985	860

Montana Creek:

Montana Creek, located on the Juneau road system, was the first non-native steelhead system to be stocked with hatchery produced smolt. A plant of 6,500 steelhead smolt of Falls Creek and Petersburg Creek origin averaging 170 mm was made in upper Montana Creek on June 5, 1976.

Twice in the spring of 1979, portions of Montana Creek were foot surveyed and sampled with rod and reel for returning steelhead from the plant in 1976.

The first survey was conducted on May 16 and 17, 1979. The upper portion of Montana Creek from the first bridge below McGinnis Creek downstream for 0.5 km was surveyed with negative results. In addition, both the section of Montana Creek upstream from the Loop Road, as well as the downstream section of the creek from the Loop Road to the Mendenhall River, was surveyed. No steelhead were seen or taken in this section.

A second survey of Montana Creek was conducted on May 31 and June 1, 1979. The same sections as described above were again foot surveyed and sampled with rod and reel. No steelhead were observed or sampled in any portion of the creek. In addition, a staff biologist from the Juneau office had just completed a rearing fish survey of Montana Creek and reported that no steelhead were observed during his survey work. Contacts with local Juneau anglers who had fished Montana Creek on a regular basis in 1979 also reported no observations of steelhead in Montana Creek.

Surveys of Montana Creek in 1978 (Jones, 1979) turned up a total of only two steelhead. It is possible that a few adult steelhead did return to Montana Creek in 1979, however, their numbers were few and they did not contribute to the local fishery.

The failure of the Falls Creek-Petersburg Creek brood stock of steelhead in the Montana Creek system was most likely due to environmental and displacement problems. Future enhancment of Montana Creek should be done with a steelhead brood stock secured from a system more in tune with environmental conditions found in the Juneau area.

Crystal Creek:

The development of a brood stock of spring-run steelhead at the Crystal Lake Hatchery was initiated in 1974, using stock from Petersburg Creek. Petersburg Creek steelhead were again used in 1975. Brood fish were obtained from Falls Creek during 1976 and 1977. Smolt releases began in Crystal Creek in 1975 and have continued on an annual basis ever since (Table 7). The first adults returned to Crystal Creek in 1977, when two fish were trapped. The second return to Crystal Creek in 1978 was much stronger and 70 fish were trapped between April 15 and June 10, 1978 (Zorich, 1978). A total of 32,000 eggs were taken from 10 female steelhead and placed in incubators at the hatchery.

Returns of hatchery steelhead in Washington State (Royal, 1972) averaged 8% to 10%. The return of the 1976 brood steelhead to Crystal Lake was 9.2%, which is consistent with expected hatchery practices. Additional

Table 7. Crystal Creek Steelhead, 1975-1979.

Date Smolt Released	No. Released	Size	Adult Returns 1977-1979*	% Returns
6/6/75	9,500	142mm	114	1.2
6/10/76	1,600	170mm	144	9.2
6/17/77	630	175mm	9	1.2
5/27/78	10,700	162mm	21	0.2
1979	0**	0	94	0.8
1980	0	0	44	0.4
1981	0	0	24***	0.2

* Includes steelhead harvested in the sport fishery in Blind Slough.

** No smolt released.

*** All fish repeat spawners.

information on the evaluation of the hatchery produced steelhead runs can be found in the annual reports of progress by Jones (1976; 1977; 1978; 1979 and 1981).

DISCUSSION

From background information gathered at Petersburg Creek and other streams, it became apparent that to adequately manage and enhance steelhead populations in southeast Alaska, a comprehensive plan must be formulated. This plan was written and it defines problem areas and provides methods and means for solving management problems.

The management and enhancement plan should remain flexible to enable the addition of new data, ideas, and techniques for the management and enhancement of steelhead in southeast Alaska. A great deal of the enhancement plan for steelhead in southeast Alaska depends on the expansion of facilities or the building of new facilities for the raising of salmonids. Creation of additional room to raise steelhead will be necessary before an extensive enhancement program can be realized.

Another method of preserving the steelhead fishery would be through the creation of new fisheries and the careful enhancement of existing fisheries. The creation of new fisheries and the enhancement of existng fisheries in close proximity to population centers will lessen the pressure on systems with only wild stock.

The rapid expansion of forest logging roads throughout the region will continue to create management problems on streams with small steelhead populations. Special management regulations may be necessary in the future to maintain these wild runs. On the positive side, the recent Presidental action creating extensive wilderness areas in southeast Alaska has taken the pressure off some steelhead systems. Many of the better steelhead systems are outside the newly created wilderness areas and will require additional effort to protect the habitat from land use activities which include urban development, road building, and logging. Additionally, restrictive steelhead bag and possession limits and closed areas may be necessary on certain waters to maintain a viable sport fishery for wild steelhead.

The establishment of brood stocks of spring- and fall-run steelhead in hatcheries in central and southern southeast Alaska is well underway. Returns to these facilities in 1982 will mark the beginning of a comprehensive enhancement program for steelhead near the road systems in central and southern southeast Alaska. Development of a brood stock and the subsequent enhancement of steelhead in northern Southeast has been hampered by the lack of a facility in which to develop the brood stock and by the scarcity of wild fish. It may be the mid-1980s before an enhancement program is underway in northern southeast Alaska.

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APPENDIX A

Selected Steelhead Surveys, 1981

Adult Spring-Run Steelhead Surveys

Surveys were conducted on five stream systems throughout southeast Alaska during the spring of 1981 to determine the presence, distribution, and general abundance of spring-run steelhead.

Harris River

The Harris River, located on the east side of Prince of Wales Island in Kassan Bay, heads in the high country near the middle of Prince of Wales Island. It flows for 32 km before entering Kassan Bay, near Hollis.

The Harris River was surveyed from the intertidal area to the Klawock-Hollis road bridge, approximately 16 km, over a 5-day period. Only three steelhead were seen or sampled during this survey, but local anglers claimed that several fish had been taken over the previous week. Also, the main run of fish reportedly occurs closer to the beginning of May.

In general, the water is brownish from tannic acid, with visibility down to about 1 meter in pools. Water temperatures were from 5.5 C to 6 C. Good spawning gravel is present throughout the area surveyed, except within about 450 meters of the Klawock-Hollis road bridge, where the bottom changes to bedrock, boulder, and large cobbles. A previous survey (1974 Stream Survey Catalog) estimated the available spawning area (ASA) at 80% (75% riffle, 25% pool), which seems reasonable. The banks are generally stable, with a low slope on the upper banks. Streamside vegetation is mainly alder and low brush. The river flows through usually flat terrain, except near the highway bridge, where it runs between steep bedrock walls with a higher gradient. Signs of angler use were most often found within 1 km of the main access points.

The river was foot surveyed from the intertidal area, accessible from a road at mile 28.7 on the highway, near Hollis, to the highway bridge at mile 19.8.

Access is also available at mile 26.5 (the road to the footbridge), mile 23.75 (a road to a removed logging bridge), mile 22.8 (a 1.6 km trail down an abandoned logging road) and mile 20.5 (the bridge on the Hydaburg Road). There is also a Y.A.C.C. constructed trail from the footbridge to the Hydaburg bridge, along the north bank, within 20 meters of the river.

The section from Hollis to the footbridge was surveyed at low tide on April 21 (Figure 1). The intertidal area was reached after walking for 45 minutes from the Hollis access to the confluence of the Harris River and Indian Creek. The average width of the channel, up to the gauging station, was about 20 meters, and the average depth was 40 cm to 70 cm. Rainfall appeared to have some effect on this, however, as the river depth had fallen an estimated 30 cm since the previous afternoon.

Several pools and riffles below the gauging station were sampled, but no fish were seen or caught. It was surveyed mainly from the north bank, but no trail is visible below the gauging station. From that point to the

Harris River: Intertidal to footbridge
Approx. 1.6 Km. (1 mile) distance.
Map not drawn to scale.

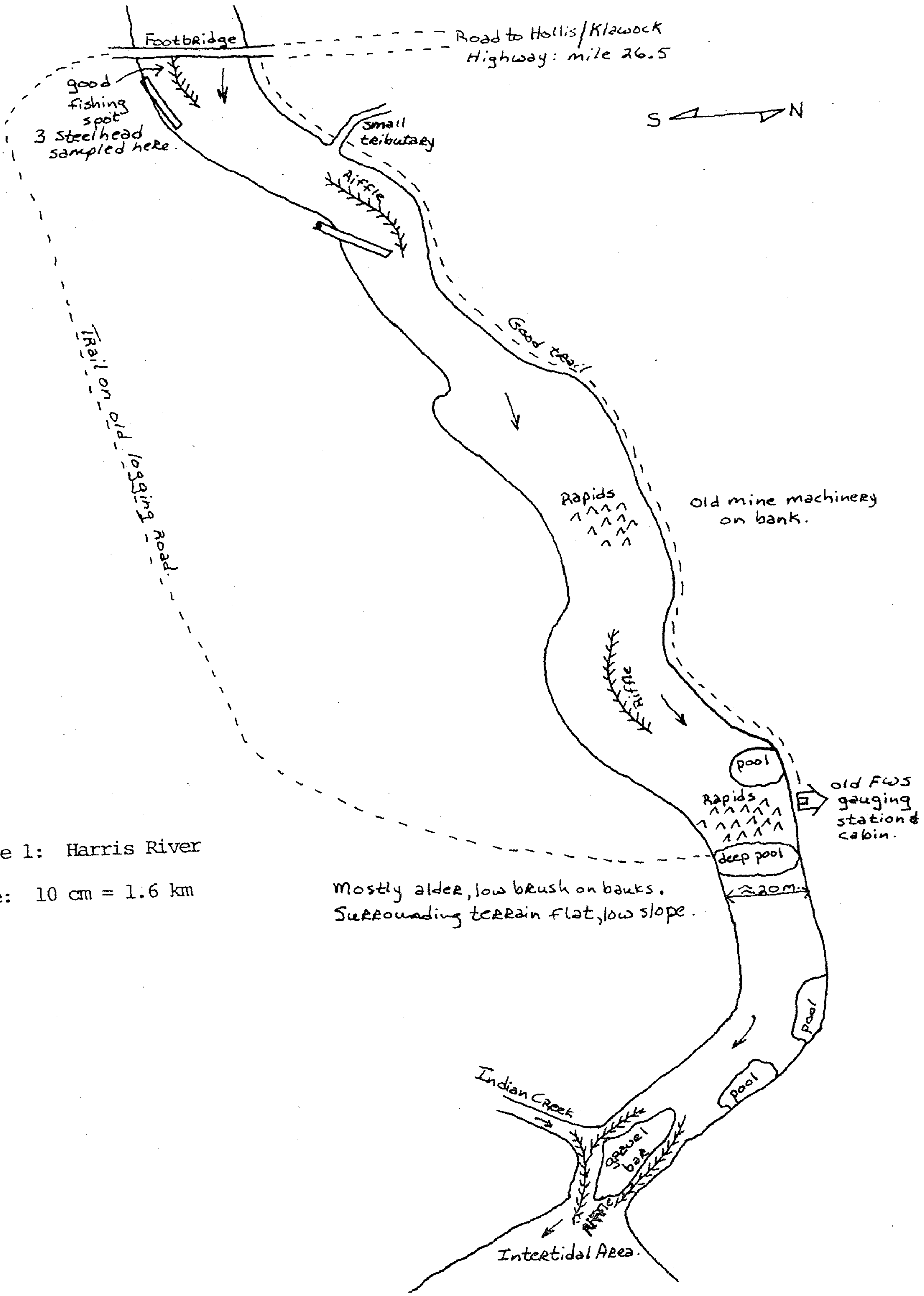


Figure 1: Harris River

Scale: 10 cm = 1.6 km

footbridge and winding away from the river, then returning to the rapids above the gauging station. It is an easy one half hour walk to the rapids, but the trail on the north bank is more direct.

Several pools were sampled between the footbridge and the gauging station, but no fish were noted. The most popular pool in the system is just below the footbridge, an area about 20 meters in length and the same in width.

An angler interviewed on April 20 reported catching two steelhead there the previous week, though he believed the main run came about the 1st of May. The only fish sampled during this survey was at this spot; a fairly bright 660 mm male.

The section from the footbridge to the Hydaburg road bridge was surveyed over 2 days, April 22 and 23 (Figure 2). The first day was from the footbridge to a trail at mile 22.8. The second day continued from there to the Hydaburg bridge at mile 20.5.

The river was consistently slow over this section, with an average depth of about 1 meter. It was easily walked on gravel bars, though there were occasional log jams. The width averaged about 25-30 meters, with pools on each curve.

The section from Hydaburg road bridge to the Klawock-Hollis road bridge was surveyed on April 23 (Figure 3). A pool directly beneath the bridge, and two fast moving pools just above were sampled. Above these pools, the river goes into a section of shallows and riffles, with somewhat larger gravel size than usual in the lower sections.

The Harris River was again surveyed for steelhead on May 7, in the area of the footbridge and immediately upstream. Five steelhead were observed in the hole just below the footbridge, and one 660 mm spawned-out male was sampled and released there. One 800 mm spawned-out female was sampled in the uppermost arm of the horseshoe bend upstream.

A further survey of the same area was conducted on May 7. Two steelhead were sampled upstream from the footbridge; an 800 mm male and a 710 mm male. Five other steelhead were also observed. The fish seemed to be pairing up and moving from the pools onto the spawning areas. Some spawning redds were also observed.

Black Bear Creek

Black Bear Creek, located on the west side of Prince of Wales Island, heads in Black Bear Lake and flows in a northwesterly direction for 3.5 km before entering tide water in Big Salt Lake.

Black Bear Creek is divided into two main sections; a section from tidewater in Big Salt Lake to the outlet of Black Lake and from the inlet at the south end of Black Lake to Black Bear Lake. The upper section extends only to the base of the falls below Black Bear Lake.

Both the upper and lower sections were foot surveyed twice; the lower section on May 5 and 27, and the upper section on May 6 and 28. Sampling methods included both minnow traps and rod and reel.

Harris River: Footbridge to Hydaburg Bridge.
Approximately 8 kilometers (5 miles) distance.

S N

Entire section has many sandbars, logs, stumps, blowdown timber. Water mostly shallow, with pools on curves. Good ASA throughout most of section.

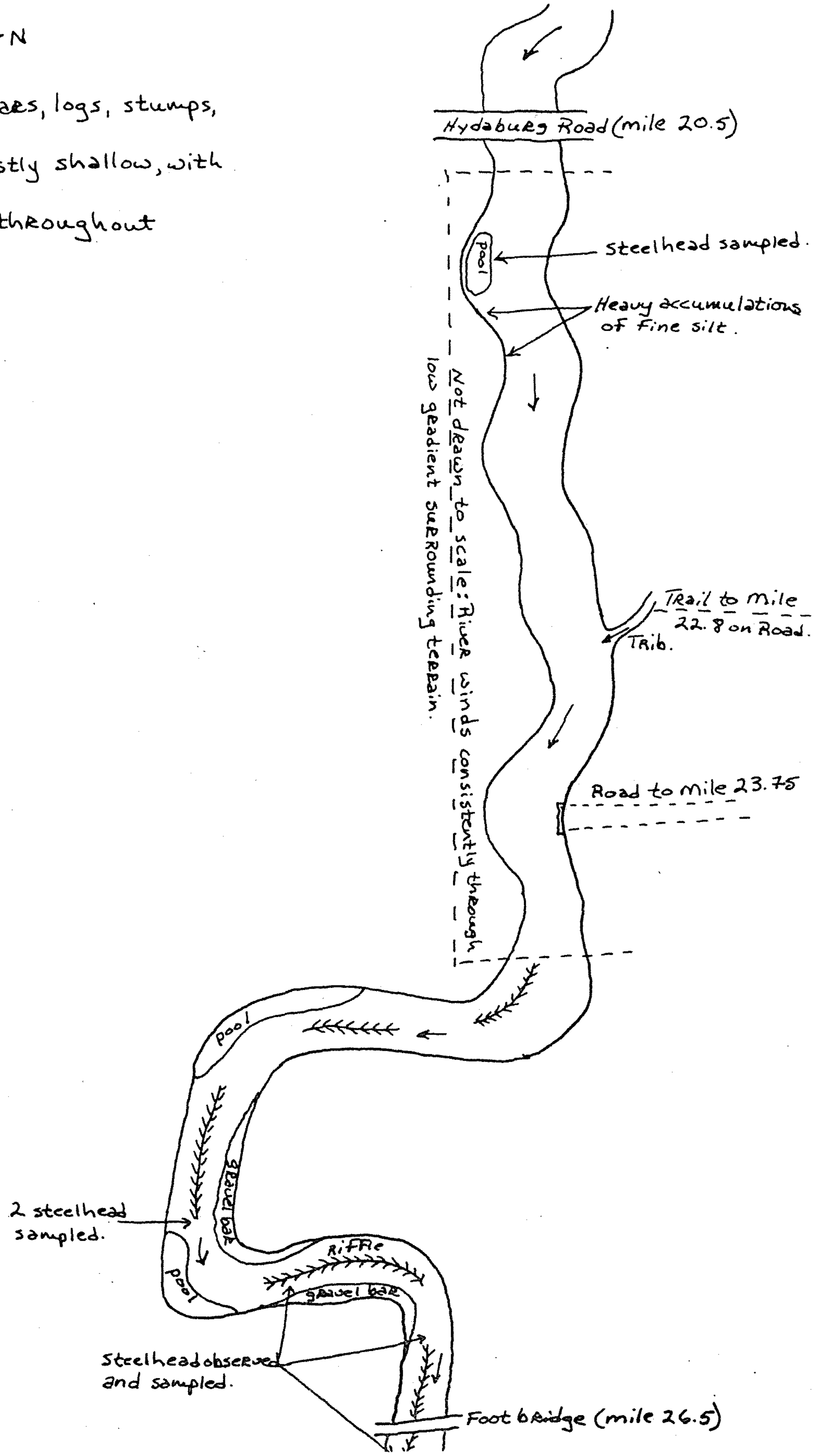


Figure 2: Harris River

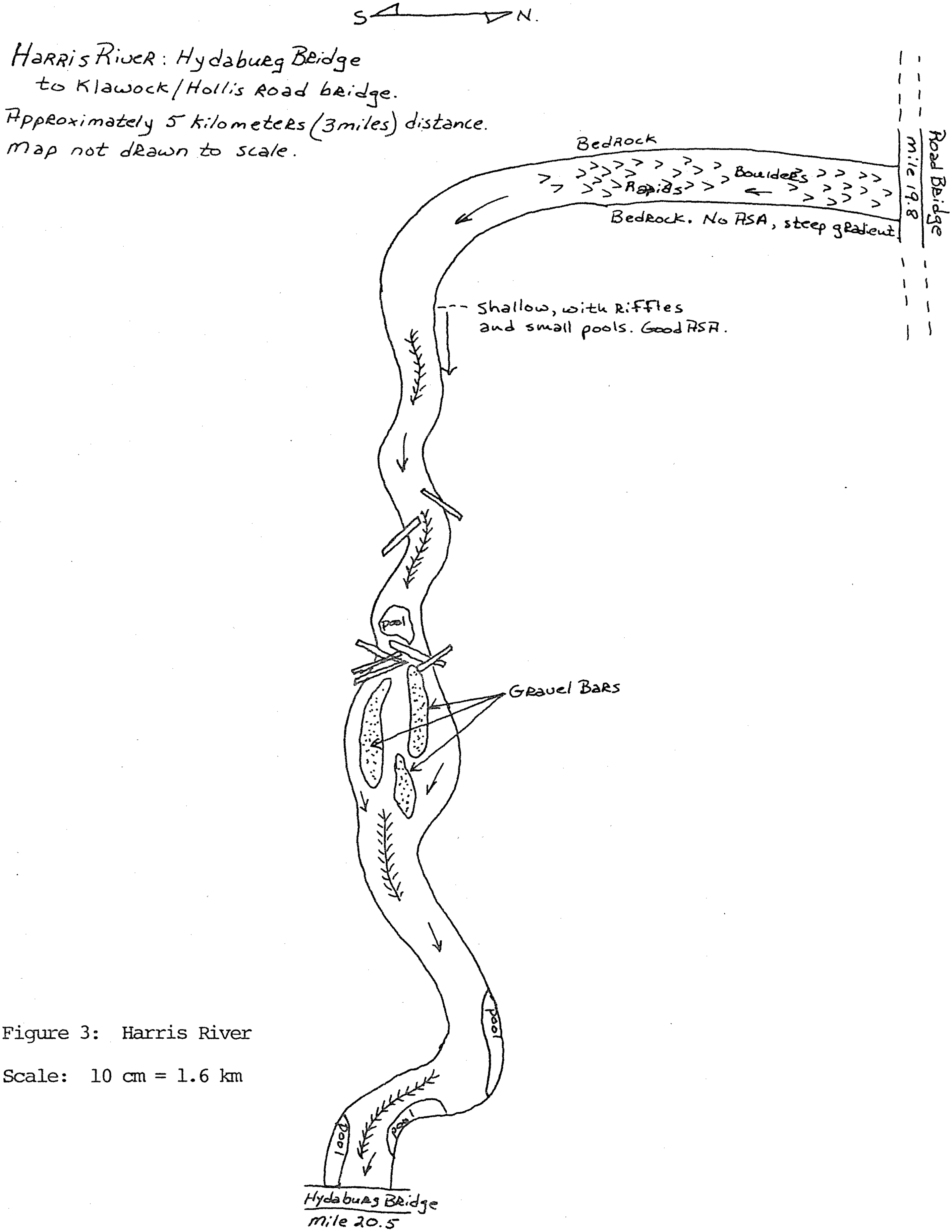


Figure 3: Harris River

Scale: 10 cm = 1.6 km

Big Salt Lake to Black Lake: This section can be divided into three sub-sections, each about 1500 m in length. The first extends from tidewater to the beginning of the muskeg pools/rearing area (Figure 4), and is characterized by small pools and riffles, with some ASA. The second section, the shortest, is deeper, slow moving, and mainly a rearing and schooling area (Figure 5). The third section is similar to the first, with riffles, pools, and some ASA. All three sections are about 20 m wide, have stable banks, and streamside vegetation of mixed conifers, alder, and the usual low brush. The only steelhead seen in any of the surveys on the system was on May 5, about 500 m below Black Lake. Clearcut units were recently (1981) created along the east bank of the third section. Water temperature throughout the section below Black Lake was 10 C. Coho fry, sticklebacks, and cutthroat trout were sampled. Coho fry averaged 50-60 mm, and the largest cutthroat sampled was a 310 mm female.

Black Lake to barrier falls: This section is about three kilometers in length. The water temperature (8°C) was slightly colder than the lower section. The first kilometer is fairly slow, averages about 2 m in depth, and has a mud bottom. The second kilometer is heavily braided and shallow with good ASA. Near the top of this section, the stream splits into two tributaries (Figure 6). One turns westward into a separate drainage system, and supplies the majority of the flow of the lower section. The other, smaller tributary continues about 1 km to the base of a high barrier falls. This final kilometer has a steep gradient, large cobble and boulder substrate, and little or no ASA. Streambank vegetation is similar to that found in the lower sections. No adult fish of any species were seen in these sections, but coho fry of 50-60 mm were present in the braided area.

Steelhead Creek

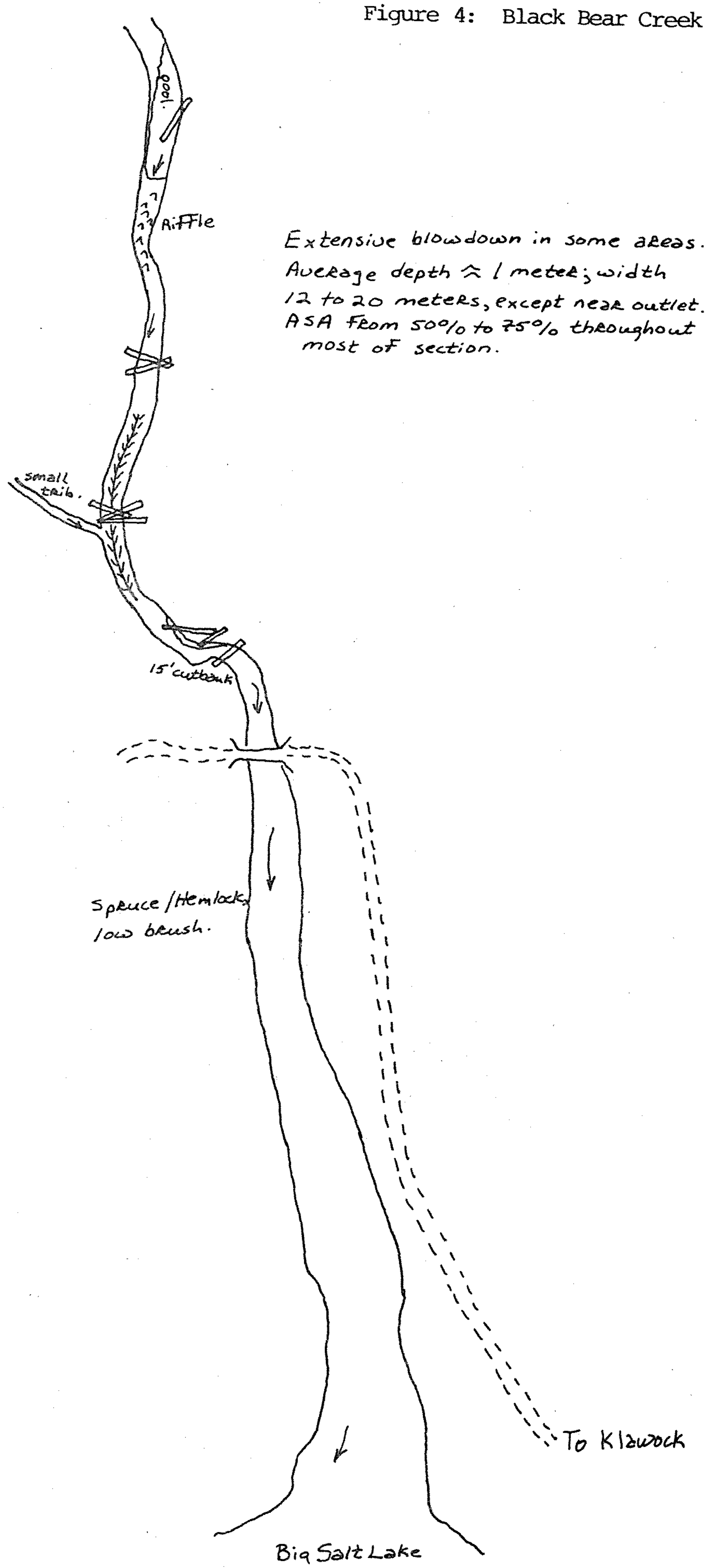
Steelhead Creek, located on the west side of Prince of Wales Island, heads in high country in the middle of the island. It flows in a southerly direction of 10 km before entering tide water at Big Salt Lake.

Steelhead Creek was surveyed on May 7, 1981, from approximately 1 km above the Big Salt Lake road downstream to just above tidewater. The upper section of Steelhead Creek, from above the bridge downstream for 2 km, contains excellent spawning and rearing habitat (Figure 7). No adult steelhead were noted until an area just above a large debris dam. Nine adult steelhead were scattered throughout the remiander of the length of Steelhead Creek with the largest concentration found in the lower sections (Figures 8 and 9).

Steelhead Creek contains excellent spawning and rearing habitat for steelhead, however, it is being severely impacted by clearcut logging. This logging is in the process of removing large sections of the stream side cover and is introducing large amounts of slash to the tributaries and to the main channel. The removal of the stream side cover could have severe impacts upon the stream's ability to support steelhead during periods of low flow and high temperatures.

Figure 4: Black Bear Creek

103-60-31
Black Bear Creek
Prince of Wales Island.
Scale: 25 cm = 1.6 km



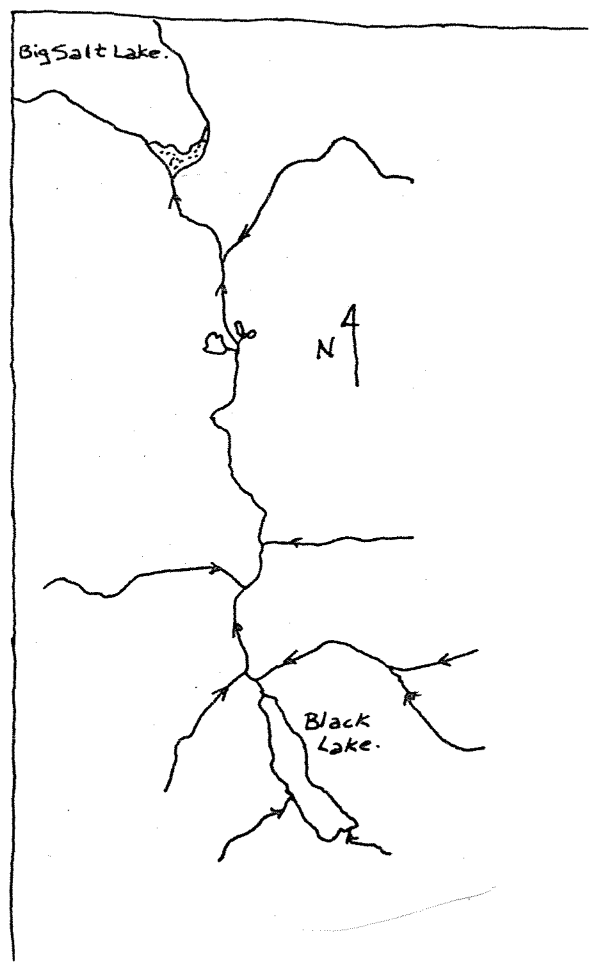


Figure 5

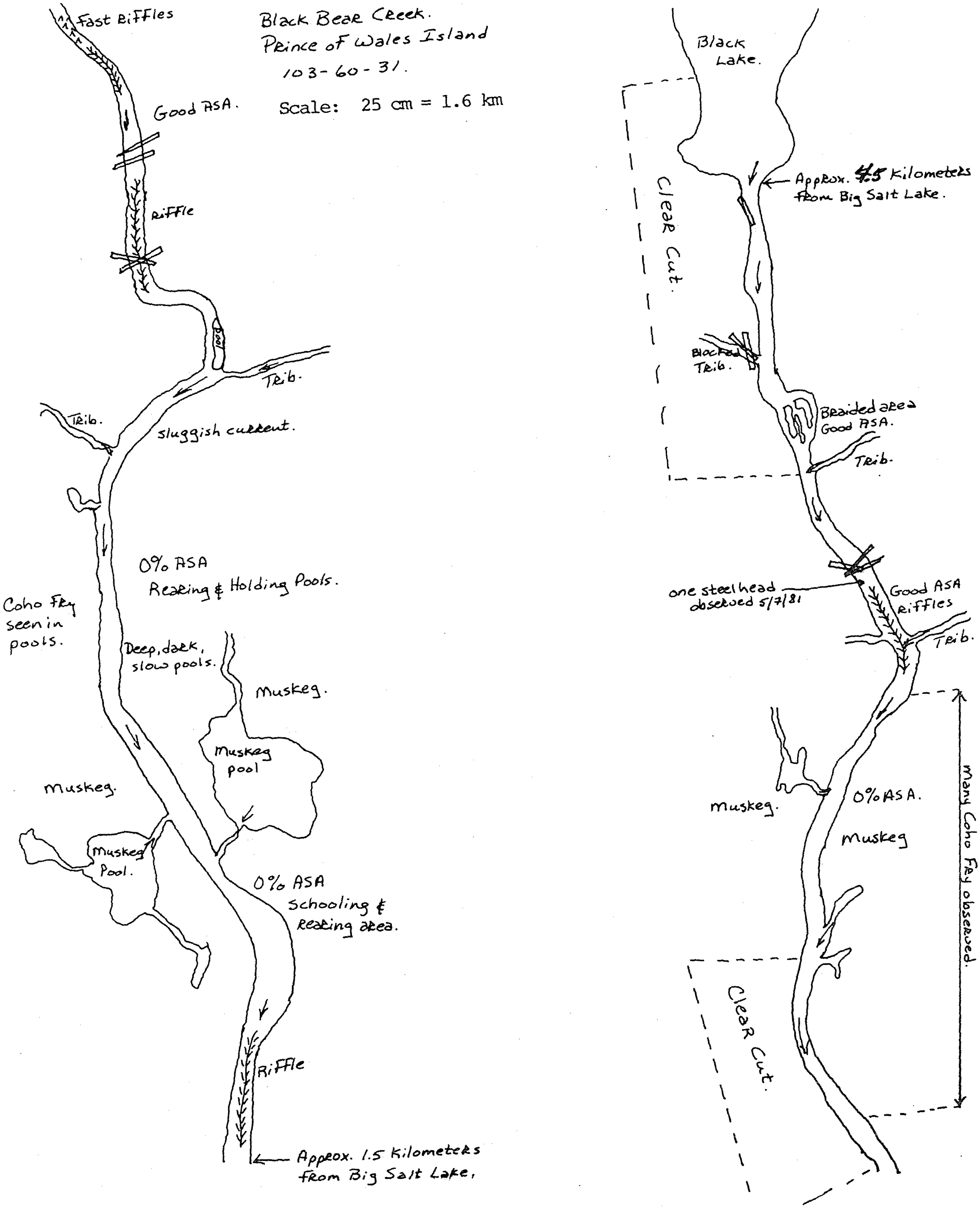
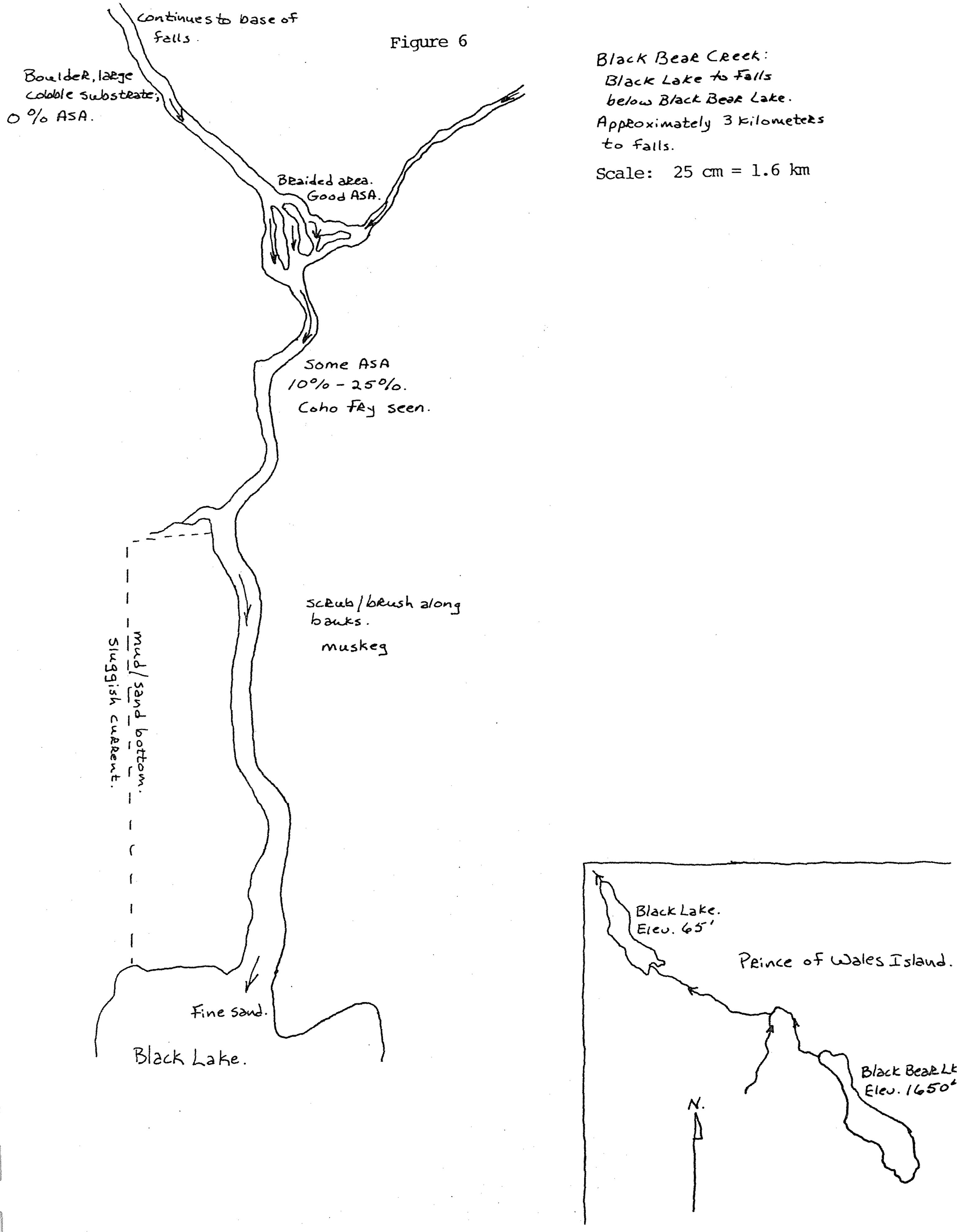

Black Bear Creek.
Prince of Wales Island
103-60-31.
Scale: 25 cm = 1.6 km
Fast Riffles
Good ASA.
Riffle
Pool
Trib.
Trib.
sluggish current.
0% ASA
Rearing & Holding Pools.
Coho Fry seen in pools.
Deep, dark, slow pools.
Muskeg.
Muskeg pool
Muskeg.
Muskeg Pool.
0% ASA
Schooling & Rearing area.
Riffle
Approx. 1.5 Kilometers from Big Salt Lake,
Black Lake.
Approx. 4.5 Kilometers from Big Salt Lake.
Clear Cut.
Blocked Trib.
Braided area Good ASA.
Trib.
one steelhead observed 5/7/81
Good ASA riffles
Trib.
Muskeg.
0% ASA.
Muskeg
Many Coho Fry observed.
Clear Cut.

Figure 6



Black Bear Creek:
Black Lake to Falls
below Black Bear Lake.
Approximately 3 kilometers
to falls.
Scale: 25 cm = 1.6 km
continues to base of
falls.
Boulder, large
cobble substrate;
0 % ASA.
Braided area.
Good ASA.
Some ASA
10% - 25%.
Coho fry seen.
scrub/brush along
banks.
muskeg
mud/sand bottom.
sluggish current.
Fine sand.
Black Lake.
Black Lake.
Elev. 65'
Prince of Wales Island.
Black Bear Lk
Elev. 1650'
N.

Figure 7

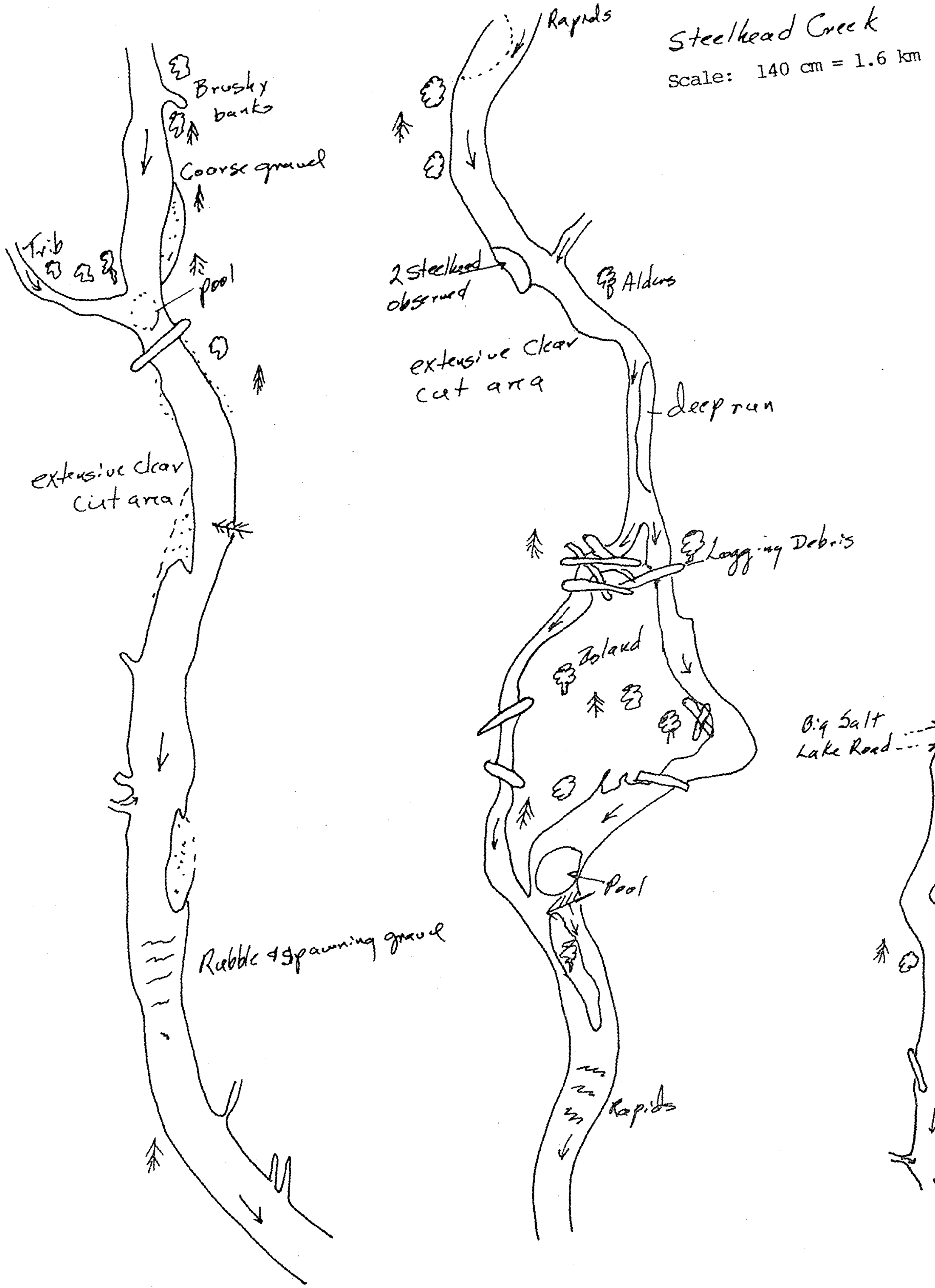
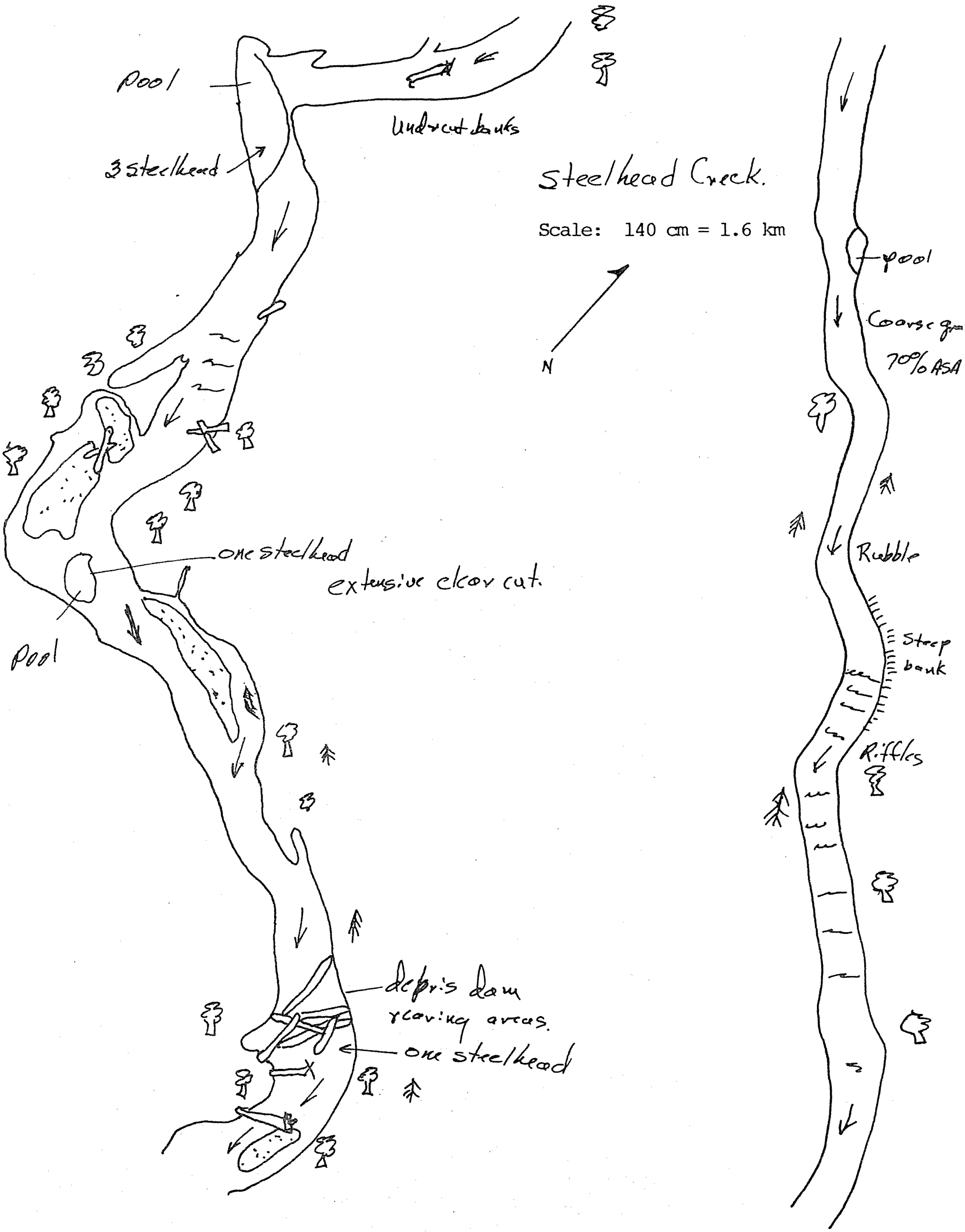
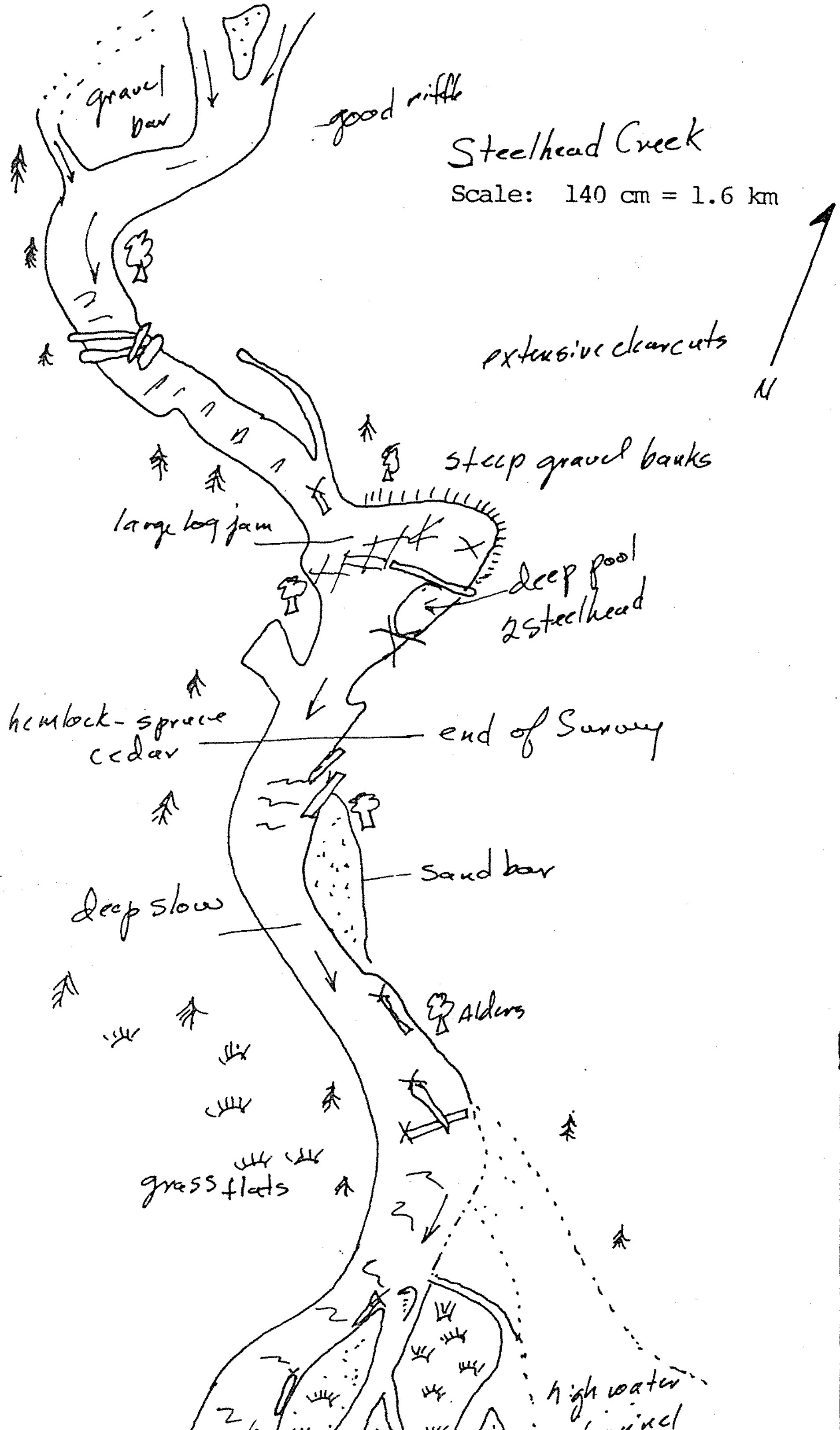

Steelhead Creek
Scale: 140 cm = 1.6 km
Brushy banks
Coorse gravel
Trib
pool
extensive clear cut area
Rubble & spawning gravel
Rapids
2 Steelhead observed
Alders
extensive clear cut area
deep run
Logging Debris
Island
Pool
Rapids
Big Salt Lake Road

Figure 8

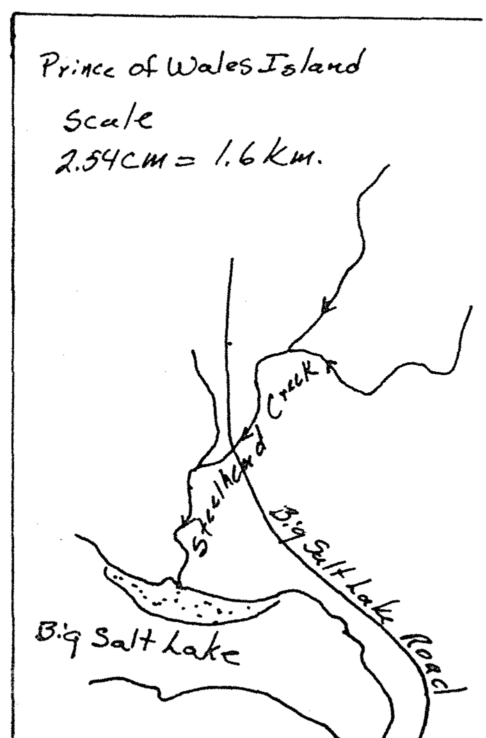


Pool
3 steelhead
Undercut banks
Steelhead Creek.
Scale: 140 cm = 1.6 km
N
one steelhead
extensive clear cut.
Pool
debris dam
rearing areas.
one steelhead
pool
Coarse gr
70% ASA
Rubble
Steep bank
Riffles

Figure 9



gravel bar
good riffle
Steelhead Creek
Scale: 140 cm = 1.6 km
N
extensive clearcuts
steep gravel banks
large log jam
deep pool
2 steelhead
hemlock-spruce
cedar
end of Survey
sand bar
deep slow
Alders
grass flats
high water
channel
Big Salt Lake



Prince of Wales Island
Scale
2.54cm = 1.6 Km.
Creek
Steelhead
Big Salt Lake Road
Big Salt Lake

Bakewell Creek

Bakewell Creek, located on the mainland southeast of Ketchikan, heads in high country and flows through Badger and Bakewell Lakes before entering tidewater in Bakewell Arm.

Bakewell Creek, Lake, and inlets, were surveyed between May 18 and 22. Bakewell Creek, from Bakewell Lake to tidewater, was surveyed and sampled on the 18. This stream is very short (1/2 km) and has a very steep gradient. An old fishway exists along the east bank. During the survey, no adult steelhead were noted in the outlet nor below the fishway. An earlier survey (May 14, 1981) by the U.S. Forest Service biologist had reported several large salmonids below the fishway. These were assumed to be steelhead, however, this was not confirmed.

On May 20, Bakewell Creek, in that section between Badger and Bakewell Lakes, was foot surveyed and sampled with rod and reel and baited fry traps. Bakewell Creek contains excellent spawning and rearing areas (Figures 10-13) and sampling caught numerous rearing coho salmon and cutthroat trout. No adult or rearing steelhead were observed throughout this 6 km section of Bakewell Creek. Three small inlets to Bakewell Lake were surveyed on the 21 and 22. These streams are quite short (less than 1/2 km) and do not contain a great deal of salmonid habitat. Rearing coho salmon and a few small cutthroat trout were the only fish observed. Rod and reel sampling in Bakewell Lake near the outlet produced the only steelhead of the survey.

Sitkoh Creek

Sitkoh Creek, located on the southeast end of Chichagof Island, heads in Sitkoh Lake. It flows in an easterly direction for 5 km before entering Sitkoh Bay (Figure 14).

Sitkoh Creek was foot surveyed from Sitkoh Lake to tidewater on April 28, in an effort to access the magnitude of the 1981 steelhead run. The survey was conducted 2 weeks earlier than in previous years, as southeast Alaska had a very early, warm spring in 1981. The counts are made to coincide with the peak of spawning. Weather and water conditions were excellent during the survey and 43 adult steelhead were observed. Three steelhead were captured, sampled for biological information, and released.

The steelhead run to Sitkoh was the best observed since surveys began in 1977. The 1981 run appeared very similar to the 1980 run, when 42 adults were observed (Jones, 1981). Sitkoh Creek has had 2 good years of escapement and may be on its way to increased production.

Steelhead Brood Stock Development

The development of a brood stock of spring-run steelhead for central southeast Alaska was started at the Crystal Lake Hatchery in 1975. The development of this brood stock is reported in another section of this report.

Badger Lake to Bakewell Lake.

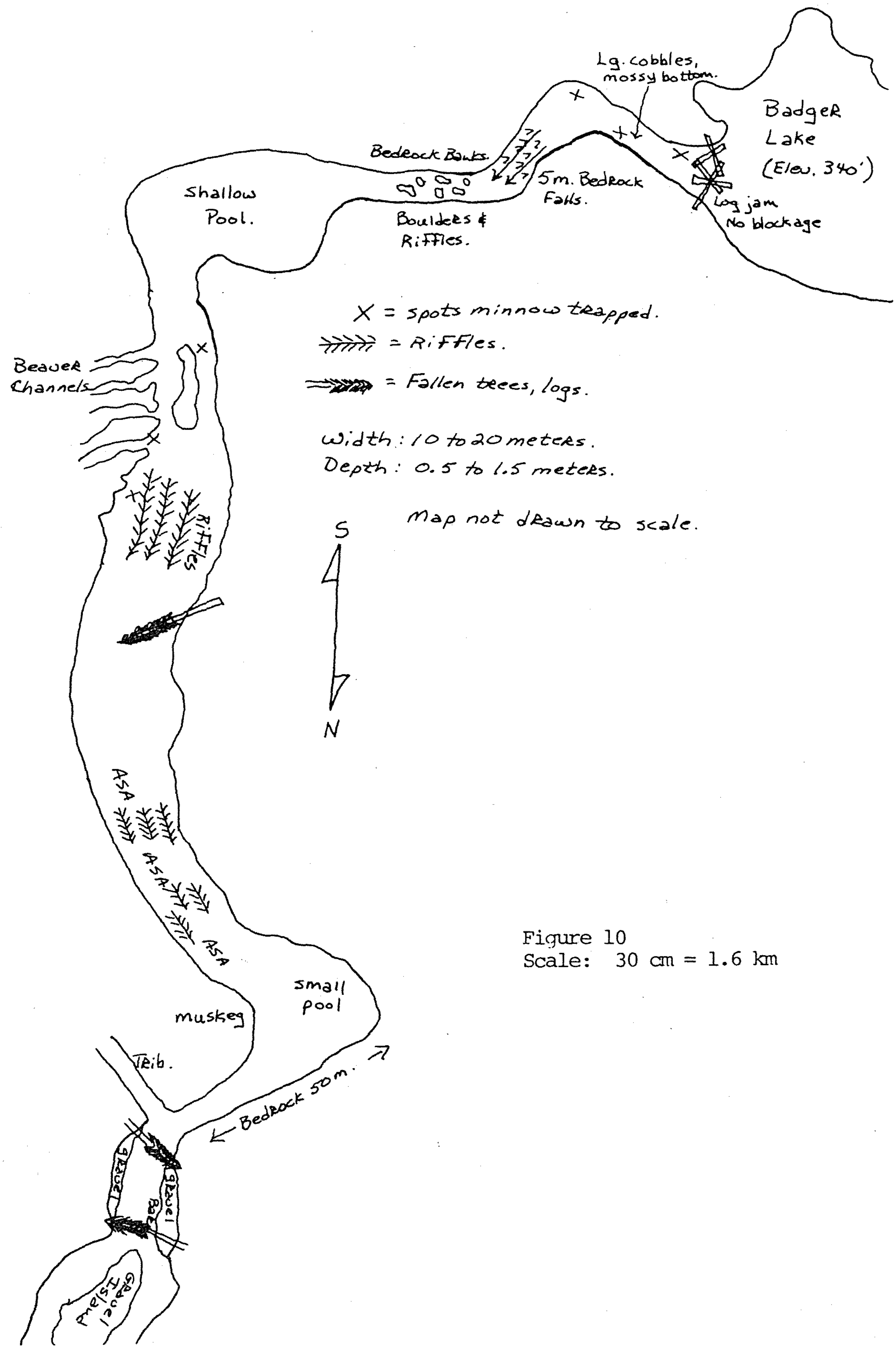


Figure 10
Scale: 30 cm = 1.6 km

Badger Lake to Bakewell Lake.
Map not to scale.

X = minnow trap

= Riffle

= Fallen trees, logs

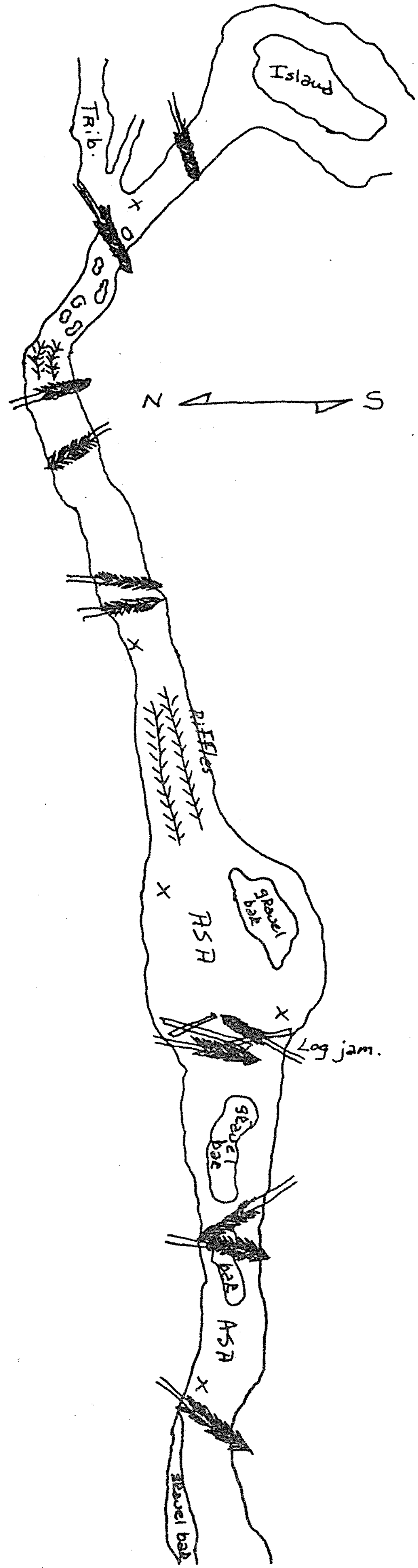


Figure 11
Scale: 30 cm = 1.6 km

Badger Lake to Bakewell Lake.

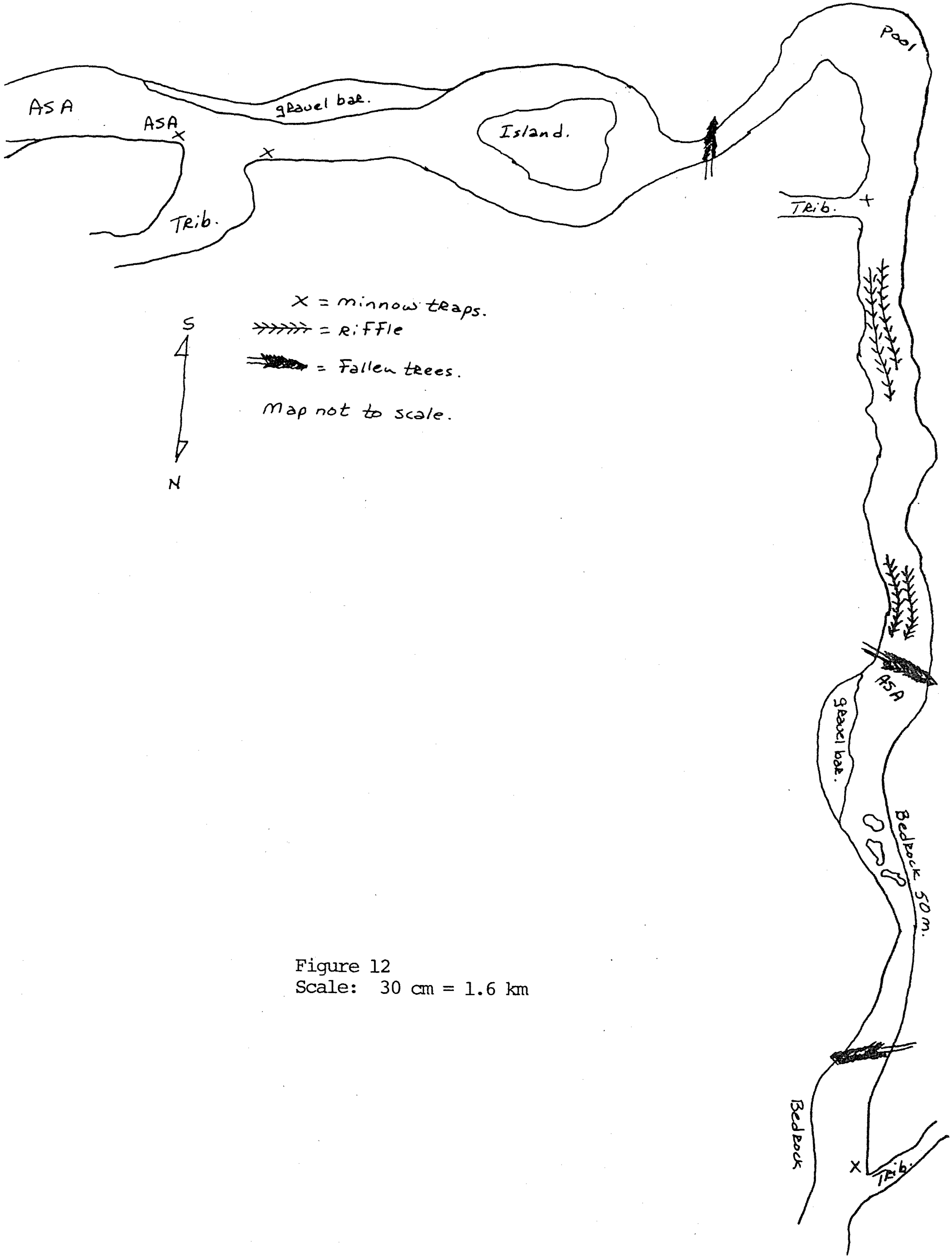


Figure 12
Scale: 30 cm = 1.6 km

Badger Lake to Bakewell Lake.

X = minnow traps.

= Riffle.

= Fallen trees.

Map not to scale.

Total distance canoed about 8 kilometers (5 miles)

S

N

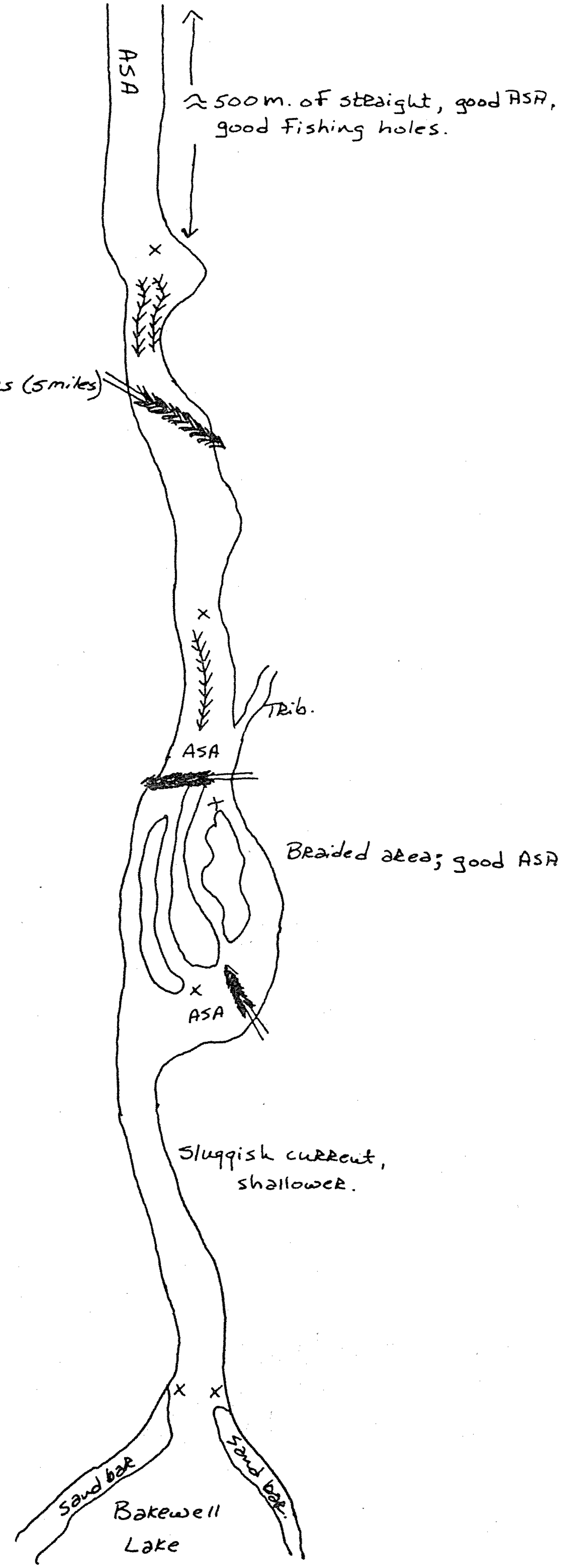
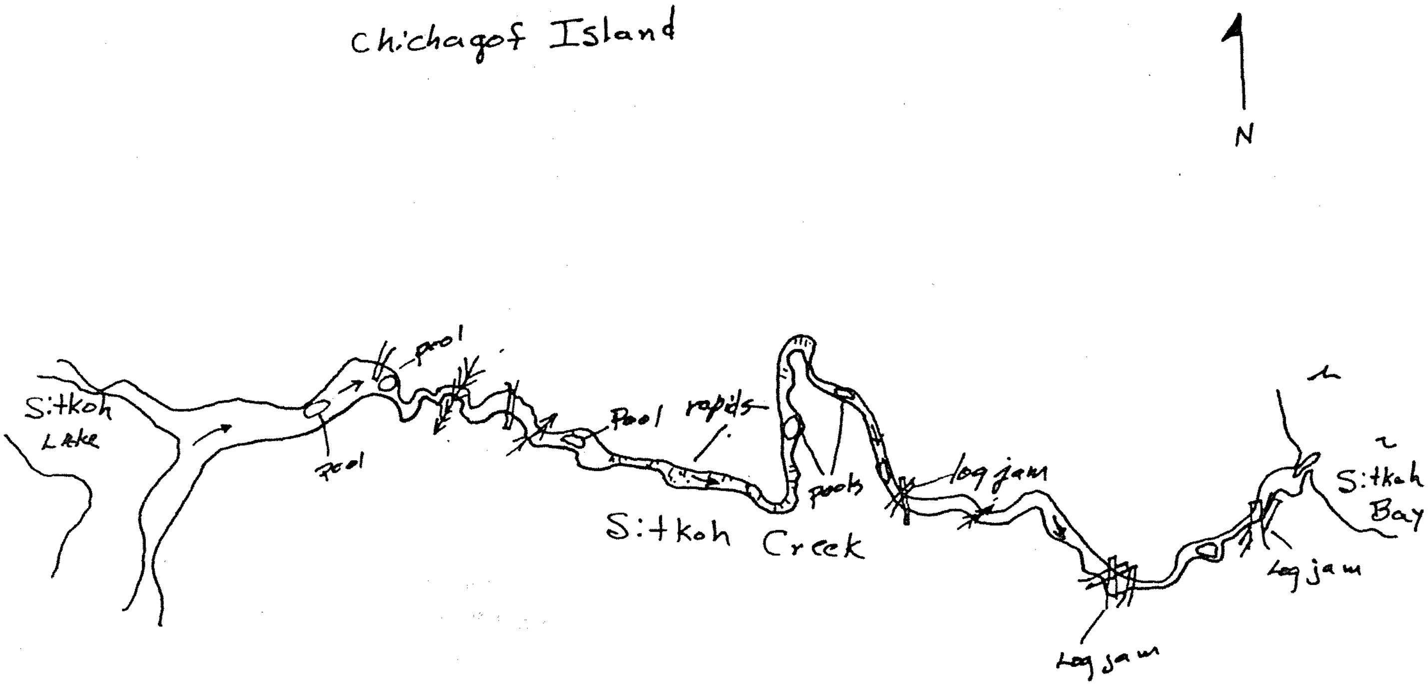


Figure 13
Scale: 30 cm = 1.6 km



Scale 5cm = 1.6 kilometers

Figure 14. Sitkoh Creek

A genetic policy change in 1978 dictated that hatchery brood stocks would not be moved and released over a large geographical area. This policy made it necessary to develop brood stocks of steelhead at other facilities for use in southern and northern southeast Alaska. Starting in 1979, a program has been underway to establish steelhead brood stocks at Deer Mountain Hatchery (Ketchikan), Klawock Hatchery (Craig-Klawock), and Snettisham Hatchery (Juneau).

Deer Mountain Hatchery - Ketchikan Creek

The newly remodeled and expanded Deer Mountain Hatchery, on Ketchikan Creek, began development of steelhead brood stock with its first egg take of 6,000 during May, 1979. This program was continued in 1980, when 10 female steelhead were used to obtain 5,000 eggs for incubation.

Weekly surveys of Ketchikan Creek were conducted during April and early May, 1981, to determine when adequate numbers of steelhead were present to conduct an egg take. In late April, an estimated 75 adult steelhead were in Ketchikan Creek, however, spawning activity was not taking place to any great extent. A foot survey on May 4 counted a total of 100 steelhead in Ketchikan Creek. Spawning activity was noted on May 5 and 14 steelhead were captured by beach seine. A total of 10,533 eggs were placed in the hatchery for incubation.

The development of the hatchery brood stock at the Deer Mountain Hatchery continued with the release of 3,200 steelhead smolt into Ketchikan Creek in 1980, 1,146 in 1981, and 2,608 in 1982. Additionally, 2,800 and 1,479 Deer Mountain Hatchery steelhead smolt were put in Ward Creek, near Ketchikan, in 1981 and 1982, respectively. The first hatchery adults should return to Ketchikan Creek in the spring of 1982 and will form the brood stock for expanded steelhead enhancement in the Ketchikan area.

Klawock Hatchery - Klawock River

The Klawock River Hatchery became operational in the summer of 1978 and is now considered the prime facility for the development of a fall-run steelhead brood stock for southern southeast Alaska. Klawock River receives a wild run of fall-run steelhead that number between 200-300 from October through January.

Brood stock development of fall-run steelhead began in the fall and winter of 1978, when 16 adults were captured. These fish were held until ripe and spawn was taken in March, 1979. This program was continued during March, 1980, when 15 adult steelhead were captured from Klawock River just below the hatchery. A total of 15,000 eggs were obtained from these fish in late March.

During the first week in March, 1981, the Klawock River was again visited to obtain fall-run steelhead brood stock. A total of 21 steelhead were captured by hook and line and net. These fish were mostly large females and yielded 45,160 eggs for incubation.

During June 1980, a total of 2,055 age-1 fall-run steelhead smolts were released into Klawock River. This marked the first release of fall-run steelhead in southeast Alaska. This was followed by the release of 6,482 age-1 and 2,608 age-2 steelhead smolt in June, 1981.

The Klawock Hatchery has a higher average year-round water temperature than other facilities in southeast Alaska. This warmer water is used to produce steelhead smolt in 1 year's rearing in the hatchery. Not all of the steelhead reach smolt size in 1 year, however, an average of 60% of the rearing steelhead are reaching smolt size in 1 year at Klawock. This ability to produce smolt in 1 year, instead of the normal two growing seasons, has speeded up the production of a brood stock at Klawock.

Snettisham Hatchery - Peterson Creek

Snettisham Hatchery, located south of Juneau in Port Snettisham, is now complete and is the prime candidate for producing a brood stock of spring-run steelhead for enhancement of fisheries in northern southeast Alaska.

Investigations of a suitable source of spring-run steelhead in northern southeast Alaska have been underway for some time. Northern southeast Alaska does not have many wild steelhead populations, and what there are, tend to be small in numbers.

Peterson Creek, located on the Juneau road system, has been surveyed on an annual basis since 1978. These surveys have shown that the run of steelhead to Peterson Creek is light; probably no more than 75 fish annually. The 1981 run was no exception.

Peterson Creek was foot surveyed on April 27, April 30, and May 12, 1981, from the mouth, at the salt chuck to the 15 m barrier falls approximately 4 km upstream. The map of the stream survey report by Kent Roth and Bob Hammer, dated July 12, 1977, was used and found to be accurate (Figure 15).

The section from the salt lake to the highway bridge (about 800 m) is sluggish, dark brown, with a mud bottom and grassy overhanging banks. The average depth is about 1 m. About 60 m upstream from the salt chuck, the stream is crossed by the gravel road to the Amalga Harbor public boat ramp. Local papers reported U.S. Forest Service recreational development plans for this area, in articles about the Cowee-Davies timber sale.

The section from the highway bridge to the barrier falls is shallow (average depth about 0.3 m), with many small pools and intermittent fast riffles. There are some areas of good ASA, though much of the bottom consists of large cobble and small bounders. The water temperature was 5 - 6 °C during the April survey, and 9 °C on May 12. Access is good, with a trail starting near the highway bridge and following the right (west) bank to the falls.

No steelhead were observed during the April survey. Small, surface-feeding fish were observed in the salt lake, near the mouth of the creek on April 30. Local anglers reported steelhead catches occasionally over the previous weeks, with one 8-10 pound steelhead having been taken a few days earlier. It was also reported that the stream is an excellent trout producer later in the season.

On May 12, a 590 mm spawned-out male steelhead was sampled and released in the first pool downstream from the large pool at the base of the barrier falls. Two other steelhead were observed about 75 m upstream from the highway bridge. A recently used spawning redd was seen about 100 m upstream from these fish. Numerous fry were observed in the first 400 m above the highway bridge.

Even though Peterson Creek's steelhead run is small, it is considered the prime candidate for contributing eggs to begin a brood stock in northern southeast Alaska.

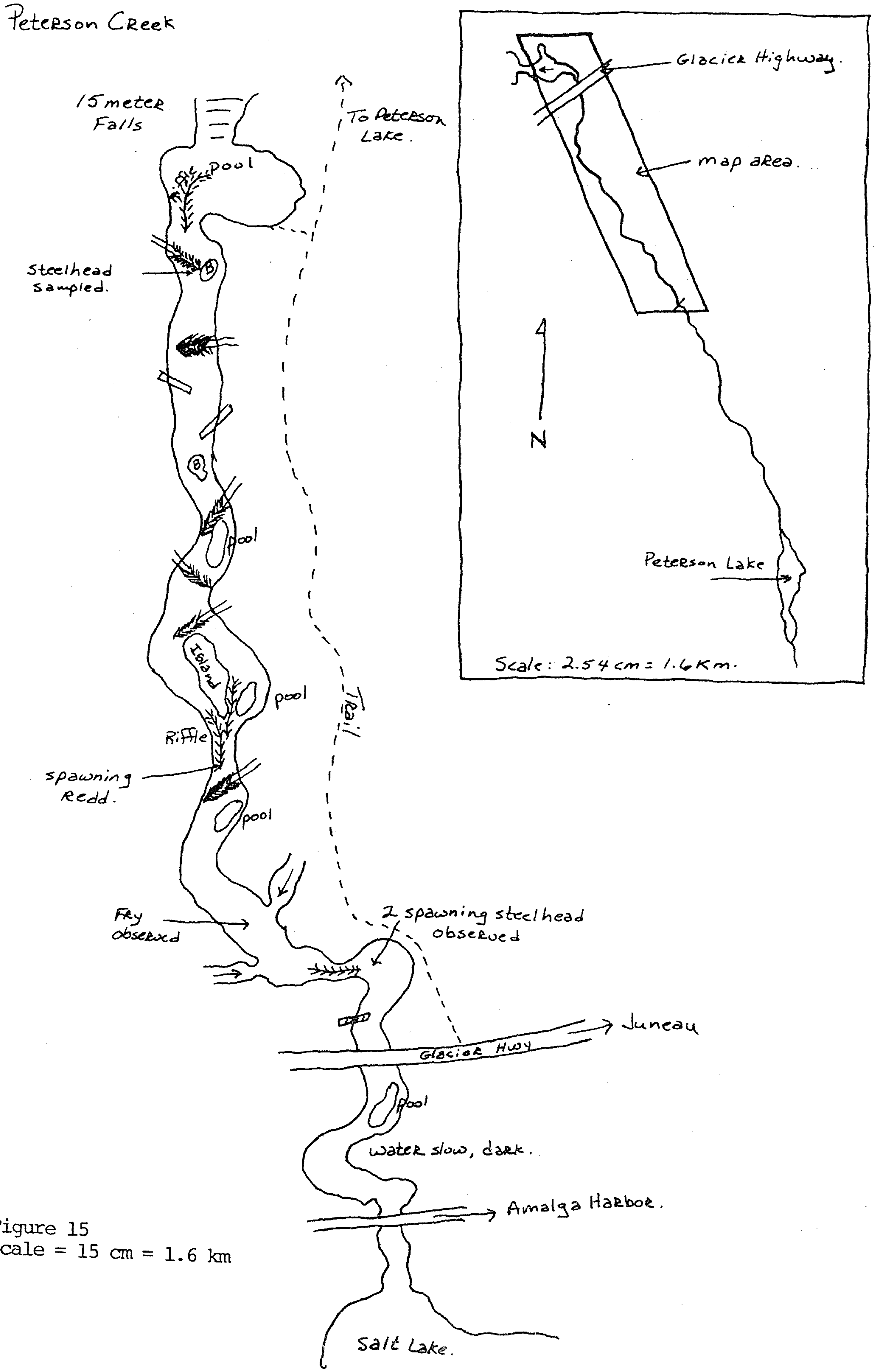


Figure 15
Scale = 15 cm = 1.6 km

Volume 23

Project AFS-42-10-B

STATE OF ALASKA

Jay S. Hammond, Governor

Annual Performance Report for

DEVELOPMENT OF TECHNIQUES FOR ENHANCEMENT AND MANAGEMENT OF CUTTHROAT TROUT IN SOUTHEASTERN ALASKA

by

Darwin E. Jones

ALASKA DEPARTMENT OF FISH AND GAME

Ronald O. Skoog, Commissioner

DIVISION OF SPORT FISH

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ABSTRACT

The final report on 10 years of study in the development of techniques for the enhancement and management of cutthroat trout, Salmo clarki Richardson, in southeast Alaska is presented. Also, the 1982 annual report of progress for this project is included in this report.

Two lake-stream systems and one non-lake system were investigated during 1976 for spawning grounds and spawning requirements for cutthroat trout. All three systems contained spawning gravels in water less that 10 cm deep near escape cover, as preferred by cutthroat trout.

During 1976, surveys of four systems in southeast Alaska were undertaken to determine the best capture methods and areas for securing a source of sea-run cutthroat trout for brood stock. Hook and line, weirs, and beach seines were found to be useful capture methods for cutthroat trout. A total of eight streams scattered throughout southeast Alaska have been surveyed for their potential as possible donor sites for anadromous cutthroat trout brood stock.

The annual harvest of cutthroat trout from the area's streams and lakes has been largely unknown. Due to the infrequent and widely distributed cutthroat trout waters in southeast Alaska and the shortage of manpower, it is impractical to attempt a physical creel census on most waters. In order to obtain the needed information, two types of mail census were conducted during 1978 and 1979.

Movement of cutthroat within a stream system and from stream to stream was investigated from 1975 through 1977. During this time, 441 cutthroat trout from seven systems were tagged. A total of 42 cutthroat were recaptured. These recaptures were made, for the most part, in the systems where they were originally tagged. The standing population size for cutthroat trout in lakes in southeast Alaska has not been well documented.

During 1979-1981, five lakes were investigated to determine their population of cutthroat trout. The cutthroat populations ranged from a low of 669 fish at Harvey Lake to a high of 5,631 at Virginia Lake.

To effectively manage anadromous and resident cutthroat trout in the streams, rivers, and lakes of southeast Alaska, a management and research plan establishing goals and objectives has been prepared.

KEY WORDS

Cutthroat trout, Salmo clarki Richardson, southeast Alaska, spawning requriements, brood stock identification, stream movements, population estimates.

BACKGROUND

Life history research on sea-run cutthroat trout was conducted at Petersburg Creek from 1971 through 1975. This work provided significant data regarding sea-run cutthroat in a typical lake-stream system in southeast Alaska.

This research indicated that the annual runs of anadromous cutthroat are not large for any given stream system and are primarily comprised of fish in the 4- to 9-year age classes. Annual fall-runs of cutthroat were found to be made up of both immature and mature fish, with mature fish accounting for no more than 60% of the population. This low number of spawners tends to limit the annual egg deposition in the Petersburg Creek system.

A steady decline in the number of anadromous cutthroat was noted during the years of study at Petersburg Creek. This decline was determined to be caused mostly by the annual harvest of 300 or more cutthroat by sport anglers (Jones, 1977). Studies at Lake Eva (Armstrong, 1971), a stream only lightly fished, showed no marked fluctuations from year to year in its sea-run cutthroat population.

Studies at Petersburg Creek showed that the preferred rearing habitat for anadromous cutthroat is quite limited in any specific stream or tributary. This may account for the low total populations of cutthroat in the streams of southeast Alaska (Jones, 1973).

Comprehensive data on the majority of the cutthroat systems in southeast Alaska is not presently available. Angler harvest of sea-run cutthroat has shown a steady increase throughout southeast Alaska. This harvest is presently concentrated around population centers. With improved access due to logging road expansion and the development of mining, the fishing pressure will expand to areas where only light or no angling occurred 10 to 15 years ago.

Considering the low natural production of anadromous cutthroat, it becomes apparent that overharvest of these populations in the more popular fishing areas is possible. In an effort to prevent this, the study for the development of enhancement techniques was undertaken. The use of hatchery-produced anadromous cutthroat may be necessary to maintain natural runs or they may be used to create new fisheries.

Studies of the movement of anadromous cutthroat from stream to stream and within a stream have shown that management of sea-run populations of cutthroat may best be accomplished by managing a small area as one unit. Cutthroat found in an area of roughly 64 square kilometers are what may be considered an area population. Movement will occur within this region but very little straying will occur to adjacent areas. The number of streams with anadromous lakes in each area will more or less determine the cutthroat population within each geographic area.

The development of techniques for the management and enhancement of cutthroat trout in southeast Alaska has now taken on an organized form with the completion of the cutthroat management and enhancement plan. This plan has set out guidelines for the management of both resident and sea-run cutthroat and has established recommendations for enhancement.

New regulations enacted in 1979 reduced the bag and possession limits of cutthroat to four per day, of which only one may be over 406 mm (16 inches). This regulation should help curb the decline of cutthroat in heavily fished areas by limiting the harvest of the large spawners.

The Crystal Lake Hatchery, near Petersburg, was the key element in the original enhancement planning for cutthroat brood stock. Disease problems associated with various salmon species at Crystal Lake resulted in the complete eradication of all fish stocks on hand and a shutdown of the facility while it was disinfected.

This action has caused a good deal of rethinking of the original enhancement plans for southeast Alaska cutthroat. It is obvious that it is desirable, and prehaps even necessary, to have more than one hatchery raising brood stock.

The enhancement of this area's cutthroat fisheries is still several years in the future. Plans to develop cutthroat brood stocks are underway.

A list of common names, scientific names, and abbreviations of all species mentioned in this report is presented in Table 1.

RECOMMENDATIONS

Management

1. Develop a comprehensive management and enhancement plan for cutthroat in southeast Alaska.

   To adequately manage and enhance cutthroat populations in southeast Alaska, there must be a plan setting out goals and a time frame in which these goals are to be achieved. At present, there are insufficient data on the many cutthroat systems in southeast Alaska to adequately manage each for its highest return to the area, yet maintaining the integrity of the population.

Table 1. List of common names, scientific names and, abbreviations of fish found in study report.

Common Name	Scientific Name & Author	Abbreviation
Cutthroat trout	*Salmo clarki* Richardson	CT
Dolly Varden	*Salvelinus malma* (Walbaum)	DV
Kokanee salmon	*Oncorhynchus nerka* (Walbaum)	K
Threespine stickleback	*Gasterosteus aculeatus* (Linnaeus)	TS
Slimy sculpin	*Cottus cognatus* Richardson	SL

2. Trophy cutthroat waters should be established in Southeast. The bag limit on these waters should be two fish daily, only one of which may be longer than 406 mm (16 inches).

   Investigations of lakes throughout southeast Alaska have shown certain landlocked populations of cutthroat with good numbers of large trophy fish. Additional studies have shown that these fish are old, 8 to 12 years. Removal of large numbers of these old fish will tend to reduce the fishing quality of these bodies of water. It is recommended that this reduction be enacted to preserve these trophy fisheries.

3. Establish selected cutthroat systems in southeast Alaska as roadless, dispersed recreation, or natural, areas.

   Research on cutthroat in southeast Alaska has shown that cutthroat populations in any given stream system are not large and that they are easily harvested by sport anglers. Where easy access is afforded to cutthroat systems, the numbers of cutthroat begin to decline. It is recommended that selected cutthroat systems be placed in a land classification that will limit the ease of access.

4. Additional background data on cutthroat populations in southeast Alaska should be gathered on an annual basis.

   Many data gaps exist on most of the cutthroat populations throughout southeast Alaska. Additional information will be needed on these cutthroat systems in order to make sound management recommendations to the Forest Service and other land use agencies. This data will also aid in evaluating systems for future enhancement with hatchery produced cutthroat.

5. Evaluate the four fish bag and possession limits for cutthroat in some of the popular fisheries throughout southeast Alaska.

   Creel census checks of anglers fishing the more popular cutthroat systems should be undertaken to determine if the four fish per day limit is reducing the overall harvest of cutthroat.

6. Develop brood stocks of cutthroat at the Fisheries Rehabilitation Enhancement and Development (FRED) Division's hatchery facilities in southeast Alaska.

   Enhancement of the existing cutthroat trout fisheries near populated areas will become necessary within the next few years. Additionally, new put-and-take cutthroat fisheries may be desirable in some specific locations. To accomplish this, brood stocks of both resident and anadromous cutthroat trout will be required at two or more of the FRED hatcheries in southeast Alaska.

Research

1. Conduct research on the intra- and inter-stream movement of sea-run and resident cutthroat in southeast Alaska.

Tagging studies conducted at Petersburg Creek from 1971 through 1975 suggested that sea-run cutthroat do not exhibit a strong homing pattern and are somewhat random in their selection of wintering areas.

Studies at Petersburg Creek also revealed that there were large numbers of cutthroat entering the system in the fall in-migration that did not originate at Petersburg Creek. Efforts to define the origins of these cutthroat have not been successful to date, and this aspect of sea-run cutthroat behavior needs further study. Results of this research will greatly aid the geographical management of sea-run cutthroat populations in southeast Alaska.

2. Research of the ecological relationship between cutthroat, steelhead, Salmo gairdneri Richardson, Dolly Varden, Salvelinus malma (Walbaum), and coho salmon, Oncorhynchus kisutch (Walbaum), should be undertaken.

   The competition among the various salmonids for rearing habitat and food will need to be better understood before large scale enhancement of any one species can begin. The enhancement of one or more species may have undesirable impacts on other species.

3. Develop techniques for determining the harvest rates for sea-run cutthroat in southeast Alaska.

   The harvest rates of sea-run cutthroat from most systems in southeast Alaska are unknown. Techniques need to be developed to determine the rate of harvest so that management districts may be set up.

4. Continue the gathering of background data on sea-run cutthroat streams in southeast Alaska.

   Completion of the cutthroat management and enhancement plan will require the gathering of large amounts of data on the many cutthroat systems throughout southeast Alaska.

5. Develop techniques for the capture of lake dwelling cutthroat for population analysis.

   The standing crop of cutthroat in lakes in southeast Alaska is mostly unknown. Techniques need to be perfected whereby an accurate estimation can be made of the cutthroat population in any given lake. This information will be necessary to adequately manage many of the more heavily used lakes.

6. Guidelines should be developed for the establishment of brood stocks of both resident and sea-run cutthroat.

   The use of hatchery-reared cutthroat to enhance or create new fisheries for resident and sea-run cutthroat has and is occurring throughout the Pacific Northwest. Programs with resident cutthroat have been mostly successful, however, programs with sea-run cutthroat have generally been less successful. It is recommended that work continue in southeast Alaska to select wild brood stock sources best suited to the fisheries desired and that these findings be turned over to the FRED Division for action.

OBJECTIVES

1. Determine systems that may be suitable for obtaining cutthroat trout brood stock for use at the various hatchery facilities throughout southeast Alaska.

2. Develop techniques for estimating cutthroat trout populations from selected lakes in southeast Alaska.

TECHNIQUES USED

Background information from prior studies conducted by the Alaska Department of Fish and Game and other agencies was reviewed.

The distribution, spawning areas, and spawning requirements were examined by conducting foot surveys of Kadake Creek, Helm Creek, and Hamilton River. Surveys of Petersburg Creek were made at night using "Coleman" lanterns for illumination.

The most suitable method of capturing anadromous cutthroat was determined for each area from surveys made on four known cutthroat spawning streams. During each stream survey, maps were made noting potential weir sites, beach seining areas, and holding areas. Each stream was sampled by hook and line and the size of the cutthroat were noted.

Samples were obtained from four selected streams using hook and line gear and gill nets to determine possible locations for obtaining a source of anadromous cutthroat brood stock. Cutthroat captured with sampling gear were anesthetized with Tricaine Methanesulfonate (MS-222), measured, and tested for ripeness. A random sample of fish was collected and various biological data were collected including sex, maturity, and otoliths. All cutthroat not sampled were allowed to recover before release at the point of capture.

To determine the contribution of various area streams to the cutthroat sport fishery, anadromous cutthroat were captured using hook and line, baited minnow traps, and backpack electro shocker. These cutthroat were anesthetized with MS-222, measured, and tagged with color-coded, numbered "Floy" internal anchor tags. These cutthroat were placed in a quiet water area of the stream to recover before release at the point of capture. The return of tags by area anglers was recorded, including the location of capture and other biological data. The intra- and inter-stream movement of cutthroat was determined. Recapture information included the point of recapture and the length of the fish. A summary was prepared on the length of time between tagging and recapture, the distance traveled, and the increase in lengths, if any. Maps depicting cutthroat movement for each stream were prepared and are on file.

Foot surveys, hook and line, and baited minnow traps were used to determine the suitability of Hamilton and Klawak Rivers as possible donor sources for sea-run cutthroat brood stock. Each system was surveyed for weir sites or other physical attributes that would facilitate capture of adult cutthroat. Also, the logistical support necessary for each system was calculated.

The determination of the harvest rates of anadromous and resident cutthroat in southeast Alaska was made by:

1. Summarizing the statewide mail sport fishing questionnaire for all known anadromous cutthroat fisheries in southeast Alaska.

2. The use of a questionnaire survey of anglers using selected recreational cabins at Hasselborg, Turner, Kah Sheets, Salmon Bay, Salmon (Karta system), Virginia, Wilson, and Humpback lakes to determine the harvest of resident cutthroat trout.

To determine systems in southeast Alaska that are suitable for cutthroat trout brood stock development, information was gathered from the Hasselborg Lake, Thoms Lake, Florence Lake, and Jim's Lake systems.

Approximate magnitude of the cutthroat spawning populations were noted. The general health of the cutthroat population was determined, e.g., pathological examination of adult spawners, impact of egg taking operations on existing sport fisheries, was considered. Capture methodology best suited to each site was determined, e.g., weirs, seine traps, etc.

Techniques for estimating cutthroat trout populations from selected lakes.

1. Capture methods included; hook and line, baited minnow traps, beach seine, and trap nets.

2. All captured cutthroat trout were measured (fork length), marked by punching a hole in the upper lobe of the caudal fin, and released.

3. All recaptured cutthroat were noted and the magnitude of the lake's cutthroat population was estimated by using a Schumacher - Eschmeyer estimate.

FINDINGS

Cutthroat Spawning Areas and Requirements

Two lake-stream systems (Petersburg Creek and Helm Creek) and one stream system (Kadake Creek) were investigated during May 1976, for spawning grounds and spawning requirements for cutthroat trout.

All three systems contained excellent spawning areas in inlets and outlets of the lakes and in the smaller tributaries to the non-lake system. Cutthroat were found spawning mostly at night in water less than 10 cm deep, near some sort of escape cover. Cutthroat were observed spawning in the same general area as steelhead, only in shallower water.

A comprehensive description of the streams surveyed can be found by reviewing the annual report of progress by Jones (1976).

Adult Cutthroat Capture Techniques

Surveys of Hamilton River, Kadake Creek, Castle River, and Helm Creek were conducted during the spring of 1976 to determine the best capture methods and areas for securing a source of sea-run cutthroat for brood stock.

Hamilton River, Kadake Creek, and Castle River are all large systems that would require large, expensive weirs. High flows in these three systems make them impractical for weir construction. The most productive capture method for the Hamilton River and Kadake Creek was found to be hook and line gear. The Castle River contains pools where a beach seine could be employed to capture cutthroat. Helm Creek is rather small in size and contains several potential weir sites. Hook and line gear would also be effective in Helm Creek.

Additional information on the four systems can be obtained by reviewing the annual report of progress by Jones (1976).

Sea-Run Cutthroat Brood Stock Development

In order to enhance anadromous cutthroat in southeast Alaska, it will be necessary to develop brood stocks of sea-run cutthroat at several of the hatchery facilities in southeast Alaska.

During the 6 years of studying cutthroat, eight streams, scattered throughout southeast Alaska, have been surveyed for their potential as possible donor sites for anadromous cutthroat brood stock. The names and locations for the eight systems surveyed are presented in Table 2 . A comprehensive description of these systems can be found by reviewing Jones (1976; 1978; 1979; 1980; and 1981).

Table 2. Sea-Run Cutthroat Brood Stock Stream Surveys, 1976-1981.

Name	Location	Capture Method
Hamilton River	W. Kupreanof Island	Hook & Line
Kadake Creek	E. Kuiu Island	Hook & Line
Castle River	E. Kupreanof Island	Beach Seine Hook & Line
Klawock	W. Prince of Wales Island	Weir & Hook & Line
Florence Lake	W. Admiralty Island	Weir & Trap
Hasselborg Lake	Admiralty Island	Weir & Trap
Thoms Creek	W. Wrangell Island	Weir & Hook & Line
Helm Creek	Helm Bay, Cleveland Peninsula	Weir & Hook & Line

Development of Techniques to Determine Harvest Rates of Cutthroat in Southeast

The annual harvest of cutthroat trout from the area's streams and lakes has been largely unknown. Specific studies at Lake Eva (Armstrong, 1971) and at Petersburg Creek (Jones, 1977) have given an insight into the harvest rates for two types of cutthroat fisheries. While these studies have been informative and have aided management, they have not given an overall harvest picture for Southeast. In addition, these studies dealt with sea-run cutthroat and did not deal with resident (non-migratory) cutthroat.

Due to the infrequent and wide distribution of the cutthroat waters in southeast Alaska and the shortage of manpower, it is impractical to attempt a physical creel census on most waters. In order to obtain the needed information, two types of mail census were conducted during 1978 and 1979. One of these surveys was directed toward obtaining information on resident cutthroat and the other toward the harvest of sea-run cutthroat from selected systems throughout southeast Alaska.

During the 2 years that the mail survey was conducted, fishermen fishing ten systems throughout southeast Alaska were asked to fill in catch statistics. Angler response to the harvest questionnaire ranged from 0 at Salmon Bay and Virginia Lake to a high of 54% at Humpback Lake. Overall, the average response for the 2 years was 16%. During the 2 years of surveys, a total of 11,312 cutthroat trout were harvested from the ten selected waters. Additional information on this mail survey, and the waters censused, can be found by reviewing Jones' annual reports (1978 and 1979).

Literature Review

A search of various libraries has been conducted to secure listings on publications of the life history, habitat requirements, hatchery techniques, and various management strategies for coastal cutthroat trout.

In addition, State and Federal agencies involved in coastal cutthroat management and research have been contacted so that a current file of ongoing management and research has been established. A bibliography of coastal cutthroat management, research, and enhancement is presented in Appendix A.

Coastal Cutthroat Life History Summary

Southeast Alaska has two forms, or races, of coastal cutthroat trout. Anadromous cutthroat and the resident or non-anadromous race. The dividing line between the two forms is indistinct. Both anadromous and non-anadromous cutthroat are found occupying the same streams amd lakes. It is not known why one chooses to go to sea and the other chooses to remain in fresh water.

Both forms of cutthroat follow much the same life history pattern. All cutthroat spawn in the spring, usually from late April to early June, with spawning occurring mostly at night in a variety of spawning sites. The most preferred spawning site is one near some form of escape cover just above or below a deep pool.

Coastal cutthroat in southeast Alaska normally mature when they are 5 or 6 years of age and continue to spawn on an annual basis. Sea-run cutthroat do not normally live to be more than 9 or 10 years old. However, resident cutthroat have been recorded as old as 14 or 15 years. The stress of the transformation from fresh water to salt water and back to fresh water may be partially responsible for the shorter life span of the sea-run cutthroat.

Young anadromous cutthroat emerge from the gravel during July and spend their first 3 or 4 years rearing in the stream, beaver pond, slough, or lake. They migrate to sea for the first time when they reach a size of approximately 200 mm. Resident cutthroat emerge at the same time as anadromous cutthroat, but they take up residency in their preferred habitat within the system. Young cutthroat of both forms prefer slow moving water as a rearing site. Beaver dams, sloughs, deep pools, and lake shores are preferred sites.

In summary, southeast Alaska has two forms of the coastal cutthroat. The anadromous form is found throughout the region and is more abundant in areas containing anadromous lakes or large rivers. The anadromous cutthroat goes to sea for the first time at an age of 3 or 4 when it has attained a length of approximately 200 mm. Time at sea varies for individual fish and may range from a few days to over 100 days, with the average being 80 days (Jones, 1977). Sea-run cutthroat reach maturity at an age of 5 or 6 and live to be 9 or 10.

The resident form of the coastal cutthroat found in southeast Alaska resides in a wide variety of types of habitat throughout the region. The resident cutthroat is most often found in lakes and streams blocked to anadromous fish migrations, but they are also found residing in anadromous systems. Some anadromous cutthroat populations may be the result of resident populations dropping over an impassible falls into the lower stream areas. Resident cutthroat differ very little from their sea-going counterparts in terms of the age at which they reach sexual maturity and in their habitat preference. Resident cutthroat do attain an older age (15 years) than the sea-run cutthoat. They are also the larger of the two, with individuals exceeding 3.6 kilograms. Both the anadromous and resident forms appear to require an overwintering site in fresh water. This site may be a lake, beaver dam, deep water slough, or deep pools within the stream proper. It has not been recorded in Alaska that cutthroat have spent the winter in salt water, as is usually the case in western Washington and southern British Columbia.

Southeast Alaska Sea-Run Cutthroat Systems

Southeast Alaska contains approximately 2,500 anadromous fish streams. Of this total, approximately 88 stream systems are known to contain runs of anadromous cutthroat. A known anadromous cutthroat stream is defined here as a system that contains an overwintering population of sea-run cutthroat and has been confirmed by on-the-ground surveys by various investigators.

The known anadromous cutthroat streams are distributed from Yakutat to Dixon Entrance, with the majority occurring south of Frederick Sound.

A large number of streams throughout southeast Alaska are host to sea-run cutthroat for a short period of time each year. Many of these systems are short with impassible barrier falls located a short distance upstream. Sea-run cutthroat are found in the lower stream and inter-tidal zone, mostly during the salmon runs-July through September. These systems are not classified as sea-run cutthroat systems, as the cutthroat found there are only on a feeding sojourn from other areas. To list these systems where sea-run cutthroat are found at any time would entail the listing of 500-600 streams. A summary of the sea-run cutthroat systems in southeast Alaska is presented in Appendix B.

Southeast Alaska Resident Cutthroat Systems

Southeast Alaska contains over 200 lakes and associated stream systems, many of which are home to resident cutthroat. Many of these lake systems contain impassible falls in their outlet streams, so the cutthroat are true residents. Others do not have impassible barrier falls and the resident cutthroat share their habitat with various anadromous species. Many of the land-locked resident cutthroat populations provide some of the finest trout angling in southeast Alaska. A summary of the resident cutthroat systems surveyed is presented in Appendix C.

Cutthroat Management in Southeast Alaska

Anadromous Cutthroat:

Anadromous cutthroat are significantly less abundant in many stream systems than they were a few years ago. This decline has been caused by a number of factors.

Sea-run cutthroat habitat throughout southeast Alaska has not been altered by man to any great extent. Local populations have been probably over-fished and depleted. However, the overriding probable cause for the decline in anadromous cutthroat numbers has been the over-fishing of the various salmon species. Rearing cutthroat depend to a large extent on salmon eggs and young for a food source. It is also suspected that without the large numbers of salmon to enrich the stream system, the basic productivity of the system is less and, therefore, not able to support as large a cutthroat population.

Resident Cutthroat:

Resident cutthroat numbers throughout southeast Alaska have remained at a fairly constant level for many years. Local exceptions to this have been noted near population centers; however, on the whole, their numbers appear to be quite good. The best populations of resident cutthroat in southeast Alaska occur in the larger lakes of the region. The very size of the lakes, together with their general lack of easy access, has limited the fishing effort on them.

Management of cutthroat in southeast Alaska began with the enactment of the first bag and possession limits in the mid-1940's. At this time, the limit was 20 trout or 15 pounds and 1 fish. The possession limit was two daily bag limits. This bag limit remained in effect until the mid-1950's, when the wording of the law was changed to drop the poundage limit. The new law read that the limit was 20 trout per day, of which no more than three should exceed 20 inches in length. This had very little affect on the harvest of cutthroat, as southeast Alaska cutthroat rarely exceed 20 inches.

During the early days of management in Alaska, the numbers of anglers were small and their impact on cutthroat were not too significant. After Alaska achieved statehood in 1959, the first regulations issued were not greatly different than those in effect during territorial days. The trout limit was reduced to 15 fish daily, of which no more than three could exceed 20 inches in length. The possession limit remained at two daily bag limits.

By 1975, it became apparent that increasing numbers of anglers were capable of over harvesting the native trout populations. Starting with the 1975 season, the bag limit was reduced to 10 fish daily, with no more than two fish over 20 inches. The possession limit remained at two daily bag limits.

The bag limit was further reduced by the Board of Fisheries in December, 1979. The bag limit was set at four cutthroat, of which only one may be over 16 inches in length. This regulation remains in effect to date.

Cutthroat Management Recommendations

The proper management of wild anadromous and resident cutthroat populations in southeast Alaska will require a different management approach, depending upon the system or area. The anadromous and resident forms of cutthroat have been considered as one and the same, as far as regulations covering their harvest.

Research at Petersburg Creek and at Lake Eva showed that the ease of access to a fishing location has a definite affect on the harvest rate of cutthroat from that location. It has been demonstrated that once road access is created, the quality of trout angling declines. A good example of this situation is the "108 Creek" system on Prince of Wales Island. Prior to the establishment of a logging camp at the stream mouth, "108 Creek" was considered an excellent cutthroat stream. After more than 12 years of easy access and heavy pressure, "108 Creek" no longer supports much of a cutthroat run.

In order to identify systems when dealing with other land use agencies, the Division of Sport Fish has attempted to categorize the various cutthroat systems in southeast Alaska. It has been decided that the best management for some systems would be to place them in "Quality Watershed" catagories. These "Quality Watershed" categories were further broken down into "first", "second", and other categories.

Cutthroat systems falling within the "first" classification constitute the best of the best and they have been recommended for restrictive management.

These recommendations call for limited access and no timber harvest, road building, or other development. The cutthroat fishery would then be managed on a sustained yield basis for wild fish. It may not be possible to retain this type of management for all systems, as the U. S. Forest Service has the final say on land use activities in most areas of southeast Alaska. A listing of the "first" quality watersheds can also be found in Appendix D.

Cutthroat systems in the "second" quality watersheds category do not rate as high as the "first" systems due to a variety of reasons. Some of these systems do not contain large populations of cutthroat, some are so remote or difficult to reach that they receive little or no use, and some have had or are receiving impacts from timber harvesting. Management recommendations for these systems will allow some land use activities, while working closely with the Forest Service to insure minimal disruption of the cutthroat habitat during land use activities. Listings of these systems can be found in Appendix D.

The remainder of the cutthroat systems in southeast Alaska are recommended for less restrictive management. These remaining systems are not normally considered top quality, due mainly to the low numbers of cutthroat, small stream size, or their degradation due to the activities of man. Many of the systems found in this category have good potential for enhancement programs and other management practices. These watersheds are also listed in Appendix D.

Future management recommendations for southeast Alaska cutthroat will incorporate the criteria mentioned above and will include, but not be limited to, the following three:

1) Mail Surveys:

   A statewide survey of randomly selected sport fish license holders is conducted annually. The results of this survey are available by each spring of the following year. Evaluation of the responses to this survey adds a great deal of knowledge on the utilization of sport fish resources of Southeast and identifies where effort is occurring and gives direction for improving future management.

2) Creel Census:

   The use of creel census data in management is useful only for specific systems. To be effective, a creel census requires a considerable amount of time and effort. However, it is an excellent management method of obtaining needed information about the harvest of cutthroat on a system by system basis.

   Creel census of anadromous cutthroat anglers for a large area is not practical due to the widespread nature of the anadromous cutthroat fishery and the lack of manpower and funds. Voluntary creel census programs have been tried in the past without much success. A census program of anglers using Forest Service cabins shows promise of being a useful tool for obtaining catch data from the many cutthroat fisheries scattered throughout Southeast.

3) Special Regulations:

The use of special regulations on a system by system basis for small geographic areas have not as yet been used for cutthroat management in southeast Alaska. Special regulations can take the form of a reduced bag and possession limit, partial or total stream closures, or the limiting of access or fishing methods. Special regulations may be most useful in the management of the anadromous cutthroat fishery and for certain land locked trophy cutthroat lakes.

Cutthroat Research in Southeast Alaska

Anadromous Cutthroat:

Proper management of anadromous cutthroat stocks in southeast Alaska requires a considerable amount of data. Some data are now available; however, information is lacking for the majority of the cutthroat systems. To gain this missing data, research will be required on a number of the key systems.

This research should take the form of an assessment of the numbers of sea-run cutthroat and their rearing habitat. The assessment of the numbers of adult sea-run cutthroat in any system is difficult, expensive, and time consuming. The only reliable survey method developed thus far has been the use of a counting weir. This method is limited by its permanent nature, its expense, and the fact that answers are obtainable for only one system at a time. A technique needs to be developed to estimate cutthroat populations. Just what form this takes must still be worked out and tested.

Techniques need to be developed for determining the annual harvest of sea-run cutthroat. Results of the ongoing statewide mail surveys may provide the necessary answers; however, a region-wide mail survey may be necessary from time to time to determine current harvest.

Resident Cutthroat:

The number of resident cutthroat found in the lakes of southeast Alaska is essentially unknown. Surveys to date have not been uniform and have only been useful for determining species composition. Techniques need to be developed to capture, mark, and release resident cutthroat so that a statistically sound estimate of their population can be generated.

Research should continue for both sea-run and resident cutthroat spawning and rearing habitat requirements. Data provided by this research will give the management biologist the tools and information necessary to make intelligent decisions and recommendations when dealing with land use agencies.

Phase II Cutthroat Management and Enhancement Plan for Southeast Alaska Literature Review

A search of various libraries has been conducted to secure listings on publications of the life history, habitat requirements, hatchery techniques, enhancement efforts, and various management programs for coastal cutthroat trout. In addition, State and Federal agencies involved in coastal cutthroat management, enhancement, and research have been contacted to obtain a current file on ongoing research and management. A bibliography on coastal cutthroat was published by Jones (1978). Additional references have been added and the bibliography is presented in Appendix A of this report.

Southeast Alaska Cutthroat Brood Stock Development

Southeast Alaska contains two races of cutthroat, anadromous and resident, with resident fish distributed throughout the region. It has been found that both races occur in the same stream system and for the most part are indistinguishable at spawning time. It has also been demonstrated that sea-run populations in some systems are recruited from resident races above migration barriers.

The selection of a cutthroat brood stock for enhancement use in southeast Alaska must meet several criteria. The ideal source of cutthroat for hatcheries would be from a population with an annual run large enough to support the removal of 50-75 females per year for a period of 3 or 4 years. The source should also come from a system with proven numbers of anadromous cutthroat. The system should be more or less centrally located, so that transplants to northern or southern southeast Alaska would be a minimal geographical displacement.

With the above criteria in mind, it is recommended that Hamilton River and Klawock Creek be selected as sources for cutthroat brood stock development.

Development of Facilities for Cutthroat Production

At present there are no State hatcheries in southeast Alaska capable of raising cutthroat for extended rearing; none are presently raising cutthroat.

In 1978, the Crystal Lake Hatchery, near Petersburg, underwent a complete sterilization process to rid it of various diseases. Crystal Lake started over with disease-free brood stocks. Crystal Lake is centrally located and should be considered as a potential site for cutthroat brood development.

The Klawock River Hatchery was completed in late 1978 and is currently incubating salmon eggs. The Klawock Hatchery is located on a prime donor system for cutthroat, and it is recommended that the initial brood source for anadromous cutthroat be developed at this facility.

Additional hatcheries throughout Southeast are being built or are in the planning stages. Once these facilities become operational, they should be evaluated as possible rearing facilities for cutthroat. Additional brood sources will need to be developed or, if the Klawock Hatchery proves successful, cutthroat roe should be transferred to it to eliminate the potential loss of the entire brood, should the Klawock Hatchery lose its fish due to disease or mechanical failure.

The use of saltwater pens for the raising of brood stock has had some success in Washington State (Jongston, 1976). This type of rearing facility must still be considered experimental and should not be considered as a production facility. It is recommended that once cutthroat smolt are available, experimental saltwater rearing be conducted either in the Klawock or Ketchikan area.

Enhancement of Existing Fisheries and Establishment of New Populations

The enhancement of existing depleted populations and the creation of new populations of cutthroat has been used as a management tool in Oregon and Washington. These enhancement programs have been quite successful for resident cutthroat and somewhat less successful for anadromous cutthroat. In southeast Alaska, all cutthroat populations are wild native fish, and management has been aimed at perpetrating these populations. Increased popularity of cutthroat, together with increased numbers of anglers with better means of access (logging road construction), have caused declines in cutthroat numbers near population centers and in some more remote locations. To offset this increased pressure on cutthroat, bag limits have been reduced and some areas put into a roadless land classification. In the long run, these may not be enough to preserve cutthroat populations and artificial enhancement will be necessary.

When sufficient cutthroat smolt become available, the following existing cutthroat fisheries are recommended for enhancement: the Montana Creek-Mendenhall River system near Juneau, Indian River near Sitka, Petersburg Creek and Blind Slough near Petersburg, and Ward Creek near Ketchikan. In addition to the above streams, it is recommended that Twin Lakes and selected waters in the Mendenhall area near Juneau be planted with cutthroat.

Additional systems throughout southeast Alaska undoubtedly would benefit from enhancement with cutthroat. These systems will be identified, surveyed, and cataloged. Results of the initial plants of cutthroat will determine the timetable on which additional systems can be enhanced with hatchery produced fish.

Evaluation of Cutthroat Enhancement Programs in Southeast Alaska

The evaluation of the results is basic to any cutthroat enhancement program. At the time this report is being compiled, no cutthroat are in hatchery production in any of the State's hatcheries; however, evaluation concepts must be formulated now for future implementation.

All cutthroat leaving the various rearing facilities should be marked so that they are recognizable when they enter the sport fishery. Evaluations of enhanced fisheries should be by angler contacts and surveys.

Evaluations of rearing facilities and brood stocks in the various facilities should be made on an annual basis with a continuing program of upgrading both rearing techniques and brood stocks.

Last, but not least, an evaluation should be made to see how well hatchery cutthroat do in multi-species systems and in single specie systems.

Cutthroat Intra- and Inter-Stream Movement

Research on sea-run cutthroat at Petersburg Creek during the years 1971 through 1975 indicated that part of the fall in-migration of cutthroat was composed of fish not tagged at the Petersburg Creek weir (Jones, 1977). The origin of these in-migrant cutthroat was not known; however, it was suspected that they came from populations in non-lake streams in the area. To determine the validity of this assumption, tagging studies initiated in 1975 were continued during the summer of 1977. Seven non-lake streams in the Petersburg area were selected (Table 3) which were all known to contain populations of anadromous cutthroat. Tagging of cutthroat began in July and continued through September 1977.

Summaries of the streams where cutthroat were tagged in 1975-1977 are presented in Table 3.

Table 3. Sea-Run Cutthroat Tagging Sites, Petersburg Area, 1975-1977.

Stream	Location	No. of Cutthroat Tagged		
		1975	1976	1977
Duncan Salt Chuck	Kupreanof Island	86	24	57
Castle River	Kupreanof Island	17	7	107
Big Creek	Mitkof Island	51	17	10
Twelvemile Creek	Kupreanof Island	4	4	8
Fivemile Creek	Kupreanof Island	8	17	10
Blind Slough	Mitkof Island	2	...	...
Portage Bay Creek	Kupreanof Island	...	...	12
Totals		168	69	204

Recaptures of tagged cutthroat were made by the angling public and project personnel. During the period that recaptures were made, 42 cutthroat were recaptured. Most of the recaptures were made in the streams where they were originally tagged. Some intra-stream movement did occur, but not to the extent expected. Additional information regarding this research can be obtained by reviewing the annual reports of progress by Jones (1975; 1976; and 1977).

Development of Techniques for Estimating Cutthroat Trout Populations from Selected Southeast Alaska Lakes

The standing population of cutthroat trout in lakes in southeast Alaska has begun to be documented. The development of the techniques for estimating lake cutthroat trout populations in lakes was begun by Schmidt (1979) at

Red Bay Lake and was continued by Jones (1980; 1981) at Virginia, Harvey, and Jim's Lakes. This program was expanded in 1979, 1980, and 1981 to cover Virginia, Harvey, Jim's, and Wilson Lakes.

Populations of resident cutthroat in the five lakes investigated have been estimated to range from a low of 669 cutthroat in Harvey Lake to a high of 6,531 in Virginia Lake. These studies have shown that lake populations of resident cutthroat are far less than was generally believed to be the case. The techniques developed over the past 3 years have shown that the standing population of cutthroat trout in area lakes can be determined, at least for that portion of the population most often caught by the angling public. Population estimation work is necessary to be able to write adequate management recommendations for the area's lakes. The fishing effort on area lakes is increasing and, without an enhancement program underway, it will be necessary to maintain restrictive bag and possession limits in order to maintain the fishery at its present level.

Additional information on these lake population studies can be found by reviewing the annual reports of progress by Jones (1979; 1980; and 1981).

DISCUSSION

It is apparent from information gathered during the life history research at Petersburg Creek that wild sea-run cutthroat populations will be hard to maintain under heavy fishing pressure near population centers. It may become necessary to enhance these populations in order to maintain them. This enhancement may be achieved via more restrictive regulations on a stream-by-stream basis, more restrictive access in the limitation of various means of transportation and accommodations, or it may require the use of hatchery-produced cutthroat fry or smolt.

Information gathered during the 1976 season indicated that the best capture techniques for wild anadromous cutthroat for brood stock depended primarily on the individual stream's characteristics. Hamilton River, Kadake Creek, and Castle River are too large to be considered for a weir structure. Helm Creek is better suited to this type of capture method. Beach seining may be possible in all of the streams studied and may prove to be a practical capture method. Hook and line capture was often successful, though the results of this method are affected by changing water and weather conditions and by the skill of the sampler. Also, this method produces a sample biased toward fish above a minimum size.

From data gathered from the four streams, it is apparent that more than one stream will need to be tapped to secure the necessary numbers of adult female cutthroat. This will also lessen the impact of spawner removal from each stream system.

Information derived from enhancement programs on sea-run cutthroat in Oregon and Washington will be helpful in planning enhancement procedures in Alaska, once hatchery-raised cutthroat become available.

The management and enhancement plan for cutthroat in southeast Alaska should remain flexible to enable the addition of new data, ideas, and techniques. Information gathered to date for this plan has been presented in this report.

The inter- and intra-stream movement of sea-run cutthroat has been a management problem for resource agencies throughout the Pacific Northwest. Sea-run cutthroat do not appear to follow a definite pattern during their time at sea, but go off in the direction of the greatest food supply or for other undetermined reasons. This erratic movement makes management of a given stream or area somewhat difficult. This erratic behavior will also make enhancement of any given stream more difficult. It appears that cutthroat from a small geographical area tend to remain in that area. This may dictate that management be carried out by area, rather than on a single stream basis.

The magnitude of the annual sport harvest of cutthroat from the area's lakes and streams, largely unknown in the past, has begun to be understood in the last 2 years. A mail questionnaire issued to anglers fishing specific cutthroat waters was initiated in 1978 and was continued in 1979. Response to the questionnaire in 1979 was better than the initial survey, however, it still lacked the response necessary to obtain valid expandable harvest data. The statewide harvest mail survey of sport fishermen was much more successful in obtaining returns and provides an excellent data base on cutthroat harvest. Refinements of the survey will provide information on specific waters where management problems have been identified.

The enhancement of existing and the creation of new cutthroat trout fisheries is a necessary management objective for specific waters adjacent to population centers in southeast Alaska. To achieve this management goal, an annual supply of cutthroat trout of various sizes will be required. At present, several potential wild brood sources of cutthroat have been investigated and certified for hatchery use. At the present time, all FRED hatchery space in southeast Alaska has been assigned to other species. Once a cutthroat enhancement plan can be written for the various areas of southeast Alaska, room can be established at one or more hatcheries to start a cutthroat brood stock.

The standing population of cutthroat trout in five lakes in southeast Alaska has been determined. These studies have shown that lake populations of resident cutthroat are far less than was generally believed. The techniques developed over the past 3 years have shown that the standing population of cutthroat trout in area lakes can be determined, at least for that portion of the population most often caught by the angling public. Population estimation work is necessary in order to be able to write adequate management recommendations for the area lakes. Fishing effort on these lakes is increasing and without an enhancement program underway it will be necessary to maintain restrictive bag and possession limits in order to maintain the fishery at its present level.

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APPENDIX A

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APPENDIX B

Cutthroat streams listed in Appendix B have been cataloged by geographic regions and are generally listed in order from north to south in each region. Some streams listed under each region have been reported to contain a population of sea-run cutthroat, however, these populations have not been confirmed to date. These unconfirmed populations are noted at the bottom of each survey sheet.

The geographic regions for cutthroat streams in Southeast Alaska are as follows:

Yakutat - The mainland from Yakutat Bay to the southern boundary of Glacier Bay National Monument.

Taku - The mainland from Glacier Bay National Monument to the Stikine River.

Stikine-Unuk - The mainland from the Stikine south to Portland Canal.

Chichagof - All cutthroat streams on Chichagof and Yakobi Islands.

Baranof - All cutthroat streams on Baranof Island.

Admiralty - All cutthroat streams on Admiralty Island.

Kupreanof - All cutthroat streams on Kupreanof and Mitkof islands.

Kuiu - All cutthroat streams on Kuiu Island.

Wrangell - All cutthroat streams on Wrangell and Etolin Islands.

Prince of Wales - All cutthroat streams on Kosciusko, Prince of Wales and Dall Islands.

Revillagigedo - All cutthroat streams on Revillagigedo Island.

YAKUTAT

Stream	Location	
	Latitude	Longitude
Lost River	59°25'N	139°40'W
Humpback Creek	59°41'N	139°31'W
Seal Creek	59°25'N	139°25'W
Italio River	59°16'N	139°W
Akwe River	59°15'N	138°55'W
East Alsek River	59°5'N	138°30'W
Doame River	59°5'N	138°20'W
Bartlett River	58°28'N	135°50'W
Salmon River	58°25'N	135°42'W

TAKU

Stream	Location	
	Latitude	Longitude
Chilkat River	59°15'N	135°33'W
Berners River	58°51'N	134°56'W
Windfall Creek	58°31'N	134°45'W
Peterson Creek	58°27'N	134°45'W
Mendenhall River	58°20'N	134°30'W
Taku River		
Crystal Creek	56°53'N	132°42'W

STIKINE - UNUK

Stream	Location	
	Latitude	Longitude
Stikine River	56°30'N	132°20'W
Crittenden Creek	56°30'N	132°16'W
Martin Creek	56°14'N	131°50'W
Tom Creek	56°13'N	131°43'W
Eagle River	56°11'N	131°35'W
Anan Creek	56°10'N	131°52'W
Black Bear Creek	55°42'N	132°10'W
Helm Creek	55°30'N	131°56'W
Wolverine Creek	55°55'N	131°50'W
Hulakon River	56°8'N	131°5'W
Unuk River	56°8'N	131°6'W
Checats Creek	55°28'N	130°52'W
Wilson River	55°25'N	130°38'W
Blossom River	55°28'N	130°38'W
Bakewell Creek	55°18'N	130°37'W

STIKINE - UNUK (cont.)

Stream	Location	
	Latitude	Longitude
Humpback Creek	55°2'N	130°40'W
Fillmore Creek	54°56'N	130°27'W

CHICHAGOF

Stream	Location	
	Latitude	Longitude
Sitkoh Creek	57°32'N	134°58'W
Kadashan Creek	57°44'N	135°12'W
Pavlof River	57°50'N	135°2'W
Goulding River	57°48'N	136°15'W

BARNOF

Stream	Location	
	Latitude	Longitude
Salmon Creek	56°58'N	135°10'W
Eva Creek	57°24'N	135°6'W

ADMIRALTY

Stream	Location	
	Latitude	Longitude
Hasselborg River	57°35'N	134°20'W
Kanalku Creek	57°28'N	134°22'W

KUPREANOF

Stream	Location	
	Latitude	Longitude
Hamilton River	56°53'N	133°42'W
Castle River	56°38'N	133°18'W
Kah Sheets Creek	56°31'N	133°10'W
Totem Bay Creeks (3)	56°31'N	133°25'W
Tunehean Creek	56°36'N	133°38'W
Duncan Salt Chuck	56°55'N	133°19'W

KUPREANOF (cont.)

Stream	Latitude	Longitude
Portage Creek	56°37'N	133°15'W
Petersburg Creek	56°46'N	133°6'W
Blind Slough	56°36'N	132°50'W
Big Creek (Bear Creek)	56°42'N	132°40'W

KUIU

Stream	Latitude	Longitude
Kadake Creek	56°46'N	133°58'W
Kutlaku Creek	56°38'N	134°9'W
Alecks Creek	56°31'N	134°4'W

WRANGELL

Stream	Latitude	Longitude
Olive Creek	56°11'N	132°18'W
Hatchery Creek	56°3'N	132°24'W
Streets Creek	56°6'N	132°36'W
Kunk Creek	56°17'N	132°25'W
Thoms Creek	56°12'N	132°10'W

PRINCE OF WALES

Stream	Latitude	Longitude
Sutter Creek	56°8'N	133°26'W
Shipley Creek	56°6'N	133°30'W
Trout Creek	56°4'N	133°42'W
Salmon Bay Creek	56°18'N	133°10'W
Red Bay Creek	56°16'N	133°19'W
Sarkar System	55°58'N	133°18'W
Staney Creek	55°46'N	133°10'W
Exchange Creek	56°11'N	133°6'W
"108" Creek	56°8'N	133°8'W
Eagle Creek	55°56'N	132°46'W
Thorne River	55°42'N	132°36'W

PRINCE OF WALES (cont.)

Stream	Location	
	Latitude	Longitude
Karta River	55°35'N	132°36'W
Hatchery Creek	55°55'N	132°55'W
Log Jam Creek	55°55'N	132°58'W
Klawak River	55°33'N	133°4'W
Harris River	55°28'N	132°41'W
Bear Creek	55°36'N	132°55'W
Hydaburg River	55°14'W	132°50'W
Klakas Creek	55°4'N	132°23'W
Miller Creek	55°7'N	132°14'W
Kegan Creek	55°1'N	132°9'W

REVILLAGIGEDO

Stream	Location	
	Latitude	Longitude
Naha River	55°35'N	131°35'W
Ward Creek	55°25'N	131°45'W
Fish Creek	55°25'N	131°12'W
White River	55°26'N	131°34'W
Traitor's Creek	55°50'N	131°30'W

APPENDIX C.

APPENDIX C.

Cutthroat lakes listed in Appendix C have been cataloged by geographic regions and are generally listed in order from north to south in each region. Many lakes remain to be surveyed throughout Southeast Alaska and new populations of cutthroat will be added to this file.

The geographic regions for cutthroat lakes in Southeast Alaska are as follows:

Yakutat - The mainland from Yakutat to the southern boundary of Glacier Bay National Monument.

Taku - The mainland from Glacier Bay National Monument to the Stikine River.

Stikine-Unuk - The mainland from the Stikine River south to Portland Canal.

Chichagof - All cutthroat lakes on Chichagof and Yakobi Islands.

Baranof - All cutthroat lakes on Baranof Island.

Admiralty - All cutthroat lakes on Admiralty Island.

Kupreanof - All cutthroat lakes on Kupreanof, Kuiu, Mikof and Woewodski Islands.

Wrangell - All cutthroat lakes on Wrangell and Etolin Islands.

Prince of Wales - All cutthroat lakes on Prince of Wales, Kosciusko, Keceta and Dall Islands.

Revillagigedo - All cutthroat lakes on revillagigedo and Gravina Islands.

YAKUTAT

Lake	Location	
	Latitude	Longitude
Square Lake	59°13'N	138°43'W

TAKU

Lake	Location	
	Latitude	Longitude
Turner Lake	58°17'N	133°48'W
Mosquito Lake	59°28'N	136°2'W
Rustabach Lake	59°7 1/2'N	135°20'30"W
Chilkat Lake	59°22'N	135°56'W
Windfall Lake	58°55'N	134°45'W
Brown Cove *(Unofficial)	56°54'N	132°45'W

STIKINE-UNUK

Lake	Location	
	Latitude	Longitude
North Arm Lake *(unofficial)	56°41'N	132°26'W
Twin Lakes		
Barnes Lake	56°42'N	131°54'W
Virginia Lake	56°28'N	132°10'W
Martin Lake	56°17'N	131°52'W
Lower Harding *(unofficial)	56°14'N	131°40'W
Eagle Lake	56°2'N	131°27'W
Boulder Lake	56°15'N	131°45'W
Anan Lake	56°13'N	131°53'
Bear Lake	55°40'N	132°06'26"W
Helen Lake	55°58'16"N	131°56'05"W
Helm Lake	55°38'01"N	131°56'15"W
Woodpecker Lake	55°56'57"N	131°46'11"W
Hofstad Lake	55°45'0"N	132°0'46"W
McDonald Lake	55°57'42"N	131°50'11"W
Reflection Lake	56°1'51"N	131°35'18"W
Scout Lake	55°42'7"N	132°01'36"W
Three Islands Lake *(unofficial)	55°42'54"N	132°13'26"W
Wasta Lake	55°51'14"N	131°55'50"W
Woodpecker	55°56'57"N	131°46'11"W
Winstanley Lake (2)	55°25'0"N	130°51'15"W
Wilson Lake	55°30'38"N	130°33'49"W
Very Inlet	55°56'50"N	130°49'56"W
W		

STIKINE-UNUK (cont.)

Lake	Location	
	Latitude	Longitude
Sykes Lake	55°09'0"N	131°0'0"W
Shrew - Fillmore Inlet	54°59'8"N	130°27'48"W
Robinson Lake	55°55'0"N	131°01'54"W
Sak's Lake	55°58'7"N	131°00"W
Reef Point (Freile)	55°5'0"N	131°16'42"W
Porky Lake *(unofficial)	55°14'40"N	130°45'14"W
Nakat Mountain Lake *(unofficial)	54°53'0"N	130°35'50"W
Nakat Lake *(unofficial)	55°11'24"N	130°42'48"W
Kah Shakes Lake	55°3'23"N	130°56'11"W
Humpback Lake		
Hidden Inlet	54°59'21"N	130°24'16"W
Hugh Smith Lake	55°5'44"N	130°34'43"W
Gene's Lake	56°13'08"N	130°52'45"W
Cobb Lake	55°3'8"N	130°38'32"W
Lower Checats	55°28'7"N	130°52'5"W
Cabin Creek	55°20'24"N	131°45'0"W
Bakewell Lake	55°15'18"N	130°41'0"W
Badger Lake	55°13'4"N	130°46'28"W
Upper Gold Standard *(unofficial)	55°38'42"N	132°1'47"W
Lower Gold Standard *(unofficial)	55°38'54"N	132°0'39"W

CHICHAGOF

Lake	Location	
	Latitude	Longitude
Surge Lake	58°00'10"N	136°31'30"W
Sitkoh Lake	57°30'30"N	135°05'W
Goulding Lake #1	57°48'N	136°13'W
Goulding Lake #2	57°48'N	136°11'W
Goulding Lake #3	57°48'N	136°08'W
Goulding Lake #4	57°48'N	136°05'W
Ford Arm Lake *(unofficial)	57°36'N	135°53'W
Unnamed (Section 22)	57°21'N	135°36'W

BARANOF

Lake	Location	
	Latitude	Longitude
Baranof Lake	57°05'N	134°51'W
(Unamed) Paddy Lake	57°15'45"N	135°29'30"W
Buck Lake		
Little Lake Eva	57°23'N	135°02'W

BARANOF (cont.)

Lake	Location	
	Latitude	Longitude
Unamed (Section 15)	47°22'N	135°35'W
Salmon Lake	56°58'N	135°09'W
Sadie Lake	57°05'N	134°45'W
Unnamed (Banks Lake)	56°33'N	134°59'W

ADMIRALTY

Lake	Location	
	Latitude	Longitude
Youngs Lake	58°7'N	134°28'W
Thayer Lake	57°44'N	134°44'W
Distin Lake	57°37'N	134°18'W
Hasselborg Lake	57°42'N	134°16'W
Kanalku Lake	57°29'N	134°21'W
Davidson Lake	57°37'N	134°18'W
McKinney Lake (Brownie)	57°40'N	134°16'W

KUPREANOF

Lake	Location	
	Latitude	Longitude
Cool Lake	56°50'N	134°15'W
Alecks Lake	56°32'N	134°2'W
Bohemian Lake	56°55'N	133°28'W
Petersburg Lake	56°53'N	133°10'W
Kah Sheets Lake	56°33'N	133°12'W
Kushneaheen Lake (Barrie)	56°30'N	133°31'W
Kalinia Lake *(unofficial)	56°43'N	133°28'W
Irish Lake	56°42'N	133°31'W
Towers Arm	56°53'N	133°29'W
Kutlaku Lake	56°38'N	134°9'W
Colp Lake	56°53'N	133°01'W
Harvey Lake	56°33'N	133°2'W

WRANGELL

Lake	Location	
	Latitude	Longitude
Trout (Pat) Lake	56°21'N	132°20'W
Crane Lake	56°39'N	132°40'W
Burnett Lake	56°7'N	132°26'W
Kunk Lake	56°17'N	132°25'W
Thoms Lake	56°14'N	132°15'W

PRINCE OF WALES

Lake	Location	
	Latitude	Longitude
Andersen Lakes (2)	55°33'50"N	132°48'51"W
Welcome Lake	54°58'53"N	133°7'12"W
Angel Lake	55°40'18"N	132°38'6"W
Brownson Lake *(unofficial)	54°45'08"N	132°15'08"W
Dora Lake	55°10'N	132°15'W
Chuck Lake	54°46'29"N	133°27'48"W
Eek Lake (2)	55°10'35"N	132°40'30"W
Hetta Lake	55°10'38"N	132°32'37"W
Johnson Cove	55°05'17"N	132°05'36"W
Stone Rock *(unofficial)	54°48'N	132°01'11"W
Karta Lake (Little Salmon)	55°34'N	132°38'W
Sukkwan Lake	55°2'18"N	132°45'39"W
Sutter Lakes	56°8'N	133°26'W
Thorne Lake	55°46'4"N	132°46'11"W
Wolf Lake	55°32'03"N	132°36'22"W
Neck Lake	56°6'N	133°10'W
Twin Island	56°10'N	133°12'W
Kasook Island	55°3'15"N	132°49'42"W
Klakas Lake	55°1'34"N	132°21'29"W
Klawak Lake	55°30'40"N	132°57'44"W
Long Lake *(unofficial)	55°55'N	133°12'W
Miller Lake	55°8'37"N	132°13'38"W
Monie Lake	55°19'24"N	132°10'28"W
Nichols Lake	54°45'26"N	132°11'25"W
Old Frank's Lake	55°26'31"N	132°31'47"W
Paul Lake	55°8'33"N	132°5'0"W
Tammy Lake *(unofficial)	55°59'N	133°13'W
Sutter Lakes	56°8'N	133 26'W
Sweetwater Lake	55°58'N	132°57'W
Sarkar Lake	55°56'N	133°14'W
Shipley Lake	56°6'N	133°27'W
Salmon Bay Lake	56°15'N	133°12'W

PRINCE OF WALES (cont.)

Lake	Location: Latitude	Location: Longitude
Red Lake	56°15'N	133°19'W
Moss Lake *(unofficial)	56°55'N	133°12'W
Hatchery Lake	55°54'N	132°56'W
Galea (Honker) Lake	55°50'N	132°53'W
Finger Lake *(unofficial)	55°57'N	133°6'W
Cavern Lake	56°10'N	133°10'
Ratz Lake	55°51'47"N	132°33'40"W
St. Nicholas Lake	55°25'34"N	132°54'39"W
Salmon Lake	55°34'30"N	132°40'43"W
Essowah Lake	54°47'15"N	132°52'16"W
Devil Lake	55°0'28"N	133°6'44"W

REVILLAGIGEDO

Lake	Location: Latitude	Location: Longitude
Little Bostwick Lake	55°18'16"N	131°44'21"W
Gravina #1 *(unofficial)	55°17'5"N	131°41'22"W
Gravina #2 *(unofficial)	55°18'57"N	131°40'50"W
Gravina #3 *(unofficial)	55°18'48"N	131°40'22"W
Big Bostwick Lake	55°19'24"N	131°44'38"W
Basin Lake	55°25'13"N	131°9'32"W
Big Lake	55°25'42"N	131°11'18"W
Chamberlain Lake	55°38'0"N	131°28'3"W
Connell Lake	55°25'57"N	131°39'43"W
Cubby Lake	55°17'31"N	131°26'7"W
Ella Lake	55°28'15"N	131°6'13"W
Emma Lake	55°37'15"N	131°32'48"W
Heckman Lake	55°34'48"N	131°31'40"W
Ingram Lake	55°26'47"N	131°38'34"W
Johnson Lake	55°20'10"N	131°20'45"W
Jordan Lake	55°36'2"N	131°33'23"W
Swan Lake	55°36'59"N	131°17'5"W
Third Lake	55°26'29"N	131°11'40"W
Ward Lake	55°24'43"N	131°41'54"W
Ketchikan Lake (Upper)	55°23'33"N	131°37'30"W
Ketchikan Lake (Lower)	55°22'15"N	131°37'41"W
Leask Cove #1	55°31'57"N	131°33'48"W
Long Lake	55°54'51"N	131°28'41"W
Low Lake	55°23'50"N	131°11'40"W
Mahoney Lake	55°25'18"N	131°31'16"W
Manzanita Lake	55°34'19"N	131°3'9"W
Margarita Bay Lake	55°41'4"N	131°35'39"W
Mesa Lake	55°23'40"N	131°7'30"W

REVILLAGIGEDO (cont.)

Lake	Location Latitude	Location Longitude
Mirror Lake	55°31'6"N	131°9'10"W
Moth Lake	55°17'5"N	131°20'50"W
Narrow Lake	55°18'15"N	131°21'04"W
Neets Lake	55°45'50"N	131°28'30"W
Orchard Lake	55°49'0"N	131°24'51"W
Otter Lake	55°18'14"N	131°20'29"W
Patching Lake	55°36'0"N	131°28'59"W
Wolf Lake (Upper)	55°32'01"N	130°35'43"W
Salt Chuck Lake	55°33'42"N	131°26'26"W
Shelter Cove #1	55°32'21"N	131°23'56"W
Shelter Cove #2	55°32'31"N	131°23'27"W
Snag Lake	55°17'59"N	131°26'36"W
Snipe Island Lake *(unofficial)	55°49'42"N	131°8'41"W

APPENDIX D

QUALITY WATERSHEDS

Quality Watersheds - Cutthroat - Southeast Alaska

First Quality Watersheds

Stream or Lake	Location
Turner Lake	Juneau - Mainland
Mud Bay Creek	Chichagof Island
Hasselborg-Thayer Systems	Admiralty Island
Goulding System	Chichagof Island
Lake Eva	Baranof Island
Castle River	Kupreanof Island
Duncan Salt Chuck	Kupreanof Island
Petersburg Creek	Kupreanof Island
Kadake Creek	Kuiu Island
Sweetwater-Thorne Systems	Prince of Wales Island
Sarkar Lakes	Prince of Wales Island
Naha River System	Revillagigedo Island
Karta River System	Prince of Wales Island

Second Quality Watersheds

Akwe River	Yakutat
Italio River	Yakutat
Square Lake	Yakutat
Chilkat Lake	Haines - Mainland
Chilkoot Lake	Haines - Mainland
Moose Lake	Juneau - Mainland
Windfall Creek	Admiralty Island
Kathleen Lake	Admiralty Island
Florence Lake	Admiralty Island

Stream or Lake	Location
Kook Lake	Chichagof Island
Sitkoh Lake	Chichagof Island
Suloia Lake	Chichagof Island
Baranof Lake	Baranof Island
Salmon Lake	Baranof Island
Alecks Lake	Kuiu Island
Towers Lake	Kupreanof Island
Kah Sheets Lake	Kupreanof Island
Ideal Cove Lakes	Mitkof Island
Virginia Lake	Wrangell - Mainland
Kunk Lake	Etolin Island
Olive Cove Creek	Etolin Island
Thoms Creek	Wrangell Island
Martin Lake	Wrangell - Mainland
Eagle River & Lake	Wrangell - Mainland
Red Bay Lake	Prince of Wales Island
Salmon Bay Lake	Prince of Wales Island
Black Bear Lake	Prince of Wales Island
Klawak Lake & River	Prince of Wales Island
Eek Lake	Prince of Wales Island
Hetta Lake	Prince of Wales Island
Miller Lake System	Prince of Wales Island
Klakas System	Prince of Wales Island
Dickman Bay	Prince of Wales Island
Kegan Lake	Prince of Wales Island

Stream or Lake	Location
Niblack System	Prince of Wales Island
Essowah System	Dall Island
Lake McDonald System	Ketchikan - Mainland
Unuk River	Ketchikan - Mainland
Helm Bay Lake	Ketchikan - Mainland
Manzanita Lake	Revillagigedo Island
Ella Lake	Revillagigedo Island
Low Lake	Revillagigedo Island
Bakewell Lake	Kechikan - Mainland
Hugh Smith System	Ketchikan - Mainland
Humpback Lake	Ketchikan - Mainland
Wilson Lake	Ketchikan - Mainland

Other Quality Watersheds

Windfall Lake	Juneau - Mainland
Mendenhall Lake	Juneau - Mainland
Shelter Island Lake	Shelter Island
Hamilton River	Kupreanof Island
Tuneheen Creek	Kupreanof Island
Ketili Creek - Barnes Lake	Stikine River
Kutlaku Lake	Admiralty Island
Kushneahin Lake	Kupreanof Island
Harvey Lake	Woewodski Island
Tom Lake	Wrangell - Mainland
Boulder Lake	Wrangell - Mainland
Streets Lake	Etolin Island