AQUATIC STUDIES PROCEDURES MANUAL

PHASE I

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Su-Hydro Aquatic Studies
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May 1981

DRAFT

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

I. INTRODUCTION

The Susitna River, Southcentral Alaska's major river system, drains into Cook Inlet near the City of Anchorage (Figure 1). The drainage encompasses an area of 19,400 square miles and extends north to Mt. Denali and east almost to the town of Glenallen. The mainstem river and its major tributaries are of glacial origin and carry a heavy silt load during ice-free months. Many of the smaller tributaries are perennially silt-free.

Construction of hydroelectric dams will affect portions of the fish and wildlife resources of the Susitna River Basin. The two dam system proposed would inundate in excess of 50,500 acres of an aquatic and terrestrial habitat upstream of Devil Canyon. Historically, the long and short term environmental impacts of hydroelectric dams have adversely altered the sport and commercial fisheries of affected drainages (Keller, 1980; Hagen et al., 1973). Regulation of the mainstem river will substantially alter the natural flow regime downstream. The transmission line corridor, substations, road corridor, and construction pad sites will also impact aquatic and terrestrial communities and their habitat.

The proposed hydroelectric development necessitates gaining a thorough knowledge of its chemical, physical and biological parameters prior to final dam design approval and construction authorization. Preliminary environmental assessments of the project noted deficiencies in the state of knowledge of the Susitna drainage fisheries (FWS-ADF&G, 1978).

To insure adequate information is available to determine the impacts of the proposed hydroelectric project and to design proper mitigative strategies, a two-phase data collection program has been developed. This manual addresses Phase I (July 1, 1980-December 31, 1981) procedures to be conducted within those study areas outlined in Figure 2.

The following objectives are to be addressed in the Phase I field fisheries studies.

OBJECTIVE 1. Determine the seasonal distribution and relative abundance of adult anadromous fish populations produced within the study area.

Task 1.1 Enumerate and characterize the runs of the adult anadromous fish.

Task 1.2 Determine the timing and nature of migration, milling and spawning activities.

Task 1.3 Identify spawning locations within the study area (i.e., subreaches of the mainstem sloughs and side channels, tributary confluences, lakes and ponds, etc.) and estimate their comparative importance.

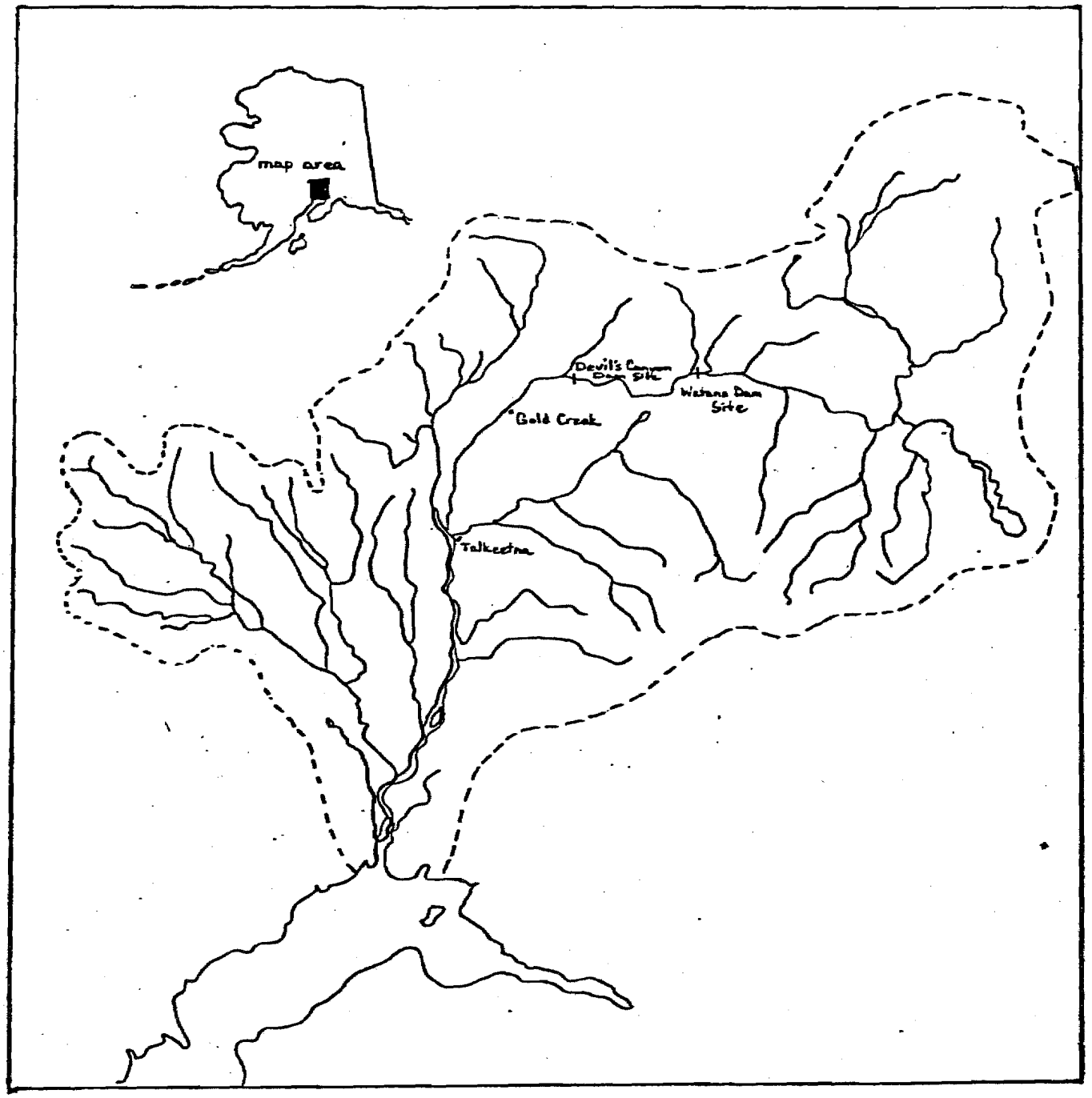


Figure 1. Susitna River Basin (approximate scale 1:2,200,000)

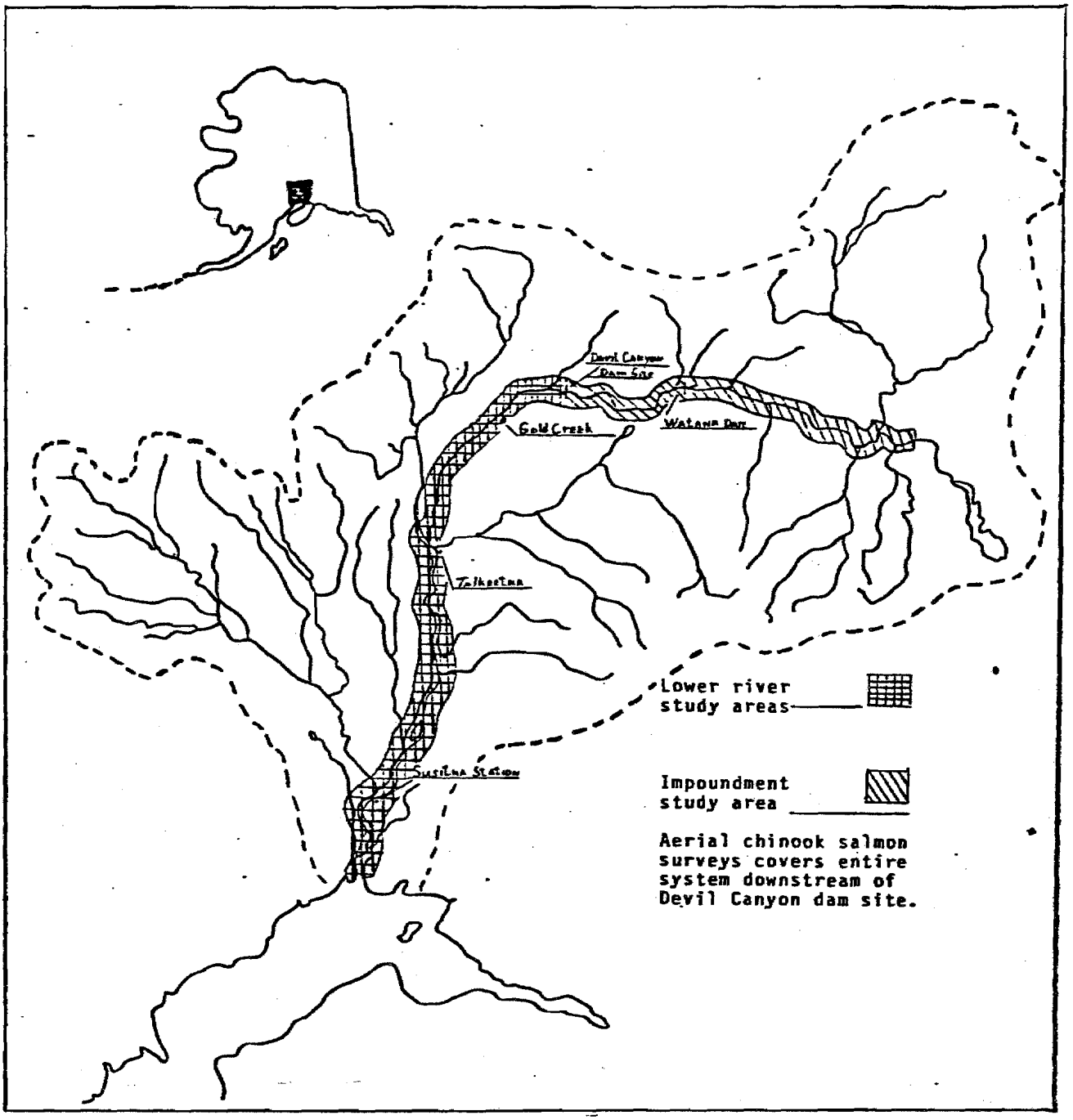


Figure 2. Phase I study areas, Susitna River basin.

Task 1.4 Identify and determine methods, means and the feasibility of estimating the Susitna Rivers contribution to the Cook Inlet commercial fishery.

OBJECTIVE 2. Determine the seasonal distribution and relative abundance of selected resident and juvenile anadromous fish populations within the study area.

Task 2.1 Identify spawning and rearing locations of the resident species and the rearing locations of juvenile anadromous species to estimate their comparative importance.

Task 2.2 Record descriptive information on captured fish (species, location of capture site, age class), and discuss seasonal migration patterns of selected adult resident species.

OBJECTIVE 3. Characterize the seasonal habitat requirements of selected anadromous and resident species within the study area.

Task 3.1 Through direct field observations and measurements identify the physical and chemical conditions which appear to be influencing the suitability of various habitat types for the species and life history stages of interest.

Task 3.2 Through direct field observations and measurements characterize the physical and chemical parameters of the various habitat types found in the study area.

To meet the above objectives, the study program is separated into three sections; Adult Anadromous Fisheries, Resident and Juvenile Anadromous Fisheries, and Aquatic Habitat and Instream Flow Studies. The operations of the Anadromous Adult and Resident and Juvenile Anadromous field investigations will be interrelated to and conducted in cooperation with the Aquatic Habitat and Instream Flow studies. The specific procedures for completion of each section of the program are described in this manual.

II. TECHNICAL PROCEDURES

A. ADULT ANADROMOUS FISHERIES STUDIES

Study Description and Rationale

Three (3) principal methods will be used to determine the distribution, abundance, timing and migrational activity of adult anadromous salmon in the study area (Tasks 1.1 and 1.2). They are: (1) deployment of side scan sonar (SSS) counters, (2) tag and recapture with fishwheels and (3) aerial surveys. The SSS counters are expected to accurately monitor pink and sockeye salmon escapement and be reasonably effective on the other species with the exception of chinook salmon because returning adults characteristically migrate upstream in mid-channel beyond the operational limits of SSS counters. Tag and recapture data using fishwheels should effectively establish the timing and escapement levels on coho, sockeye, chum and pink salmon. Chinook salmon escapement and distribution will be provided through an aerial survey program covering all known and suspected spawning grounds of this species.

Various types of sampling gear will be used on the Susitna River mainstem and subreaches (sloughs, side channels and tributary confluences) along with ground and waterbourne surveys to assist in determining the extent of salmon spawning activity (Task 1.3). Radio tagging will also be conducted to gather specific information on the migrational behavior, timing and spawning locations of chinook, coho and chum salmon in the upper Susitna River, principally between Talkeetna and Devil Canyon (Tasks 1.2 and 1.3).

Lastly, an evaluation will be made of the various means and methods available for assessing the Susitna River contribution to the Cook Inlet commercial salmon fishery. The emphasis will be directed toward formulating a plan which can be implemented in Phase II that provides stock identification (Task 1.4).

Sonar Counters

Operation Dates

A training class on sonar operation will be held from 1 May to 30 May; field activities for sonar enumeration will begin and terminate on the following dates:

Susitna Station	15 June to 7 September
Yentna Sonar	15 June to 7 September
Sunshine Sonar	15 June to 15 September
Talkeetna Sonar	15 June to 15 September

Methods

Two Bendix side scanning sonars (SSS) will be deployed at each of the four (4) sonar sites (Figure VI-1A). This equipment will be operated by trained ADF&G personnel. A training program for two (2) members of each crew will be conducted on the Kenai River by ADF&G/Commercial Fisheries Division biologists Ken Tarbox and Bruce King; both have several years of field experience each with SSS counters.

Procedures for deployment of the substrate and equipment operation are described in the 1980 Side Sonar Counter Installation and Operation Manual, Bendix Corporation (Appendix I).

Counts of salmon crossing the substrate will be recorded on printer tape each hour of the day. The paper printouts will be removed from the counters and the counts tabulated on a separate form each day. Counter accuracy will be monitored four (4) times daily for 3.5 minutes by hand tallying fish related echos displayed on an oscilloscope (Appendix II). The ratio of visual counts to SSS counts will be used to derive a calibration factor. This calibration factor will then be used to adjust the daily raw sonar counts (III Data Procedures).

A fishwheel will be installed below each SSS counter to provide escapement samples and relative abundance data by species for apportioning sonar counts. The fishwheel will be placed so that its presence does not conflict with or bias the sonar counters performance. All fishwheel captured salmon will be enumerated by species and sampled for the data required below (III Data Procedures).

Sockeye Salmon: Forty (40) sockeye salmon will be sampled daily for age, sex, and length.

Chinook Salmon: Age, sex and length samples will be obtained daily from all captured chinook salmon.

Chum Salmon: Twenty five (25) age, sex, and length samples will be obtained daily from all captured chum salmon.

Coho Salmon: Twenty five (25) age, sex and length samples will be collected daily from fishwheel captured coho salmon.

Pink Salmon: Forty (40) length and sex samples will be collected daily from fishwheel captured pink salmon.

The number of fish sampled for age, sex and length information is adequate to define escapement characteristics and variability based on previous findings by the ADF&G Stock Separation Office. Age samples will not be collected from pink salmon due to there being only one (1) age class involved in the adult return.

Sonar counts and attendant data will be forwarded to the Anchorage office every two (2) weeks.

Tag/Recapture

Operation Dates

Field operations for tag/recapture projects will start and end on the following dates:

Sunshine Tag/Recapture	15 June to 15 September
Talkeetna Tag/Recapture	15 June to 15 September
Curry Tag/Recapture	15 June to 21 September

Methods

Two (2) fishwheels will be deployed off each bank of the Susitna River at both the Sunshine and Talkeetna sites (Figure VI-1A). Two (2) fishwheels, one on each bank, will be operated at the Curry site. All fishwheels will be operated continuously, 24 hours per day. Fishwheel design and operation is described in Appendix III.

Each fishwheel will be checked five (5) or more times daily to insure minimal holding time and reduce stress. All adult salmon with the exception of chinook salmon will be tagged and released. Chinook salmon escapement will be acertained by aerial survey of all known and suspected spawning areas. Tagging method is outlined in Appendix IV. Floy FT-4 spaghetti tags color coded International Orange and consecutively numbered, will be used exclusively at the Sunshine site. Yellow color coded FT-4 spaghetti tags will be used to mark adult salmon at the Talkeetna site; they will also be consecutively numbered. The Curry site will use one (1) inch diameter Peterson disc tags, similarly consecutively numbered.

Fish recaptured at upstream tagging locations will be immediately released following identification and recording of the tag type, color and number (III Data Procedures).

The tagging crew at the Curry site will also collect age, length and sex data for each species as follows:

Sockeye Salmon: Forty (40) sockeye salmon will be sampled daily for age, sex and length.

Chinook Salmon: Age, sex, and length samples will be obtained daily from all captured chinook salmon.

Chum Salmon: Twenty five (25) age, sex and length samples will be collected daily from captured chum salmon.

Coho Salmon: Twenty five (25) age, sex and length samples will be collected daily from fishwheel captured coho salmon.

Pink Salmon: Forty (40) length and sex samples will be collected daily from fishwheel captured pink salmon.

The number of fish sampled for age, sex and length information is adequate to define escapement characteristics and variability based on previous findings by the ADF&G Stock Separation Office. Age samples will not be collected from pink salmon due to there being only one (1) age class involved in the adult return.

Tag and recapture data will be forwarded to the Anchorage office every two (2) weeks.

Survey

Operation Dates and Survey Reach

Field operations for identifying Susitna River mainstem and slough spawning areas will begin and end on the following dates:

Susitna Station Survey	15 July to 1 October
Sunshine Survey	15 July to 7 October
Gold Creek Survey	15 July to 15 October

The geographic area of responsibility for each crew is:

Susitna Station Survey - Estuary to Kashwitna River
Sunshine Survey - Kashwitna River to Chase
Gold Creek Survey - Chase to Devil Canyon

Mainstem and slough survey will be performed weekly. The Sunshine and Gold Creek crews will perform the tag and recapture surveys as scheduled below:

CREW	LOCATION	SURVEY PERIOD	FREQUENCY
Sunshine	All tributary streams between Chulitna River and Chase	25 July to 10 Oct.	Weekly
	Birch Creek	1 Aug. to 15 Aug. and 7 Sept. to 21 Sept.	Weekly Weekly
	Troublesome Cr.	7 Aug. to 15 Aug. and 7 Sept. to 21 Sept.	Weekly Weekly
	Byers Creek	7 Aug. to 15 Aug.	Weekly
	Byers Lake	1 Sept. to 15 Sept.	Weekly
	Question Creek	1 Sept. to 21 Sept.	Weekly
	Swan Lake Trib.	7 Sept. to 19 Sept.	Once

CREW	LOCATION	SURVEY PERIOD	SURVEY FREQUENCY
	Horseshoe Creek	7 Sept. to 21 Sept.	Weekly
	Clear Creek (lower 2 miles)	7 Aug. to 15 Aug.	Once
Gold Creek	All Tributary streams between Chase and Devil Canyon with exception of Portage Creek and Indian River which, because of their length, will be surveyed only for the first one (1) quarter mile upstream from the mouth.	25 July to 1 Oct.	Weekly

From 25 July to 15 September, the Gold Creek crew will also be responsible for fishing gill nets at various locations on the Susitna River between Devil Canyon and a point approximately 1/2 mile above Portage Creek once every five (5) days for four (4) hours. Collections will be made in a manner as uniform and unbiased as possible to assure that the study area is satisfactorily sampled.

Chinook salmon enumeration surveys of mainstem and tributary systems will be conducted from July 15 through August 15, 1981.

All sampling periods and survey frequencies area based upon the results and experiences of previous studies conducted in the Susitna River basin by ADF&G.

Methods

Mainstem Surveys

The following gear will be used to determine the presence of mainstem spawning:

1. Drift gill nets
2. Electroshockers
3. Echo recorders
4. Egg deposition pump

Each crew will have assigned a 20 foot river boat powered by a 75 hp jet outboard.

Drift gill nets will be fished by extending the net out perpendicular to the river channel, with the outside end of the float line attached to a buoy and the other fixed to the boat. The boat will drift under just enough power to keep the net reasonably straight and perpendicular to the current. Mainstem areas fished by this method should be substantially free of surface and subsurface debris and sufficiently shallow enough to allow the net to reach within a foot (or less) of the bottom. Catch data will be recorded as outlined in the drift net form (III Data Procedures). Salmon caught by drift netting will not be assumed spawning at the catch location unless all of the following criteria are met:

1. Fish exhibits spawning maturation colors and morphology.
2. Fish expells eggs or milt when slight pressure is exerted on the abdomen.
3. Fish is in vigorous condition, with 25 percent or more of the eggs or milt remaining in the body cavity.
4. An additional drift produces fish meeting criteria 1 through 3 above.

Each crew will have an echo recorder (depth finder) available which will be used on the Susitna River mainstem in those areas where water depth precludes use of a drift gill net. Method of operating the echo recorder will be in accordance with manufacturer's guidelines except that the transducer beam will be directed horizontially across the river channel instead of vertically. Suspected fish targets will be verified at first opportunity with electroshocking equipment or any other methods which based on site conditions appears feasible.

Two (2) electroshocking boom units will be available for use between the three (3) crews. Operating procedures are outlined in Appendix VI. These units will be worked whenever feasible on the Susitna River mainstem. The same criteria outlined under drift gill netting will be used to ascertain whether captured fish are spawning at the catch location.

Where water depth allows, suspected mainstem spawning areas will be sampled for egg deposition. A standard backpack water pump and two (2) circular standing screen cod nets 18 inches in diameter will be used to sample the river bed. Equipment operating procedures will be demonstrated in the field. Results will be recorded in the appropriate sampling form (III Data Procedures).

Set gill nets will be deployed by the Gold Creek crew in slack water areas and eddies on Susitna River mainstem between Devil Canyon and a point approximately 1/2 mile upstream of Portage Creek. Deploying a gill net is achieved by tying one (1) end of the float line to the shore and "playing out" the net from the side or bow of the boat

and then releasing the end of the net with an anchor and buoy attached to the offshore end of the lead line and float line respectively. Properly positioned, the net should extend offshore in a straight line or with a slight downstream arc.

Each survey crew will report the location of suspected mainstem, slough and tributary spawning areas twice weekly to the Aquatic Habitat (AH) crew assigned to that area. This information will be transferred to the AH crew on duplicate sampling forms (III Data Procedures). Each Adult Anadromous (AA) crew will also perform those co-operative duties discussed in the AH technical procedures section.

Slough and Tributary Surveys

Sloughs (clear water) and tributaries listed in the preceeding section will be surveyed in their entirity except as indicated according to the schedule. Surveys will be conducted on foot by two (2) crew members; one counting live fish and one counting carcasses. Observers will wear polarized glasses and use tally counters when enumerating fish. Survey information will be recorded on the appropriate form along with the number of tagged fish, catagorized by tag type and color (III Data Procedures).

Survey data will be forwarded to the Anchorage office every two (2) weeks.

Chinook Salmon Aerial Surveys

Aerial surveys to enumerate individual chinook salmon will be conducted via helicopter over all known and suspected spawning grounds. Data reported will reflect the total number of fish observed.

Eulachon Survey

Eulachon, are known to utilize lower portions of the river for spawning. A survey addressing Eulachon is planned for Phase II operations in the spring of 1982 and will not be discussed further here.

Stock Assessment

Operation Dates

Program will begin and end on the following dates:

1 July to 1 December

Methods

A Fisheries Biologist II will perform a comprehensive literature search on salmon stock identification methodology and procedures. All available fisheries data on each species and stock north of Anchor Point

in Cook Inlet focusing on age, size, run timing and abundance will also be compiled. Data sources will include but not be limited to ADF&G Cook Inlet Data Reports, Management and Catch Statistic Reports, Federal Aid Reports, USFWS & NMFS publications, and unpublished data from ADF&G staff and other state, federal and private fisheries scientists.

After compiling available stock information and evaluating proven and suggested stock separation methods, an analysis will be made of the suitability of each stock separation technique in determining the contribution of Susitna River fish to the Cook Inlet fishery. The results will be presented in a final report along with specific recommendations on implementing a stock separation program for Susitna River fish.

Radio Tagging

Operation Dates

A training class will be held from 15 May to 1 June on the Kenai River for personnel assigned to the radio tagging program.

Field activities for radio tagging and tracking will begin on the Susitna River and terminate on the following dates:

15 June to 1 October

Methods

The training class will be conducted under the direction of Carl Burger. All personnel assigned to the radio tagging program will be trained in the use of proven techniques to sample, tag and radio track salmon. Carl Burger is a biologist with the U.S. Fish and Wildlife Service and has considerable radio tagging expertise.

Following training, project personnel will radio tag approximately 40 adult salmon. The salmon will be collected at the Talkeetna fishwheel site which is far enough upstream of the Talkeetna/Chulitna/Susitna River confluence to insure that radio-tagged individuals are actually utilizing the drainage upstream of this point.

SPECIES	NUMBER RADIO TAGGED	TAGGING PERIOD
Chinook	15	15 June-15 July
Chum	13	1 August-7 September
Coho	12	15 July-1 September

All tags used will be low frequency (40 MHz) and will have a life expectency of 90 days or more, with a reception distance of not less than one (1) mile.

The fish will be selected from fishwheel captures at the Talkeetna tag/recapture site. There will be no attempt to bias selection other than no fish will be tagged with a transmitter that has been tagged previously with either Floy or Peterson disc tag or is lethargic or shows any external injury. Once a fish has been selected it will be transferred to a water tight box containing a fish anesthetic to subdue the specimen. The fish will be ready to tag within about two (2) minutes.

The cigar-shaped radio transmitter to be used is next tested for signal reception in water. Thence, it is coated with water soluble glycerin, and with the help of plexiglass tubes, is slid through the mouth and esophagus and into the stomach. Prior to release of the fish, the transmitter is tested again. The salmon is gently transferred to the river near shore, where it is held until consciousness is regained and the fish can forcefully swim away. Preliminary tracking studies will commence from a boat.

When several fish have been tagged and released, periodic boat trips and flights will commence to document their new locations. In this study, boat tracking will occur at least twice weekly. At least two (2) tracking flights will also be made per week (weather permitting), with fixed wing aircraft and/or helicopters. Both manual and scanning radio receivers will be used. From the boats, fish will be pinpointed to 20 $\pm$ feet of their actual locations.

Data will be recorded on the appropriate forms (III Data Procedures) and will be forwarded to the Anchorage office every two (2) weeks.

B. RESIDENT AND JUVENILE ANADROMOUS FISHERIES STUDIES

Study Descriptions and Rationale

Phase I of Resident and Juvenile Anadromous (RJ) field operations will extend over one summer and two partial winter seasons. The following discussions outline seasonal work plans to be implemented.

Summer Field Operations

Summer field operations will be conducted from May through October utilizing riverboats, rafts, fixed-wing aircraft, helicopters and pick-up trucks as the primary means of transportation. A total of four riverboats, crewed by Resident and Juvenile (RJ) and Aquatic Habitat and Instream Flow (AH) biologists, will operate on the Susitna River from the Estuary to Devil Canyon.

The riverboat crews will be based at the Yentna, Sunshine and Talkeetna Adult Anadromous (AA) Studies fishwheel/sonar camps and at the Gold Creek RJ Camp. Basing the boats at these locations will provide the necessary security and logistical support required for project implementation. Each riverboat will be staffed by one to three RJ biologists accompanied by one AH biologist as indicated in Figure 2. The responsibilities assigned to the four RJ riverboat biologist crews will include:

Systematic sampling of resident and juvenile anadromous populations using established techniques including gillnets, minnow traps, adult traps, hook and line, seines and electrofishing.

Design an effective downstream migrant trap to be deployed during Phase II.

Tag and release adult resident fish and attempt recapture.

Conduct informal interviews of sport fishermen between Talkeetna and the Tyone River and record the following information:

Date and location of catch.

Species, number of fish and number of hours fished.

Method of access to the area.

Carry out those co-operative duties discussed in the AH procedures section.

A fifth crew consisting of three RJ biologists and one AH biologist will operate in the upper Susitna River Basin. This crew will enter the study area as soon as practicable after break up. They will be provided both fixed-wing and helicopter air support in addition to two (2) inflatable rafts for primary river transportation. These biologists will be mobile; moving their base of operation between habitat locations every one (1) to three (3) days. Emphasis will be placed primarily at tributary mouths, tributary reaches and natural lakes which would be inundated after impoundment.

Winter Field Operations

Winter field operations were initiated in December 1980 along the Susitna River from the estuary to Devil Canyon. This period of the field program will continue to such time as ice-out (April) and begin the following November or December. Two to three crews as required to complete sampling objectives, are operating from base camps at Gold Creek and Montana Creek. Primary river travel is by snowmachine with support from fixed or rotary wing aircraft as necessary. Field camps and local lodging facilities are being used as appropriate.

Winter field crews are assigned as depicted in Figure 3.

Study Habitat Locations

Resident and Juvenile Anadromous Fisheries Studies sampling locations are depicted by number in Appendix VI, Figures 3-8. The general area of each habitat location is indicated by a corresponding number in the map code column of Table 1, Appendix VI. More specific locations follow each numerical group code. An explanation of the system of specifying geographic locations is included in Appendix VI.

Due to the inherent variability of a dynamic system such as the Susitna River, actual placement of gear can not be precisely defined. However, every effort has been made to insure that the reproducability necessary for the acquisition of meaningful data has been incorporated into the sampling site selection scheme.

Selection of individual sites at habitat locations is based on the following criteria. Each site will be sampled bi-weekly.

Tributary Stream Mouth Sites

Selection of sites at tributary stream mouths will include up to three (3) sites within the back-water pools commonly found at tributary/mainstem confluences. They are:

Mainstem river/tributary interface (a).

Approximately one half (1/2) the distance up the back-water pool (b).

Interface of back-water pool and tributary flow (c).

On many smaller tributaries only sites (a) or (a) and (c) will be sampled, while it is anticipated that on larger tributaries all three sites will be sampled. This will be necessary to insure that the sampling gear is not spaced so close to influence overall gear effectiveness.

Slough Sites

Selection of sampling sites at sloughs will include up to three (3) sites, depending on the size of the slough. They are:

Slough mouth.

Approximately one half (1/2) the distance up the slough.

Slough head.

Mainstem River Sites

Mainstem river sites will be selected in areas suitable for effective deployment of the various gear types. The actual location of mainstem sites will be marked on a prominent shoreline object (tree) by blazing and/or placing an aluminum plate with the site location and number inscribed thereon.

Upper Susitna River Tributary Sites

Preliminary ground reconnaissances of upper Susitna River tributaries which will be affected by the proposed impoundment were conducted by the U.S. Fish and Wildlife Service (1974) and the Alaska Department of Fish and Game (Williams, 1976). Based on these findings, eight major tributaries have been selected for in-depth studies of fish populations. These streams, with the mile which may be inundates, are listed in Table 1.

A typical tributary stream is shown in Figure 1 with sampling sites defined. Preliminary ground and aerial surveys have shown that prime fish habitat occurs primarily in the lower one mile of tributaries. A distance of one mile will be measured relative to the thalweg of the stream. Starting from the stream mouth, every other 500 foot section of stream will be sampled within this mile. Proceeding upstream, the sites will be numbered one (1) through five (5). A non-sampling area of 500 feet will follow each site sampled.

At site one (1), gear fished will initially include the following: Five (5) minnow traps, five (5) trot lines, one (1) set for burbot variable mesh gillnet, seines, electric shocker, and rod and reel. Gear fished at sites two (2) through five (5) will include: seine, electric shocker, and rod and reel.

Set gear will be fished for 48 hours. A maximum of one (1) hour will be spent fishing seines and/or shockers at sites two (2) through five (5) to yield a qualitative and quantitative indication of fish present. At site six (6) extending from the end of mile one (1) to the upper flood level any or all of the non-fixed gear will be fished to determine the presence or absence of fish.

Sample sites will be blazed and tagged to insure the same areas are sampled each time.

Selective Sampling of Fish Concentrations

To augment the tag and recapture portion of the project, areas of observed fish concentrations will be sampled without regard to sampling design or quantitative comparison. It is envisioned that this sampling selection method will insure that adequate numbers of resident species are tagged for study of migratory behavior.

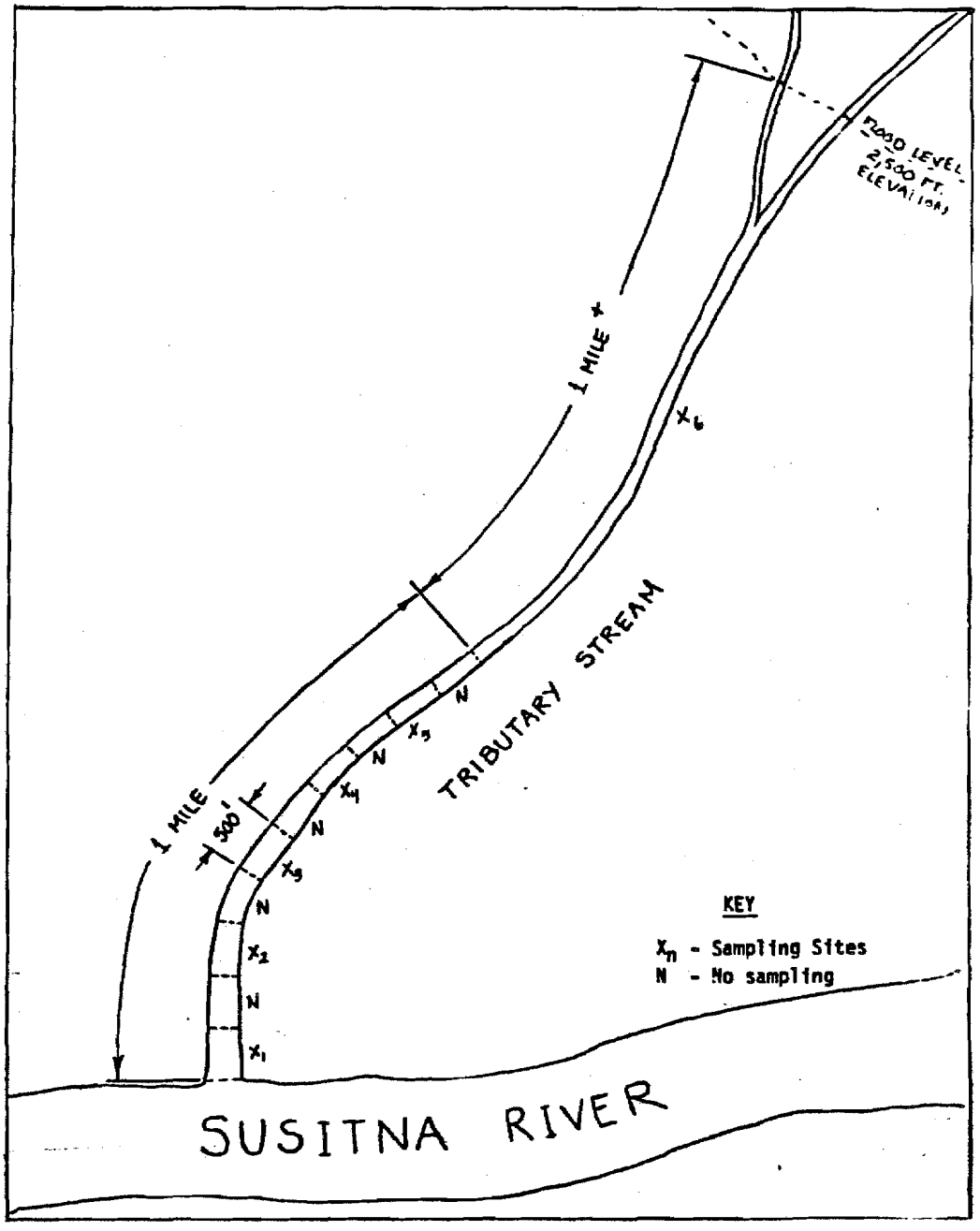


Figure 1. Sampling sites in a typical impoundment stream.

Table 1 . Sampling Streams Proposed Susitna Impoundment.

Sample No.	
	Impoundment - Lower 2,050
(1)	Fog 6.5 miles in impoundment. Talkeetna D4. Trib. to Rt (South) side of Susitna to Next site 5 miles.
1/ (2)	Tsusena 4.5 miles in impoundment. Talkeetna D4. Left (North) side trib. to next site 4.5 miles.
	Impoundment - Upper 2,200
1/ (3)	Deadman 2.0 miles in impoundment. Talkeetna D3. Left (N) side trib. to next site 7.0 miles.
(4)	Watana 8 miles in impoundment. Talkeetna D3. L side trib. to next site 12 miles.
(5)	Kosina 4.0 miles in impoundment. Talkeetna D2. Rt. side trib. to next site 1.5 miles.
1/ (6)	Jay 2.5 miles in impoundment. Talkeetna D2. Left side trib. to next site 21 miles.
(7)	Goose 1.5 miles in impoundment. Talkeetna C1. Rt side trib to next site 2.0 miles.
(8)	Oshetna 3.5 miles in impoundment. Talkeetna C1. Rt side trib. to next site 11 miles.

1/ High falls in lower river likely preclude all upstream fish passage to upstream sampling areas.

Study Methods

A variety of sampling techniques and equipment will be used to capture resident and juvenile fish. The transactions of the American Fisheries Society have through the years presented articles on the relative effectiveness of gear types. Discussions and illustrations of gear along with fishing techniques are presented by Lagler (1959) and illustrated by Sundstrom (1957). The use of the rod and reel in the capture of the various fish species is discussed at length by McClane (1965).

Gear types are divided according to season of intended use and mobility of deployment. Minnow traps, burbot sets, trot lines, jigging sets and under-ice gillnets are intended for winter use while minnow traps, trot lines, burbot sets and set gillnets are intended for summer use. Beach seining, hook and line angling, electro-shocking and drift gillnetting are primarily mobile techniques intended for summer use.

Detailed instructions on the assembly, use (setting) and checking of the various gear types used is in Appendix VII.

Tagging of Resident Adult Species

Efforts will be made to capture up to 3,000 resident adult fish for tagging. Species to be tagged are Arctic grayling, burbot, rainbow trout, round whitefish, humpback whitefish, and suckers.

The Floy Tag and tagging system described in Figure IV-1 will be utilized in all tagging except for burbot. Tagging of burbot will be accomplished with a disk dangler type tag (Figure IV-2; Figure IV-3) using methodology described by Mauney, (1965) and Rounsefell, (1963). Abbreviated instructions for attaching the disk-dangler are in Appendix IV section B.

Resident Adult Tag Recovery

Recovery of tags placed on adult resident fish will be accomplished by the following means:

The angling public will be requested to return recovered tags to Fish and Game or if captured fish is released, to report the tag number. The public will be informed of the tagging program by: (1) news releases to the media, and (2) posters placed in locations frequented by anglers.

Resident and Juvenile Anadromous field operations.

Radio Telemetry

An experimental telemetry program will be conducted with large resident species. The purpose of the program will be to determine if resident fish can be successfully tagged and monitored. Ten (10) tags will be employed with tagging commencing just prior to freeze-up. The movement of resident fish will be monitored to determine intra-system migration patterns. The limited data will provide a basis for determining feasibility of more extensive studies during Phase II.

Details of tagging procedures are discussed in the Adult Anadromous section.

Level of Effort

Schematics of study personnel by primary area of responsibility are given in Figures 2 and 3 the full staff of RJ will include: 1 Fisheries Biologist III, 1 Fisheries Biologist II, and 10 Fisheries Biologist I's. Personnel of AH staff will participate in field operations.

C. AQUATIC HABITAT AND INSTREAM FLOW STUDIES

Study Description and Rationale

Phase I of the Aquatic Habitat and Instream Flow Study (AH) will be subdivided into two segments (Figure 4): 1) fishery habitat evaluations of the principal resident fish, and juvenile and adult anadromous salmon sampling areas to include point specific and general habitat evaluations; and 2) selected habitat evaluations which represent similar habitats in the study area in addition to those slated for fish sampling.

Fishery Habitat Evaluations

Fishery habitat evaluation studies will be performed during the winter and summer field seasons and are subdivided into point specific and general habitat evaluations (Figure 5).

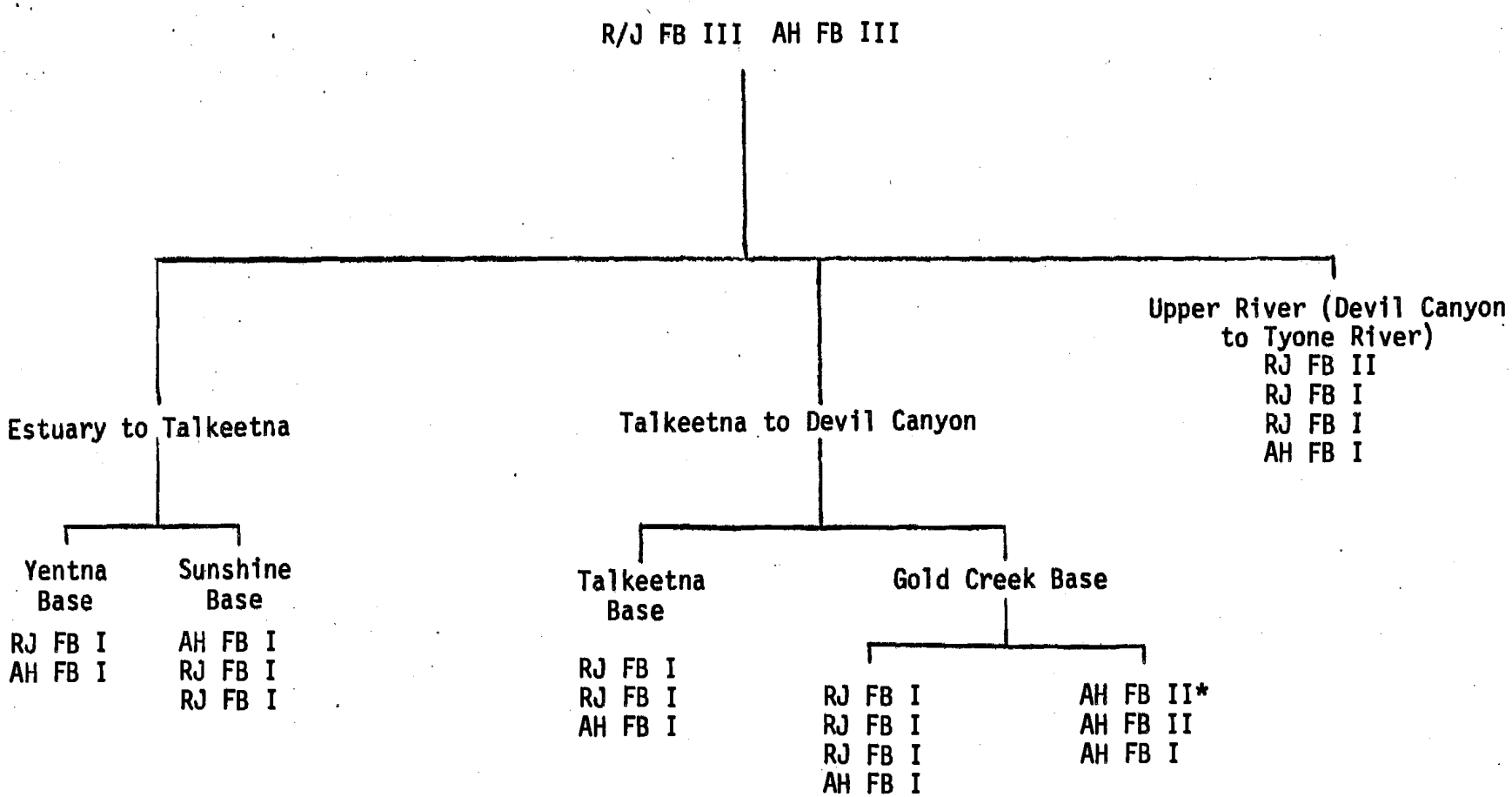
Point Specific Evaluation

Velocity, depth, and substrate data will be collected at the gear placement sites (gps) to characterize the range of streamflow dependent characteristics which appear to be influencing the suitability of various habitat types for the species and life stages of interest. Velocity, depth, and substrate data will also be recorded at points where fish are observed. These data will be collected according to the AA ground survey and RJ sampling schedules.

RESIDENT AND JUVENILE ANADROMOUS (RJ) AND AQUATIC HABITAT AND INSTREAM FLOW (AH) STUDY
PERSONNEL DEPLOYMENT - ICE FREE MONTHS

Figure 2.

RESIDENT/JUVENILE - AQUATIC HABITAT
PROJECT LEADERS

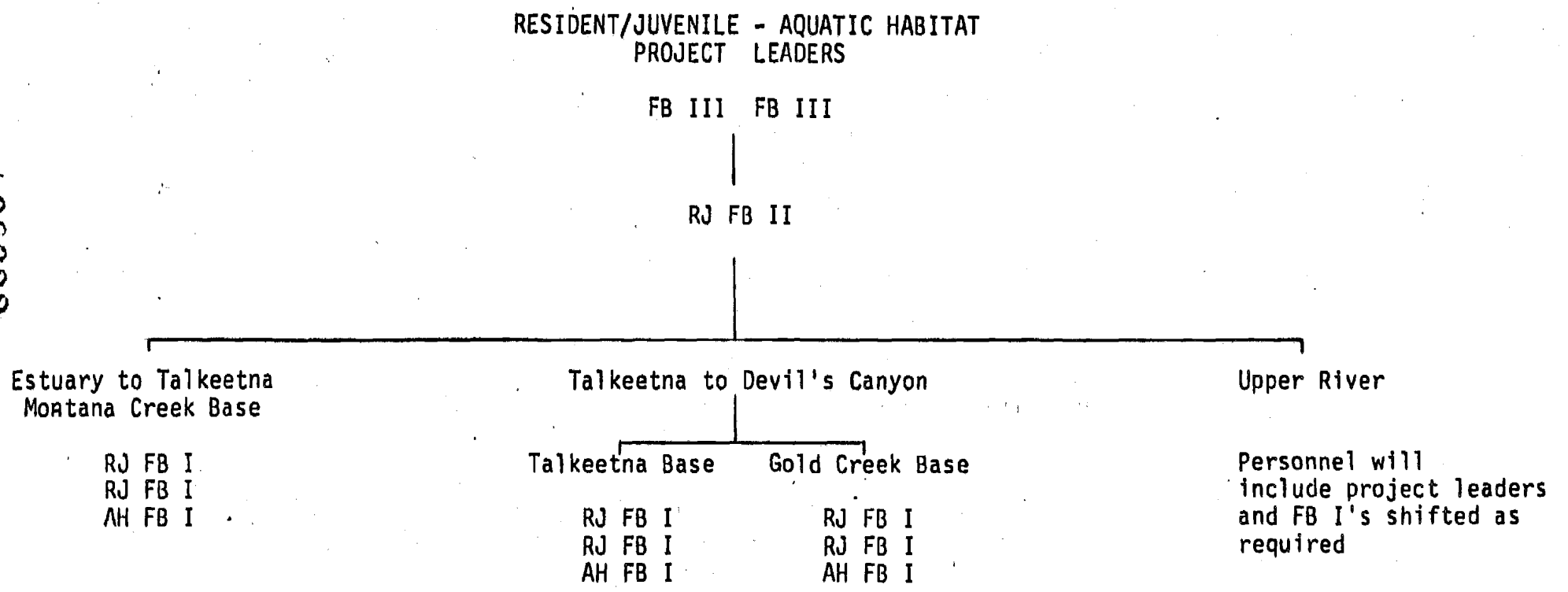


*Selected Habitat Evaluation Study Crew.

RESIDENT AND JUVENILE ANADROMOUS (RJ) AND AQUATIC HABITAT AND INSTREAM FLOW (AH) STUDY

PERSONNEL DEPLOYMENT - ICE COVERED MONTHS

Figure 3.



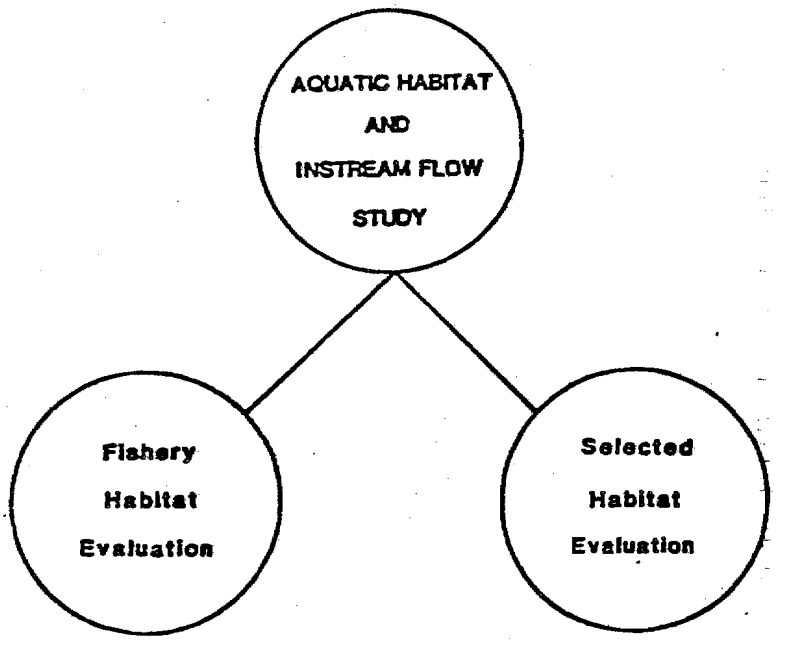


Figure 4. Aquatic Habitat and Instream Flow Study Program Components.

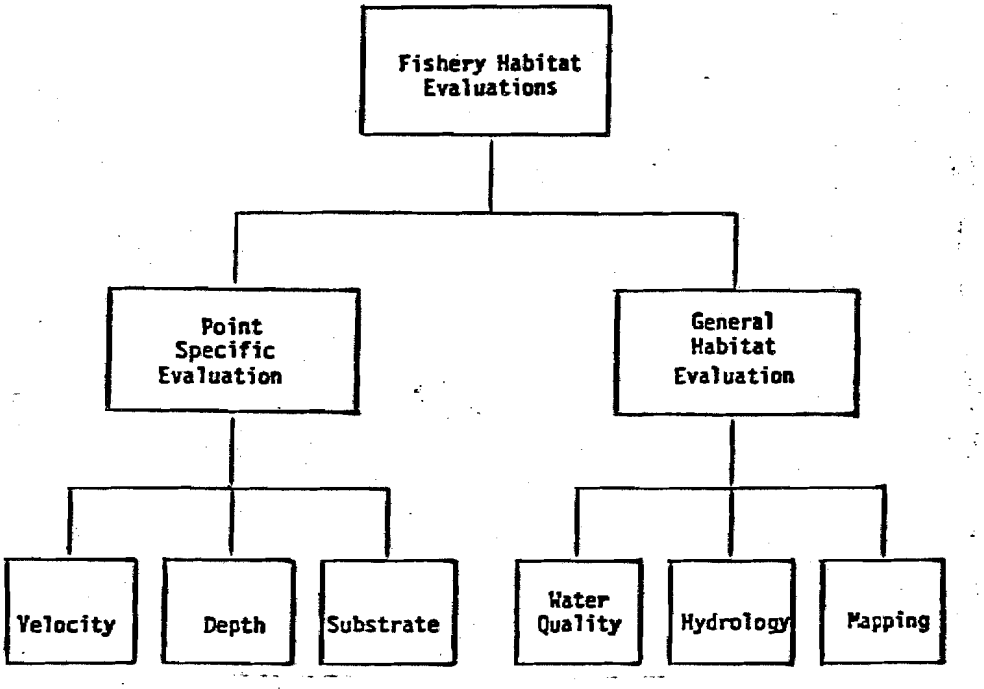


Figure 5. Fishery Habitat Evaluation Components.

General Habitat Evaluation

General habitat evaluations will provide the necessary data to describe and map the overall habitat characteristics of each RJ and AA study site. These data will be collected in the study area below Devil Canyon on a twice per month basis with the exception of discharge. Discharge will be measured three times, once per seasonal period of low, medium, and high flows based on existing flow records. Data will be collected in the study area above Devil Canyon, according to the schedule detailed in the RJ section. Data collected will include the parameters listed in Table 2.

Table 2. General Habitat Evaluation Parameters.

Water Quality	Hydrology	Mapping
temperature (air, water, and intra-gravel*)	velocity	photography
pH	stage*	substrate
dissolved oxygen	discharge*	cover
specific conductance	substrate	pools
turbidity		riffles
		dimensions (aerial and cross sectionals*)
		gear placement sites

*Note: these parameters will not be measured in the study area above Devil Canyon.

Selected Habitat Evaluation

Habitat locations which can be used to represent areas between Talkeetna and Devil Canyon that have comparable physical and chemical characteristics will be evaluated one time per seasonal low, medium, and high flows. These data will be used to determine how many miles or what percent of this section of the river has similar characteristics (Figure 6).

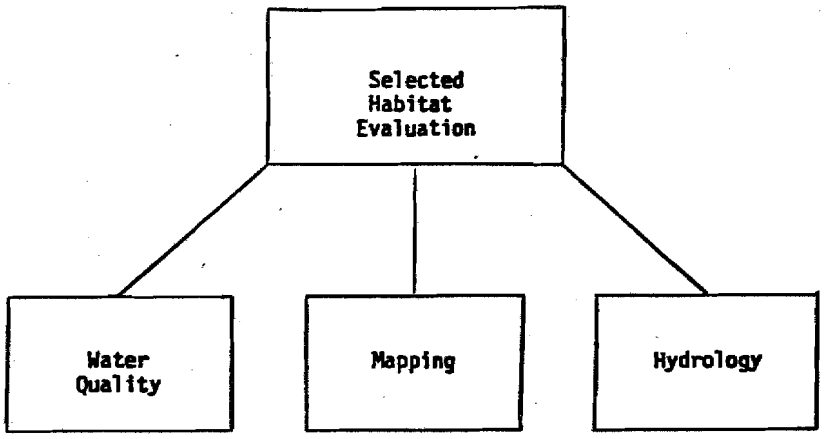


Figure 6. Selected Habitat Evaluation Components.

Data collected on maps and evaluations of these sites will include the parameters listed in Table 3.

Table 3. Selected Habitat Evaluation Parameters.

Water Quality	Mapping	Hydrology
temperature (air, water, and intra-gravel)	photograph	velocity
pH	substrate	stage
dissolved oxygen	cover	discharge
specific conductance	channel dimensions	substrate
turbidity	pools	
	riffles	
	morphometry	
	gear placement sites	

Additional water quality data will be jointly collected by AH and U.S. Geological Survey (USGS) personnel (Table 4).

Table 4. ADF&G/USGS Additional Water Quality Measurements.

Nutrients And Organics

NO_2 + NO_3 dissolved	NH_4 Organic N Total
NH_4 dissolved	Phosphorus Dissolved Total
NH_4 + Organic N dissolved	Phosphorus Total
NO_2 + NO_3 Total	Dissolved Organic Carbon
	Suspended Organic Carbon

Inorganic Constituents

Silica	Chloride
Calcium Magnesium	Fluoride
Sodium	Sulfate
Potassium	Turbidity
	Dissolved Solids (residue at 18°C)

Minor Elements Dissolved and Total

Arsenic	Iron
Barium	Lead
Cadium	Manganese
Chromium	Mercury
Cobalt	Nickel
Copper	Selenium
Zinc	

Field Parameters

Specific conductance, alkalinity, pH, temperature, dissolved oxygen.

Sediment Analysis

Suspended sediment concentration and complete particle size analyzed.

Study Site Locations

Fishery Habitat Evaluation Sites

Point specific measurement sites data will be collected at each RJ gear placement sampling site location. Data will also be collected at the AA sonar and fishwheel sites and spawning sites which will be identified by the AA ground survey crew.

General habitat evaluation sites will be the same as those described in the AA and RJ Study Habitat Location Sections of this manual.

Selected Habitat Evaluation Sites

Project personnel will review and analyze aerial photographs, topographic maps, and the water surface profile analysis of the study area between Talkeetna and Devil Canyon to identify five representative habitat locations. These locations will be selected in May, 1981. Additional sites will be added at a later date if they are determined to have value to the Phase I study.

Methods

Water Quality

Water Quality will be evaluated at the fishery habitat evaluation and selected habitat evaluation staff gage placement sites in the study area below Devil Canyon. Water quality data will be collected from the center of each index area in the study area above Devil Canyon. General habitat evaluation water quality data will be collected twice monthly below Devil Canyon and once per month above Devil Canyon. Selected habitat evaluation water quality data will be collected one time per seasonal period of low, medium, and high flows.

Dissolved oxygen (DO), pH, temperature, and specific conductance of surface waters will be measured in the field with a Hydrolab model 4041 multiparameter meter or a combination of instruments (YSI model 57 dissolved oxygen meter, a YSI model 33 S-C-T meter and a Digi-sense model 5985-40 pH meter). Intragravel water temperatures will be measured with a combination Digi-sense thermistor C-8522-10 and YSI 400 series semi-solid insertion probe system. The instruments will be operated following the manufacturers' instructions (Appendix 8) and when applicable calibrated according to the procedures established by the USGS in 1981 (USGS, 1981). Water samples for turbidity analysis will be collected at the same time the preceding water quality field parameters are measured. Samples will be collected in 250 ml plastic bottles filled two-thirds full and stored in a cool, dark location prior to analysis. Turbidity samples will be returned to Anchorage once per week for analysis on a Hach model 2100A turbidimeter. Air temperature will be measured at these sites with a thermometer shielded from the direct rays of the sun.

Surface water temperatures will be continuously monitored at staff gage placement sites by Model J-90 Ryan thermographs to identify thermal characteristics within the study area. These sites will include, but not be limited to the four (4) AA sonar and eight (8) fishwheel sites, and the mouths of major tributaries below Devil Canyon. Thermographs will be enclosed within minnow traps, weighted with stones and attached to the staff gage with wire. The traps and wire will be concealed to prevent tampering with by the public. Thermographs will be inspected twice monthly and the time, date, and temperature recorded on the chart to calibrate the instrument. The "O" ring seal will be cleaned and greased lightly with vaseline to prevent leakage before resealing the thermograph. Charts will be replaced every ninety days. In addition to surface water temperatures, intragravel temperatures will also be continuously monitored by thermographs buried in the gravel to characterize the relationships between surface and ground water temperatures.

Hydrology

Mean column, point velocity, and depth measurements will be measured with Marsh-McBirney, Price AA, or Pygmy flow meters and top-setting wading rods according to the respective manufacturers' instructions and procedures approved by the USGS (Smoot and Novak, 1977; Buchanan and Somers, 1973). Point velocities are measured at the same depth as the organism (i.e. fish) or object (i.e. minnow traps, spawning redd, etc.) of interest. The mean column velocity is the measurement of the average velocity in the same vertical plane as the preceding point velocity. In water with a depth of three feet or less, as measured with a top-setting wading rod, the mean column velocity will be measured at the one point located .6 of the total depth from the surface of the water. For depths greater than three feet, two velocities will be measured to compute the mean column velocity. They will be measured at .2 and .8 of the total depth from the surface of the water and averaged. If the channel bottom is soft, care must be taken to avoid submerging the foot of the wading rod or the sounding weight into the substrate material.

When using a Price AA or Pygmy flow meter, the velocity at the point of the current meter is determined by counting the number of signals ("clicks") per unit of time. Each meter is calibrated by the commercial supplier and an equation for the relationship between velocity and revolutions per unit time is derived. To facilitate field use, the equation is solved for a number of revolutions ("stop counts") and various time steps. A rating table (Figure 7) which shows the velocity for a given number of revolutions per time interval is provided with each meter. The real trick in using the rating table is to memorize the "stop counts". One should count clicks for at least 40 seconds, remembering to stop counting at one of the stop counts in the rating table. Failure to do so will negate the ability to obtain the velocity directly from the rating table. One cannot simply interpolate between stop count values given in the table; the rating curve equation must be solved.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Water Resources Division

RATING TABLE FOR TYPE AA CURRENT METER

EQUATIONS: V=2.180R + .020 (2.200) 2.170R + .030 Std Rating No. 1

Time in Seconds	VELOCITY IN FEET PER SECOND — Revolutions									Time in Seconds
	3	5	7	10	15	20	25	30	40	
40	.183	.292	.401	.565	.837	1.11	1.38	1.65	2.20	40
41	.180	.286	.392	.552	.818	1.08	1.35	1.62	2.15	41
42	.176	.280	.383	.539	.799	1.06	1.32	1.58	2.10	42
43	.172	.273	.375	.527	.780	1.03	1.29	1.54	2.05	43
44	.169	.268	.367	.515	.763	1.01	1.26	1.51	2.00	44
45	.165	.262	.359	.504	.747	.989	1.23	1.47	1.96	45
46	.162	.257	.352	.494	.731	.968	1.20	1.44	1.92	46
47	.159	.252	.345	.484	.716	.948	1.18	1.41	1.88	47
48	.156	.247	.338	.474	.701	.928	1.16	1.38	1.84	48
49	.153	.242	.331	.465	.687	.910	1.13	1.35	1.80	49
50	.151	.238	.325	.456	.674	.892	1.11	1.33	1.76	50
51	.148	.234	.319	.447	.661	.875	1.09	1.30	1.73	51
52	.146	.230	.313	.439	.649	.858	1.07	1.28	1.70	52
53	.143	.226	.308	.431	.637	.843	1.05	1.25	1.67	53
54	.141	.222	.303	.424	.626	.827	1.03	1.23	1.63	54
55	.139	.218	.297	.416	.615	.813	1.01	1.21	1.61	55
56	.137	.215	.292	.409	.604	.799	.993	1.19	1.58	56
57	.135	.211	.288	.402	.594	.785	.976	1.17	1.55	57
58	.133	.208	.283	.396	.584	.772	.960	1.15	1.52	58
59	.131	.205	.279	.389	.574	.759	.944	1.13	1.50	59
60	.129	.202	.274	.383	.565	.747	.928	1.11	1.47	60
61	.127	.199	.270	.377	.556	.735	.913	1.09	1.45	61
62	.125	.196	.266	.372	.547	.723	.899	1.07	1.43	62
63	.124	.193	.262	.366	.539	.712	.885	1.06	1.40	63
64	.122	.190	.258	.361	.531	.701	.872	1.04	1.38	64
65	.121	.188	.255	.355	.523	.691	.858	1.03	1.36	65
66	.119	.185	.251	.350	.515	.681	.846	1.01	1.34	66
67	.118	.183	.248	.345	.508	.671	.833	.996	1.32	67
68	.116	.180	.244	.341	.501	.661	.821	.982	1.30	68
69	.115	.178	.241	.336	.494	.652	.810	.968	1.28	69
70	.113	.176	.238	.331	.487	.643	.799	.954	1.27	70
	3	5	7	10	15	20	25	30	40	

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RATING TABLE FOR TYPE AA CURRENT METER

Actual Rating Limits: 0.25 to 8.0 feet per second Date: 03-05-70

Time in Seconds	VELOCITY IN FEET PER SECOND — Revolutions									Time in Seconds
	50	60	80	100	150	200	250	300	350	
40	2.74	3.28	4.37	5.45	8.17	10.88	13.59	16.30	19.02	40
41	2.68	3.21	4.26	5.32	7.97	10.62	13.26	15.91	18.55	41
42	2.61	3.13	4.16	5.20	7.78	10.36	12.95	15.53	18.11	42
43	2.55	3.06	4.07	5.08	7.60	10.12	12.65	15.17	17.69	43
44	2.50	2.99	3.98	4.96	7.43	9.89	12.36	14.83	17.29	44
45	2.44	2.92	3.89	4.85	7.26	9.67	12.09	14.50	16.91	45
46	2.39	2.86	3.80	4.75	7.11	9.46	11.82	14.18	16.54	46
47	2.34	2.80	3.72	4.65	6.96	9.26	11.57	13.88	16.19	47
48	2.29	2.74	3.65	4.55	6.81	9.07	11.33	13.59	15.85	48
49	2.24	2.69	3.57	4.46	6.67	8.89	11.10	13.32	15.53	49
50	2.20	2.63	3.50	4.37	6.54	8.71	10.88	13.05	15.22	50
51	2.16	2.58	3.43	4.28	6.41	8.54	10.67	12.79	14.92	51
52	2.12	2.53	3.37	4.20	6.29	8.38	10.46	12.55	14.64	52
53	2.08	2.49	3.31	4.12	6.17	8.22	10.27	12.31	14.36	53
54	2.04	2.44	3.24	4.05	6.06	8.07	10.08	12.09	14.09	54
55	2.00	2.40	3.19	3.98	5.95	7.92	9.89	11.87	13.84	55
56	1.97	2.35	3.13	3.90	5.84	7.78	9.72	11.65	13.59	56
57	1.93	2.31	3.08	3.84	5.74	7.64	9.55	11.45	13.35	57
58	1.90	2.27	3.02	3.77	5.64	7.51	9.38	11.25	13.12	58
59	1.87	2.24	2.97	3.71	5.55	7.39	9.22	11.06	12.99	59
60	1.84	2.20	2.92	3.65	5.45	7.26	9.07	10.88	12.69	60
61	1.81	2.16	2.88	3.59	5.37	7.14	8.92	10.70	12.48	61
62	1.78	2.13	2.83	3.53	5.28	7.03	8.78	10.53	12.28	62
63	1.75	2.10	2.79	3.47	5.20	6.92	8.64	10.36	12.09	63
64	1.72	2.06	2.74	3.42	5.12	6.81	8.51	10.20	11.90	64
65	1.70	2.03	2.70	3.37	5.04	6.71	8.38	10.05	11.71	65
66	1.67	2.00	2.66	3.32	4.96	6.61	8.25	9.89	11.54	66
67	1.65	1.97	2.62	3.27	4.89	6.51	8.13	9.75	11.37	67
68	1.62	1.94	2.58	3.22	4.82	6.41	8.01	9.60	11.20	68
69	1.60	1.92	2.55	3.17	4.75	6.32	7.89	9.46	11.04	69
70	1.58	1.89	2.51	3.13	4.68	6.23	7.78	9.33	10.88	70
	50	60	80	100	150	200	250	300	350	

Figure 7. USGS Type AA Current Meter Rating Table.

After 40 seconds has elapsed it is only necessary to concentrate on stopping at a "stop count". The rating table is usually contructed in one-second steps from 40 seconds to 70 seconds. When using a Marsh-McBirney electronic flow meter, allow the meter to calibrate, place in the proper location and read the meter.

Locations of point and mean column velocity measurements will include minnow traps, salmon redds, gillnets, and trot line sites. Velocities will also be measured at sites where fish are observed.

Minnow trap velocities will be measured at the upstream mouths of traps each time they are set and reset. Location and identification of salmon redds where velocity and depth will be measured are based on standards established by the ADF&G (Estes, Hepler, and Hoffmann, 1981) and the Arctic Environmental Information and Data Center, AEIDC (Baldridge, 1981). Biologists will select vantage points within study sites that allow both good visability for observation and create the least disturbance to the fish. Polarized sun glasses will be worn to screen out reflected glare from the water and increase the observer's efficiency. Redds will be defined by direct observation of the repeated fanning and digging actions of the female at the same site. Redds will also be located by observing characteristic spawning behavior including biting and chasing of intruders by a male-female pair, or an individual adult remaining over a distinct excavated depression in the streambed. When a redd is located, the site will be marked by methods similar to those used by Bovee and Cochnauer (1977). After all of the redds within a sampling site have been identified, the velocities and depths will be measured.

Velocities at set gillnet and trot line sites will be measured ~~at three (3) foot intervals~~ at the center of each panel gillnet which has a different mesh size or at the ends and the middle of a gillnet with 1 size mesh along the length of the initial set when set perpendicular to the flow. When set parallel to the flow, one velocity measurement will be taken immediately upstream of the net or trot line. Measurements will be recorded each time the gillnets and trot lines are set and the locations of fish captured noted.

Every attempt will be made to obtain velocity measurements. When location of fish sampling gear and water depth make these measurements impossible to obtain, this will be noted on the point specific habitat evaluation form.

Staff gages, will be installed at fishery habitat and selected habitat evaluation sites in the study area below Devil Canyon. Specific placement will be determined by the crew in charge of selected habitat evaluation. Staff gages will be read twice monthly to determine the stage/discharge relationship between sloughs, side channels, and the mainstem river with the exception of side sonar and fishwheel site staff gages which will be read every six (6) hours when the sites are manned by AA crews.

A transect will be surveyed and the stream bed profile determined in a plane perpendicular to the flow of water at each gage site prior to installing a gage. Staff gage elevations in the study area between Talkeetna and Devil Canyon will be determined from the R&M Consultants datum used to establish streambed elevations. The staff gage will be read before and after collecting the discharge data. This information will be used to develop stage/discharge rating curves and to estimate reach specific streamflows. Where applicable, mainstem discharge information will be obtained from the closest USGS gaging station as a control.

Discharge will be measured at staff gage placement sites during three seasonal flow periods (high, medium, and low). These measurements and the following discussion are based on procedures developed by the USGS (Smoot and Novak, 1977; Buchanan and Somers, 1973), and USFWS Instream Flow Group (Bovee and Milhous, 1978; Trihey and Wegner, 1981).

Discharge will be computed from the mean column velocity and depth information recorded at vertical columns (verticals) collected along the transects surveyed when placing the staff gages. A tagline will be stretched across the water parallel to the transect. One should attempt to subdivide the channel such that no more than 5% of the total flow passes between successive verticals. The spaces between verticals are termed cells. Verticals are to be placed such that they best describe velocity distribution and changes in the cross sectional channel geometry. If the direction of flow is not at right angles to the cross section, find the velocity vector normal to the section. Measure the cosine of the horizontal angle (Figure 8) by holding the discharge measurement note sheet in a horizontal position with the point of origin (O) on the left edge over the tag line, bridge rail, or any other feature parallel to the cross section. With the long side parallel to the direction of flow, the tag line or bridge rail will intersect the value of the cosine of the angle (a) on the top, bottom, or right edge. Multiply the measured velocity by the cosine of the angle to determine the velocity vector component normal to the measuring section.

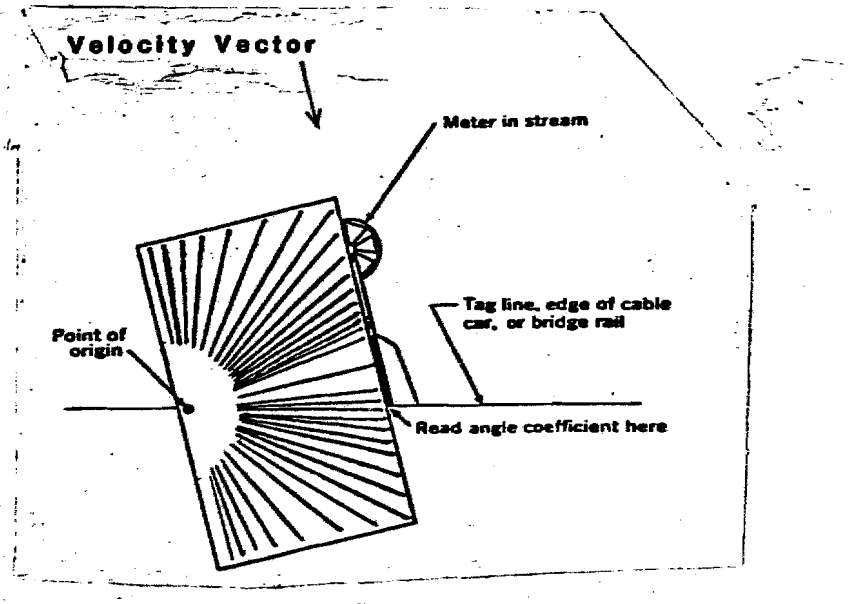


Figure 8. Measurement of Horizontal Angles (from Buchanan and Somers, 1973).

Substrate data will be collected based on procedures used by the AEIDC (1981), ADF&G (Estes, Hepler, and Hoffmann 1981) and Shirazi (1979), at fishery habitat evaluation (point specific and general habitat) and selected habitat evaluation sites.

General habitat and selected habitat evaluation substrate data will be collected along the discharge measurement transect(s) at each velocity and depth measurement site. Point specific habitat evaluation substrate data will be collected from a 2 foot radius around the velocity and depth measurement site.

Substrate classes will be assessed by selecting up to three predominant substrate groups and recording the percent of each. The size and type of substrate are grouped into the following classes:

0. Organic Detrius	4. 1/4"-1"	8. 10" +
1. Silt Clay	5. 1"-3"	9. Bedrock
2. Sand	6. 3"-5"	
3. 1/16"-1/4"	7. 5"-10"	

Notes will also be made as to the absence or presence and amount (% cover) of periphyton (attached algae) and other aquatic vegetation. The degree of embeddedness will also be recorded. Embeddedness is defined as the filling of interstitial space by fines between substrate of Class Five (5) or greater (Figure 9).

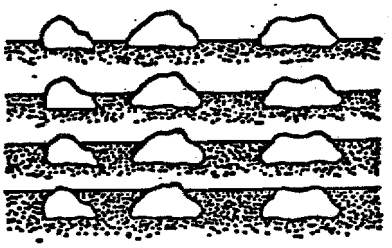
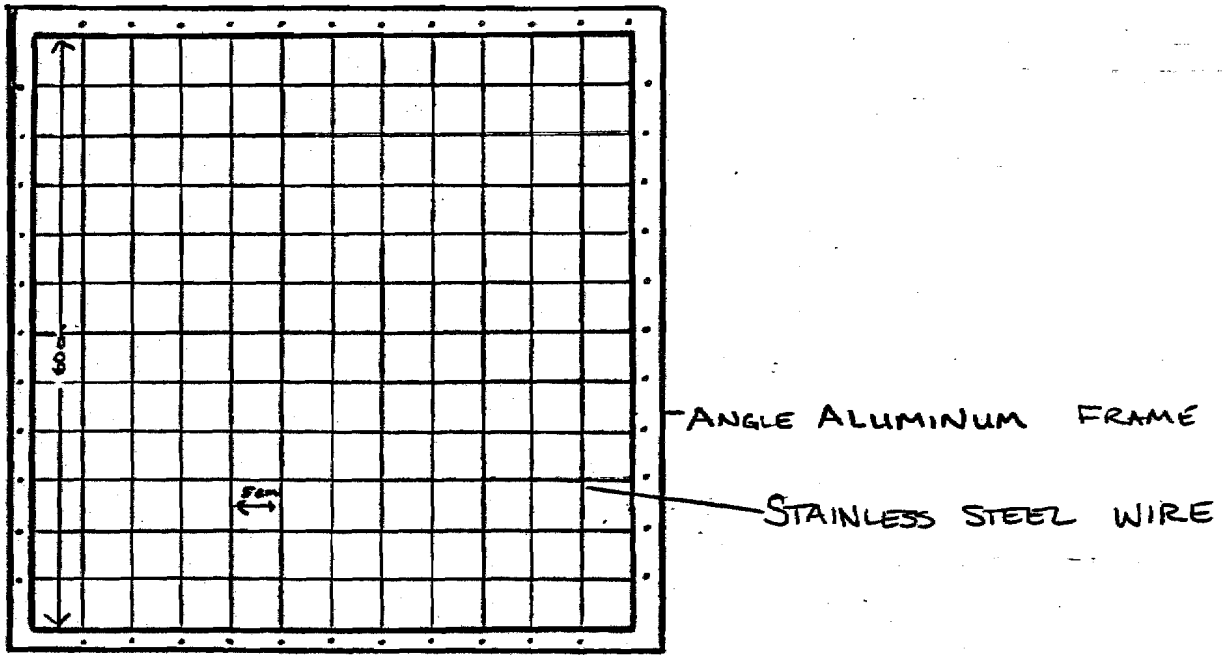
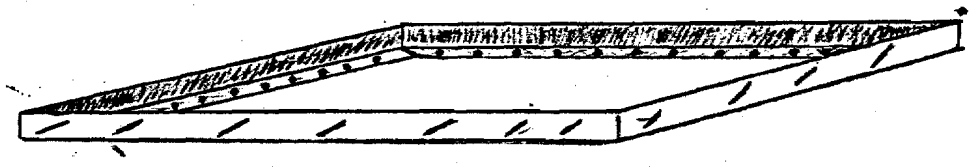
Code	Degree of Imbededness (%)	Illustration
2	25	
5	50	
7	75	
9	90 to 100	

Figure 9. Embeddedness Classification System (from AEIDC, 1980).



TOP VIEW



SIDE VIEW WITH FRAME UPSIDE DOWN
SHOWN WITHOUT WIRES

Figure.10. Substrate Grid Diagram.

Maps will be drafted which identify substrate data sampling sites and the locations of various substrate classes (III. DATA PROCEDURES). The boundary between each distinct substrate class area within the sampling site will be delineated on the Aerial View Map form (AH-81-03). The substrate classification within each of these distinct areas will also be identified and recorded on the map. Substrate from each of these areas will be ~~photographed and~~ mapped. Three (3) photographs will be taken at one third intervals along each transect using photography procedures similar to those used by R&M Consultants (Griffiths 1981). A 60 X 60 cm grid subdivided into 5 X 5 cm squares (Figure 10) will be placed on top of the substrate and photographed (Kellerhals and Bray, 1970; Griffiths, 1981).

~~An~~ Additional photographs will depict the 3 substrate types

Mapping

An upstream view cross sectional profile map will be drafted for each staff gage transect (Figure 11). The staff gage location and the channel dimensions; top width, wetted perimeter, bankfull top width, and water's edges, of the cross sectional profile will be included. Definition of terms follow:

Top Width: The top length of the water surface of a channel cross section measured in a plane perpendicular to the direction of the flow between the two water's edges.

Wetted Perimeter: The length of the submerged portion of a channel cross section measured in a plane perpendicular to the direction of flow between the two water's edges.

Bankfull Top Width: The top width of a channel cross section measured in a plane perpendicular to the direction of the flow between the two highest water's edgemarks.

Water's Edge: The point where the water surface comes into contact with the bank.

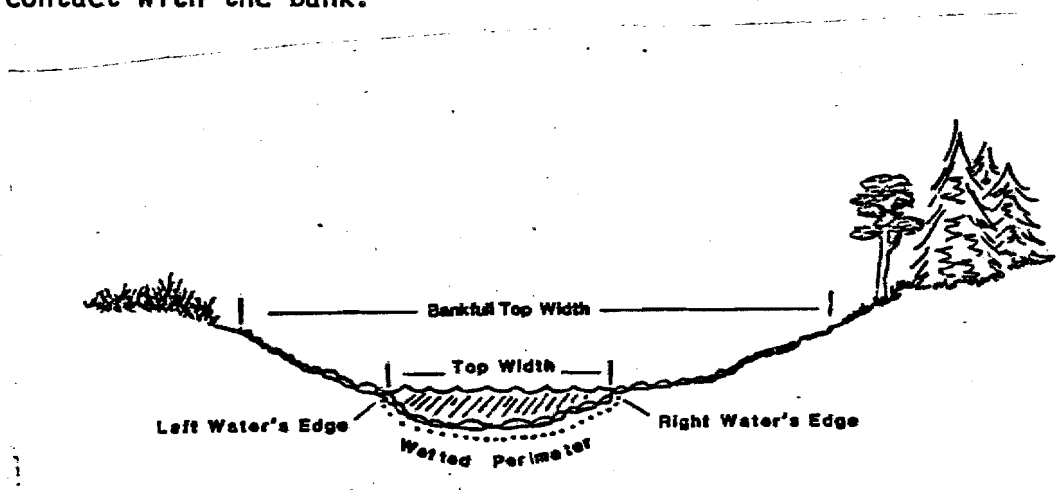


Figure 11. Cross Sectional Profile Diagram.

An aerial view map will be drawn for each sampling site and will include the following (III. DATA PROCEDURES):

Substrate Types: The boundary of areas covered by a distinct substrate composition using the substrate classification system. The degree of embeddedness of Class Five (5) and larger substrate, and the percent of area covered by attached algae and higher aquatic plants.

Cover: Overhanging vegetation, trees, dead fall obstructions, large boulders, and undercut banks.

Channel Dimensions: The boundaries of the water's edges and the bankfull water's edges.

Pools and Riffles: The locations of pools and riffles within study areas. Pools will be defined as a deeper, placid, and slower moving section of a stream and riffles as the shallow rapids in an open stream, where the water surface is broken into waves by obstructions wholly and partly submerged (Stalnaker and Arnette, 1976).

Compass Direction: Orientation to the magnetic north.

Sampling Points: The position of each gear placement site, and staff gage and transect locations.

Selected habitat evaluation sites will be morphometrically mapped (Figure 12). A tag line will be stretched along transects to determine horizontal distances between the two banks and the position of each vertical depth measurement between them. An electronic distance finder (EDF) will be substituted for taglines when the distance between the bank is greater than 150 feet. Depths will be measured from a boat with a Raytheon Model DE 719B portable survey fathometer or on foot with a wading rod depending upon depth and accessibility. Where use of the tag line and/or wading rod is not feasible due to the length of transect and depth of water, the following method will be used. A person located on the shore will operate an EDF and direct the boat operator via two-way radio. When the boat crosses the transect, a distance will be registered on the EDF and manually recorded. At the same time that distances are measured, a radio signal will be transmitted to the boat and a marking device will be triggered by the boat operator to record the depth on the fathometer chart.

At least one photograph will be taken at each of the fishery habitat and selected habitat evaluation sampling sites which represents the general habitat. Additional slides will be taken to depict a unique situation or habitat type.

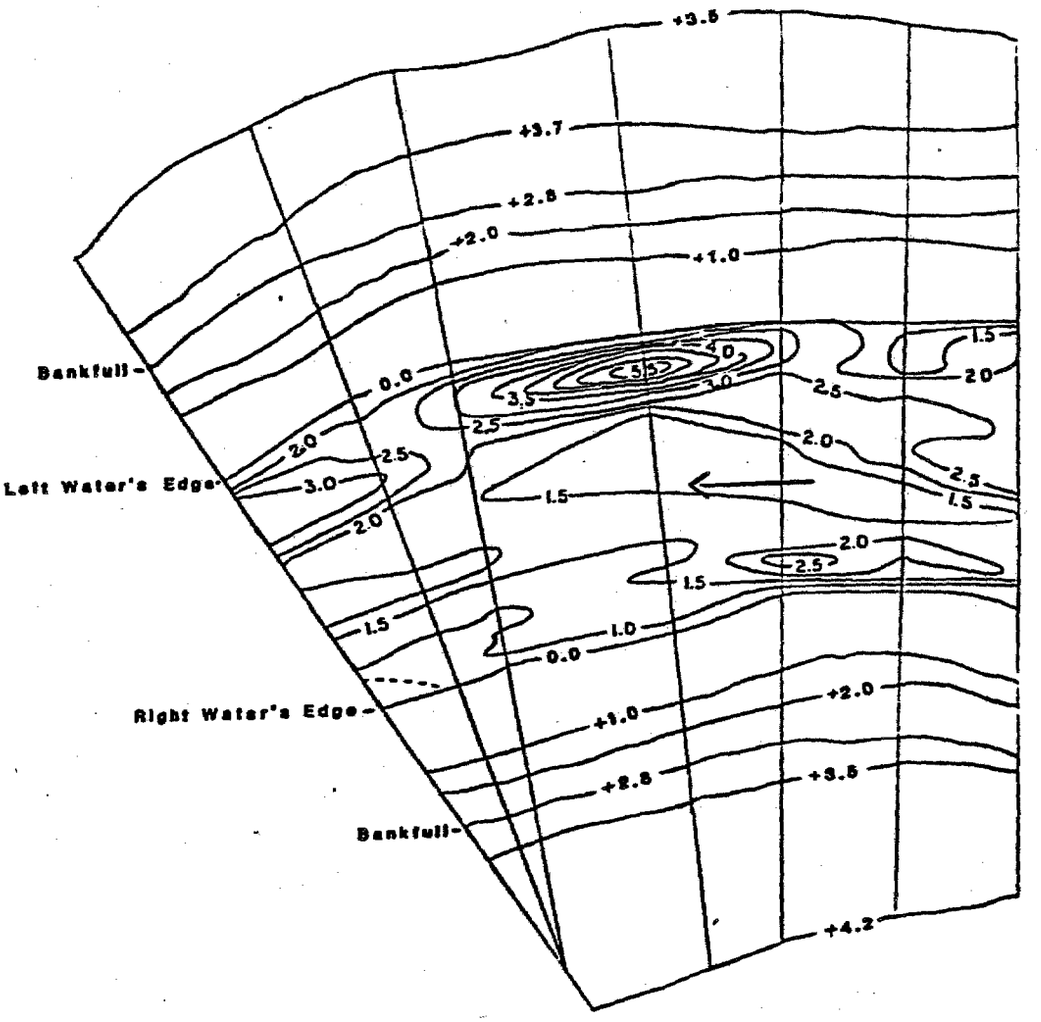


Figure 12. Example of morphometric map with depths and elevations in feet (modified from Bovee and Cochnauer, 1977).

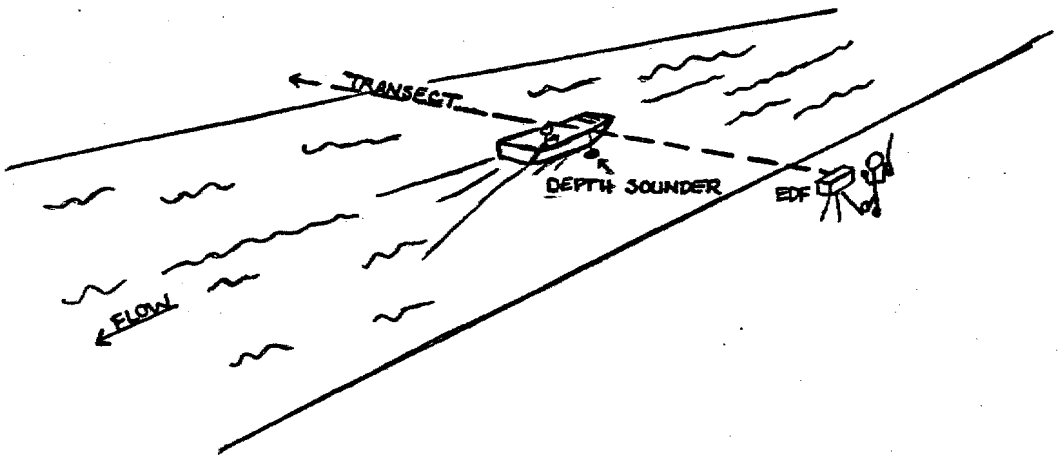


Figure 13. Large River Velocity and Depth Procedure Diagram.

The information recorded on the top section of the General Aquatic Habitat form (AH-81-01) will be photographed for site identification prior to photographing the sampling site. Each AH crew member will maintain a personal log book and establish a section to record the photography information. Orientation (i.e. upstream view, downstream view, etc.), subject, time, and date will be noted. Each roll of film and canister will be assigned a number before use. As an example, the first roll of film being used by Jim Doyle in 1979 would be labeled JD-79-01, the second JD-79-02, etc. He would list each photo under this number in his logbook, identify the date, stream name, survey area, and section number. The roll and canister number and the quantity of photos taken will also be recorded in the related data column space of the General Habitat Evaluation form (AH-81-01).

Level of Effort

Aquatic Habitat personnel will be distributed within the study area as illustrated in Figures 2 and 3. The AH staff will include one (1) FB III, two (2) FB II's and six (6) FB I's. Aquatic Habitat, RJ and AA crew members will jointly collect data as indicated in this manual.

III. DATA PROCEDURES

Essential to this program are data analysis procedures. Due to personnel constraints, this segment of the project has been delayed. An amendment to this manual will be filed once the biometrics program becomes operational.

A. ADULT ANADROMOUS FISHERIES STUDIES

Sonar Data Collection and Preparation

Daily Procedures

1. PRINTER TAPE STAMP: Each day's printer tape should be stamped (Figure 1) at the beginning and end of the tape as well as anytime during the day that control settings are changed. Each morning the tape is removed from the counter, stamped on both sides of the tear and filled with the same information on each stamp.

2. DAILY LOG FOR SSS CONTROLS: This is a summary of changes in controls which should be updated daily (Table 1). The information is necessary when interpreting raw counts and calibration factor data.

3. SIDE SCANNER COUNTER LOG: Details the mechanics of operation of the counter, substrate and related equipment (Table 2). Any apparent malfunctions should be recorded with description, frequency, and consistency noted. Also, changes in sensitivity, spare card changes, raising or moving of substrate, anticipated problems, and needed repairs on equipment. This is the place where suggestions on improving operations, notes on river conditions which might have an effect on the equipment, and general comments should be noted.

4. SIDE SCANNER COUNTS: Raw counts from printer tapes are entered by hour and sector (Table 3). Counts which register debris or are skipped in printing should be noted with a "d" or "s" in the appropriate hour-sector box. Enter "0" if there are no counts. To tabulate data: An average of the hour on each side of a skip should be used for the skip and counts should be totaled for each sector and each hour. The grand total is the total of all sectors or all hours (they should be equal). This is known as the "daily raw count". In addition the percent of total raw count by sector and hour should be recorded in parentheses next to the total. After each day's counts are tabulated and reported, printer tapes and SSS count forms should be placed in notebooks until sent to the main office.

5. FIELD COUNTER CALIBRATION: Raw counts will be calibrated in season by visual monitoring of the counters with an

Location: _____

Date: _____ Time: _____

Beam Angle: _____

Velocity: _____

Dead Range: _____

Live Range: _____

Observers: _____

Remarks: _____

_____

Figure 1. Printer tape stamp.

Fi[illegible] Number _____ Page ___ Of _____

Table 1. DAILY LOG FOR SIDE SCAN SONAR COUNTER

River: ____________________ Bank: ____________________ S/N: ____________________ Year: ______________

Date	Time	Fish Velocity	Beam Angle	Dead Range	Counting Range	Command Print Time	Printout Time	Auto Test Time

File Num ____

Page ___ Of ___

Side Scanner Counter Log

Location _____ Year _____

Date	Time	Remarks (ie. substrate lifted, any controls reset, etc.)

File Number _____ Daily Sonar Counts Page____ Of ____

River _____ Bank _____ Date _____

Time	Sector 1	2	3	4	5	6	Total	Sector 7	8	9	10	11	12	Total
0100														
0200														
0300														
0400														
0500														
0600														
0700														
0800														
0900														
1000														
1100														
1200														
1300														
1400														
1500														
1700														
1800														
1900														
2000														
2100														
2200														
2300														
2400														
Total														

_____ (Total raw counts)
- _____ (Total debris counts)
= _____ (Total good counts)
_____ (debris blocks)

Total good counts _____ x 144 =
Total good blocks _____

Adjusted Raw Count
(Sectors 1-6) _____

_____ (Total raw counts)
- _____ (Total debris counts)
= _____ (Total good counts)
_____ (debris blocks

Total good counts _____ x 144 =
Total good blocks _____

Adjusted Raw Count
(Sectors 7-12) _____

TOTAL DAILY ESCAPEMENT (Adjusted raw count sectors 1-6 + 7-12) = _____

COMMENTS ON BACK

SIDE SCAN SONAR COUNTER FIELD CALIBRATION LOG

River: ____________ Bank: ____________ S/N: ____________ Year: ________

Date	Observer	Time		Scope Count (1)	Sonar Count (2)	Percent Agreement (1÷2)100	Beam Width Alt., 2°,4°	Fish Velocity (Sec/Ft)	Sensitivity	Comments
		Start	Stop							

oscilliscope. Field crews will be instructed by permanent staff in the procedure for visual counting and filling out the FIELD CALIBRATION FORM FOR SIDE SCANNING SONAR COUNTER (Table 4).

6. DAILY DATA REPORTS: Side scanner counts and field counter calibration results should be recorded on the DAILY ESCAPEMENT DATA form (Table 5). Data should be recorded by bank and the four (4) daily calibration counts should be recorded individually.

Escapement Sampling - Age & Length Data

Fish Sampling Procedures

1. Check species of each intended sample (see Pacific Fishes of Canada, Fisheries Research Board of Canada, Bulletin 180, Ottawa 1973).

2. A scale should only be taken from the left side of the fish (see Figure 2).

3. The "preferred scale" is located two (2) rows above lateral line on the diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin.

4. If the preferred scale is missing take a scale, again on the left side of the fish, within the area behind the dorsal fin but forward of the ventral fin, and no more than four rows above the lateral line.

5. If no scales are present in this area, discard the fish.

6. If the scale is stuck or dried, moisten and pull toward the head of the fish gently rather than straight back.

7. Clean all slime, grit, skin and silver pigment from the scale by moistening and rubbing it between the fingers. The scale should be completely clean and transparent.

8. Mount on gum card after moistening. Scales are mounted on the gum card number which corresponds to Age Weight Length (AWL) form number containing the length, weight and sex information for that fish. Place it directly over the number on the gum card with the anterior edge facing the bottom of the card (Figure 3). The ridged side of the scale must be facing upward or no impression will be made in the acetate card. This is the same side that is exposed on the salmon.

9. Cover completed gum cards with wax paper after drying, if possible.

10. Length measurements should be taken from mid-eye to fork of tail and recorded to nearest millimeter.

File Number _____ Page___ Of ____

DAILY EXCAPEMENT DATA

River: _____ Year: _____

Year	Month	Day	Bank	Raw Sonar Count	Visual Count	Electronic Count	No. Wheels	Hours Open	Red	Pink	Chum	Coho	King

Table 5. Daily escapement data.

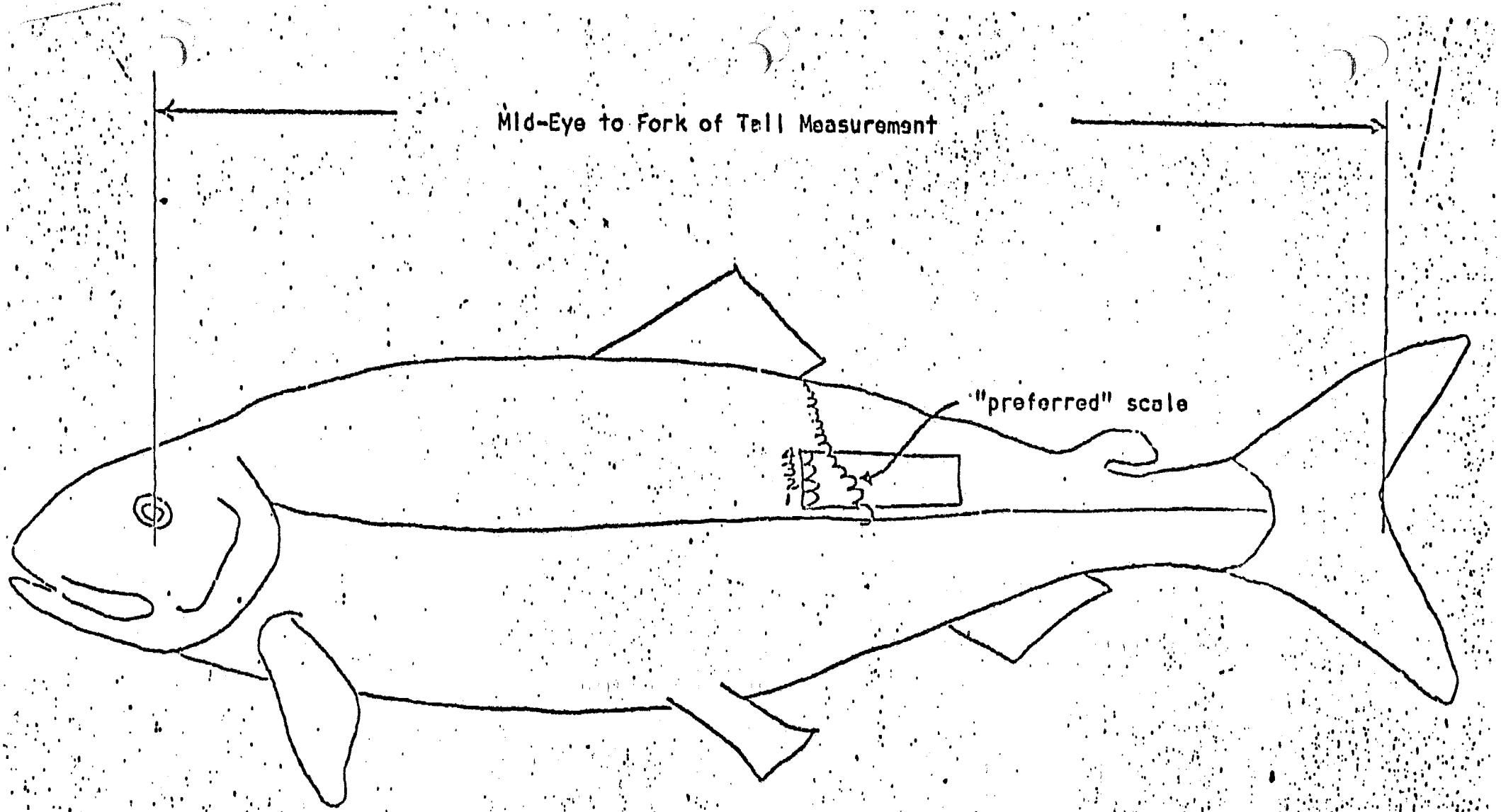
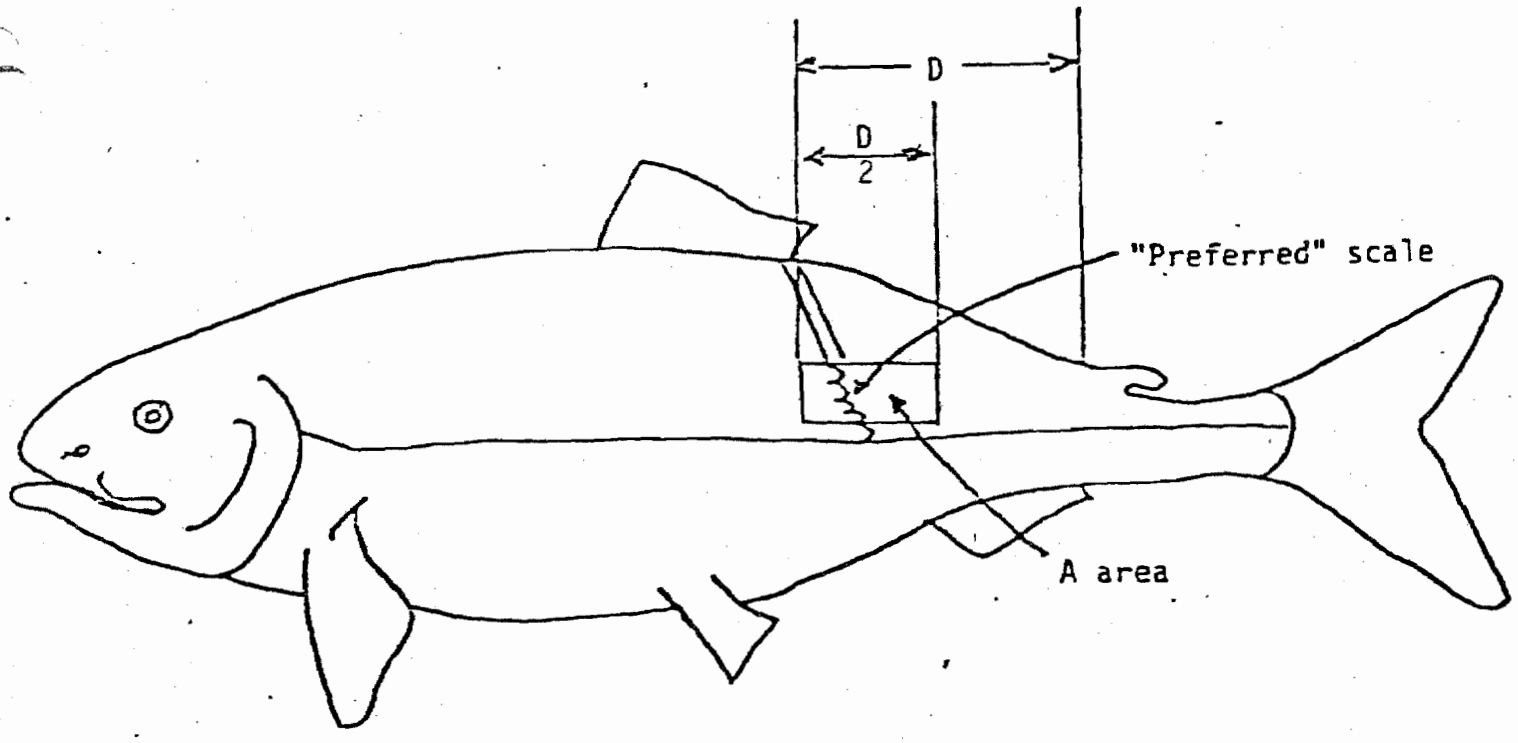
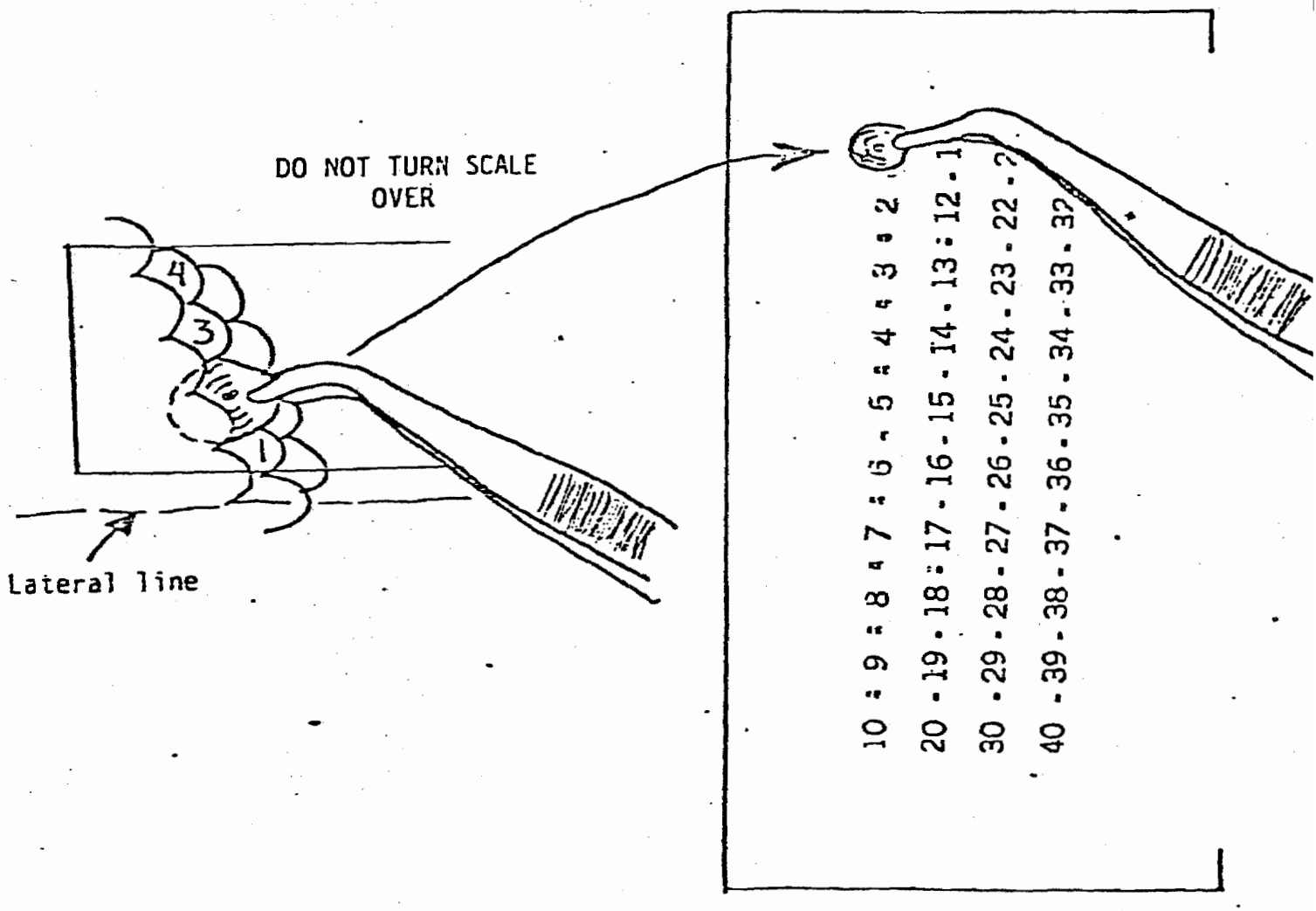


Figure 2. Preferred scale, preferred scale zone, and length measurement

Figure 3 SCALE SELECTION AND MOUNTING ON GUMMED CARD





Labeling Procedures

The functions of proper labeling is to produce a set of sample data which includes a gum card, an acetate impression and an AWL Form (Table 5A and 5B). These have corresponding location, date, species, gear code and subsample number. None ever has more than a single location, date, species, gear code or subsample number.

A. Numbering

Numbering begins with 001 for each species at each escapement sampling location for the 1980 season. Each card, AWL and acetate for a specific group is consecutively numbered throughout the season (i.e., CI Yentna R. 6-29-80 Red 001 to CI Yentna R. 7-29-80 Red 025). It is the responsibility of collectors to check the numbers being used each sampling day to maintain correct sequence and omit duplication.

B. Gum Cards

1. General Guidelines
   (a) Note which number to begin with, for each sample location, for the date in question.
   (b) Prior to sampling, cards may be filled out with species, date, gear, locale, and collector's name. They may also be numbered when the total cards for a given area are known for that date. These must be carefully checked when scales are to be fixed to assure correct information.
   (c) On location before mounting scales, all pertinent information should be completed on that card, in pencil.
2. Information Explanation
   (a) Species: (O. nerka or Reds) Scientific or common name of sample.
   (b) Card No.: Consecutive for this area and species (see A. Numbering).
   (c) Locality: Name of beach, river or area and may include cannery or site name. Use the COOK INLET SAMPLE LOCATION CODES. (Table 6.)
   (d) Scow/Gear: Gear number code is listed on reverse of AWL for appropriate type used.
   (e) Sampling date: mo./day/year that the scales were taken. Omit if the same as period date.
   (f) Period date: mo./day/year fish actually caught.
   (g) Collector: Last name(s) of person(s) collecting scales and data.
   (h) Remarks: Include anything unusual about weather, the sample or anything else considered pertinent by collectors.

DISTRICT	SECTION OR SUB-DISTRICT	RIVER (STREAM)	SAMPLING LOCATION	PROJECT	DATE MONTH	DAY	YEAR	PERIOD	GEAR	MESH SIZE	SAMPLE NUMBER
										/	

Check Check

UNIT OF MEASUREMENT	ENGLISH (1) / METRIC (2)	TYPE OF LENGTH MEASUREMENT	AGE CLASS DESIGNATION	GILBERT/RICH (1) / EUROPEAN (2)

Spec.	SEX M	SEX F	LENGTH	WEIGHT	AGE CLASS	A	B	C	D	E	F	G	H	I

Table 5A. Age, weight and length (AWL) form.

Sex

Scales Read By:

SAMPLING INFORMATION

CATCH DATE _____ HOURS FISHED _____
Month Day

Remarks (Weather - Water conditions) etc. _____

CODING

Note: District, Subdistrict, River (stream) and sampling location codes will be provided separately.

PROJECT
1 - Commercial Catch
2 - Subsistence Catch
3 - Escapement (tower, weir, etc.)
4 - Escapement (spawning grounds)
5 - Test Fishing
6 -

GEAR
0 - Trap
1 - Purse Seine
2 - Beach Seine
3 - Drift Gillnet
4 - Set Gillnet
5 - Troll
6 - Long Line - Skates
7 - Otter Trawl
8 - Fish Wheel
9 - Pots
11 - Herring Purse Seine
12 - Handpicked
13 - Dip Net
17 - Beam Trawl
18 - Shovels
19 - Weir
20 -

SPECIES
- King
- Red, Sockeye
43 - Coho, Silver
44 - Pink
45 - Chum
51 - Smelt
52 - Arctic Char
53 - Dolly Varden
54 - Steelhead
55 - Lake Trout
56 - Northern Pike
57 - Sheefish
58 - Whitefish
59 -

TYPE OF MEASUREMENT
1 - Snout to Fork of Tail
2 - Mid-eye to Fork of Tail
3 - Orbit[1] to Fork of Tail
4 - Mid-eye to Hypural Plate
5 - Orbit[1] to Hypural Plate

1/ Orbit refers to posterior edge of eye socket.

BLANK COLUMNS
A - F -
B - G -
C - H -
D - I -
E -

INJURY
1 - Inshore Net
2 - High Seas Net
3 - Canine-Tooth Predator
4 - Shark
5 - Beluga
6 - Lamprey
7 - Other

AGING DATA
1 - Otolith Sample
2 - Inverted
3 - Regenerate
4 - Illegible
5 - Missing
6 - Reabsorbed

REMARKS

1) If the same code is to be used throughout a column, enter the code for the first fish, then draw an arrow vertically through the column.

2) Length-weight measurement. This form is designed for: a) length measured to the nearest millimeter or tenth of an inch, b) weight measured to the nearest ten grams (i.e. decagram or thousandth of a kilogram) or tenth of a pound.

When recording length-weight data, be sure to enter the digits in their proper columns. For example, a 4.7 lb. fish should be recorded in the 2nd and 3rd colums, not the 1st and 2nd columns. If for some reason length is measured to inches rather than tenth of inches, a zero should be entered in the third column.

3) Blank Columns. These colums are for use as needed. It is anticipated that these uses will vary from area to area, but might include written remarks, tag data, circuli counts, etc.

3. Example

Species_____Card No._____

Locality_____

Scow/Gear_____

Sampling Date_____Period Date_____

Collector_____

Remarks_____

C. Age Weight Length (AWL) Form

1. General Guidelines
   (a) Information on the back of the gum card should be the same as that on the corresponding AWL form.
   (b) Each finished scale card should be attached to the corresponding AWL form with a paper clip.
   (c) Always use No.2 or softer pencil.
   (d) When filling in length data, place the decimal point in the same column consistantly.
   (e) Put zeros in columns where data not taken - do not leave columns blank.

Table 6. Anadromous Adult Invenstigations - Susitna Hydro Statistical Codes and Code Samples.

DISTRICT	SUBDISTRICT	RIVER	LOCATION CODE	LOCATION NAME
247	41	100	101	Yentna Sonar
247	41	100	102	Sunshine Sonar
247	41	100	103	Talkeetna Sonar
247	41	100	104	Curry Tag/Recapture

2. Information Explanation (See Table 6).
   (a) Heading: At the top of each AWL form, the sample name is written out. The log number will be filled out in Anchorage.
   (b) District, sub-district and river: See Table 6 for proper codes.
   (c) Sampling location: See Table 6.
   (d) Project: Code from reverse side of AWL form.
   (e) Note first date only.
   (f) Period: Not necessary to fill out.
   (g) Gear: Code for type used to catch the fish. Obtained from the reverse side of the AWL form.

(h) Mesh size: Remains blank.
(i) Sample number: Sequential number which matches an appropriate gum card (see A. Numbering).
(j) Spec.: Code for each species (see reverse of AWL form).
(k) Sex: Check male or female appropriately. Use 1 for male, 2 for female.
(l) Length: Recorded in millimeters from mid-eye to fork of tail.
(m) Weight: Recorded to nearest one-tenth kilogram.
(n) Age class: Completed by biologists after viewing scale impressions.
(o) Column A and I: Used by Stock Identification - do not use.
(p) Column B: River bank designation.
(q) Column C: Injury code (see reverse of AWL form. Table 5b).
(r) Columns D-H: Remarks.

Tag/Recapture Data Collection and Preparation

Daily Procedures

1. Daily fishwheel catch will be reported on the Daily Log/Individual Fishwheel Catch Record form (Table 7). Each fishwheel will have it's own log. Each time a fishwheel is checked, the catch will be recorded along with the corresponding time in military hours. Following, the last daily check, a summation shall be entered in the appropriate space on the form (Table 7).

2. Fish which are tagged will be recorded on the Tag Deployment Record form (Table 8). This form may be used between fishwheels. Appropriate information recorded on each fish tagged shall include: date; tag number; fishwheel location; species; and sex. A sheet summary on the number of fish tagged by species shall be entered in the appropriate location (Table 8).

3. Tagged fish which are recaptured shall be logged on the Tag Recapture Record form (Table 9). Information recorded on each recapture shall include: fishwheel location; tag number; color and type; and species. A sheet summary of recaptures by species shall be entered at the location indicated on the form (Table 9).

File Number ____ Page ____ of ____

Date ____

DAILY LOG

Individual Fishwheel Catch Record

Project Site (Camp): ____

Habitat Location ____ Sampling site ____ River mile ____ / / /

PROJECT SITE: FISHWHEEL LOCATION:

TIME	NUMBER OF FISH CAPTURED					
	SOCKEYE	PINK	CHUM	COHO	CHINOOK	OTHER [1]
DAILY TOTAL						

HOURS ABSORBED

[1] IDENTIFY SPECI

File Number____ Page____ of ____

TAG DEPLOYMENT RECORD

Habitat Location (Camp): _____ Tag Type _____ Tag Color _____

	Date	Tag Number	Fishwheel Location	Species	SEX M	SEX F	OFFice Use Only
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							

Summary: No. Fish Tagged.

Sockeye ____; Pink ____; Chum ____; Coho ____; Total ____

File Number______ Page____ of____

TAG RECAPTURE RECORD

Project Site (Camp):

DATE	FISHWHEEL LOCATION	TAG DATA Number	Color 1/	Type 2/	SPECIES	LEAVE BLANK (OFFICE USE ONLY)

SHEET SUMMARY/

	No. Recaptures
Sockeye	
Pink	
Chum	
Coho	

1/ Color: Int. Orange = O
Yellow = Y

2/ Type: Floy Spaghetti = S
Peterson Disc = P

File Number ____ Page ____ of ____

STREAM SURVEY LOG

Stream or Slough	Legal: Township	Legal: Range	Legal: Section	Date	Species Surveyed	No. Observed: Live	No. Observed: Dead	No. Observed: Total	No. Tagged Observed (Live): Orange Disc	No. Tagged Observed (Live): Yellow Floy	No. Tagged Observed (Live): Orange Floy	‖ REMARKS
					sockeye							
					coho							
					pink							
					chum							
					sockeye							
					coho							
					pink							
					chum							
					sockeye							
					coho							
					pink							
					chum							
					sockeye							
					coho							
					pink							
					chum							
					sockeye							
					coho							
					pink							
					chum.							
					Sockeye							
					coho							
					pink							
					chum.							

‖ General Observation Information Including:

1. Survey Distance (Area)
2. Survey Personnel
3. Predator Activity
4. Carcuss Tag Numbers, Types and Co[illegible]

Fin Number ____ Page ____ of ____

VARIABLE GEAR LOG

Date	Gear Type and Specs. [1]	Habitat Loc., Sampling Site and River Mile	Fishing Time (Military)			Catch						REMARKS [3]
			Begin	End	Total	Sockeye	Pink	Chum	Coho	Other [2]		

[1] Include Net length, depth, mesh size. (if applicable)

[2] Identify Species

[3] Include Collector Name(s), Recapture and Maturation (ie. Prespawner, Spawner, Postspawner)

File Number_____ Page___ of___

Date

EGG DEPOSITION LOG

Crew _____

Habitat Location _____ Sampling Site _____ River Mile _____ - - - / - - / - - / - - / -

PLOT NUMBER (SEQUENTIAL)	NUMBER				REMARKS
	EGGS		FRY		
	LIVE	DEAD	LIVE	DEAD	

Survey Data Collection and Preparation

Foot surveys on clear water sloughs and stream will be recorded on the Stream Survey Log form (Table 10). Data recorded on each survey will include: stream or slough name; data; survey conditions (Excellent, Good, Fair, Poor); individual species surveyed; live and dead counts on particular species surveyed; and number of live tagged members by tag type/color. The "Remarks" column, in particular, will include information on tagged carcasses (tag type, number and color by species).

Deployment of electro fishing gill, net and other similar sampling gear will be recorded on the Variable Gear Log form (Table 11). Information recorded will include: gear type; survey location (general and legal); date; time (beginning and end); and catch by species.

Egg pumping results will be recorded on the Egg Deposition Log form (Table 12). A separate form will be used for each sampling site. Number of eggs and fry collected will be logged as either dead or alive by individual plot. Sampling location will be identified in legal and general terms.

Development of data forms for the chinook salmon survey is pending review of the survey design by the absent project biometrician.

B. RESIDENT AND JUVENILE ANADROMOUS FISHERIES STUDIES

Resident and Juvenile Anadromous Fisheries Studies field forms are presented in draft form (Tables 13-15) pending review by the project biometrician. At such time as this review is complete, the final forms and procedures will be released.

General guidelines for collection of biological data on individual fish by species are given under the heading Biological Data. Forms used to record AWL data are the same as those used by the Adult Anadromous Project (Figures 5A and 5B).

Biological Data

1. Age class composition: Age class composition will be accomplished by scale reading and size frequency analysis.

2. Size sample: The size class sample will consist of the first 50 juvenile chinook captured in each size class and 10% of those captured in each size class thereafter. Measurement will be in mm to total length.

File No. _____ Page ____ of ____

Table 13. SUSITNA HYDRO RESIDENT & JUVENILE ANADROMOUS STUDY BIOLOGICAL DATA RJ 81-02

Habitat Location _____ Sampling Site _____ River Mile _____ __/__/__/__/__

Date(s) Collected _____ Collector(s) _____

	species code	length (mm)	sex	age	scale card #	gear type code	PSN	mesh size	remark on back		species code	length (mm)	sex	age	scale card #	gear type code	PSN	mesh size	remark on back
1										26									
2										27									
3										28									
4										29									
5										30									
6										31									
7										32									
8										33									
9										34									
10										35									
11										36									
12										37									
13										38									
14										39									
15										40									
16										41									
17										42									
18										43									
19										44									
20										45									
21										46									
22										47									
23										48									
24										49									
25										50									

GEAR TYPE CODE

beach seine	3
burbot set	10a
drift gillnet	1a
electroshock	2
gillnet	1
hook & line	9
minnow trap	5
trot line	10

SPECIES CODE

burbot	590	humpback whitefish	582
chinook 0+	410	lake trout	550
chinook 1+	411	longnose sucker	920
chum salmon	450	pink salmon	440
coho 0+	430	rainbow trout	541
coho 1+	431	round whitefish	586
coho 2+	432	smelt/eulachon	511
cottid	910	sockeye 0+	420
dolly varden	530	sockeye 1+	421

File No. _____ Page _____

Table 14. SUSITNA HYDRO RESIDENT & JUVENILE ANADROMOUS STUDY
TAG AND RECAPTURE DATA RJ 81-03

TAGGING DATA								RECAPTURE DATA						
				LOCATION						LOCATION				
tag no.	date	species code	length (mm)	Habitat Location	T	R	S	date	length (mm)	Habitat Location	T	R	S

SPECIES CODE

burbot	590	humpback whitefish	562	rainbow trout	641
dolly varden	530	round whitefish	566		
grayling	610	lake trout	550		

File No. _____ Page 1 of _____

Table 15. SUSITNA HYDRO RESIDENT & JUVENILE ANADROMOUS STUDY CATCH DATA RJ 81-01

Habitat Location _____ Sampling Site _____ River Mile _____ ___/___/___/___/___

DATE: Gear Set _____ Gear Pulled _____ Collector(s) _____

gear type code	PSN	net length	mesh size	no. hooks	TIME set	TIME pulled	TIME total*	CATCH – SPECIES CODE NO.								REMARKS

* total time for beach seine haul, electroshock and hook & line

GEAR TYPE CODE

beach seine	3
burbot set	10a
drift gillnet	1a
electroshock	2
gillnet	1
hook & line	9
minnow trap	5
trot line	10

SPECIES CODE

burbot	590
chinook 0+	410
chinook 1+	411
chum salmon	450
coho 0+	430
coho 1+	431
coho 2+	432
cottid	910
dolly varden	530
grayling	610
humpback whitefish	562
lake trout	550
longnose sucker	920
pink salmon	440
rainbow trout	541
round whitefish	566
smelt/eulachon	511
sockeye 0+	420
sockeye 1+	421
stickleback	660

3. Scale analysis: Scale samples will be taken monthly from 25 fish captured in the mainstem river and it's major tributaries.

Juvenile chinook, coho and sockeye salmon will be processed to the extent of collecting data on age class, size class and scale analysis. Juvenile pink and chum salmon will be processed only to the extent of collecting size class data.

Rainbow Trout

1. Age class composition: Age class composition will be accomplished by scale reading and size frequency analysis. Scale samples will be taken from all adult rainbow trout captured.

2. Size sample: All rainbow trout captured will be measured for fork length in mm.

3. Sex composition, maturity, and spawning condition determination: Autopsies will be performed on all sampling mortalities but no more than 10% of fish captured will be killed specifically for these purposes.

Arctic Grayling

1. Data taken same as rainbow trout with the exception that if large numbers of grayling are captured for tagging in the upper study area a 10-20% sample will be taken. Fork length will be recorded in mm.

Round (RWF) and Humpback (HWF) Whitefish

1. Age class composition: Age class composition will be accomplished by scale reading and size frequency analysis. Scale samples will be taken from all adult round (RWF) and humpback (HWF) whitefish.

2. Size sample: All round (RWF) and Humpback (HWF) Whitefish captured will be measured for fork length in mm.

3. Sex composition, maturity, and spawning condition determination: Autopsies will be performed on all sampling mortalities but no more than 10% of fish captured will be killed specifically for these these purposes.

Dolly Varden/Arctic Char

1. Age class composition: Age class composition will be accomplished by scale reading and size frequency analysis. Scale samples will be taken from all adult Dolly Varden/Arctic Char.

2. Size sample: All Dolly Varden/Arctic Char captured will be measured for fork length in mm.

3. Sex composition, maturity, and spawning condition determination: Autopsies will be performed on all sampling mortalities but no more than 10% of fish captured will be killed specifically for these purposes.

Lake Trout

1. Age class composition: Age class composition will be accomplished by scale reading and size frequency analysis. Scale samples will be taken from all adult lake trout.

2. Size sample: - All lake trout captured will be measured for fork length in mm.

3. Sex composition, maturity, and spawning condition determination: Autopsies will be performed on all sampling mortalities but no more than 10% of fish captured will be killed specifically for these purposes.

Long Nose Sucker

1. Age class composition: Age class composition will be accomplished by scale reading and size frequency analysis. Scale samples will be taken from all adult long nose sucker.

2. Size sample: All long nose sucker captured will be measured for fork length in mm.

3. Sex composition, maturity, and spawning condition determination: Autopsies will be performed on all sampling mortalities but no more than 10% of fish captured will be killed specifically for these purposes.

Burbot

1. Age class composition: Age class composition will be accomplished by reading otoliths of all burbot killed.

2. Size sample: All burbot captured will be measured for total length in mm.

3. Sex composition, maturity, and spawning condition determination: Autopsies will be performed on all sampling mortalities but no more than 20% of fish captured will be killed specifically for these purposes.

Three Spine Stickleback

1. Size sample - If possible a sample of fifty fish or 10% whichever is greater, will be collected and measured for total length in mm on a monthly basis.

C. AQUATIC HABITAT AND INSTREAM FLOW STUDIES

Assigning Gear Placement Site Numbers (GPSN)

The GPSN is a two-part code which identifies gear type and sample number, thus providing a sampling location designation for each point specific measurement made within a given sampling site.

The first part of the code indicates gear type employed at the sampling location; the second part indicates sample number. For example, if three minnow traps were set within a sampling site, the GPSN's would be: 5-01, 5-02, 5-03.

Gear code designations are as follows:

Gear Type	Code
Beach Seine	3
Burbot Set	10a
Drift Gillnet	1a
Electroshock	2
Gillnet	1
Hook and Line	9
Minnow Trap	5
Trot Line	10
Observation	0

GPSN's will be included when mapping a sampling site. Resident Juvenile and AA crew members will assign GPSN's and will provide AH personnel with this information to facilitate the correlation of data. AH personnel will assign GPSN's when fishery data are not being collected.

Personal Log Book

A personal log book will be maintained by each AH crew member. Daily entries will include the following:

Date: Year, month, day
Sites visited and activities of that day
Weather: Air temperature, precipitation, cloud cover, wind, etc. Military Time: Twenty-four (24) hour system.
Water Conditions: Turbidity, clarity, color, odor, ice stage, floating debris, etc.
Sampling Problems.
Equipment Problems.
Suggestions for changes or improvements.
Personal Impressions.
Record of Photographs: Establish a separate section in the personal log book for the following data: frame number, roll number, orientation, location, date, and time.
Crew Members: Names of AA, RJ, and AH sampling crew.

Completing Aquatic Habitat Forms

Instructions for completing the AH forms are explained in this section. The numbers introducing each instruction corresponds to a number encircled in the appropriate form. Numbers one (1) through ten (10) apply to all forms with the exception of the Staff Gage form (AH-81-05) while numbers greater than ten (10) apply to the specific form under which they are listed. On the Staff Gage form, numbers one (1) through six (6) refer to the general instructions whereas numbers seven (7) through thirteen (13) refer to specific information.

General Instructions

1. File No.: Indicates file location.

2. Crew: List names or initials of personnel making measurements and entering data on form.

3. Habitat Location: Enter descriptive name of study area (i.e. Slough 8A).

4. Sampling Site: Enter descriptive name of the sampling area within the habitat study location (i.e. head, mouth, etc.).

5. River Mile: Enter the number of miles from the river mouth to the habitat location. River miles are indicated on the Alaska Power Authority's Susitna River hydrographic map set.

6. Geographical Code (GC): Enter the 12 digit code identifying the sampling location.

7. Gage Number (no.) and Height (ht.): Record the established identification number for the gage and the stage reading (i.e., water depth at the gage).

8. Dates: Enter the date or the beginning and ending dates (General Habitat Form AH-81-01) for period which data was collected.

9. Page: Indicate the page number and the total number of pages used (i.e. 1 of 5, 2 of 5, 5 of 5).

10. Description: Enter any information which helps describe the sampling site or the sampling location (i.e. bend in river, riffle 100 yards downstream of small island, river is braided, straight, or meandering, etc. Figure 4).

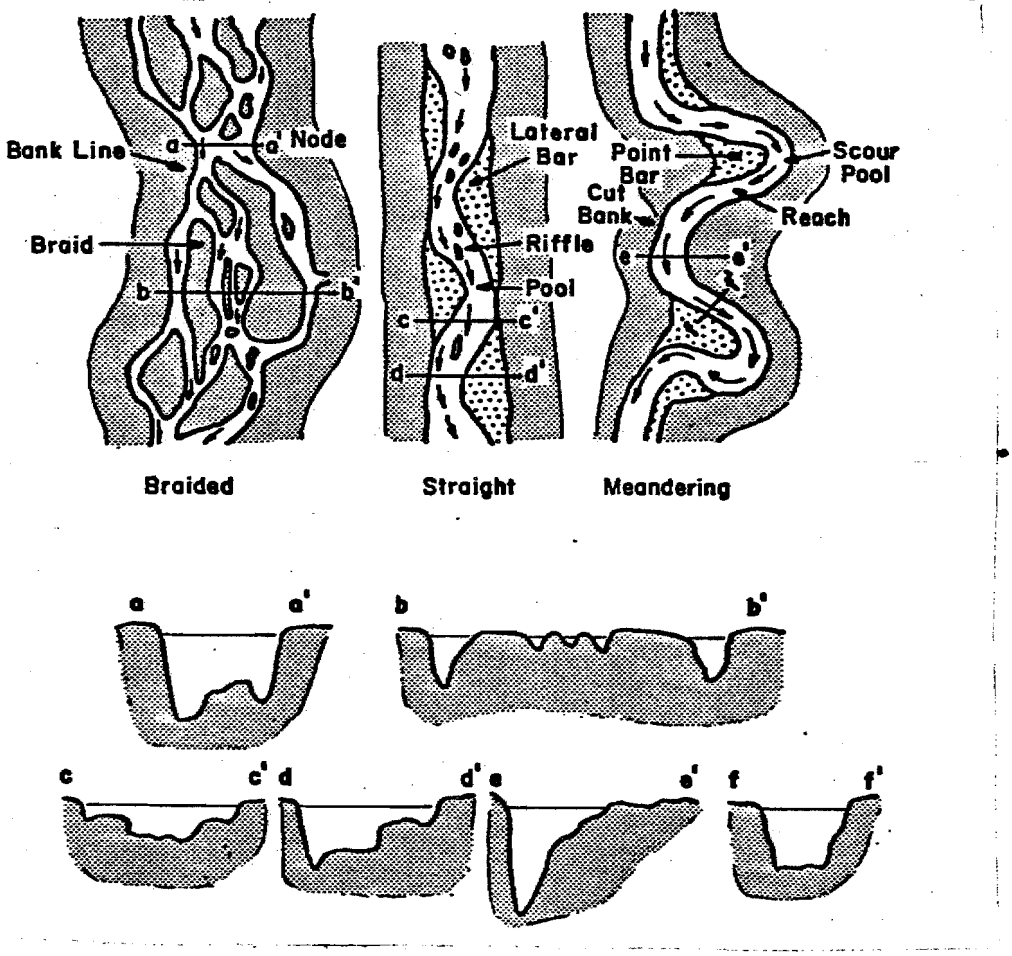


Figure 4. River Channel Patterns (from Richardson et al, 1975).

General Aquatic Habitat Evaluation Form (AH-81-01)

This form to be completed in the field when measuring the general aquatic habitat parameters discussed in the study description.

Instructions:

1-10. Refer to general instructions.

11. Date: Enter date measurement is being taken.

12. Military Time: Enter time using the 24 hour system (i.e. for 1:00 p.m., enter 1300).

13. Temperature (Temp) °C: Enter air and water temperature.

14. Specific Conductance (Cond, μ mhos/cm): Enter specific conductance value as measured by the procedure described in the methods section.

15. pH: Enter value as measured using the procedure described in the methods section.

16. Dissolved Oxygen (D.O., mg/l): Enter value as measured following the procedure in the methods section.

17. Turbidity (FTU): Indicate with a check (✓) on left side of blank that a turbidity sample was taken, enter turbidity value after analysis.

18. Discharge (cfs): Indicate with a check on left side of blank when measurement is made, enter value after calculated from the discharge data form.

19. Related Data: Record number of any data forms that you know were filled out at the same time and place, film roll number and number of photos taken and identification of photographer or other data that will relate (i.e., USGS, R&M etc.)

20. Date: Enter date data collected.

21. Aquatic Vegetation: Estimate the percent of the area within the sampling site covered by aquatic vegetation, specify if algae or macrophyte.

22. Substrate Classification (0-9): Estimate the three major substrate types within the sampling site and enter their respective percentages, also note if other identifiable size classes are present in minor amounts by entering a P for present.

23. Embeddedness: Enter the code of the size class(es) that are embedded, percent embedded and the size class(es) of the embedding material.

Point Specific Aquatic Habitat Evaluation Form (AH-81-02)

This form to be completed in the field when measuring the point specific habitat parameters discussed in the study description.

Instructions:

1-10. Refer to general instructions.

11. GPSN: Enter the two-part gear placement site number (GPSN) which identifies the type of fish sampling gear indicated in the gear code and the sample number (i.e. trot line sample #3 would be 10-3).

12. Depth: Enter water depth at the gear placement site.

13. Velocity: Enter the point velocity at the depth of the sampling gear and the mean column velocity.

14. Substrate: Enter the percent and the class number of each sediment size class (up to three) identified within a two (2) foot radius of each velocity/depth measurement point.

15. Embeddedness: Enter the class number for the size of substrate Class Five (5) and larger embedded in surrounding materials, the percent (%) of embeddedness and the class number for the size of the embedding material, within the same area as the substrate evaluation.

16. Aquatic Vegetation: Enter the percent (%) cover of algae or vascular plants within a two (2) foot radius of the gear placement site.

17. Related Data: Record the data form number of any data collected at the same time and site. Also note any observation which may be pertinent to the sample (i.e. minnow trap placed under cut bank, number of fish at three (3) foot intervals along gill net, etc.).

18. Notes: Include any information which may help in interpreting data. For example: document any deviation from the methods described in the Procedures Manual and the conditions which prevented use of conventional methods, unusual weather or other circumstances.

Aerial View Map Form (AH-81-03)

A map describing the study habitat site is drawn on this form in the field.

Instructions:

1-10. Refer to general instructions.

11. Draft map to include the following:

Substrate
Cover
Bankfull top width and top width
Pools and riffles
Channel dimensions
Location of staff gages and transect
Location of sampling gear (use GPSN)
Compass orientation

Discharge Form (AH-81-04)

This form to be completed in the field to record total discharge measurements and calculations.

Instructions:

1-10. Refer to general instructions.

11. Type Meter and Number: Record the type of meter (i.e., Price AA, Pygmy or Marsh McBirney meter) and the serial number.

12. Distance From Head Pin or Water's Edge: The horizontal measurement from the head pin or waters edge to each vertical along the transect.

13. Angle Coefficient: A correction factor for the angle of flow as it intersects the transect line. Values fall between 0.00 and 1.00 and are determined by use of an angle coefficient chart.

14. Velocity Depth: This is the vertical distance from the water surface to the channel bottom at each vertical measured to the nearest 0.1 foot if possible.

15. Streambed Elevation: Computed at each vertical by subtracting the velocity depth from the average of the right bank (RB) and left bank (LB) water surface elevations for that transect at that particular flow. Left and Right banks are determined by looking upstream. These data are collected only where surveyed head pins are established.

16. Observation Depth: Indicate at what depth the point velocity was measured. Velocity will be measured at .6 of the depth from the surface for a depth less than three (3) feet and .2 and .8 for depth greater than three (3) feet.

17. Revolutions: Recorded number of revolutions when using a Price AA or Pygmy flow meter. When using a Marsh McBirney meter draw a line through this column.

18. Time: Recorded in seconds by use of a stopwatch, when using a Price AA or Pygmy flow meter. When using a Marsh McBirney meter draw a line through this column.

19. Point Velocity: This is the velocity obtained from the rating table using revolution and time information or the velocity reading from a direct readout meter.

20. Mean Vertical Velocity: The average of the 0.2 and 0.8 point velocity readings for the vertical. If the velocity was measured only at 0.6 the depth this is the same as the point velocity.

21. Mean Cell Velocity: The average of the two adjacent mean vertical velocities are normally grouped beginning from the LB to the RB water's edges.

22. Mean Cell Depth: The average of the depths of two adjacent verticals.

23. Cell Width: The horizontal distance between adjacent verticals.

24. Cell Area: Computed by multiplying each mean cell depth with the cell width.

25. Flow (Discharge): Computed by multiplying each cell area by its respective mean cell velocity, and when applicable, the angle coefficient and totalling the resultant values.

Staff Gage Form (AH-81-05)

Used to keep a complete record of all readings made on a specific staff gage.

Instructions:

1-6. Refer to general instructions.

7. Page: Indicate the page number and the total number of pages used.

8. Staff Gage No.: Enter the established identification number.

9. Calibration Factor: Distance from channel bottom to zero mark on gage.

10. Date: Enter date of reading.

11. Time: Record military time of reading.

12. Height: Record stage reading to the nearest 0.01 foot.

13. Initial: Initials of person who records staff gage data.

File No. (1)

Crew (2)

GENERAL AQUATIC
HABITAT EVALUATION
AH-81-01

Page (9) of

Dates (8) to

Habitat Location (3) Sampling Site (4) River Mile (5) GC (6) / / / / / / / / / /

Description (10)

Date	Military Time	Temp. C° Air	Temp. C° H_2O	Gage no.	Gage ht.	DO (mg/l)	pH	Turbid. (FTU)	Conductivity (μmhos/cm)	Discharge (cfs)	Related Data
(11)	(12)	(13)		(7)		(16)	(15)	(17)	(14)	(18)	(19)

		0	1	2	3	4	5	6	7	8	9	EMBEDDEDNESS		
Date	Aquat. Vegeta	Organ. Detr.	Silt/ Clay	Sand	1/16- 1/4	1/4-1	1-3	3-5	5-10	10 +	Bed- rock	Embedded material	%	Embedded material
(20)	(21)	←					(22)				→	←	(23)	→

File No. (1)

Crew (2)

POINT SPECIFIC AQUATIC HABITAT EVALUATION
AH-81-02

Page (9) of

Gage Number (7) Height Date (8)

Habitat Location (3) Sampling Site (4) River Mile (5) GC (6) ___ / ___ / ___ / ___ / ___

Description (10)

GPSN	DEPTH (ft)	VELOCITY POINT	VELOCITY MEAN	SUBSTRATE % CLASS	SUBSTRATE % CLASS	SUBSTRATE % CLASS	EMBEDDEDNESS %	AQUATIC VEGETA. %	RELATED DATA
(11)	(12)	(13)		← (14) →			← (15) →	(16)	(17)

NOTES: (18)

AH-81-03

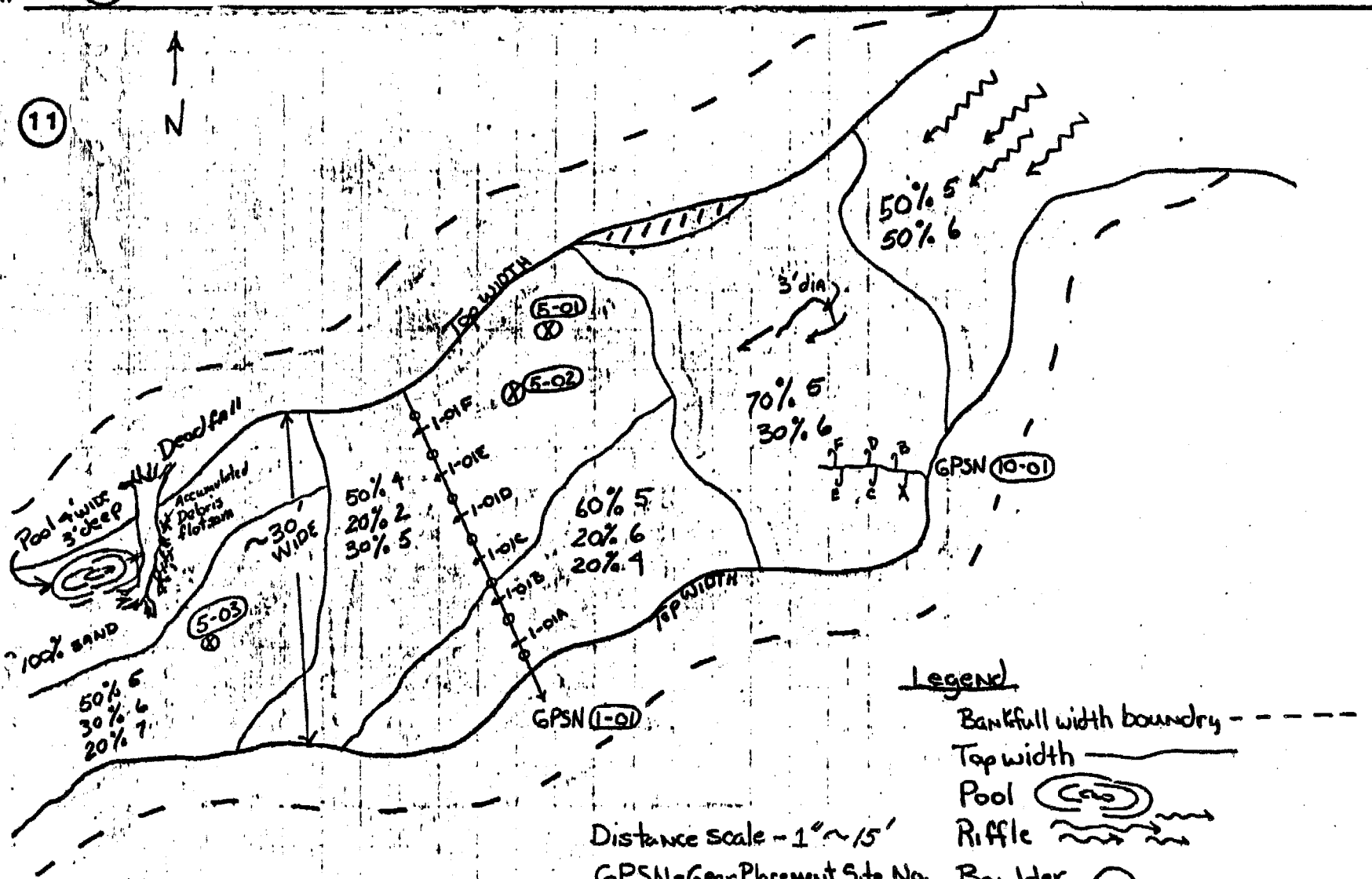
Date (8) _____ Gage # (7) _____ Heigl _____

Crew (2) _____

Habitat Location (3) _____ Sampling Site (4) _____ River Mile (5) _____ GC (6) __/__/__/__/__

Description (10) _____

(11)



Legend

Bankfull width boundry - - - - -

Top width ——

Pool

Riffle

Boulder

Frytrap ⊗

Trotline

Gillnet

Undercut bank

Distance scale - 1" ~ 15'

GPSN - Gear Placement Site No.

C4000!

File No. (1)

DISCHARGE
AH-81-04

Page (9) of ____

Crew (2)

Date (8)

Habitat Location (3) Sampling Site (4) River Mile (5) Meter Type (11) No. ____

GC (6) __ / ___ / ___ / ____ / __ Gage Number (7) Height ____

Description (10)

Distance from Head Pin (ft) LB RB	Angle Coef.	Vel. Depth (ft.)	Stream-bed Elev.	Obs. Depth %	Revo-lutions #	Time (sec)	Velocity fps			Mean Cell Depth (ft.)	Cell Width (ft.)	Cell Area (ft.^{2})	Flow (ft^3/s)
							Point	Mean Vertical	Mean Cell				
(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)

STAFF GAGE NO. (8)
AH-81-05

File No. (1) Page (7) of ____

Crew (2) GC (6) __/__/__/__/__

Habitat Location (3)

Sampling Site (4) River Mile (5)

Calibration Factor (9)

DATE	TIME	HEIGHT	INITIAL
(10)	(11)	(12)	(13)

DATE	TIME	HEIGHT	INITIAL

000077

IV. QUALITY CONTROL

A. ADULT ANADROMOUS FISHERIES STUDIES

Field sampling techniques and data recording procedures will be monitored of each crew weekly by the Adult Anadromous Project Leader or his appointed designee. This will insure consistency, accuracy and conformance with standard sampling and data collection and recording methods.

Sampling gear and support equipment will be maintained in good working order. It will be the responsibility of each crew leader to insure that preventive maintenance is conducted on all equipment. Minor equipment breakdowns will be repaired in the field. Major equipment breakdowns and/or losses will be reported immediately to Anchorage headquarters. Replacement equipment or parts will be provided at first available opportunity.

B. RESIDENT AND JUVENILE ANADROMOUS FISHERIES STUDIES

Fishing techniques utilized in the various sampling schemes have been proven for effectiveness in earlier biological studies (Lagler, 1956; Sundstrom, 1957; and McClane, 1965). Personnel will be instructed to use proven lures. Natural baits, where used, will be changed regularly to insure "freshness" and ensure maximum scent transfer to the water.

Gillnets and seines will be kept mended or will be replaced if badly damaged in operations. Equipment such as tagging guns, fishing tackle, firearms, and other tools used in day-to-day operations will be cleaned and oiled after each use to prevent rust.

Data forms will be filled out in a neat and legible manner and will be subject to periodic review by the project leader or his assistant.

C. AQUATIC HABITAT AND INSTREAM FLOW STUDIES

A systematic approach for maintaining desired standards for the measurement of field parameters has been established for the instruments used in this study. Thermometers are periodically compared to a National Bureau of Standards (NBS) standard thermometer for the range of temperatures to be encountered. If present, variations are noted and correction factors are calculated and taped onto each thermometer.

Thermographs are calibrated following the above procedures. Timing mechanisms are also evaluated for accuracy. Operational thermographs are periodically inspected comparing the temperature and time on the chart with the known time and temperature data. A mark is made on the chart at that point.

Dissolved oxygen probes (Hydrolabs and YSI) are checked over the range of use against the Winkler determination (Standard Methods, 1975). Other instruments (i.e., pH meters and conductivity meters) are periodically evaluated by the USGS. Whenever a question arises concerning quality control, the USGS, EPA, and manufacturer of the data collection device will be consulted.

Literature is periodically reviewed to insure that state-of-the-art data collection and analysis techniques are being observed. A hydraulic engineer will be consulted to evaluate the accuracy of data collection and analysis techniques. The USFWS is periodically consulted to evaluate the accuracy of instream flow data collection and analysis techniques.

The project biometrician is consulted to evaluate the accuracy and statistical merit for collecting data.

State-of-the-art habitat data collection and analysis courses are attended when it is determined attendance will improve the quality of the program.

The field data are reviewed periodically by the field biologist responsible for its collection. A brief narrative is prepared summarizing the habitat characteristics described by the data set. Any abnormal or intervening field conditions or sampling problems which might have biased the data set are also to be discussed in the narrative.

Data Routing

Raw data from the respective project sections will be forwarded to the Anchorage Su Hydro office for copying and filing. Actual routing will follow the path in figure 1.

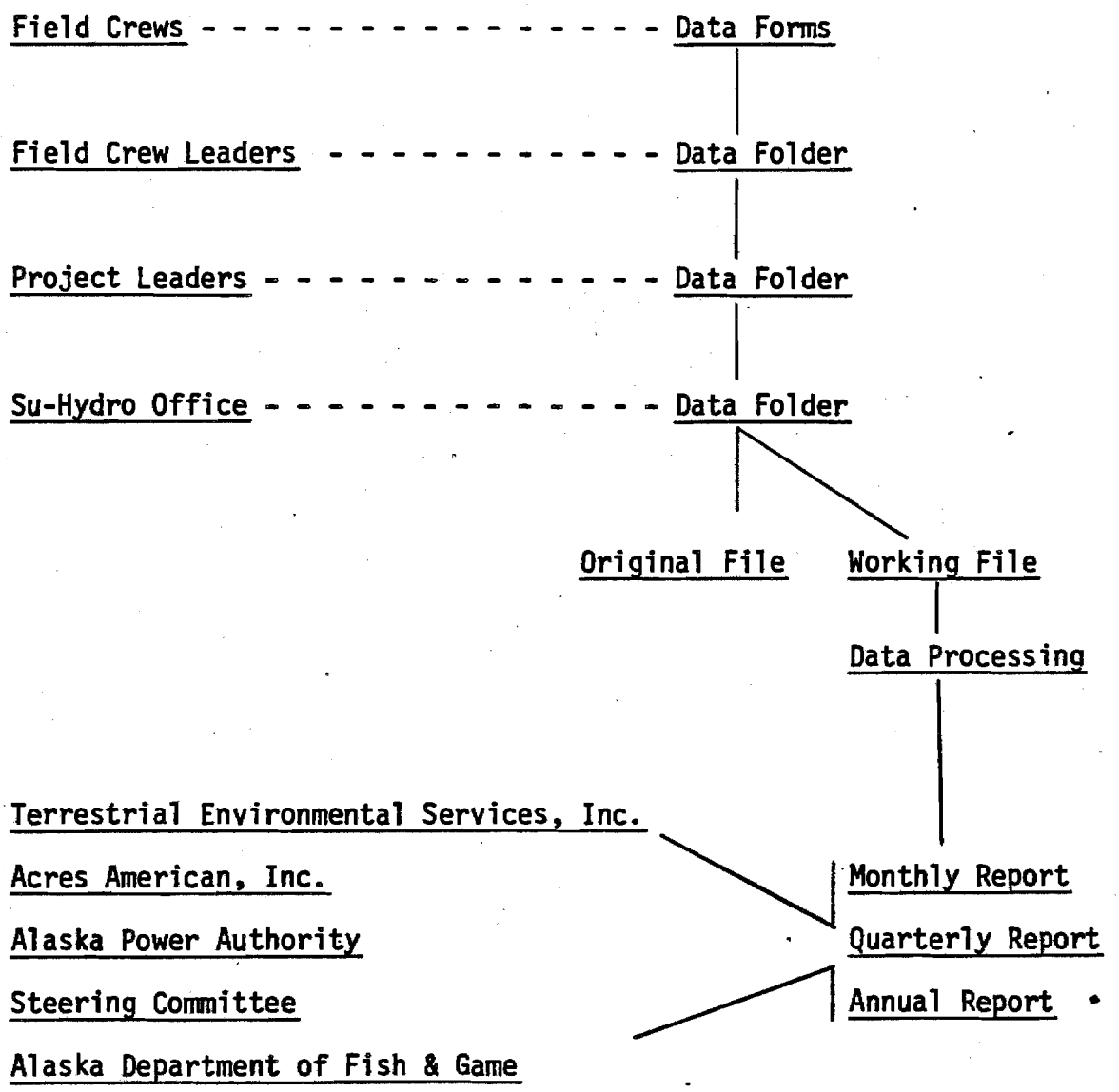


Figure 1. Data Routing, Phase I, 1981.

V. SCHEDULE

Project scheduling is as outlined in Figures 1, 2 and 3. By inspecting the figures, it becomes evident that the Adult Anadromous Fisheries Project will conduct it's field program between June 15 and October 17 at the sites indicated on Figure 1. The Resident and Juvenile Anadromous Fisheries Project will integrate it's field program with the Aquatic Habitat and Instream Flow Project along those river reaches indicated in Figure 2. These projects will operate year round from the estuary to Devil Canyon and from March 15 through October 15 upstream from Devil Canyon.

Reporting dates for all projects are depicted in Figure 3.

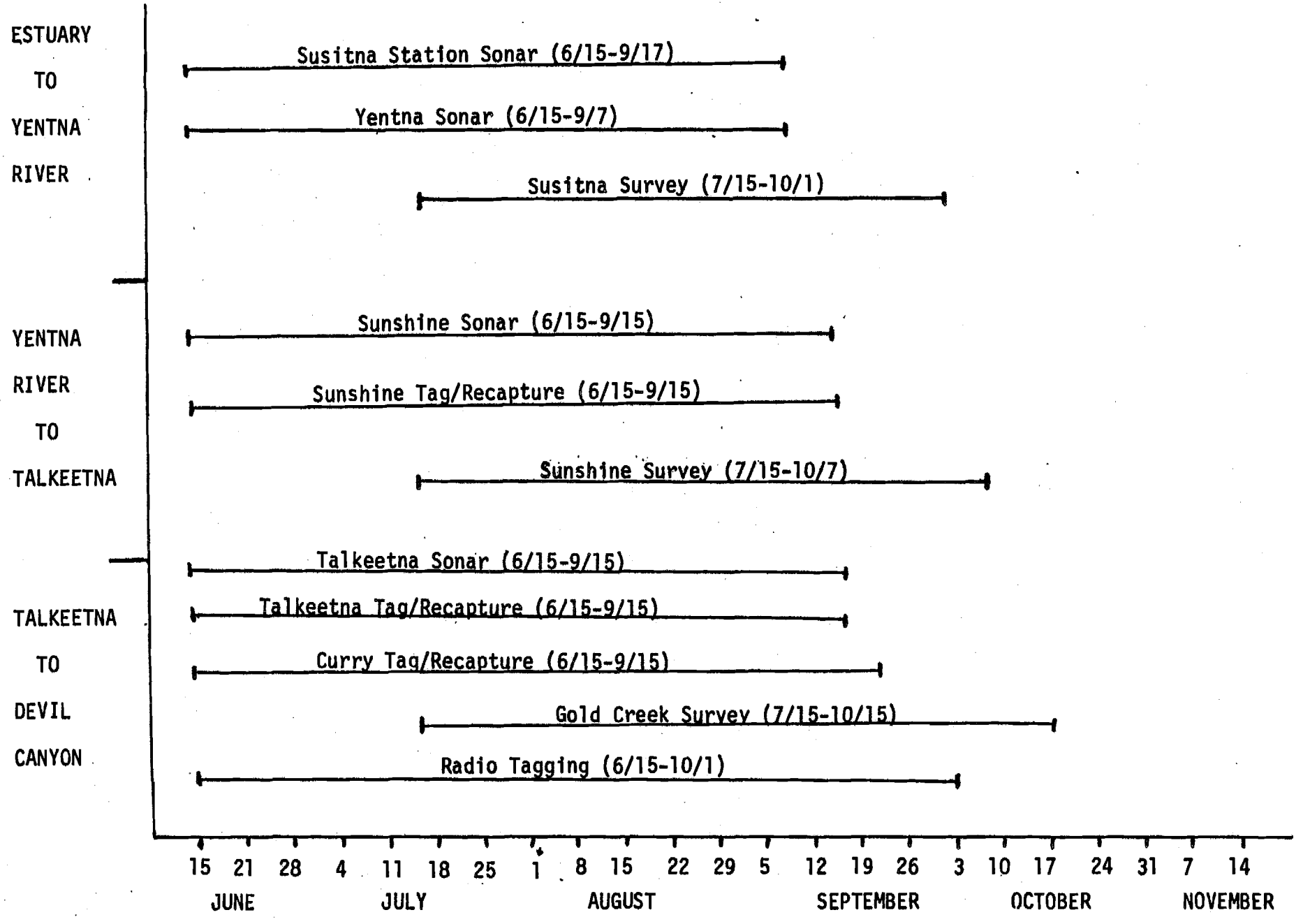


Figure 1. Adult Anadromous Project Schedule, 1981.

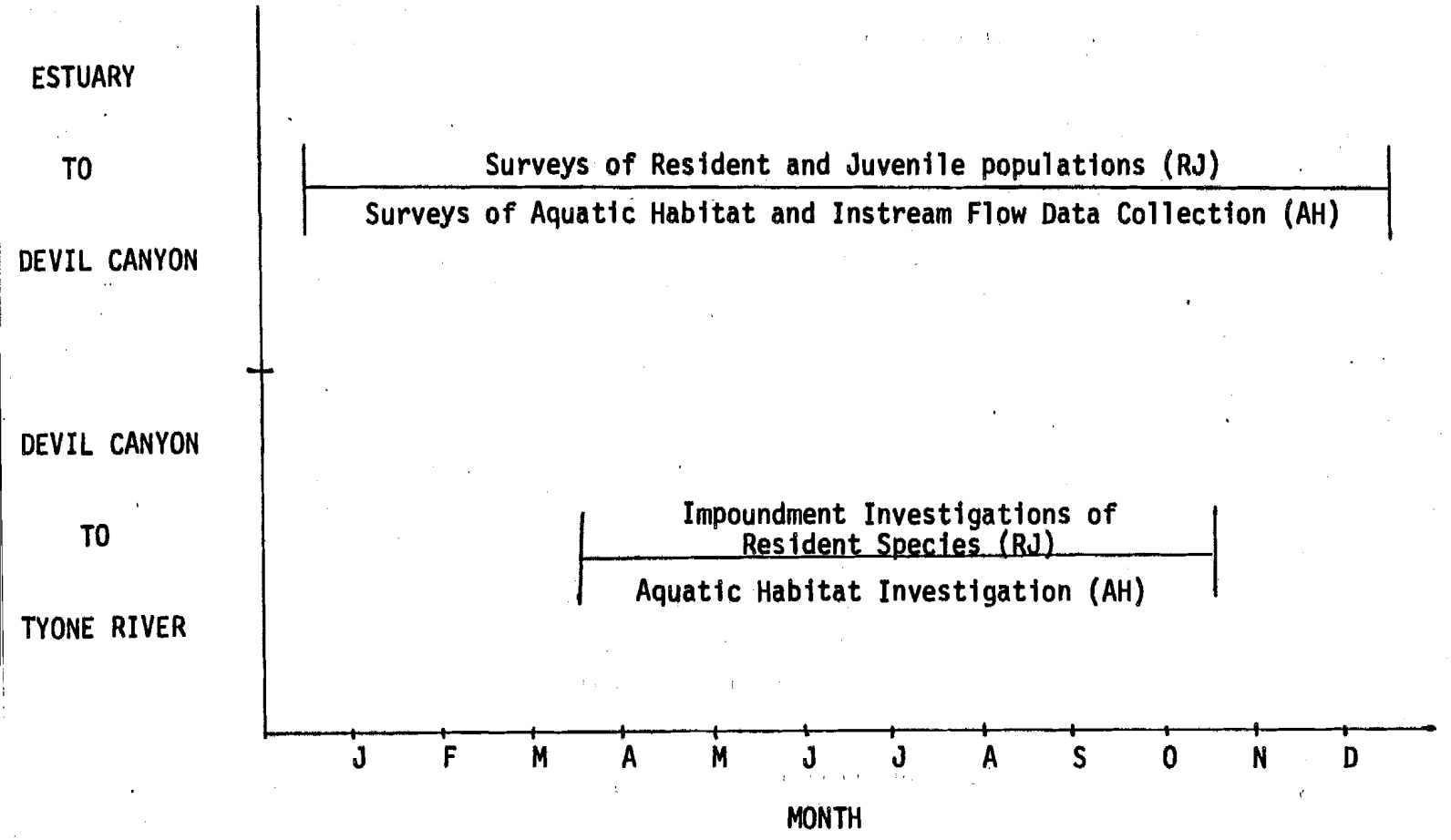


Figure 2. Activity schedule, 1981. Integrated Resident and Juvenile Anadromous Fisheries and Aquatic Habitat and Instream Flow Projects.

January -
10 - Monthly Report

February -
10 - Monthly Report

March -
10 - Monthly Report

April -
10 - Monthly Report

May - Quarterly Report
10 - Monthly Report

June -
10 - Monthly Report

July -
10 - Monthly Report

August - Quarterly Report
10 - Monthly Report

September -
10 - Monthly Report

October -
10 - Monthly Report

November - Quarterly Report
10 - Monthly Report

December -
10 - Monthly Report

15 - Anadromous Phase I Draft Report

Figure 3. Reporting Schedule, 1981.

VI. PERSONNEL

Mr. Thomas W. Trent will supervise coordination of the Su Hydro Aquatic Studies. Tom is a 1965 graduate of the University of North Dakota with a degree in biological and physical sciences. After graduation, he undertook extensive post-baccalaureate and graduate studies at Oregon State University in fisheries and water resources.

Tom acquired professional experience in fisheries science and water pollution biology as a trainee for the Federal Water Quality Administration and with the Oregon Game Commission Research Division before he joined the Alaska Department of Fish and Game in 1971. Since joining ADF&G, Tom has held positions with the Sport Fish Division in the Anchorage area and West Side Susitna river sport fisheries management programs, and with the Habitat Protection Section dealing with development activities and environmental impact evaluation. In 1974, the Commissioner of Fish and Game delegated Tom the responsibility of developing and coordinating the Department's positions and policies on the proposed Susitna River hydroelectric project.

Tom resigned from the Department of Fish and Game in early 1975 to accept a position with the U.S. Bureau of Land Management as the State Fisheries Biologist. He subsequently rejoined the Alaska Department of Fish and Game in 1976 as supervisor of the Region II Habitat Protection Section. In this capacity, Tom was responsible for coordination of fish and wildlife resource planning and policy input to the DNR State Land Disposal program, management of the Title 16 regulatory program for Southcentral Alaska, and coordination of ADF&G Susitna River Hydro Project matters.

Mr. Bruce M. Barrett will supervise the Adult Anadromous Project. Bruce holds a Bachelor of Science degree in fisheries from the University of Alaska in Fairbanks and completed one year of graduate study in fisheries before joining the Alaska Department of Fish and Game in 1972.

Bruce has held several key positions with the Department of Fish and Game involving anadromous fish investigations in Cook Inlet and the Susitna River system. In 1974 he conducted the first ADF&G anadromous fish study on the Susitna River between Devil Canyon and the village of Talkeetna.

Mr. Kevin Delaney will head the Resident and Juvenile Anadromous Fisheries Study. Kevin holds a Bachelor of Science degree from St. Cloud State University in St. Cloud, Minnesota. In 1974 he joined the Alaska Department of Fish and Game in Kodiak, Alaska as a shellfish research biologist. Kevin transferred to Anchorage in 1976 where he co-authored the Alaskan Fisheries Atlas Volumes I and II.

Kevin has been involved with Susitna River studies since 1977. He conducted research on Susitna River juvenile chinook and coho salmon and held the assistant area Sport Fish biologist position for the western Susitna drainage before joining the Su Hydro feasibilities study.

Mr. Christopher Estes will lead the Aquatic Habitat and Instream Flow Studies. Christopher holds a B.A. in Environmental Science from Prescott College, Prescott, Arizona. Graduate course work at Washington State University was directed toward instream flow and aquatic habitat evaluation procedures. Upon approval of his thesis, he will receive a MS degree in the fall of 1981.

Christopher conducted his first instream flow and aquatic habitat evaluation study for the Montana Department of Fish, Wildlife, and Parks in 1975. He joined the ADF&G as a fishery research biologist in 1977 and has been associated with the Su Hydro feasibility studies since that time. In 1979, he initiated the ADF&G Instream Flow Program. During the same year, he was appointed Co-chairman of the Western Division of the American Fisheries Society Water Development and Streamflow Committee, a position he continues to fill.

VII. LITERATURE CITED

ADF&G. 1978. Preliminary environmental assessment of hydroelectric development on the Susitna River: Prepared for the U.S. Fish and Wildlife Service by the. Alaska Department of Fish and Game. Anchorage, AK. 51pp.

Arnold, . 1966. (Cited in ADF&G manual on fish tagging. nd. Ak. Department of Fish and Game. Anchorage, AK.)

AEIDC. 1980. An assessment of environmental effects of construction and operation of the proposed Terror Lake Hydroelectric Facility, Kodiak, Alaska. Instream Flow Studies: Arctic Environment Information Data Center. Anchorage, AK. 197pp.

_____. 1981. An assessment of environmental effects of construction and operation of the proposed Terror Lake Hydroelectric Facility, Kodiak, Alaska. Instream Flow Studies Final Report: Arctic Environment Information Data Center. Anchorage, AK. 419pp.

Baldridge, J. 1981. Appendix 3; Development of habitat suitability criteria, In: An assessment of environmental effects of construction and operation of the proposed Terror Lake Hydroelectric Facility, Kodiak, Alaska. Instream Flow Studies Final Report. Arctic Environment Information Data Center. Anchorage, AK. pp. 391-94.

Bovee, K.D. and T. Cochnauer. 1977. Development and evaluation of weighted criteria, probability-of-use curves for instream flow assessments: Fisheries. Instream Flow Information Paper No. 3, USFWS, Ft. Collins, CO. 39pp.

Bovee, K.D. and R. Milhous. 1978. Hydraulic simulation in instream flow studies: Theory and Techniques. Instream Flow information paper No. 5. Cooperative Instream Flow Service Group. FWS/OBS-78/33. Ft. Collins, CO. 131pp.

Buchanan, T.J. and W.P. Somers. 1973. Discharge measurements at gaging stations. Techniques of Water Resources Investigations of the United States Geological Survey. Arlington, VA. Book 3, Chapter A8. 65pp.

Estes, C., K. Hepler, and A. Hoffmann. 1981. Willow and Deception Creeks Instream Flow Demonstration Study. ADF&G. Habitat Protection Section and Sport Fish Division. Anchorage, AK. 78pp.

Fulton, T.W. 1893. (Cited in ADF&G Manual on Fish Tagging. nd. Ak. Dept. of Fish and Game, Anchorage, AK.)

Griffith, L. 1981. Discussion of R&M Consultants substrate data collection techniques. (Personal Communication.) R&M Consultants. Anchorage, Ak.

Hagen, R.M. et. al. 1973. Ecological impacts of water storage and diversion projects. Environmental quality and water development. Ed. Goldman, C.R. et. al. W.H. Freeman Co. San Francisco, CA.

Keller, E.A. 1980. Environmental Geology. 2nd ed. Chas. E. Merrill Pub. Co. Columbus, OH. 548pp.

Kellerhals, R. and D.I. Bray. 1970. Sampling procedures for coarse fluvial sediments. ASCE Hydraulics Division. Specialty Conference, University of Minnesota, Minneapolis, MN. August 19-21, 1970.

Lagler, K.F. 1959. Freshwater Fishery Biology. 2nd ed. Wm. C. Brown Co. Dubuque, IA. 421pp.

Mauney, J.L. 1965. A study of the channel catfish, (ictalurus punctatus), in the Crowan River system. Raleigh, NC.; NC. State Univ. Thesis. 87pp.

McClane, A.J. (ed.) 1965. McClanes' Standard Fishing Encyclopedia and International Angling Guide. Holt, Rinehart and Winston, Inc. New York, NY. 1057pp.

Parsons, M. 1980. Stream Assessment Procedures and Guidelines. Suislaw National Forrest U.S. Forest Service, U.S.D.G. Pacific Northwest Region. Portland, OR. 17p.

Petersen, CGJ. 1894. (Cited in ADF&G Manual on Fish Tagging. nd. AK. Dept. of Fish and Game. Anchorage, AK.).

Richardson, E.V., et. al. 1975. Highways in the river environment; hydraulic and environmental design considerations. U.S. Dept. of Transportation. Wash., D.C. np.

Rounsefell, G.A. 1963. Marking fish and invertebrates. Fishery Leaflet 549. U.S. Dept. of Interior. Wash., D.C. 12pp.

Shirazi, M.A. and W.K. Sein. 1979. A stream system evaluation. An emphasis on spawning habitat for salmonids. US Environmental Protection Agency. Corvalis, OR. EPA-600/3-79-109. 39pp.

Smoot, G.F. and C.E. Novak. 1977. Calibration and maintenance of vertical-axis type current meters. Techniques of Water Resources Investigations of the United States Geological Survey. Book 8. Chapter B2. Instrumentation. Arlington, VA. 15pp.

Stalnaker, C.B. and J.L. Arnette (eds). 1976. Methodologies for the determination of stream resource flow requirements: an assessment. USFWS/OBS, and Utah State University, Logan, UT. 199pp.

Sundstrom, G.T. 1957. Commercial fishing vessels and gear. U.S. Fish and Wildlife Service. Cir. 48. 48pp.

Trihey, W.E. and D.L. Wegner. 1981. Field data collection procedures for use with the physical habitat simulation system of the Instream Flow Group. USFWS, Cooperative Instream Flow Service Group. Ft. Collins, CO. 151pp.

USFWS. 1976. Southcentral railbelt area - Susitna River basin. Fish and Wildlife studies related to the U.S. Army Corp. of Engineers Devil Canyon-Watana hydroelectric project. USFWS/ADF&G. Anchorage, AK. 15pp.

USFS. 1981. ASGS/ADF&G - Su Hydro 1981 Cooperative agreement. USGS. Anchorage, AK. np.

Williams, F.T. 1976. Upper Susitna River Investigations. Alaska Dept. of Fish and Game. Anchorage, AK. np. Unpublished.

Sonar Installation + Operation

APPENDIX I

A. ADULT ANADROMOUS FISHERIES STUDIES

Sonar Installation and Operation Manual

THE
BENDIX
CORPORATION

Electrodynamics
Division
North Hollywood
California

INSTALLATION

AND

OPERATION

MANUAL

SIDE SCAN

SALMON COUNTER

(1980 Model)

Report No.
SP-78-017
10 March 1980)

Prepared For:
The State of Alaska
Department of Fish
And Game
Anchorage
Alaska

TABLE OF CONTENTS

INDEX

INTRODUCTION

Before attempting to operate or install the Side Scanner, thoroughly read this manual to become familiar with the system operation.

Section I will familiarize you with all the controls and their purpose. It is probably the most important section of this manual.

Section II will show you how to initially set up the unit and test it to determine that it is operating properly. Read this section before applying power to the unit.

Section III will aid you in pinpointing any source of problems and in making any necessary field repairs by replacing printed circuit cards.

Section IV will show you how to install the artificial substrate in the river.

I. FUNCTION OF FRONT PANEL CONTROLS

A. PRINTER

1. Printout

The printer prints out 12 lines of data.[1] The number at left designates the river sector, the next column is a letter identifying various conditions such as normal, command print, or auto test. These letters are explained on the front panel. If normal, the letter "A" will be printed.[2] The following 4 digits are the number of fish counts that have been accumulated in each sector. Each sector represents a length of river, perpendicular to the shore that is equal in length to 1/12 of the "COUNTING RANGE" control setting, with sector 1 being closest to shore. E.G., if the "COUNTING RANGE" control is set to 60 feet, then each sector represents 5 feet in distance. A + in the 3rd column indicates debris has been detected in the corresponding sector. Anytime PRINTOUT TIME OR AUTOTEST TIME is changed, the time must be reset.

2. Set Time (Printer)

The purpose of this pushbutton is to initially set the printout time and auto test time at any point. The "SAFETY SWITCH" must be "OFF" to do this.[3]

3. Print Command

The printer may be commanded to print its contents at any time without affecting the timing. The letter "C" is printed when this pushbutton is depressed to permit you to know that this is a command print and not in the normal time sequence. The printout timing is not affected but the counts are erased after printout.[4]

4. Printer On-Off Switch

This switch does not affect the timing or data in any way and is merely used to shut off the printer. The sounder will sound to alert you to put the printer ON-OFF switch back on. It normally takes only a minute to change paper so try to plan your paper change between prints.[5] models using the "DATEL" printer, be sure to shut off printer switch when changing printer paper.

5: Replacing Printer Paper - See next page.

B. Data Clear Time

Data is cleared (erased from memory) after each print out. Set for AT Print position on 1978 and 1979 models.

C. Clear Pushbutton

The red CLEAR pushbutton located on the left side of the panel will clear the data in the memories controlling the printer and 4 digit

5. Replacing Printer Paper

A blue line on the paper alerts you about 1 day in advance of depletion. To change paper, shut off the printer switch and screw the 2 small silver knurled screws on the printer face. a new pad of paper in the rear tray with the blue lines towar tray bottom. Feed the paper over the silver roller in front a between the plastic face and rubber roller. Start the paper t revolving the rubber roller with your finger. When replacing printer, push it in while making sure the paper is not pinched tween the printer and panel by manually pulling some paper out the slot. Make sure the printer seats completely flush with t panel since an electrical connector must make contact. Retigh the two knurled screws as tightly as possible with your finger If the ink becomes dim after 2 to 4 years operation, loosen th two black screws on the printer face and pull out the ink pad. new pad may then be screwed in. Spare pads have been supplied Alaska and spare printers have been included. Any printers may interchanged between systems, as they are identical.

1/ Set to print out on the hour. During operation place a binder on the end of the tape as it comes out of the counter. Hanging clip over the edge of the counter stand will allow tape to move smoothly out of the counter, eliminating printer malfunction.
2/ 1978 model this may appear as a dot.
3/ On the hour.
4/ Erasure of data on '78 and '79 models can be avoided by setting DATA CLEAR TIME switch in NEVER position until printout is over
5/ Or a complete printout could be missed without your knowledge.
6/ Screws on printers must be tightened daily as vibrations can cause them to loosen.

C. Clear Pushbutton Contd.

liquid crystal display. It does not affect the cumulative counter at right. To clear the data, the "SAFETY" switch must be "OFF". The sounder alerts you when this switch is left off.

D. 4-Digit Display and Manual Sector Selector

The liquid crystal display shows you the number of counts accumulated in any of the 12 sectors that is selected by the black thumbwheel switch above it. It is always on since it uses only 1 microamp of current. Being liquid crystal, it is a reflective display and requires some ambient light to be seen. At night a flashlight or match may be necessary to see it.

E. Meter, Meter Switch and Battery

When in the "BATT" position, the meter reads the condition of the GEL-CELL battery. When in the "SOLAR CHARGE" position, the meter reads the output of the solar panel. In full, unobscured sunlight the meter will read at the extreme right indicating the solar panel is supplying 12 times the current that the Side Scanner is using with the excess going to charge the supplied GEL-CELL battery. When the meter is at the point where the red and green meet (such as cloudy weather) the solar panel is supplying twice as much current as the Side Scanner is consuming with the excess going to charge the GEL-CELL battery. This would be enough to indefinitely carry it through the night hours. Although a 12V, 16 amp hour rechargeable GEL-CELL battery is supplied with each system, any 12V battery of equal or greater capacity may be used. The supplied battery, when fully charged, will operate the Side Scanner for approximately 300 hours, or about 2 weeks, day and night, with no solar charging. Internal protection is provided against battery overcharging in the event of constant full sun.

F. Fish Velocity Control

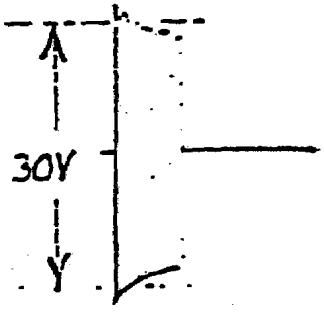
This thumbwheel switch controls the transmit repetition rate of the system. It has been observed that salmon migrate upstream at about 1.75 feet per second (ground speed). Since the switch is labeled in seconds per foot, the reciprocal of 1.75 feet per second is 0.571 seconds per foot so until new fish speed information is obtained, set the control to 0.571. (33[illegible] on Susitna west bank).

G. Sensitivity Control

This controls the amount of power transmitted to the transducer and is essentially a system sensitivity control.

To adjust it initially requires a fine bladed screwdriver or knife blade and an oscilloscope. It is adjusted as follows:

(1) Connect the oscilloscope input to the red test point on the panel marked XM2°. Set the vertical sensitivity of the scope to 5V per division and the scope trigger to internal. Set the horizontal scope sweep speed to 50 μsec per division. Make sure the transducer is properly connected and in the water.



(2) Set the beamwidth switch to 2°. Adjust the front panel sensitivity control for an average peak to peak (top to bottom) signal of 30V. It will look something like the Waveform at left so adjust for an average as shown.

(3) In very muddy rivers such as the Susitna, set this level to 35V.

H. Dead Range Control

This controls the distance from the face of the transducer that the system is "blanked out." That is, any echos received within this preset range will not be accepted for processing. The control may be set from 0 to 10 feet. This control is necessary to blank out transducer "ringing" which occurs for about 2½ feet and would result in false counts. Sometimes a source of air bubbles near shore exists which could cause false counts. In this case, increase the DEAD RANGE control until the count stops in sector 1 (as evidenced by the #1 fish light blinking). The fish would then have to be weired out to beyond the dead range. See "weirs" under Misc.

I. Counting Range Control

This controls the total perpendicular distance to which fish counts will be accepted. This preset distance starts immediately after the DEAD RANGE ceases, thus the total range from the face of the transducer is the total of both the "DEAD RANGE" and "COUNTING RANGE" settings.

J. Transducer Aiming

The end of the artificial substrate contains a target, approximately 60 feet from the transducer face. This is necessary for proper

J. Transducer Aiming (Contd.)

initial aiming of the transducer beam. 1/To do so, merely set the range controls for a total somewhat over 60 feet and manipulate the transducer until the sector #12 fish light consistently blinks. The 2^{o} beam should be used for this although the 4^{o} beam may be used to initially locate the beam. When in position, tighten the transducer mounting knurled handles.

The beam should be as low as possible without actually reflecting back from irregularities on the pipe so the best way to set the beam is to start high and lower the beam until it hits the target, then lower it further until echos begin returning from some point before the target, then raise it just enough to miss the early target.

To facilitate transducer aiming, the knurled handles should be partially tightened and the 3 foot rod supplied with the system alternately inserted in the vertical and horizontal holes in the transducer plate to move the transducer. Make sure that the final tightening does not upset the aiming.

An oscilloscope should be used in lieu of the #12 FISH LIGHT for more precise aiming. To do so, trigger the oscilloscope from the XM 2^{o} panel test point, connect the scope ground to the GND, test point and the scope input to the RCVR test point. Set the scope vertical control to 1 V/CM and the horizontal control to 5 milliseconds per CM. 2/The target will be observed on the scope 24 milliseconds from the start of the trace and the transducer may be manipulated for a maximum "spike" at that point. If the transducer is aimed too low, early echos coming from rough surfaces on the pipe will be seen before 24 msec. 3/

The new (1978) artificial substrates have an improved method of transducer adjustment and have transducers modified for the new substrates. (See Figure 4 on the last sheet.) The transducer plate should be installed in the shroud on the shore end member. The 3 studs attached to the plate will be secured to the plate with the 3/8-16 locknuts. 4/About 1½ inch away there will be a 1/2-20 nut followed by a flat washer, a spring and flat washer in that order. The three studs should be pushed through the three corresponding holes in the shroud with the last flat washer against the inside of the shroud. A hand wheel should then be screwed onto the outside of the shroud on each of the protruding studs. 5/The transducer cables should be fed over the top of the transducer and back to shore, securing them with tape to prevent chafing and to

1/ Prior to submersion, transducer plate should be flushed on all sides with transducer housing. This can be accomplished by "feel" or using a straight edge.

2/ See section titled Oscilloscope Operation for the Side Scanner.

3/ See section titled Typical Side Scanner Oscilloscope Waveforms for various transducer aiming conditions.

4/ Use lockwashers and tighten with channel lock pliers.

J. Transducer Aiming (Contd.)

provide a little service loop to prevent their being torn off the transducer. The three hand wheels should be tightened with an equal amount of stud protruding through the wheel. The transducer will now be approximately aimed at the target end 60 feet away. (The remaining three hand wheels should be used after final transducer adjustment by running them up the stud and tightening them against the first wheel to lock them in place.)

The transducer should be accurately aimed at the target by the oscilloscope method discussed in the previous section with the following new exception. To raise the beam, screw the upper wheel clockwise (to the right) one turn for each 3/4 foot beam movement 60 feet away (or counterclockwise to lower it). To move the beam to the right, turn the lower right wheel clockwise and the lower left wheel the same amount counterclockwise at the same time. To move the beam to the left, reverse the procedure.1/ Each full turn of both wheels together will move the beam horizontally 1-1/2 feet. By turning them together, the vertical aiming remains unchanged and the upper wheel does not affect horizontal beam movement. The 2^{0} beam is 2 feet wide at 60 feet away. See attached section on Transducer aiming.

K. Cumulative Counter

This counter maintains a running total of all counts. It is an 8-digit counter and being of the L.E.D. type, consumes a fair amount of power when lit. For this reason a "READ" pushbutton is provided below it to read the total when desired. To clear the cumulative counter, shut OFF the SAFETY switch and depress the "CLEAR" pushbutton located below the counter. The alarm will alert you that the "SAFETY" switch is OFF.

L. Safety Switch

This switch is an interlock provided to prevent accidental clearing of the data or accidental resetting of PRINTER time or AUTOMATIC TEST time. Whenever it is left in the "OFF" position the sounder will sound, alerting you of this fact.

M. Sounder

The sounder will alert you whenever any of the following three switches are left in the "wrong" position to prevent walking away from the unit in that condition: (The sounder will "click" whenever fish is counted. 2/

1/ Horizontal movements should involve exactly the same amount of turning on each wheel to avoid "skewing" the beam out and up or down.

2/ Speaker may be covered when working to lessen obnoxious noise. However, the speaker is not a gum repository.

M. Sounder (continued)

a. Sounds when "DATA" switch is left "OFF".

b. Sounds when "PRINTER" switch is left "OFF".

c. Sounds when "SAFETY" switch is left "OFF".

N. Test Pushbutton and Data Switch

The purpose of this test is to verify proper functioning of almost the entire system (except the transmitter). This button, when depressed, electronically simulates fish in the first 11 sectors. When the system is operating properly, the first 11 fish lights will blink, the sounder will sound, the cumulative counter and the 4-digit counter at left will record these counts. If only a partial system test is desired, without interfering with data already present in the memories or the cumulative counter, the "DATA" switch should be left "OFF". This will prevent these "false counts" from being recorded but will permit the FISH lights to blink. When a full system test is desired at the cost of losing the data already present, the "DATA" switch may be left "ON".

O. Fish and Sector Lights

The two red SECTOR L.E.D.'s indicate that the electronics logic card is probably functioning properly. The sector lights must always blink. If a light(s) does not blink, the cause may be merely a burned out light. This can be verified by dialing the large thumbwheel switch to the sector in question and simulating fish by depressing the "TEST" pushbutton with the "DATA" switch "ON". If data is recorded in that sector, it merely means that either the light is bad or the L.E.D. card in the system is bad, which will not affect proper operation.

To check sector 12, merely increase the "RANGE" control setting a few feet to "count" the target at the end of the substrate. The FISH lights will blink whenever fish are detected in the corresponding sector and the sounder will sound.

P. Automatic Test

This feature permits automatic self testing of the entire system including the transducer and its proper aiming. It functions automatically each 12 hours as follows:

Note: 1978 and 1979 models can be set at 6, 12, or 24 hours. Set at 24 hours.

P. Automatic Test Cont'd.

To start the 12 hour timing sequence at any point in time, press the "SET TIMES" red pushbutton. This initiates both the printer and auto test times. Precisely 2 seconds after the normal printout 12 hours later, the system will go into an automatic test mode. It will automatically electronically simulate between 2 to 7 fish in each of the first 11 sectors and it will automatically extend its range by 3 feet, thus counting the artifical target 60 feet away and recording these counts in sector 12. It will then print out all these counts and the letter E in the second column to indicate a self start.1/ None of these counts will enter the cumulative counter at right, and will be erased right after the print.

Q. Test Points on Panel

The test points have the following purposes:

1. XMALT. This test point is connected to the 4^0 section of the transducer which shows the transmitted voltage when the unit is transmitting at 4^0.

2. The $XM2^0$ test point is directly connected to the transducer sector that is selected by the beamwidth switch and permits oscilloscope reading of the transmitted voltage, thus checking the transmitter card in the system. The 4^0 transmit will always be considerably higher than the 2^0 transmitted voltage except when the beamwidth switch is set to 2^0. When the "BEAM WIDTH" switch is in the "ALT" position, the transmitted voltage can be seen to alternately go high and low as the 2^0 and 4^0 sectors are automatically selected.

3. RCVR Test Point. This test point is the receiver output and gives a true "analog picture" on an oscilloscope of what is happening in the water. Any echos received are amplified and presented at this test point. Any time the echo exceeds 3 volts at this point for the proper pre-programmed number of "hits" it will result in a count. To use this feature, the scope input is connected to the "RCVR" test point, the scope ground connected to the "GND" test point and the scope may be

1/ 1978 and 1979 models will have letter I in the second column.

Q. Test Points on Panel Contd.

triggered from either the "XM" test point which permits observation of the entire 60 feet or from any one of the "SCOPE - TRIG" test points which starts the scope trace at the beginning of any of the 12 sector "listening times." The scope trigger must be set to - . By doing this and properly expanding the scope sweep speed, any one or more of the 12 sectors may be individually observed.

R. Beamwidth Switch

This switch electronically controls the transducer beamwidth by connecting only the center section of the transducer for a 4^{0} beamwidth or paralleling both the center and outer transducer sections for a 2^{0} beamwidth. Any of the three modes may be selected, but for optimum coverage, the "ALT" position should be used since this tends to make the lateral coverage more uniform. When in the "ALT" position, the system alternately transmits on the 2^{0} sector then on the 4^{0} sector and back to the 2^{0} sector, etc. After transmitting on the 4^{0} sector, only those echos received during the first half of the active range are accepted (sectors 1 thru 6). When transmitting on the 2^{0} sector, only those echos received during the last half of the active range are accepted (sectors 7 thru 12). The system electronically gives more weight to sectors closer to the transducer face since the fish will be in the beam a shorter period of time because of the fact that the closer to the transducer, the narrower the beamwidth. A number of samples of each fish are taken, permitting different "aspects" of the fish to be sampled as it crosses the beam. A varying number of valid "hits" are required before the system "decides" the target is a fish and enters it into permanent memory. The number of valid hits required for detection is a function of which of the 12 sectors the fish was detected. For example, although a fish travelling at 1.75 feet/sec is sampled 9 times, if it is detected in sector 9, only 5 valid "hits" are required to count, so if 5, 6, 7, 8 or 9 hits are made during the passage of the fish, only 1 count will result.

This feature essentially eliminates downstream passing debris which typically is travelling at the river velocity which is usually much faster than 1.75 ft/sec and which would not be in the "beam" long enough to count. To prevent single debris counts occurring over a period of time from adding up to the number required for a valid fish count, the temporary fish decision memories are automatically cleared 4 transmissions after receipt of any single echo

5. Debris Alerting

Any time 24 counts are made in any one of the 12 sectors in a 35 second period (starting from the first count), the system assumes that this cannot be fish and is probably a piece of debris hung up on the artificial substrate. When the next printout occurs, the corresponding sector column will contain the symbol "+" in the 3rd column next to the sector identification number 1/ After printout, the debris detector is cleared and starts out "fresh" again. If the debris is still present, the system will again accept up to 24 counts in 35 seconds and indicate "+" again. If the debris has washed away, it will resume normal operation.

NOTE: Some of the front panel switches are of the "PULL TO CHANGE" types. This is to prevent inadvertent changing of the switch positions. The switch handle must be pulled away from the panel and then changed. Make sure that the switch is firmly seated in the desired position.

T. Tape Recorder Operation

The salmon counter is designed with the provision to tape the following two outputs on a JVC-1636 cassette stereo tape recorder:

a. RECEIVER - This output is the raw but amplified echos received by the transducer.

b. FISH - This output provides a 65 microsecond pulse every time the system decides that the echos received were that of a fish and not passing debris (unless the debris becomes hung up on the pipe and counts continuously.

c. TAPE PWR - This output provides a regulated 8.7 volts to power the tape recorder automatically for 3.6 minutes after each printout.

The purpose of the tape feature is to permit calibration of the system, after the fact, at some later date. It has been found that visual oscilloscope observation of the receiver output is an excellent indicator of fish passage, even in glacially silty water. Test conducted in Wood River have shown that, with a little practice, an oscilloscope observer can count the fish passage with a better than 95 percent correlation with an observer on the fish counting tower since passing debris echos are of a fleeting nature while fish can be seen entering and leaving the beam with a gradual build-up and decay of its echos.

Thus, by recording the receiver echos and the actual simultaneous fish counts that the salmon counter has electronically decided upon, the two may be compared and system accuracy determined for any given site. The fish velocity control may then be changed to permanently calibrate system.

To record, merely plug the dc power cord of the tape recorder into the side scan TAPE PWR plug, plug the RECEIVER output into the right channel line input of the tape recorder. Plug the FISH output into the left channel line in of the tape recorder 1/ Set the tape recorder controls as follows: SUPER ANRS, CRO2,-line, (use only TDK SA-C90 tape) 2/ Set the recorder level controls to maximum, press the RECORD and PLAY buttons. Be sure the tape is inserted and at its beginning. When the TAPE PWR switch is in the AUTO position, the tape recorder will automatically come on for 3.6 minutes after each print, thus recording a 3.6 minute sample of the echos and counts each hour at the usual printout setting of 1 hour. Since each side of the cassette has 45 minutes recording time and there are twelve 3.6 minute periods in 45 minutes this means that the recorder can operate unattended for a 12 hour period before turning over the tape.

NOTE: Never leave the TAPE PWR switch in the "ON" position, since this position is only used to set up the tape recorder or to record for greater time periods. Even if no tape recorder is plugged into the side scanner, this would cause the system to consume 20 percent more power needlessly.

II. INITIAL SET UP AND SYSTEM TEST

To verify proper system operation when first turned on or anytime desired, do the following:

Before the battery is plugged in, which turns on the system, place the following switches in the noted positions:

(1) PRINTER OFF.

(2) TRANSDUCER NOT PLUGGED IN.

(3) SAFETY SWITCH OFF.

(4) METER SWITCH in BATT position.

(5) FISH VELOC to 0.571.

(6) DATA ON.

(7) ACTIVE RANGE to about 50 feet.

The remainder of the controls may be left in any position.

Next, plug in the battery and then press the SET TIMES pushbutton. (This synchronizes the system.) Some of the FISH lights may remain on. To clear the system, press and hold the red TEST pushbutton noting that each of the FISH lights blink in sectors 1 thru 11. The system is now cleared and ready for operation. At this time, the SECTOR lights should be blinking and the BATTERY CONDITION METER should be in the green.

1/ FISH output is left or white cord.
2/ Tapes should be run through fast forward and reverse once to lessen wow and flutter effects.

Press the two red CLEAR pushbuttons to erase any counts from the memories

Press and hold the red TEST pushbutton. This will simulate counts on sectors 1 thru 11. Hold it in until a few hundred counts appear on the CUMUL counter. (You have to press the black READ pushbutton to see this.

The next step will be to verify that counts have been registered on each section of the 4-digit liquid crystal display and that the printer is functioning, and that all counts agree. To do this, turn on the PRINTER switch and momentarily press the black PRINT COMM pushbutton. The printer should now print out 12 lines of data. The left will be the sector identification number and should sequentially read 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, 1, 2. The next column should have printed the letter "C" Dial the large black thumbwheel switch through its 12 positions and compare the numbers in the 4-digit numerical display with the corresponding blue printed columns. They should agree.

Next, add up the column of figures. The total should agree with the total CUMUL count within one or two digits.

Solar Panel

The purpose of the solar panel is to charge the 16AH GEL-CELL battery supplied with the system.

Mount the solar panel such that it will receive a maximum average amount of light throughout the day. Plug it into the side connector marked SOLAR PANEL (observing polarity).1/ Put the METER switch in the SOLAR CHARGE position. If full sunlight is falling directly on the solar panel, the meter will be at the extreme right. In very cloudy weather the meter will probably be in the red. When it is at the red/green cross-over point, the solar panel is supplying twice as much current as the system is consuming, with the excess going to the battery. This condition will be adequate to indefinitely carry the system through the night hours. Make sure no part of the solar panel is shaded because shading one cell is the same as shading the entire panel.

If the solar panel is connected backward, no damage will result, but the meter will read no solar charge when exposed to light.

III. TROUBLESHOOTING

Many complete sets of printed circuit card spares have been supplied to Alaska Department of Fish and Game. They contain pre-tested cards of every type used in the Side Scanner System.

They are identified by a function name etched on the component side of the cards at the upper left corner of the card. The following table lists the P.C. card names and their functions to aid in troubleshooting.

1/ This means red to red and black to black.

Printed Circuit Card Name & Location in P.C. Card File	Card Function
MEMORIES (Slot 1 & Slot 2) (These 2 cards are identical)	The memory cards store valid fish counts after the electronic decision has been made if debris or fish. They drive the 4 digit liquid crystal display and the printer. They have nothing to do with the cumulative counter display. The 2 cards are identical and interchangeable. The memory card in slot 1 controls the two most significant digits of the display and printer fish counts, i.e., the two digits on the left. The memory card in slot 3 controls the 2 least significant digits of the display and printer fish counts, i.e., the two digits on the right.
LOGIC (Slot 5)	The logic card controls the system repetition rate (or "ping" rate). It controls the duration of the transmit signal, the 11 simulated fish counts for test, the automatic range extension during auto test, the counting range, the dead range, the smolt vs. fish function, the power to the receiver, all the L.E.D. functions, the 12 sector scan, the cumulative counter, the sounder duration when fish are detected and the temporary memories which decide whether the echo detected is fish or debris. If debris, it is erased; if fish, it is routed to the previously mentioned permanent memories cards for storage and then erased from this card. This card also controls the 2^0, 4^0 and ALT beam routing in conjunction with the beamwidth switch.
PRINTER (Slot 7)	The printer card controls the printer time clock, the printer command, the 12 print sequencing, the printer sector I.D. number printed on the left of the printed paper, the letters printed next to the left on the printed paper, the automatic self test timing, the erasure or automatic clearing of the data after print, the tape recorder automatic power turn-on for 3.6 minutes after each print, and makes the decision whether a very high rate of counts is fish or debris and if debris it tells the printer to print the symbol "+".

Printed Circuit Card Name & Location in P.C. Card File	Card Function
RECEIVER (Slot 11) CAUTION: If this card is changed, it will be necessary to readjust the sensitivity screwdriver control on the front panel as discussed earlier in this manual.	The receiver card contains the receiver which takes the minute fish echos, amplifies them 23,000 times and if the echo exceeds a predetermined threshold it triggers a device which sends a signal to the temporary memory card for subsequent decision as to whether it was fish or debris. This card also contains a 9V regulator to power the entire system. It also controls the battery and solar charge meter and provides T.V.G. which means time variable gain which causes fish echos detected far away to be amplified at a greater factor than fish close by since the echo decreases with distance in a log manner. This card also contains the transmitter which transmits a 515 kHz signal to the transducer. The card also contains part of the circuitry to electronically simulate fish in the first 11 sectors for automatic and manual test. The tape recorder power regulator is located on this card also.
LIQUID CRYSTAL DISPLAY CARD. Located on front panel.	This card contains a 4-digit liquid crystal display on the front panel. If it becomes defective it may be removed from the inside by removing the two retaining 6-32 nuts and replacing it with a spare display card. If this done, be sure the two flat plugs that are inserted in its connector are firmly inserted in the new card in identical orientation. The display has an average life of about 7 years. It will be noticed that in cold weather the display takes longer to change its numbers. This is a normal characteristic of liquid crystal displays.

Most of the card functions are self-explanatory so that in the event of trouble, a card may be replaced. Since many of the card functions are inter-related, a problem may sometimes not be definitely localized to a specific card and more than one card may have to be interchanged to cure the problem (one at a time).

To change a printed circuit card, disconnect the battery and solar panel. Remove the 6 screws holding the front panel and carefully lift the front panel straight up. It may then be turned and laid down next to the electronics.

CAUTION: The electronic components on the cards are suceptible to immediate destruction by static electricity. They should never be handled in an office where carpets generate static electricity.

Replace the suspect card with a new one and retest. The system can be operated in the open position so it will not be necessary to close the system to test it, but be very careful not to short anything.

To remove a card, pull up on the two card ejectors. To replace a card, press the card firmly down and hook the combination black card ejector/inserter under the ridge of the card file and push the two black interters down. These will force the card into its sockets and may have to alternately be "rocked" until the card is firmly seated in its socket.

CAUTION: NEVER remove or replace a card with power from the battery or solar panel connected.

To replace the panel, reverse the removal procedure being careful not to pinch any cables between the panel and the case. The 6 nuts are on sliding plates and may have to be repositioned with a knife blade if they were moved.

IV. SIDE SCAN ARTIFICAL SUBSTRATE

General Description

The array (Figure 1, 2 and 3) is made up of three 18½ foot long sections of tubes that plug together with an 18 inch overlap forming a single tube.

Off shore and on shore sections terminate the assembly ends. A 1/4 inch diameter wire rope runs through the assembly and is pinned to the off shore cap. The on shore cap has a threaded shaft and handwheel which is used to provide tension holding the array sections together by tensioning the cable.1/ Alignment of the vortex shedding fins on each section is required in order to prevent oscillation or vibration of the array in fast currents. Install and tighten the 1/4" bolts on the welded brackets. These will squeeze the slots together thus securing the pipes together.2/

NOTE: The bolts should be tightened with the pipe upside down from the way it will lie on the river bottom. This will help straighten the pipe.

The off shore cap provides the wire rope termination, has a water check valve used for blowing out and floating the array, mounts the off shore cable attachment point and has a target attached for acoustic signal alignment.

The on shore cap has a 2 inch diameter hole in the end which is used to stake the array in position on the shore. A second 2 inch hole may be used

1/ Cable should be threaded on downstream side of bolts which hold sections together.

2/ 1978 and 1979 arrays: tighten 1/2 inch diameter bolts to 45 ft/lbs (second bolt from target end - tighten to 20 ft/lbs only). If too loose, the array will bend excessively, allowing fish to escape under the beam. If tightene to greater than 60 ft/lbs, -14- the bolts will break or the tube deform.

to tie off the array for safety. A mount for the transducer is provided on this cap. Both verical and horizontal adjustment of the transducer is possible. A 1/2 inch diameter x 2 feet long bar is provided to use as a lever for aligning the transducer on the 1976 systems. The new systems have adjustment hand wheels. Mount the transducer in the upper 3 holes of it's housing.

A traveler, attached to the cable swivel, rides on a bar preventing rotation of the cable when tightening.

NOTE: The cable must be as tight as possible to prevent array breakup in fast rivers. Hand tighten only.

A 1/2 inch threaded plug is provided for an air hose to blow out and float the array prior to removal from the river bed. Netting is tied to the lower vortex fin. 1/8 inch diameter holes spaced at 1-1/2 inch intervals provide net tie points. Holes are provided on both top and bottom fins as installation on the opposite shore requires turning the array end for end and rotating 180°.

NOTE: It has been found by A.D.F.&G. that if no air is available, the array may be raised by allowing the pipe to tilt down in the direction of the water flow. The fairings act as ailerons and will raise the pipe to the surface. Conversely, when sinking the array, the stake on the shore end should be attached via a "come-along" to a tree and should be tilted upstream a few degrees to help sink the array and hold it firmly on the river bottom.

Assembly Procedure for 60 Foot Array

1. Layout the following parts on a reasonably level surface parallel to the river bed in the order listed. Leave 1 foot space between parts.

   1 each Off Shore Cap.

   2 each 18-1/2 foot section with couplers attached.

   1 each 18-1/2 foot section without coupler.

   1 each On Shore Cap (screw in tension screw handwheel all the way).

2. Attach swivel end of 1/4 inch cable (36-1/2 foot long) to eye on threaded tension screw.

3. Feed opposite end of cable (with eye) through the 18-1/2 foot tube sections. Cable must pass through center hole in bulkheads (2 places), and on downstream side of 3/8" bolts.

4. With the on shore cap transducer housing straight up, slip the first 18-1/2 foot section onto the shore cap (male), reduced diameter, align the bolt holes and install 1/4 inch diameter bolts. Be sure 18-1/2 foot section is facing in right direction. Fins go downstream. 1/

5. Install second and third sections in similar manner. 1/

NOTE: If couplings hang up and do not seat the cable and tension screw can be used to pull the couplings together. However, care must be taken to align the fins during coupling insertion as turning the sections after complete assembly may be difficult.

6. Insert cable eye through the off shore cap and install cap on last section. Insert bolt. Target (curved projection) should be up.

7. Install end plate (with slot for pin) onto off shore cap. Cable should project through cap center hole and extend out about 12 inches if all couplings are seated.

8. Start to tighten handwheel inside on shore cap until cable eye is aligned with slot in end plate.

9. Install pin through eye and seat in slot of end plate.

10. Tighten cable hand tight, using handwheel. All couplings should now be fully seated.

11. Install coupling bolts and cap nuts not previously installed. Tighten to 20 ft/lbs only; apply silicone.

12. Install end cap onto end plate covering cable and pin using two 3/8 inch bolts. 2/

13. The array is now ready for placing into the river.

Array Installation Procedure

Installation of the array into the river will vary from one location to another dependent on local terrain and river conditions. Primarily, current speed will determine whether the array can be floated and swung into place from a parallel to the river position, see Figure 2A (slow currents 2-3 feet per second) or pushed into the river at right angles to the current with the off shore end controlled by a cable, see Figure 2B, current of 4 to 7 feet per second.

1/ Coat outside of reduced diameter portions with clear silicone to prevent air leaks. Also coat both ends of bolts.

2/ To prevent air leaks (when raising):
1) Wrap all seams tightly with grey 2" pvc tape (this may require cutting fins back 2-3" on each side of seam).
2) Place 2 connected 8" hose clamps on each side of seam and over tape.
3) Tighten clamps being careful to keep clamp nuts to downstream side of array and out of beam path.

A judgement as to the best procedure must be made at each site based on the results of past experience. The following steps will apply to both methods.

1. Attach an appropriate shore cable 1/4 inch minimum diameter to upstream end of clamp provided on off shore cap.1/

2. Attach opposite end of shore cable to stake, tree or other available attachment point. CAUTION NOTE: In 7 foot per second currents cable tension of floating array will be as high as 850 pounds.

3. Push the array into the river with transducer housing in a vertical position. (Vortex fins parallel to water flow.) Array must be positioned with reasonable speed as water will leak into the numerous unsealed joints allowing the array to sink in 5 to 10 minutes. The array will have an initial positive buoyancy of about 900 pounds when floating.2/

4. A 1-1/2 inch diameter steel stake should be ready to drive through the on shore cap into the river bed during deployment of the array. This stake must be long enough to be driven securely into the river bed as well as extend out of the water. See following page for new inshore end instructions.

5. Remove the 1/2 inch plug on top and the plastic plug on the side to permit the pipe to sink quickly.

6. The array when installed should have at least 1/2 foot of water over the transducer.

7. Alignment of the transducer beam with the target mounted on the off shore cap is accomplished by separate horizontal and vertical adjustment procedures, see Figures 1B and 1C.

Horizontal

Loosen Knob "A" and the two horizontal adjustment plate bolts. Install adjustment bar into horizontal adjustment hole (do not loosen opposing side knobs B and D). Adjust beam by moving bar forward or aft as required. When correctly positioned tighten the horizontal adjustment plate bolts.

NOTE: This adjustment is a one-time adjustment and should not require readjustment until the transducer is replaced.

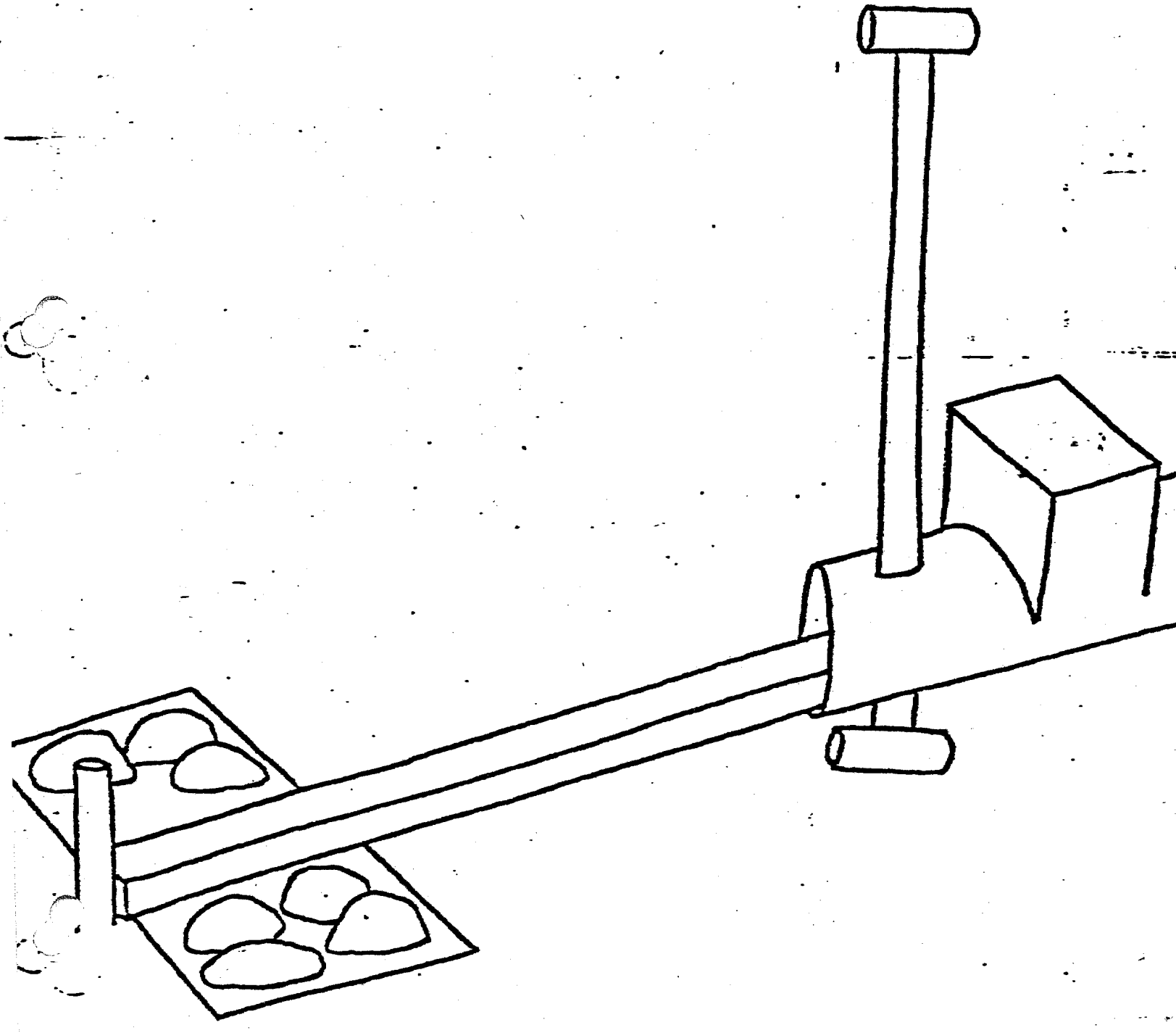
Vertical

Loosen knobs A, B, C, and D. Install adjustment bar into vertical adjustment hole. Adjust by moving bar forward and aft in slotted hole. When adjusted tighten knobs A, B, C, and D.

1/ Easier in and out movement of array while in water can be accomplished by using an inshore cable also. REMEMBER the longer the cable, the easier it will be to move the array in and out.

2/ If correct sealing procedures are followed, the tube will not sink rapidly.

4) The 1 1/2" diameter stake should be replaced with a 2" O.D. x 4' long steel pipe thread on both ends which acts as a "pivot point". Pipe "T"'s are attached to both ends after it is pushed through the holes provided on the inshore end. Movement of the array inshore from current pressure is prevented by placing a 4 x 4 or pole in the opening below the transducer housing and butting it up against the pivot pole. Weights or stakes can then be used to hold the 4 x 4 or pole in place (see drawing).



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2. Attach opposite end of shore cable to stake, tree or other available attachment point. CAUTION NOTE: In 7 foot per second currents cable tension of floating array will be as high as 850 pounds.

3. Push the array into the river with transducer housing in a vertical position. (Vortex fins parallel to water flow.) Array must be positioned with reasonable speed as water will leak into the numerous unsealed joints allowing the array to sink in 5 to 10 minutes. The array will have an initial positive buoyancy of about 900 pounds when floating. 2/

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7. Alignment of the transducer beam with the target mounted on the off shore cap is accomplished by separate horizontal and vertical adjustment procedures, see Figures 1B and 1C.

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NOTE: This adjustment is a one-time adjustment and should not require readjustment until the transducer is replaced.

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Loosen knobs A, B, C, and D. Install adjustment bar into vertical adjustment hole. Adjust by moving bar forward and aft in slotted hole. When adjusted tighten knobs A, B, C, and D.

1/ Easier in and out movement of array while in water can be accomplished by using an inshore cable also. REMEMBER the longer the cable, the easier it will be to move the array in and out.

2/ If correct sealing procedures are followed, the tube will not sink rapidly.

Array Removal Procedure

1. Blow out water in the array through the check valve located in the shore cap. This is done by removing the 1/2 inch pipe plug located in the shore cap and replacing with an air hose. Air pressure applied here (as from a diver's tank) will force water out the check valve floating the array assembly.

   If no air is available, the alternate raising method described earlier may be used, i.e., allow the shore end stake to tilt forward (downstream) which will raise the array by the aileron action of the fins.

2. The floating array can now be hauled ashore either by pulling straight out or by pulling in the off shore cable.

Array Disassembly Procedure, See Figure 1A, 1B and Figure 3

1. With the array on a reasonably level area remove the end cap by unscrewing the two 3/8 inch bolts.

2. Untighten (screw in) the handwheel inside the on shore cap. This will loosen the tension cable and allow removal of the pin on the off shore end plate.

3. Remove the end plate.

4. Drive a stake through the 2 inch on shore cap hole into the ground. Also drive a second stake into the ground about 10 feet from the opposite end of the array.

5. Attach the "Y" cable to the off shore cap, see Figure 3. Install come-along between stake and "Y" cable.

6. Remove through bolt of first section to be disassembled (any order is OK).

7. Pull apart with come-along.

8. Install 2 eye short cable between sections pulled apart. See Figure 3.

9. Remove next through bolt and pull apart next section.

10. Continue process until all sections are pulled apart.

General Caution Notes

1. Before placing array in water inspect check valve operation.

2. Cable must be tensioned before array deployment.

3. Do not turn array votex fins into current in currents over 4 feet per second. Excessive load may damage array.

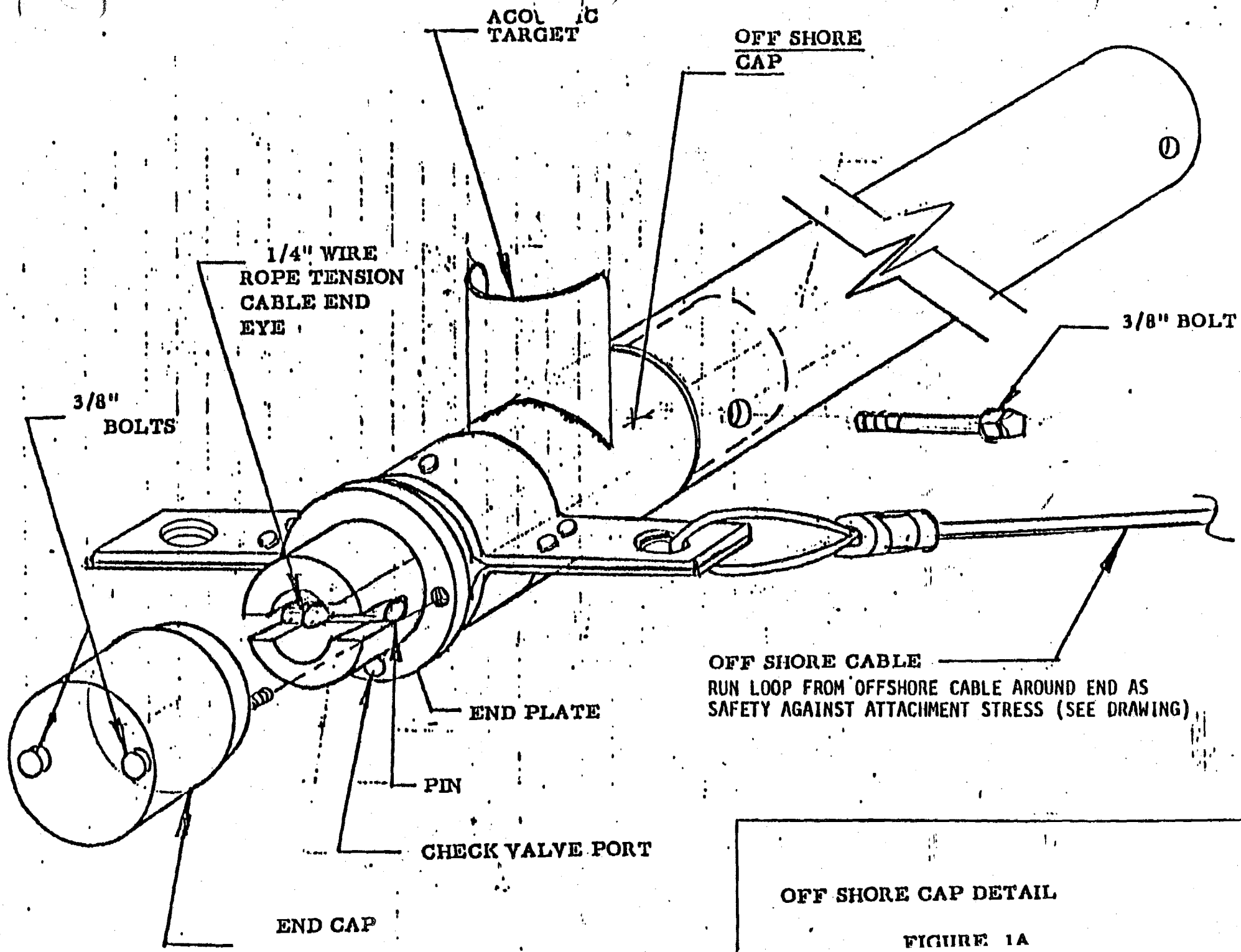
4. Installation of a cable around the on shore cap to a stake upstream on shore may be useful in a fast current river.

5. If corrosion prevents loosening of cable tension wheel on assembled array, the off shore cap pin may be driven out, after removal of the cap, thus releasing cable tension.

6. Handle exposed section ends with reasonable care to avoid nicks or tube distortion.

7. Be sure 1/2 inch diameter carrage bolt in coupling sections are tightened to 45 ft. lbs. in order to eliminate coupling to tube clearance thus preventing array sag. Never exceed 50 ft. lbs.

8. Transducer. The transducer, although reasonably rugged would be destroyed if dropped on a rock. Before use, the radiating polyurethane face should be washed with a detergent, preferably liquid detergent with the liquid left on the face. This cleans off finger oils. Any oil or grease will completely block the high frequency output and make the transducer inoperative. In some rivers, a buildup of various forms of "crud" may develop on the transducer face after a week or two, so a quantity of liquid detergent should be placed in the hand and the hand quickly put under water to rub the face of the transducer. This should be done whenever too much buildup of "junk" is felt or seen on the transducer face. A moderate amount of detritus will not affect normal operation.



OFF SHORE CAP DETAIL

FIGURE 1A

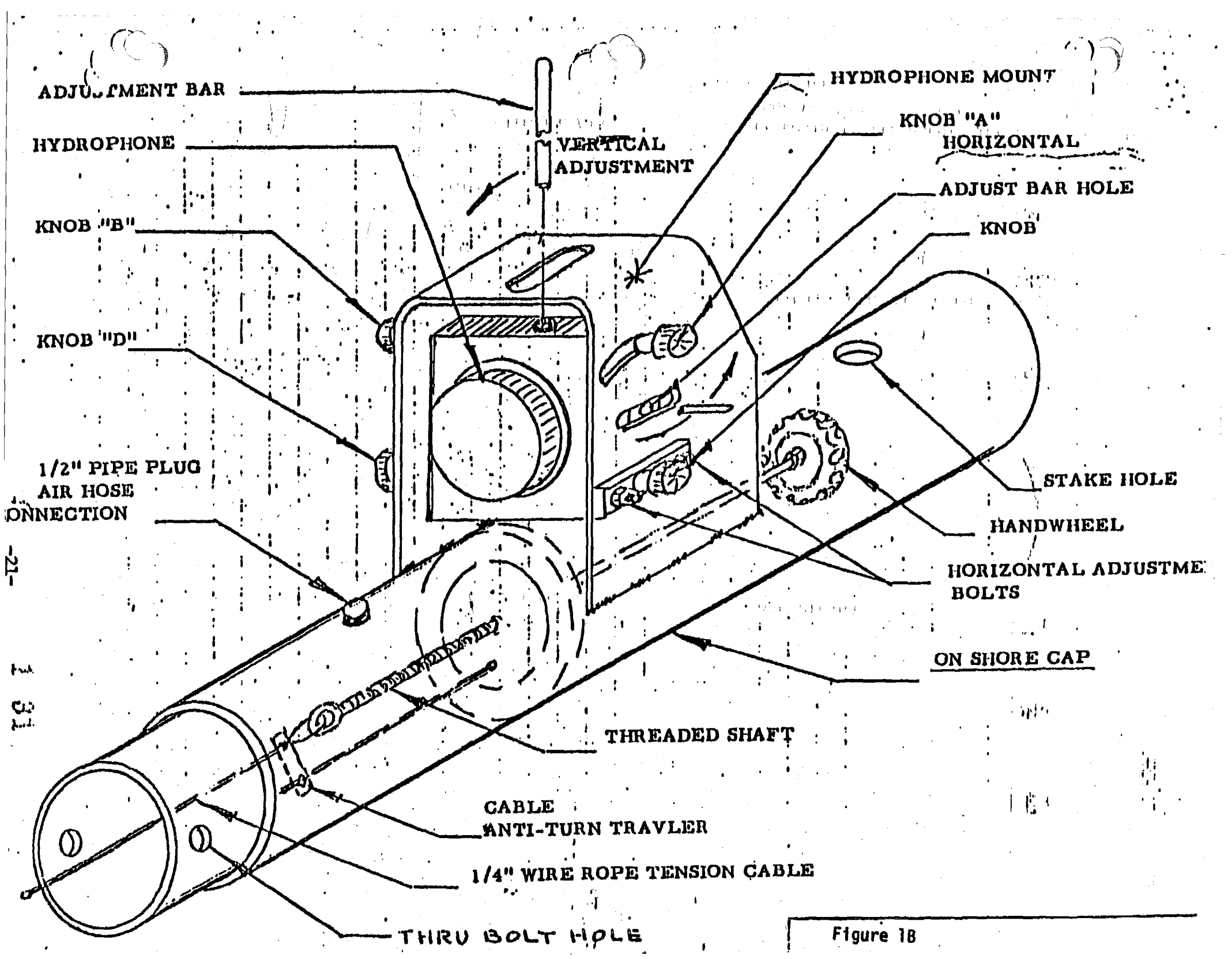
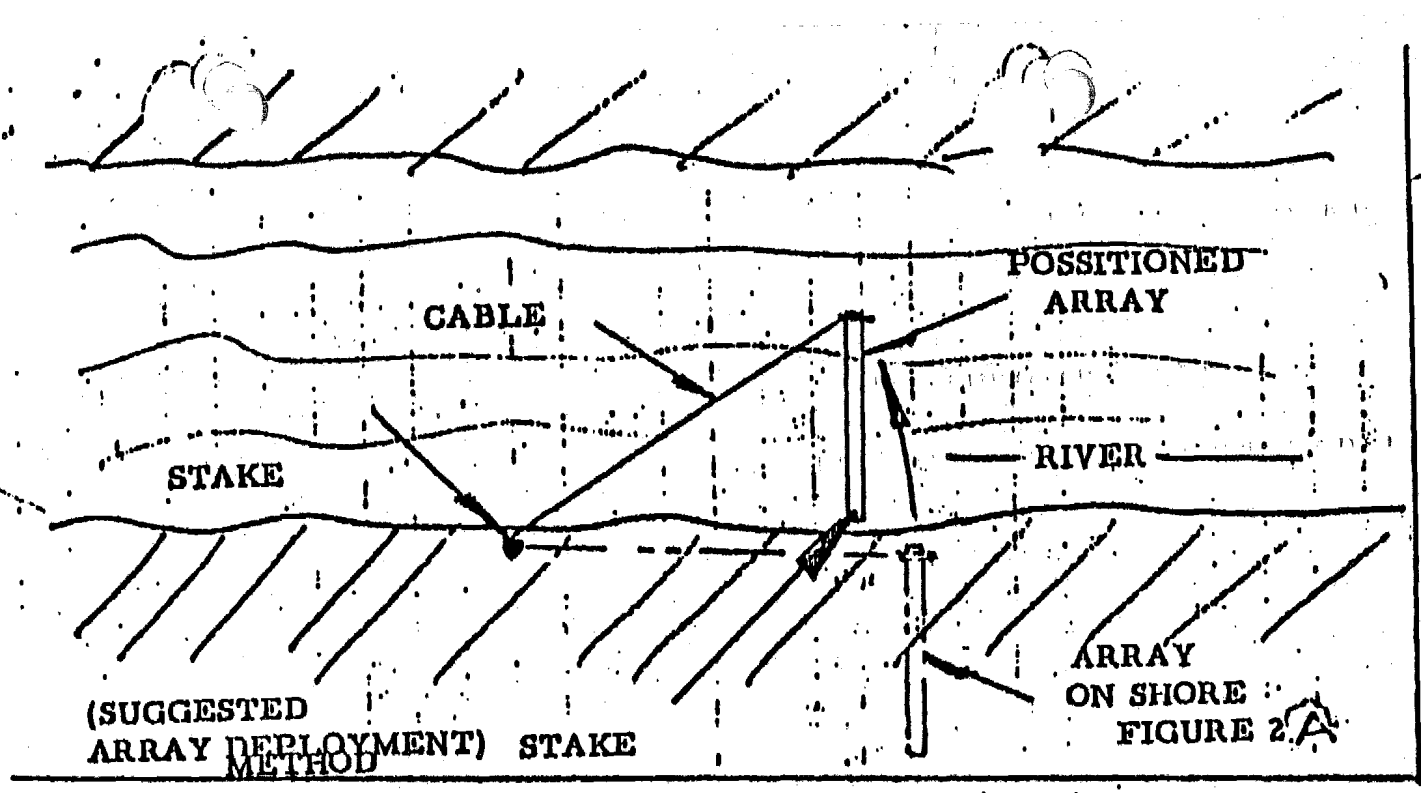
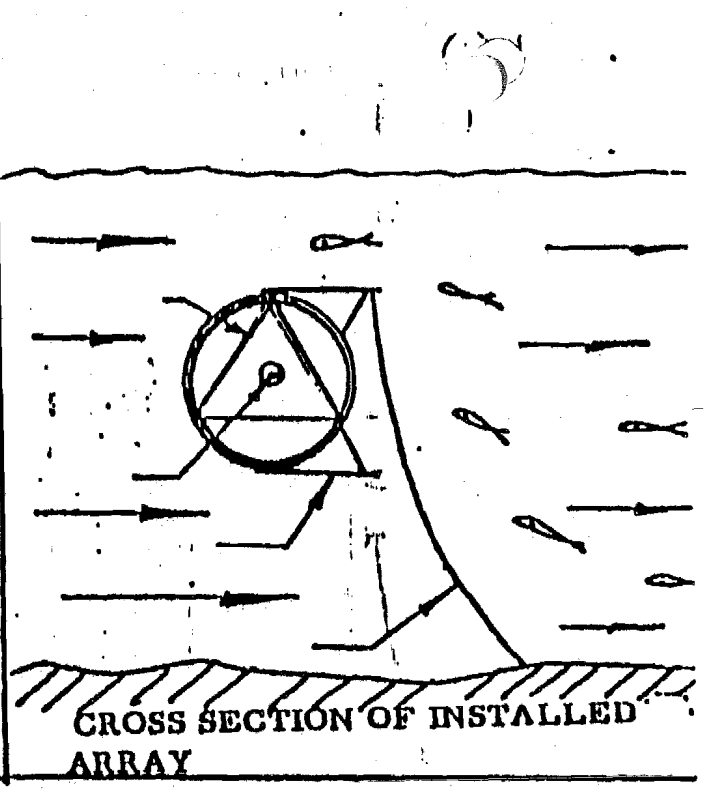

ADJUSTMENT BAR
HYDROPHONE
KNOB "B"
KNOB "D"
1/2" PIPE PLUG
AIR HOSE
ONNECTION
VERTICAL
ADJUSTMENT
HYDROPHONE MOUNT
KNOB "A"
HORIZONTAL
ADJUST BAR HOLE
KNOB
STAKE HOLE
HANDWHEEL
HORIZONTAL ADJUSTME
BOLTS
ON SHORE CAP
THREADED SHAFT
CABLE
ANTI-TURN TRAVLER
1/4" WIRE ROPE TENSION CABLE
THRU BOLT HOLE

Figure 18

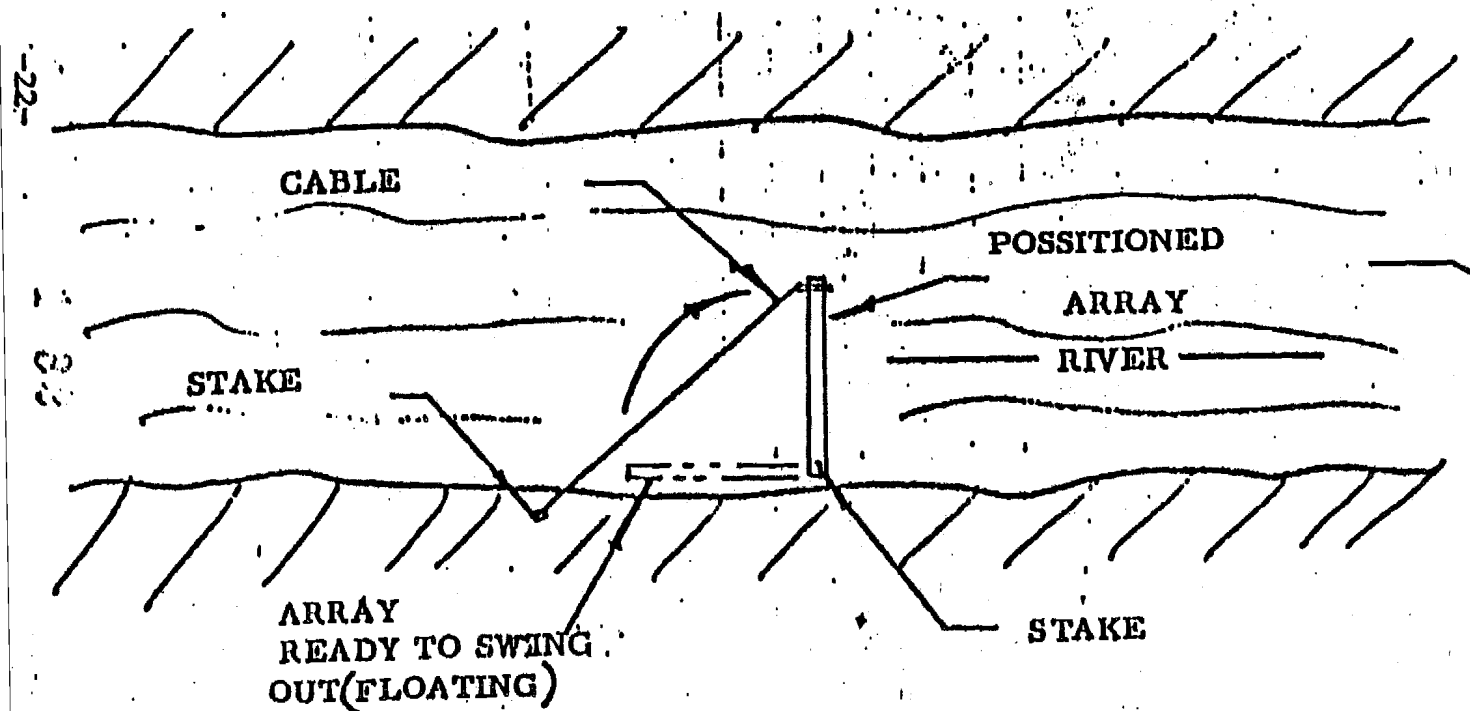


(SUGGESTED ARRAY DEPLOYMENT METHOD)

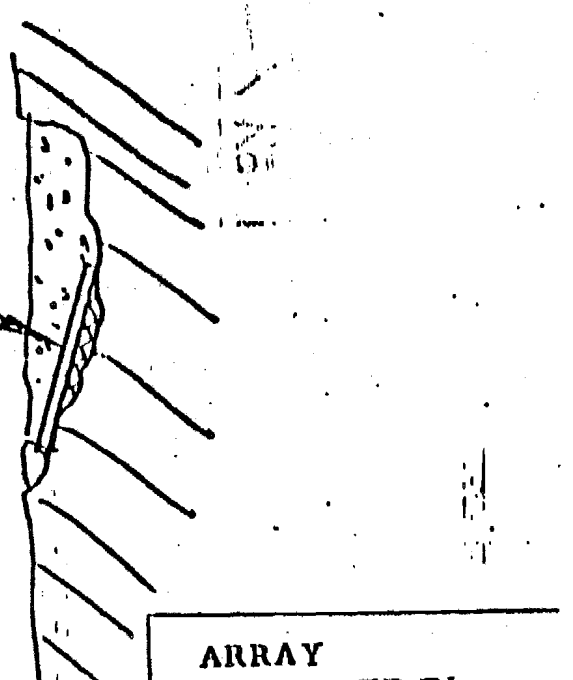
FIGURE 2A



CROSS SECTION OF INSTALLED ARRAY

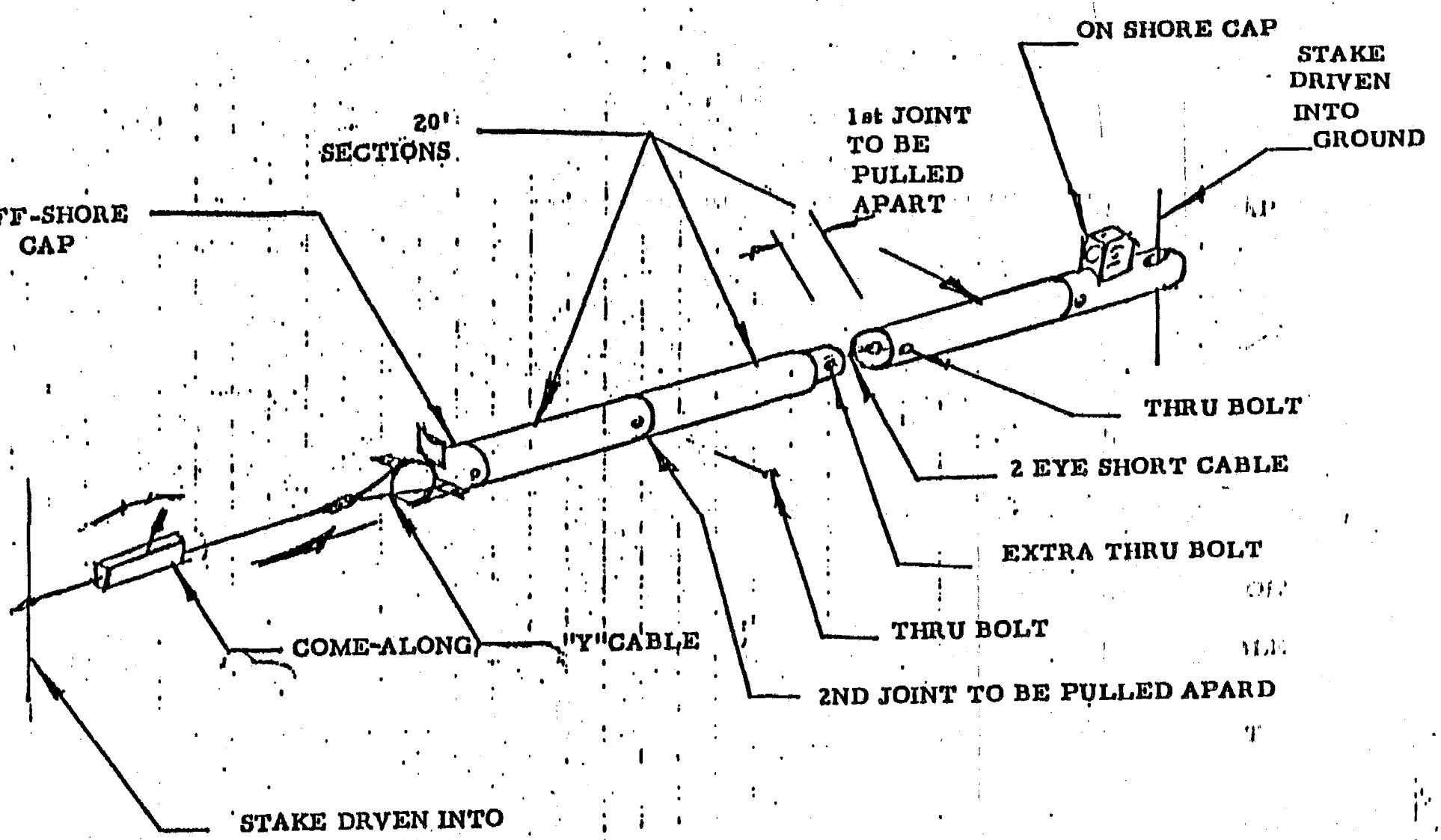


ALTERNATE ARRAY DEPLOYMENT METHOD
(SLOW CURRENT STREAMS)

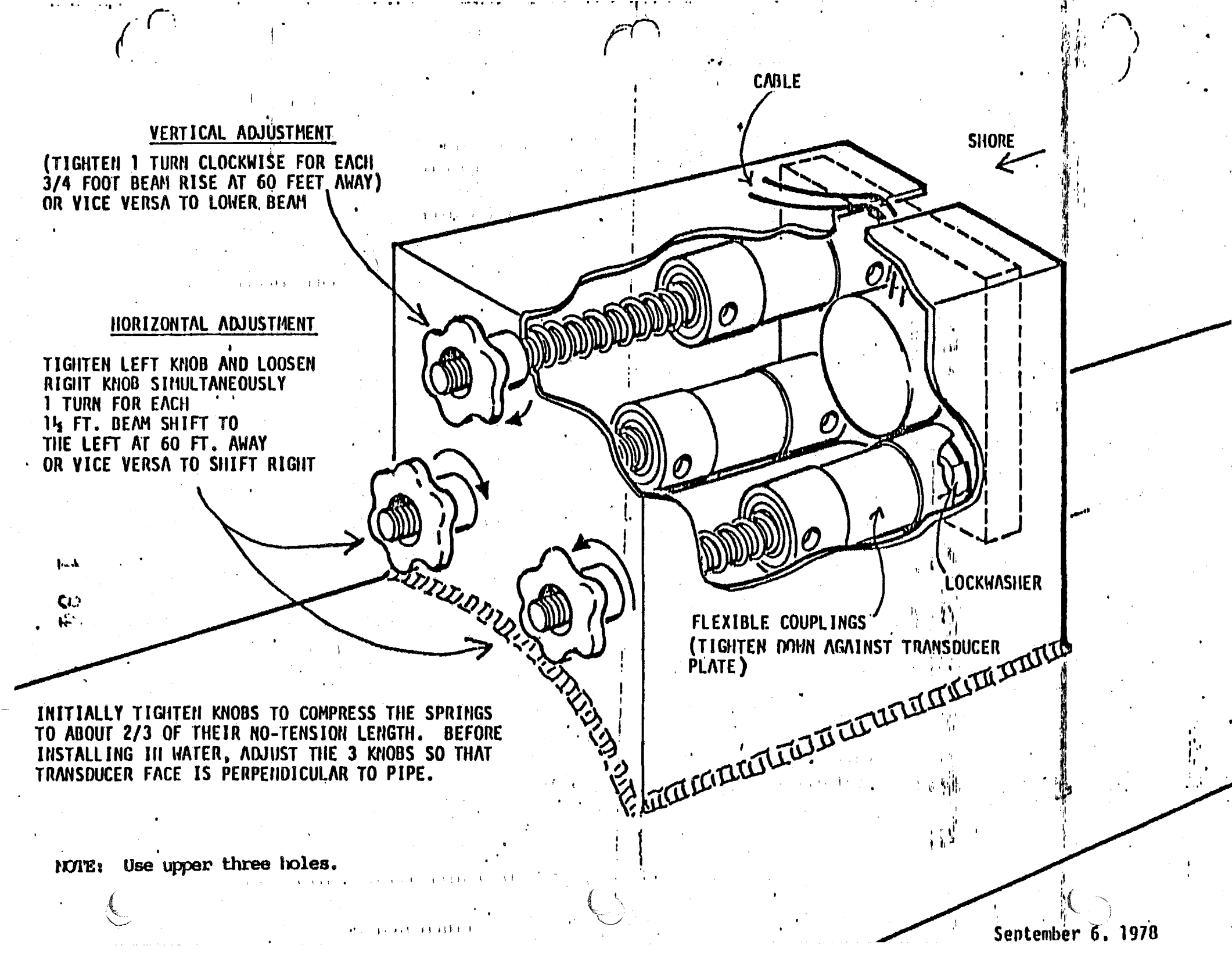


ARRAY INSTALLED IN RIVER

Figure 2



ARRAY DISASSEMBLY



September 6, 1978

APPENDIX II

A. ADULT ANADROMOUS FISHERIES STUDIES

Oscilloscope Operation

July 16, 1979

A. Menin

OSCILLOSCOPE OPERATION

for the

SIDE SCANNER

This manual describes how to use the oscilloscope in conjunction with the side scanner. Although it is specificially written around the Tektronix model 323 "scope", the same basic rules apply to virtually any model scope except for the location of controls.

THEORY OF SCOPE OPERATION

The scope is basically a time variable voltmeter. A bright dot moves across the screen at a constant rate from left to right. The speed at which it moves is determined by the TIME/DIV control setting on the scope. At most settings, the dot moves so quickly that it looks like a continuous horizontal line to the human eye.

The VERTICAL INPUT of the scope (on the left side of scope) is the same as the + & - input leads on a voltmeter except that a voltage connected to VERTICAL INPUT scope connector will cause an upward vertical deflection of the moving dot of light proportional to the amount of voltage at the input at the point in time that the moving dot happens to be when that voltage is connected. For example, if there is no voltage on the scope input for the first half of the trace, you will see a straight line. If a + voltage is then applied during the middle of the trace (or sweep as it is usually called), the bright dot will go vertically up to the corresponding place on the scope's face as determined by the VOLTS/DIV setting of the scope. Example: With a 2V/DIV setting, the dot would rise three divisions at the precise instant in time that you connected the + of a 6V battery to the scope's VERTICAL INPUT with the - of the battery connected to the scope ground.

TRIGGERING

The bright dot on the screen requires an electrical voltage on the TRIGGER INPUT of the scope (on the left side of scope) to start the dot moving at the

rate (or speed) set by the TIME/DIV control on the scope's front panel. This trigger is required for each "sweep" of the dot. At the instant in time that a voltage is applied to the TRIGGER INPUT of the scope, the dot will start moving from left to right. This provides synchronization of what you see on the screen with the side scanner. In the case of the side scanner, the TRIGGER INPUT will be connected to either XM2°, XM4° (or XM ALT. in the latest version of the side scanner). Each time the side scanner transmits a "burst of sound", the transmitted voltage momentarily appears on the XM pin connector of the side scanner. At this instant in time, this voltage causes the dot to start moving from left to right. Since you will have the TIME/DIV set to 2 ms (MILLISECONDS) for proper operation with the side scanner, this dot is now moving across the screen at the rate of 2 milliseconds (2 thousanths of a second) per division. This of course is too fast for the human eye to follow so it looks like a straight line to the eye. Since sound travels (in water) at about 5000 feet per second which equals 5 feet per milliseconds (1 thousanth of a second), when the scope's VERTICAL INPUT is connected to the RCVR (receiver) pin connector of the side scanner, an echo (a vertical line) from a fish (or other object) 25 feet away from the transducer would be seen as a vertical line at 5 divisions from the left of the start of the sweep of the bright dot. This is because it took 5 milliseconds for the sound to travel the 25 feet to the "fish" and another 5 milliseconds for the "echo" from the fish to return to the transducer for a total of 10 milliseconds round trip travel time. Since the scope is set to 2 milliseconds per division, 10 milliseconds would be 5 divisions.

To see the metal target at the end of the pipe which is about 59 feet away from the transducer, you should expect to see this target 23.6 milliseconds from the face of the transducer (the start of the sweep) because at 5 feet per

millisecond travel time, it will take 11.8 milliseconds for the sound to hit the metal target and another 11.8 milliseconds for the "echo" to return to the transducer or a round trip travel time of 11.8 + 11.8 = 23.6 milliseconds. Since the TIME/DIVISION of the scope is set to 2 Msec/DIVISION, that would be just beyond the 10 divisions on the scope screen and would not be seen, so a fine variable adjustment knob located in the center of the TIME/DIV coarse control should be rotated a little counter clockwise so that the echo from the metal target can be seen on the scope's face. Rotating this small control counterclockwise increases the time per division to some amount greater than the 2 milliseconds per division that the coarse control was set to.

SCOPE CONTROLS AND THEIR FUNCTIONS

1. POWER SWITCH-ON (see fig. 1) - CAUTION: Be sure to shut off power when scope is not being used since it draws much more power than the side scanner and would rapidly discharge the battery.

2. POWER SOURCE SELECT SWITCH (see fig. 2) - This is a small slide switch on the rear of the scope and should be pushed down to the EXT DC position which means that the scope is being powered by an external 12V from the side scanner.

3. VOLTS/DIV. ROTARY CONTROL (see fig. 1) - This switch may be set as desired for viewing the side scanner RCVR output. It should be set to either 1V or 2V. If it is set to 1V per division you may want to rotate the small "fine control" center knob inside the coarse control VOLTS/DIV to reduce the height of the vertical lines or fish echos to about 1 inch.

4. POSITION CONTROLS (see fig. 1) - These 2 controls merely affect the horizontal and vertical position of the scope display. You may want to set the vertical position control so that the horizontal trace of the scope is a little above the bottom of the screen and the first vertical line on the left

is about 1/4 inch inside of the screen. (This corresponds to the transmitted burst of sound or the transducer position).

5. INPUT LEVER SWITCH (see fig. 1) - This should be down (in the DC position).

6. TRIGGER LEVER SWITCH (see fig. 1) - This important switch should be in one of the 2 bottom external trigger positions, either AC or DC. This switch is located on the right side of the model 323 scope.

7. TRIGGER KNOB (see fig. 1) - This is probably the most important (and most often mis-set control). Its function is to assure that the start of the sweep of the scope picture exactly coincides with the instant the side scanner transmits its burst of sound. This will cause the transmit burst vertical line to be at the start of the sweep (the extreme left side of the trace). If this knob is rotated completely clockwise or completely counterclockwise, the scope trace will "free run", that is to say, it will never be synchronized with the transmit burst and therefore the transmit burst vertical line on the scope's face may occur anywhere along the scope sweep.

8. TIME/DIV. ROTARY CONTROL (see fig. 1) - This controls the speed at which the bright dot crosses the screen. For use with the side scanner, it should be set to the 2 Ms (MILLISECONDS) position.

9. ATTEN. SLIDE SWITCH (see fig. 1) - This switch is located on the left side of the scope. Although it can be operated in either position, stable triggering is a little easier to adjust if this slide switch is in the 10X position.

10. FOCUS AND INTENSITY (see fig. 1) - These two controls are located on top of the scope.

The intensity control should be rotated fully clockwise for maximum brightness of the trace. After adjusting the brightness, rotate the focus control for the sharpest vertical lines.

At night you may want to decrease the brightness. If you do, refocus the FOCUS control.

OSCILLOSCOPE CONNECTIONS TO SIDE SCANNER

1. EXT. D.C. POWER (see fig. 2) - This twin connection is located on the right side of scope. This should be connected to the mating connector labeled "SCOPE" on the right side of the side scanner. CAUTION: This is the 12 volt power connection to the scope and does not have reverse polarity protection. If these leads are reversed, the scope will burn out instantly.

2. EXT TRIG. (see fig. 1) - This connector is located on the left side of scope. It should be connected to either the 2° or 4° (or ALT. in 1980 model side scanner). This is to provide triggering of the scope from the side scanner. Use either one of the supplied connector cables. The black pin on the connector cable is ground and may be connected to the gnd. pin of the side scanner or left disconnected if you like, since the scope will be grounded anyway through the power connector.

3. VERT. INPUT (see fig. 1) - This connector is also located on the left side of the scope. It should be connected to the RCVR connector on the face of the side scanner using the supplied connector cord which is identical to the ext. trig. cord. The black pin is ground and need not be connected to the side scanner ground since the scope is already grounded through the 12V power cord.

This is the vertical input to the scope and causes the bright moving dot of the scope to go up vertically when a voltage is present on the RCVR output of the side scanner as it would be when a fish echo is present.

OSCILLOSCOPE ADJUSTMENTS

1. After all three connectors are in place (trigger, vertical input and external 12V power) turn on the scope power.

2. Turn the brightness control fully clockwise.

3. Place the rear slide switch in the down (ext DC) position (Fig. 2).

4. Place the ext. trig. switch on the left side of scope to the 10X position.

5. Place the input lever switch on the scope face to the DC position (down).

6. Place the trigger lever switch (on the right side of scope face) down, to the EXT TRIG DC position.

7. Set the TIME/DIV rotary switch to 2 ms.

8. Rotate the small center knob inside the TIME/DIV switch about 1/3 of a revolution counterclockwise from its fully clockwise (detent) position.

9. Set the VOLTS/DIV rotary switch to 1 volt.

10. Rotate the small center knob inside the VOLTS/DIV switch about 1/3 of a revolution counterclockwise from its fully clockwise (detent) position.

11. Push in the 2 POSITION controls located on the bottom center of the scope face. These 2 rotary controls are also push-pull switches and should always be pushed in.

12. Rotate the trigger knob on the lower right side of scope face fully counterclockwise to its detent position. This will cause the scope to operate even without an external trigger so that you can adjust the two position controls.

13. Rotate the vertical position knob on the bottom center of the scope until the trace on the screen is about 1 division from the bottom of the screen.

14. Rotate the horizontal position control on the lower center of the scope face until the trace starts about one division from the left side of the scope screen.

The scope is now ready for final trigger adjustments.

15. Put the side scanner beamwidth switch in the 2° position and connect the EXT TRIG. cable to the XM2° pin connector on the face of the scope. Rotate the TRIGGER knob on the right side of scope face to about the 10 o'clock position. Somewhere near this point, the scope should be triggering properly as evidenced by a stable vertical "spike" being seen on the extreme left (the beginning) of the scope trace. Now place the beamwidth switch on the side scanner to the Alternate position. The scope trace should look the same as it did in the 2° position meaning that you are still triggering only on 2°. If it looks different or seems to speed up or get brighter that means you are slightly misadjusted. If so, rotate the TRIGGER knob a bit until the scope picture does not change as you switch between the 2° to the ALT positions on the side scanners beamwidth switch.

Now put the EXT TRIG connector cord in the XM4° connector (or the XM ALT. on the 1980 model). When the side scanner beamwidth switch is in the ALT position the trace on the scope should now be triggering twice as fast (brighter) as in the 2° position since now you are alternately triggering the scope twice as fast as you were. You are causing the scope to alternately trigger on 2°, 4°, 2°, 4° etc. If you now move the EXT TRIG. cable connector back to the XM2° connector you will see a change in the trace since it will only be triggering on the 2° beam (half as often).

You should now see a stable vertical spike, about 1 inch high on the left side of the trace and you should see the metal target echo (about 1 inch high) near the right side of the trace if you increase the COUNTING RANGE control on the side scanner to beyond 60 feet. To operate the side scanner normally, you should now reduce the COUNTING RANGE control slowly until it just ceases to count the target (on sector 12) and then reduce it about one foot more for safety.

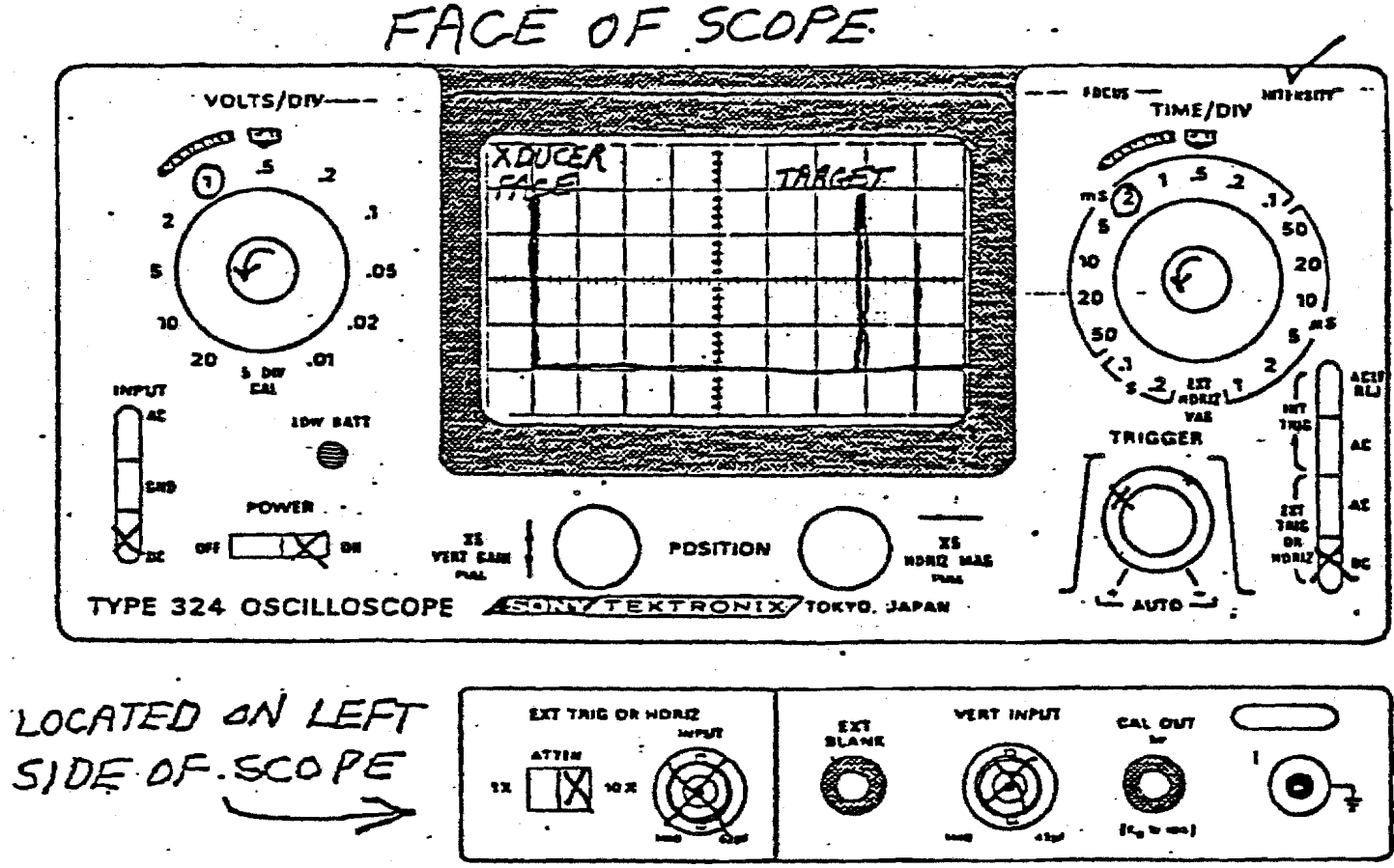


Figure II-1. Oscilloscope controls. Sony Tektronix type 324 oscilloscope.

FIG, 1 R 10

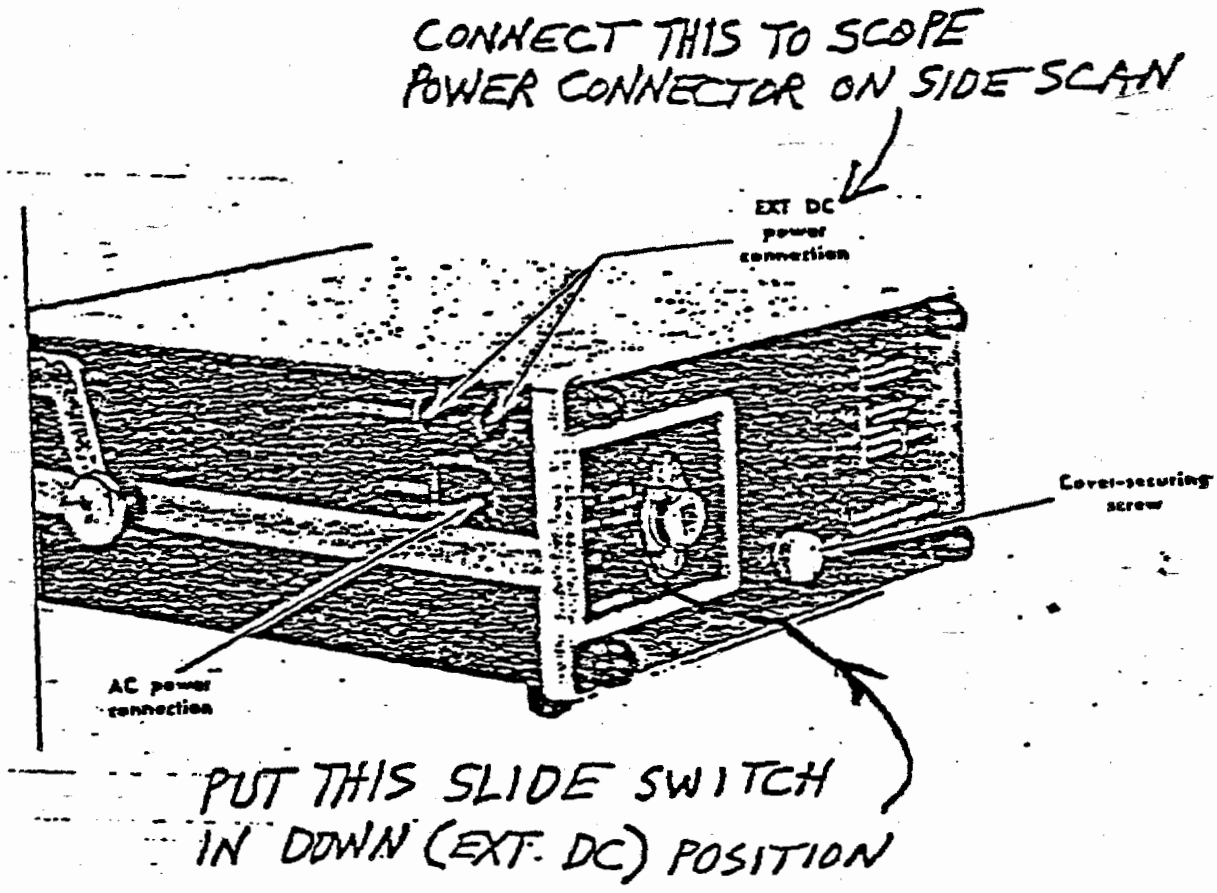


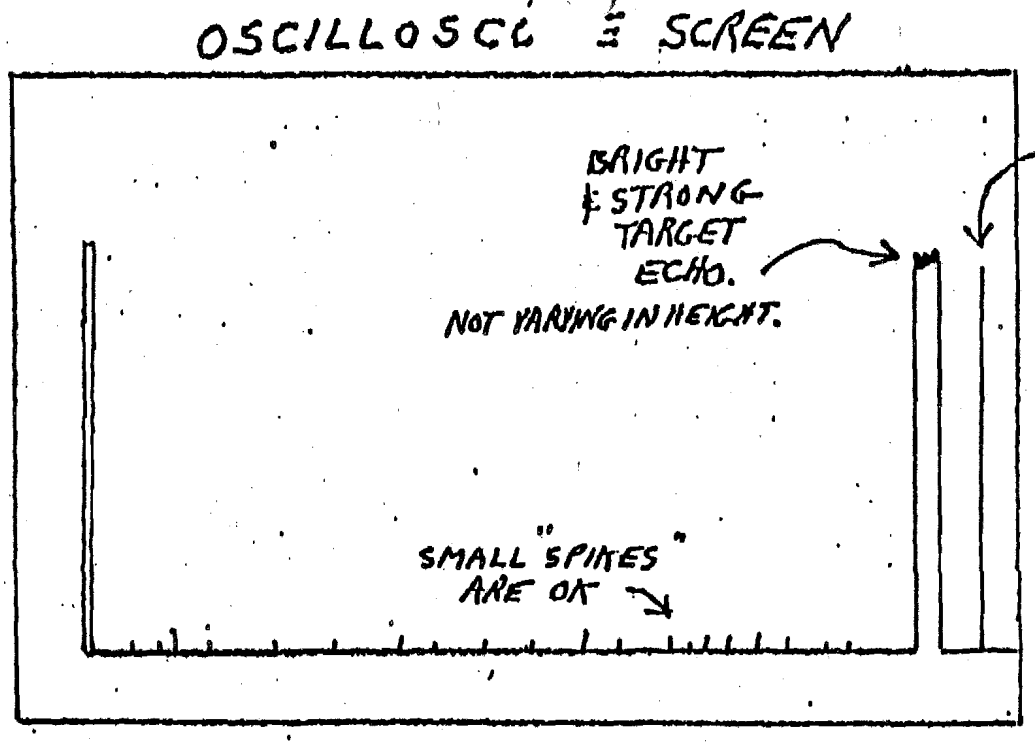
Figure II-2. Oscilloscope adjustments. Sony Tektronix type 324 oscilloscope.

FIG 2.

Table II-1. TYPICAL SIDE SCANNER OSCILLOSCOPE WAVEFORMS FOR VARIOUS TRANSDUCER AIMING CONDITIONS

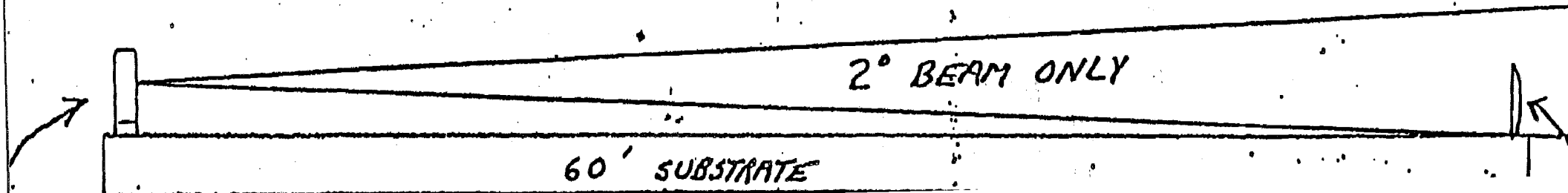
FIGURE #	CONDITION
II-3.	PROPER VERTICAL AIMING. 2°
II-4.	PROPER VERTICAL AIMING. ALT. BUT SCOPE TRIG. ON 4°
II-5.	PROPER VERTICAL AIMING. ALT. BUT SCOPE TRIG. ON 2°
II-6.	IMPROPER VERTICAL AIMING. (AIMED TOO LOW)
II-7.	IMPROPER VERTICAL AIMING. (AIMED TOO HIGH). 2°
II-8.	IMPROPER VERTICAL AIMING. (AIMED TOO HIGH). 4°
II-9.	IMPROPER HORIZONTAL AIMING. (AIMED TOO FAR DOWNSTREAM)
II-10.	PROPER HORIZONTAL AIMING.
II-11.	IMPROPER VERTICAL AIMING. (TOO LOW AND BOUNCING OFF SUBSTRATE
II-12.	ECHOS FROM BOAT WAKE
II-13.	IMPROPER VERTICAL AIMING IN SHALLOW WATER

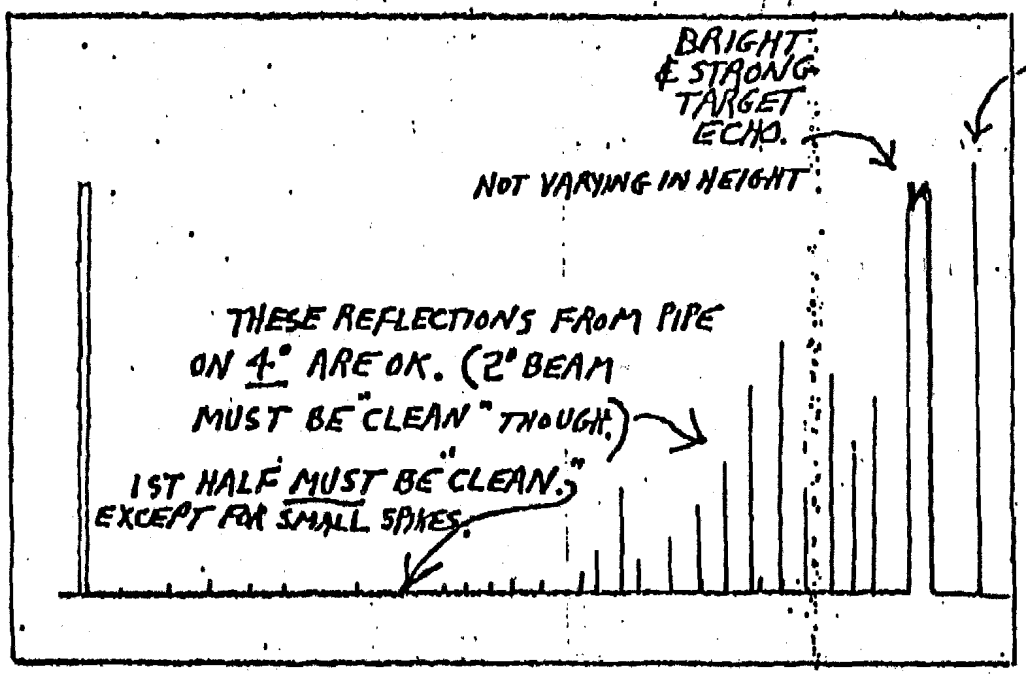
FIG.



RANGE CONTROL ON SIDE SCANNER SET TO JUST BEYON TARGET. (SECT 12 WILL COUN

Figure II-3. PROPERLY AIMED TRANSDUCER WHEN BEAMWIDTH SWITCH IS SET TO 2° AND SCOPE TRIGGERED FROM XM 2°





RANGE CONTROL ON SIDE SCANNER SET TO JUST BEYOND TARGET. (SECT. 12 WILL COUNT.)

Figure II-4.

PROPERLY AIMED TRANSDUCER WHEN BEAMWIDTH SWITCH IS SET TO ALTERNATE & SCOPE IS TRIGGERED FROM XM 4°. NOTE 4° BEAM IS SKIMMING SURFACE OF SUBSTRATE BEYOND THE 50% POINT ON SUBSTRATE THUS CAUSING REFLECTIONS FROM IMPERFECTIONS ON SUBSTRATE SURFACE. THIS IS OK, SINCE THE 4° BEAM WILL NOT COUNT ANY ECHOS BEYOND THE 50% POINT.

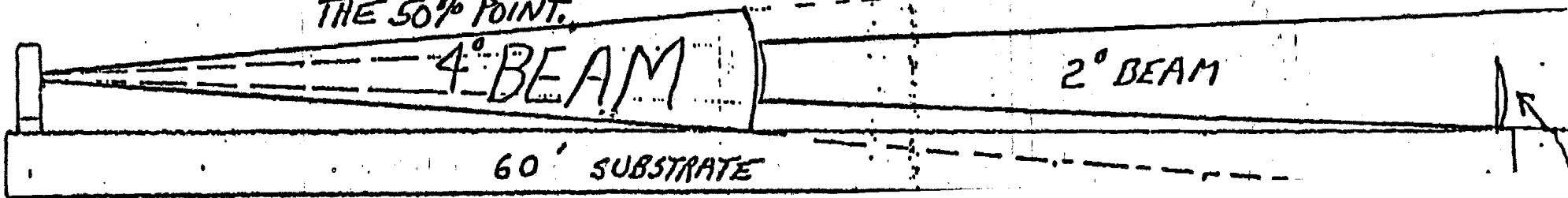


FIG 3.

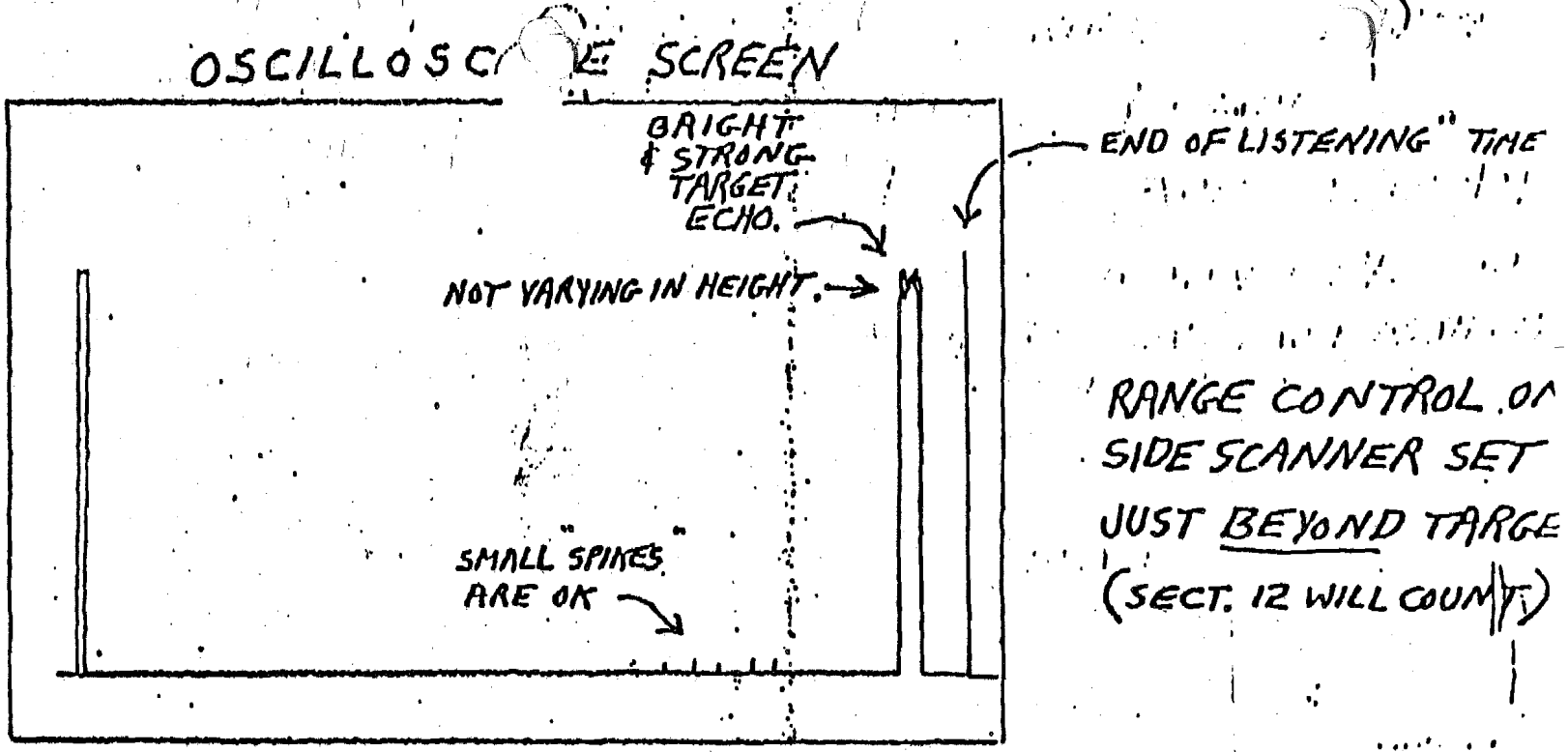
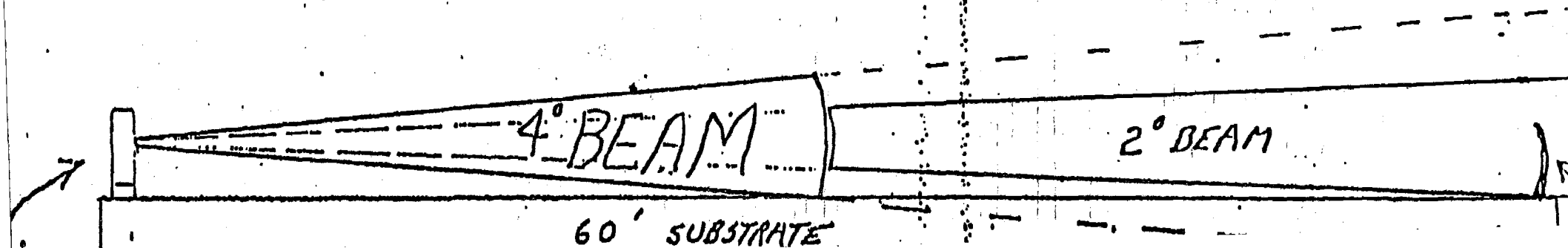
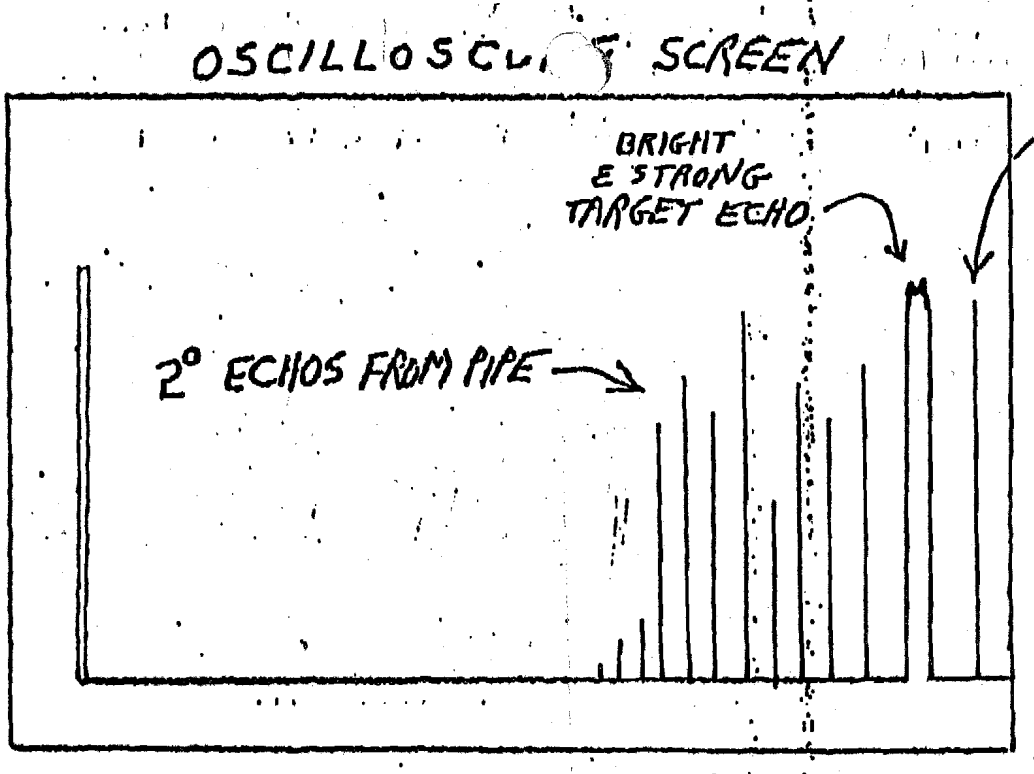


Figure II-5.

PROPERLY AIMED TRANSDUCER WHEN BEAMWIDTH SWITCH IS SET TO ALTERNATE BUT SCOPE TRIGGERED FROM XM 2°





RANGE CONTROL SIDE SCANNER SET JUST BEYOND TARGE

(SECTS. 9, 10, 11 & 12 WILL C

Figure II-6. IMPROPERLY AIMED TRANSDUCER WHEN BEAMWIDTH SWITCH IS SET TO 2° & SCOPE IS TRIGGERED FROM XM 2°. NOTE THAT BEAM IS AIMED TOO LOW, CAUSING ECHOS TO BE RETURNED FROM LAST 1/3 OF SUBSTRATE IMPERFECTIONS EVEN THOUGH TARGET ECHO IS STRONG & DOESN'T VARY IN HEIGHT

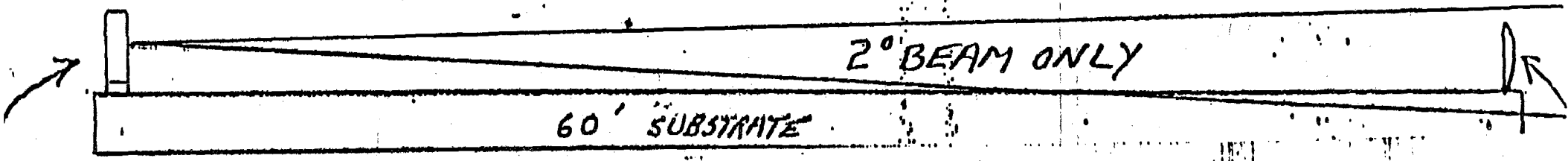


FIG.

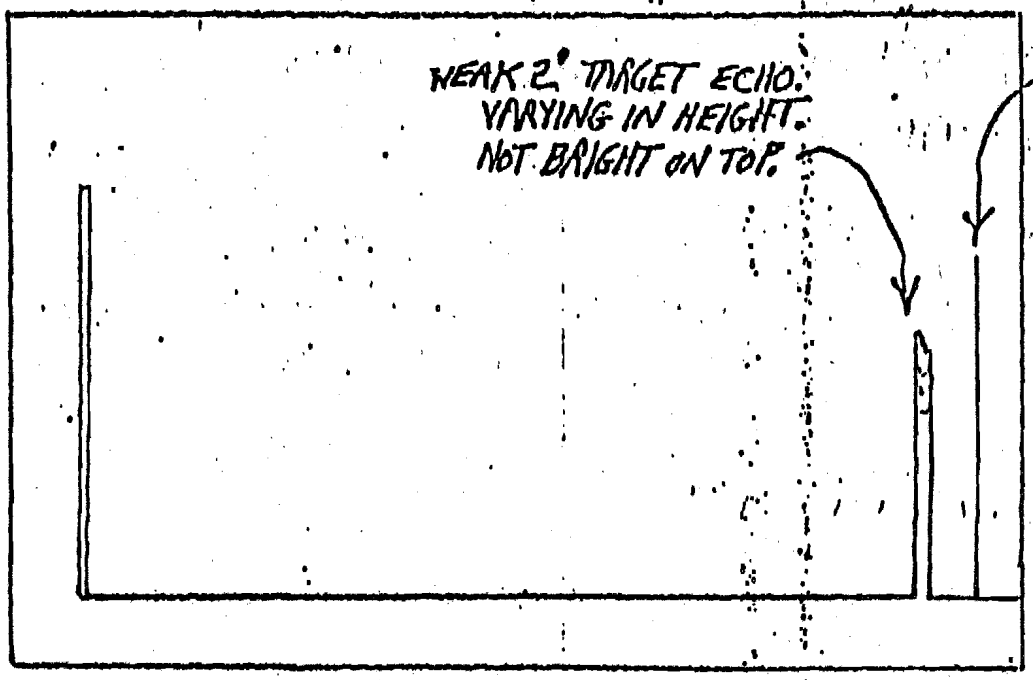
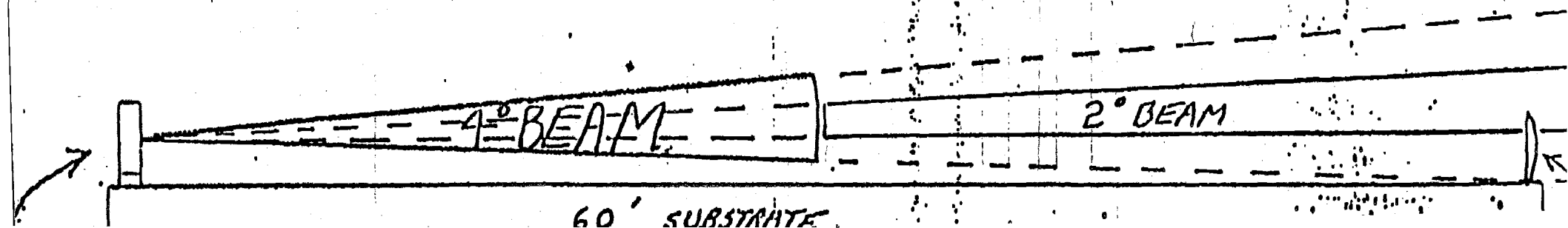


Figure II-7.

IMPROPERLY AIMED TRANSDUCER. BEAMWIDTH SWITCH IS SET TO A
& SCOPE IS TRIGGERRED FROM XM 2°. NOTE THAT BEAM IS AIMED TOO HIGH,
JUST BARELY CATCHING TARGET IN 2° BEAM ALTHOUGH 4° BEAM DOES
HIT TARGET. (SEE FIG. 6.) LOW PASSING FISH MAY BE MISSED.



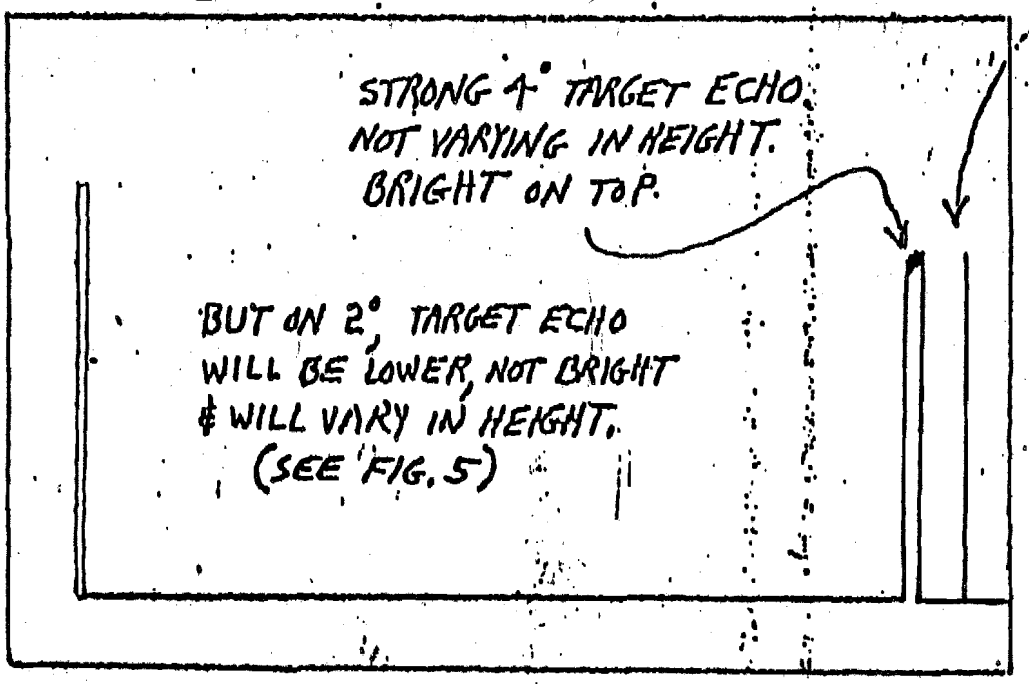


Figure II-8. IMPROPERLY AIMED TRANSDUCER. BEAMWIDTH SWITCH IS SET TO ALT. (OR 4°). SCOPE IS TRIGGERED FROM XM 4°. NOTE THAT BEAM IS AIMED TOO HIGH. ALTHOUGH THE 4° BEAM SOLIDLY HITS THE TARGET, THE 2° BEAM JUST BARE HITS TARGET (SEE FIG. 5 FOR 2° SCOPE WAVEFORM). FISH MAY BE MISSED.

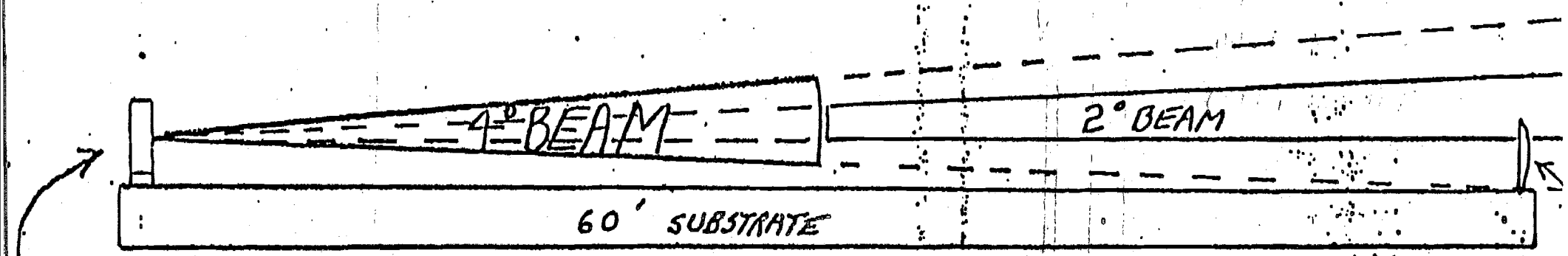


FIG 3

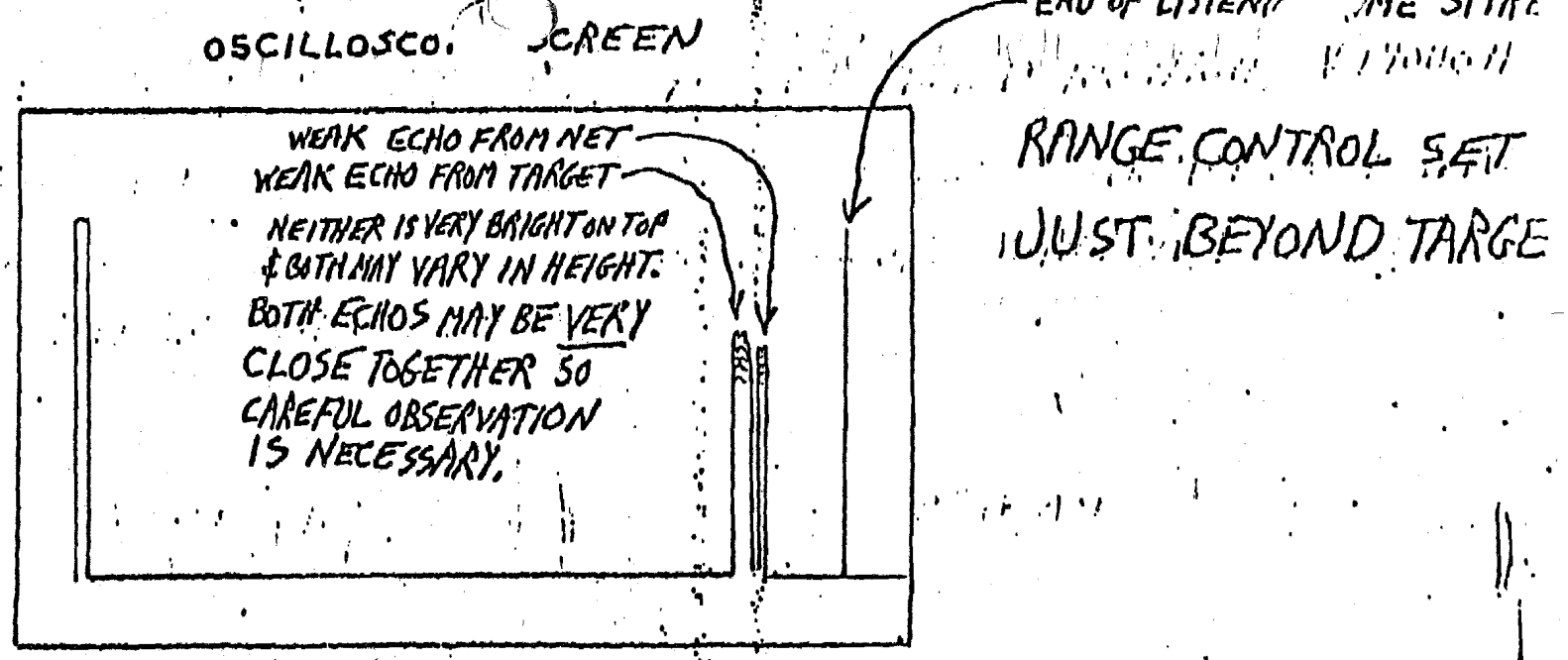


Figure II-9. IMPROPERLY AIMED TRANSDUCER. BEAMWIDTH SWITCH IS SET TO 2° & SCOPE IS TRIGGERRED FROM 2°. TRANSDUCER IS AIMED TOO FAR DOWNSTREAM, JUST BARELY HITTING TARGET. THIS WILL CAUSE AN OVERCOUNT ON SALMON IN THE LAST HALF OF SUBSTRATE BECAUSE SALMON TEND TO LINGER DOWNSTREAM OF PIPE BEFORE CROSSING. IF SALMON TEND TO OVERCOUNT NEAR END OF SUBSTRATE, THIS MAY BE THE PROBLEM. REAIMING THE TRANSDUCER MORE UPSTREAM WILL CURE THE PROBLEM.

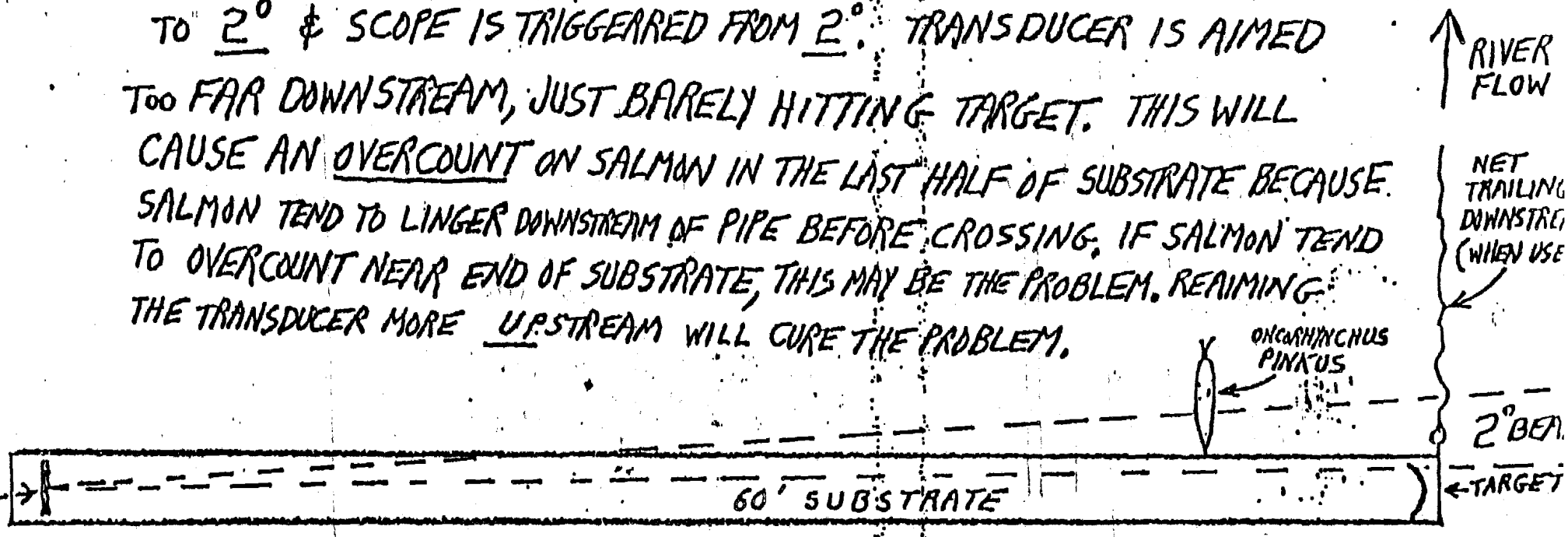
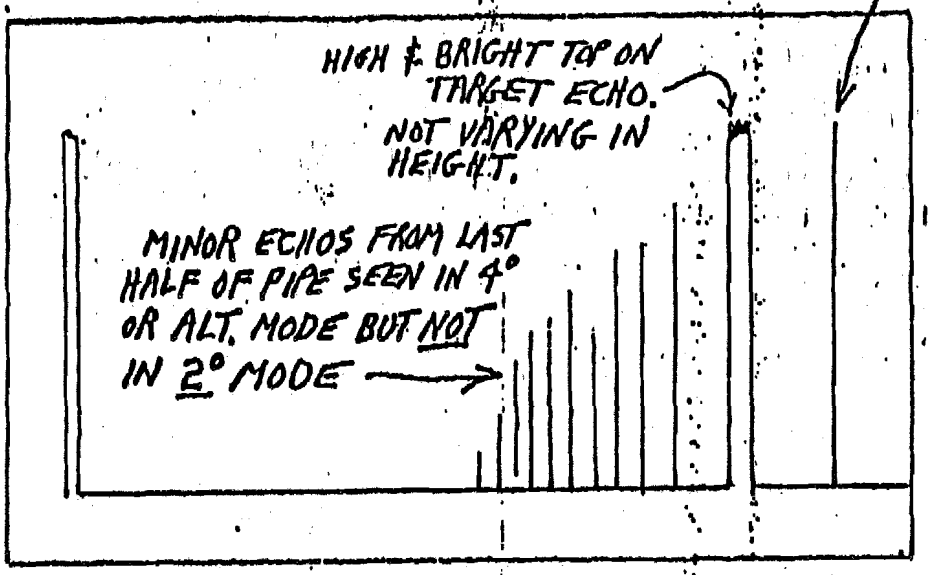


FIG (5)



RANGE CONTROL SET JUST BEYOND TARGE

(SECT. 12' ONLY WILL COUNT.)

Figure II-10. PROPERLY AIMED TRANSDUCER.

TRANSDUCER BEAMWIDTH SWITCH IS SET TO ALT.
SCOPE IS TRIGGERRED FROM XM 4°

(ASSUMING VERTICAL AIMING OF TRANSDUCER IS CORRECT.)

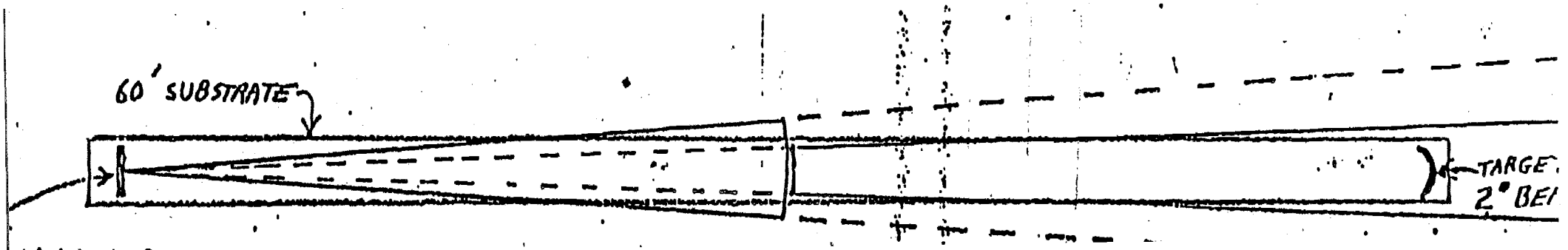
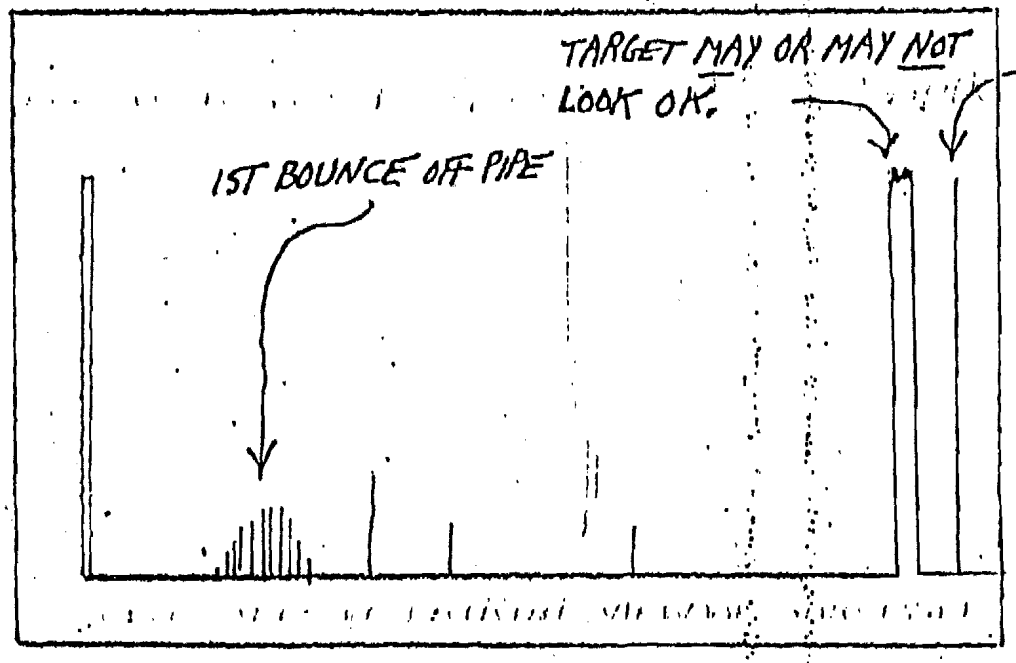


FIG. 9

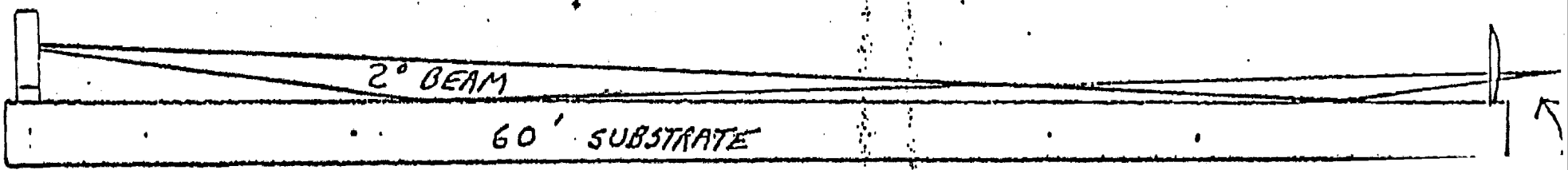


RANGE CONTROL SE
TO JUST BEYOND TARG

(VARIOUS SECTS. MAY COUNT.

Figure II-11. IMPROPER TRANSDUCER AIMING.

BEAMWIDTH SWITCH SET TO 2° & SCOPE TRIGGER TO XM 2°. TRANSDUCER IS AIMED MUCH TOO LOW & BEAM IS BOUNCING OFF PIPE NEAR TRANSDUCER, THEN HITS TARGET & RETURNS BY SAME PATH.



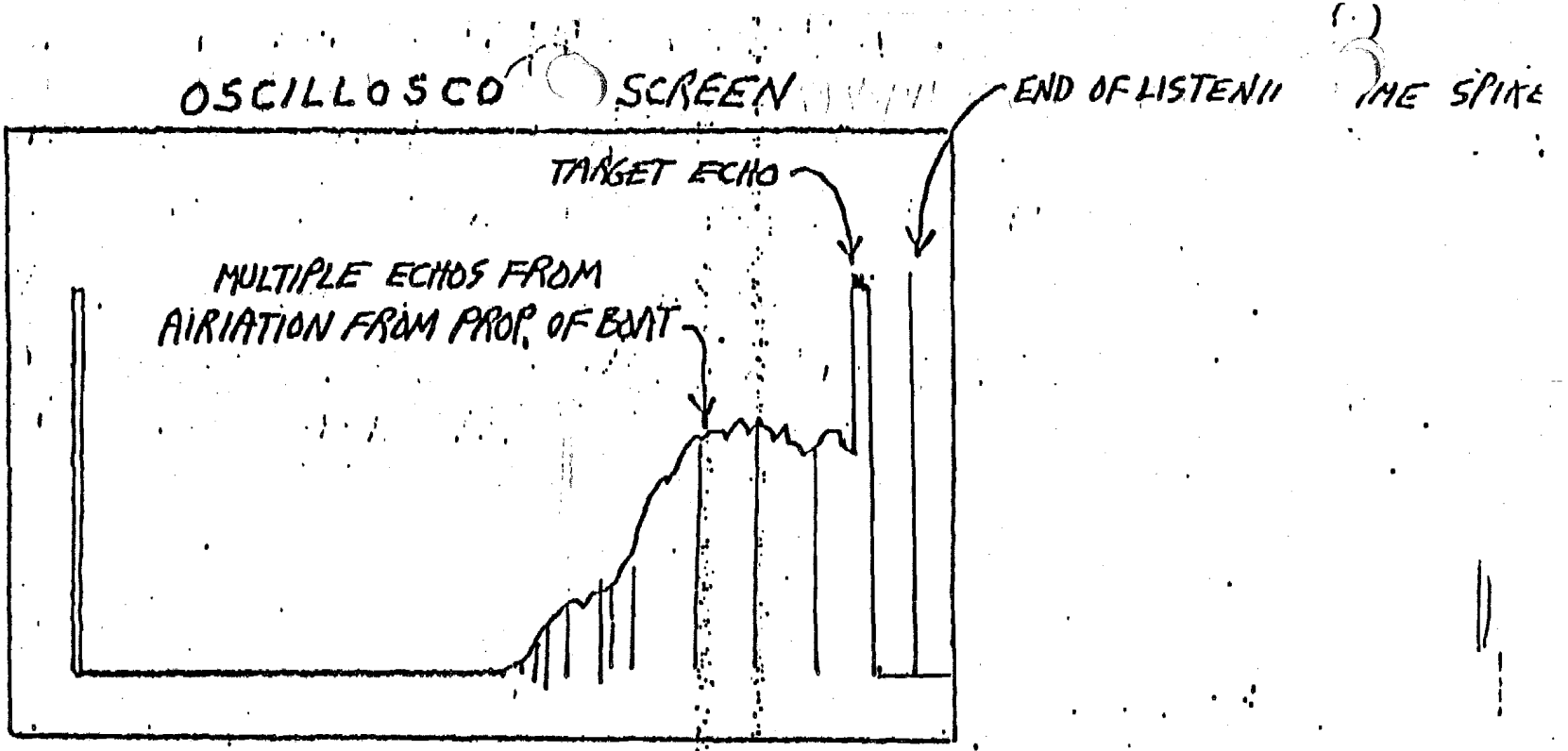
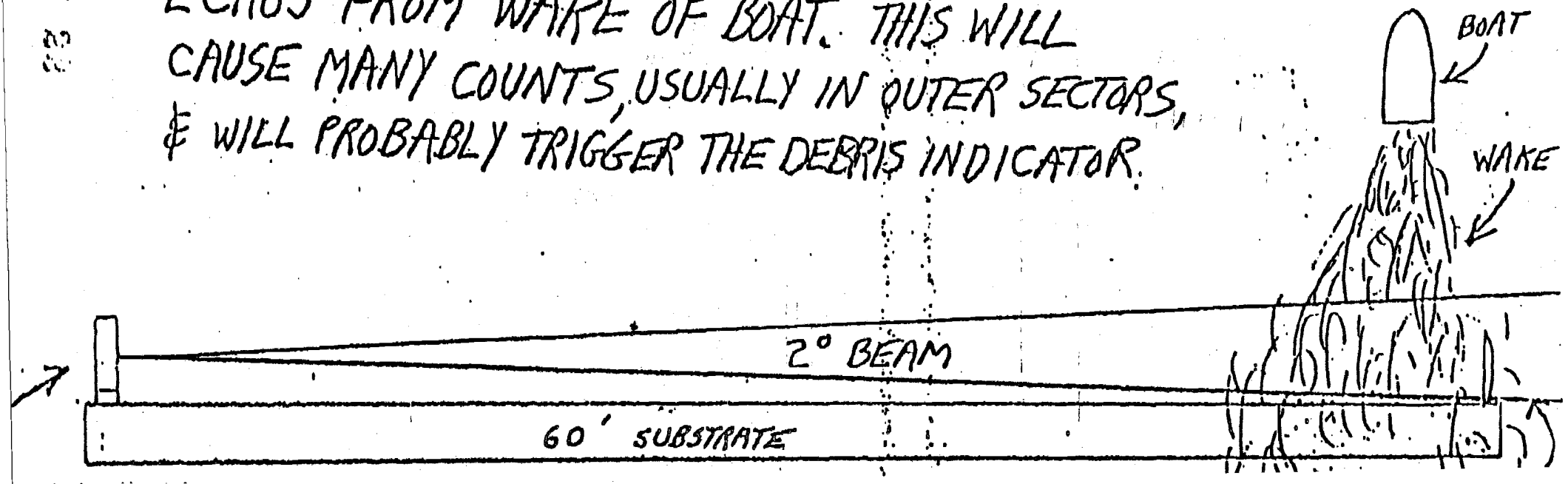
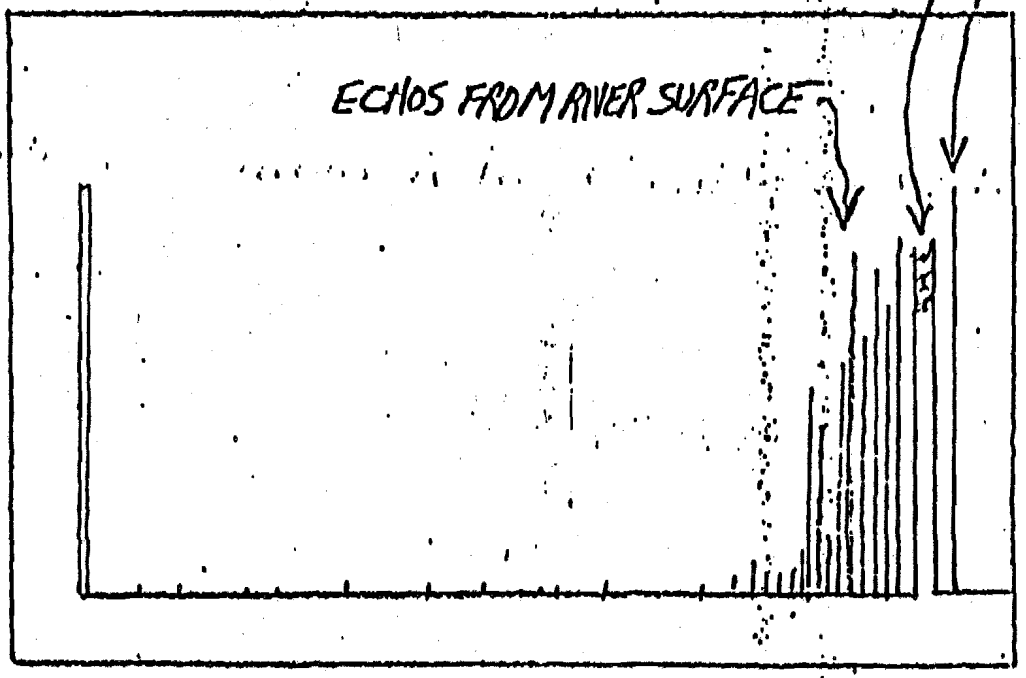


Figure II-12.

PROPERLY AIMED TRANSDUCER BUT MULTIPLE ECHOS FROM WAKE OF BOAT. THIS WILL CAUSE MANY COUNTS, USUALLY IN OUTER SECTORS, & WILL PROBABLY TRIGGER THE DEBRIS INDICATOR.



END OF LIST[illegible] TIME SI[illegible]

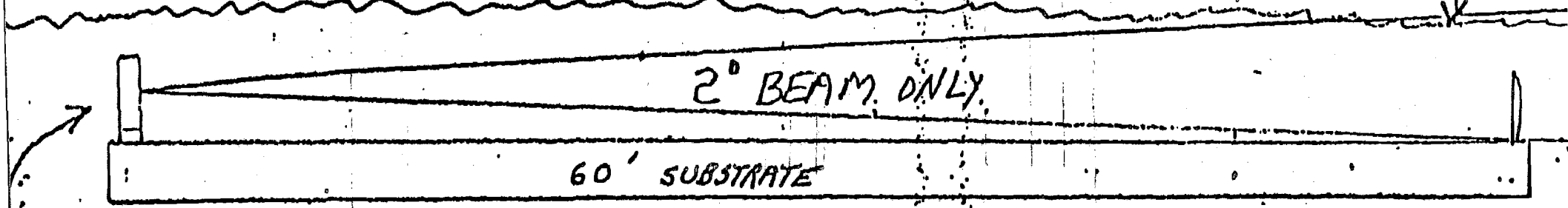


RANGE CONTROL SET JUST BEYOND TARGET

(WILL PROBABLY COUNT ON SECTS 10, 11 & 12.)

Figure II-13.

IMPROPERLY AIMED TRANSDUCER. BEAMWIDTH SWITCH SET TO 2 AND SCOPE TRIGGERRED FROM 2°. NOTE WATER IS TOO SHALLOW EVEN FOR 2° BEAM WHICH IS "BOXED IN". COUNTING RANGE ON SIDE SCANNER WOULD HAVE TO BE REDUCED TO ABOUT 50' TO PREVE SURFACE ECHOS FROM COUNTING. TARGET WILL BE OBSCURED BY SURFACE ECHOS.



APPENDIX III

A. ADULT ANADROMOUS FISHERIES STUDIES

Fishwheel Operation

Design

A schematic of the type of fishwheel to be deployed on the Su/Hydro program is shown in Figure III-1. The axle is adjustable to accomodate water depths ranging from seven (7) to four (4) feet: the axle turns on nylon pillow blocks. The pillow blocks are designed to allow friction adjustments therein providing a breaking mechanism. Native spruce poles form the baskets and paddles. Basket web or netting is rubber coated fencing material. Floatation is provided by styrofoam logs shielded by plywood. The wheel is equipped with a plywood livebox which is collared between the two (2) offshore floatation logs. A fish sampling platform spans the two (2) outside floats on the downstream side of the livebox. The fishwheel is anchored by a cable or rope bridle anchored to a deadman upstream of the fishwheel. The wheel is kept offshore by a boom log arrangement as shown in Figure III-2.

Lead Weir

The purpose of positioning the livebox on the offshore side of the fishwheel is to allow placement of a weir on the inshore side between the bank and the near shore float. A sketch of the weir is presented in Figure III-3. The weir is comprised of several willow or alder pannels contoured to the stream bed. The pannels are held in place by the downstream boom log and on the bottom, by the stream bed. The latter is accomplished by sliding the weir pannels into the water at an upstream angle to the riverbed. The weir is a critical component of the fishwheel. An improperly installed or incomplete weir will allow bank migrant fish to pass inshore of the wheel thus reducing catch.

Debris Deflection

At a few fishwheel sites it will be necessary to install a debris lead. A deflector which is reasonably efficient in channeling debris past a fishwheel is illustrated in Figure III-4.

Operation

The fishwheels are designed to operate at 2.5 revolutions per minute (rpm). Under no circumstances should a fishwheel be operated at a speed greater than 3.5 rpm. The preferred speed is 2.5 rpm with a range between 2.0 and 3.0 rpm. For maximum catch efficiency, fishwheel baskets should be adjusted to scoop within six (6) inches of the bottom. Anything more than six (6) inches will reduce catch efficiency.

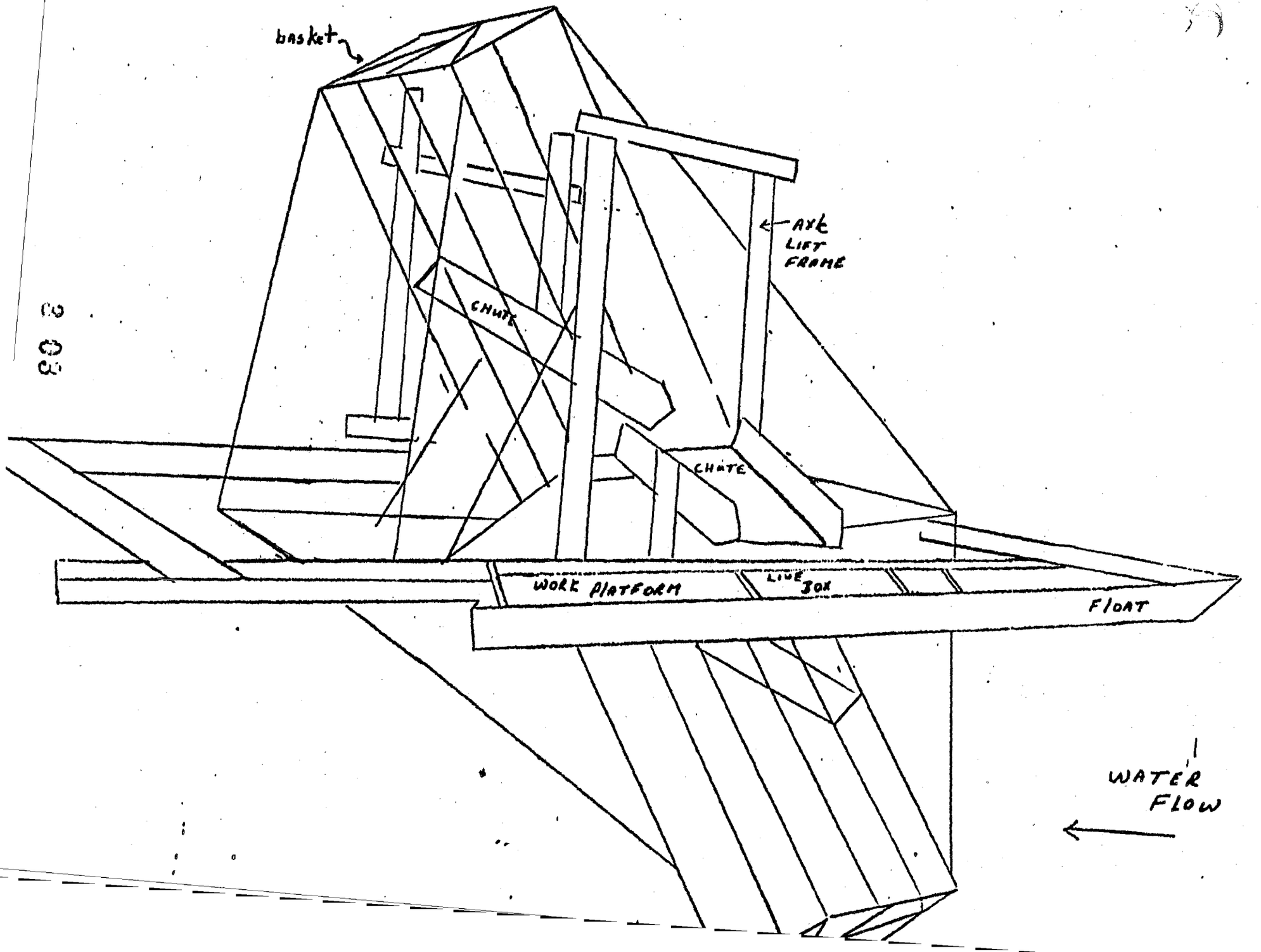
Maintenance

Lead weirs should be inspected to insure they are functioning once every (3) days. Debris cleaning should be performed as often as necessary but at least once every day. Inspection must be made twice daily for wear, broken components and loose riggings. Appropriate repairs are to be effected at first indication of a problem. Fishwheel basket depth should be monitored twice daily and appropriately adjusted.

FISH WHEEL

Figure III-1.

(SIDE VIEW)



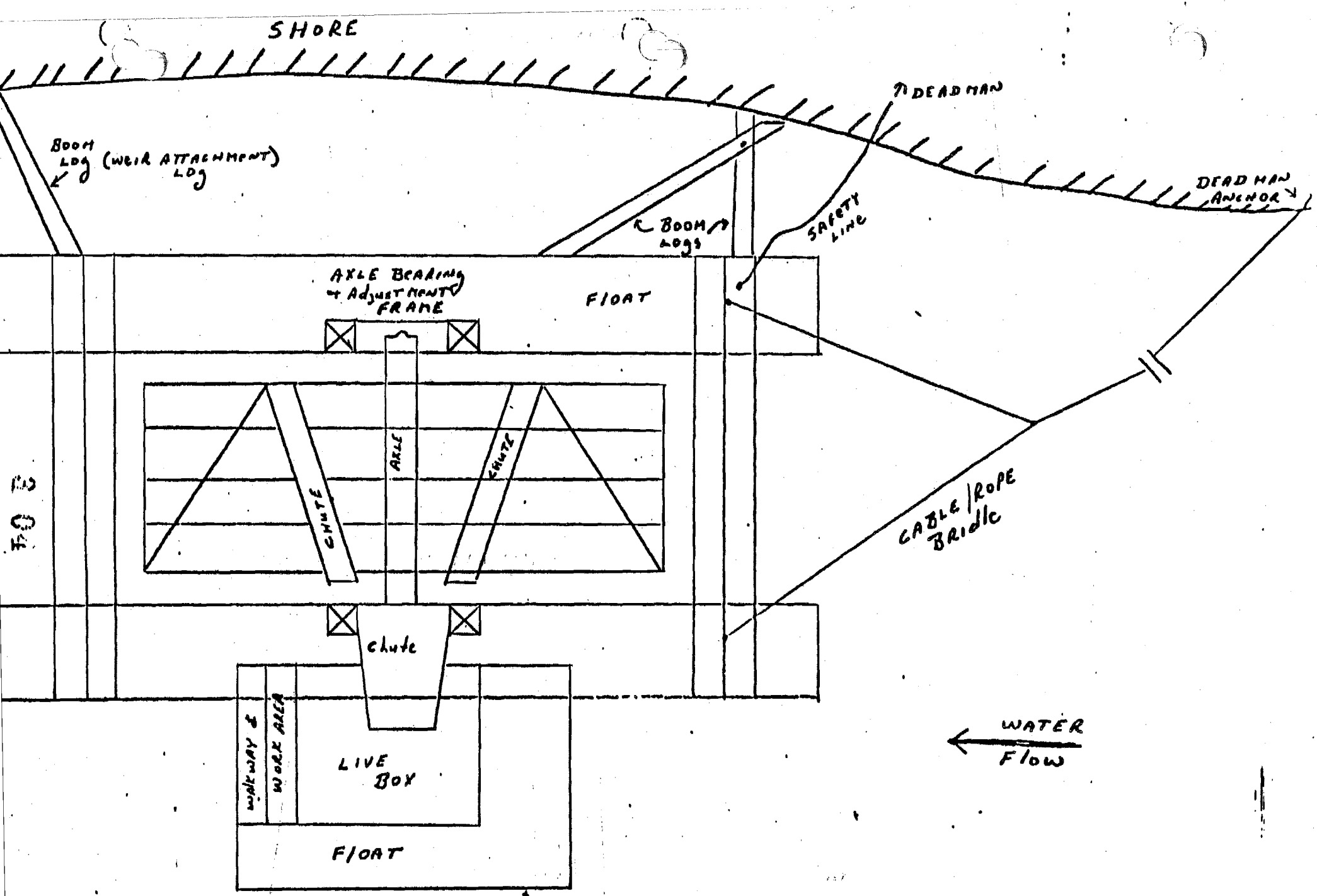
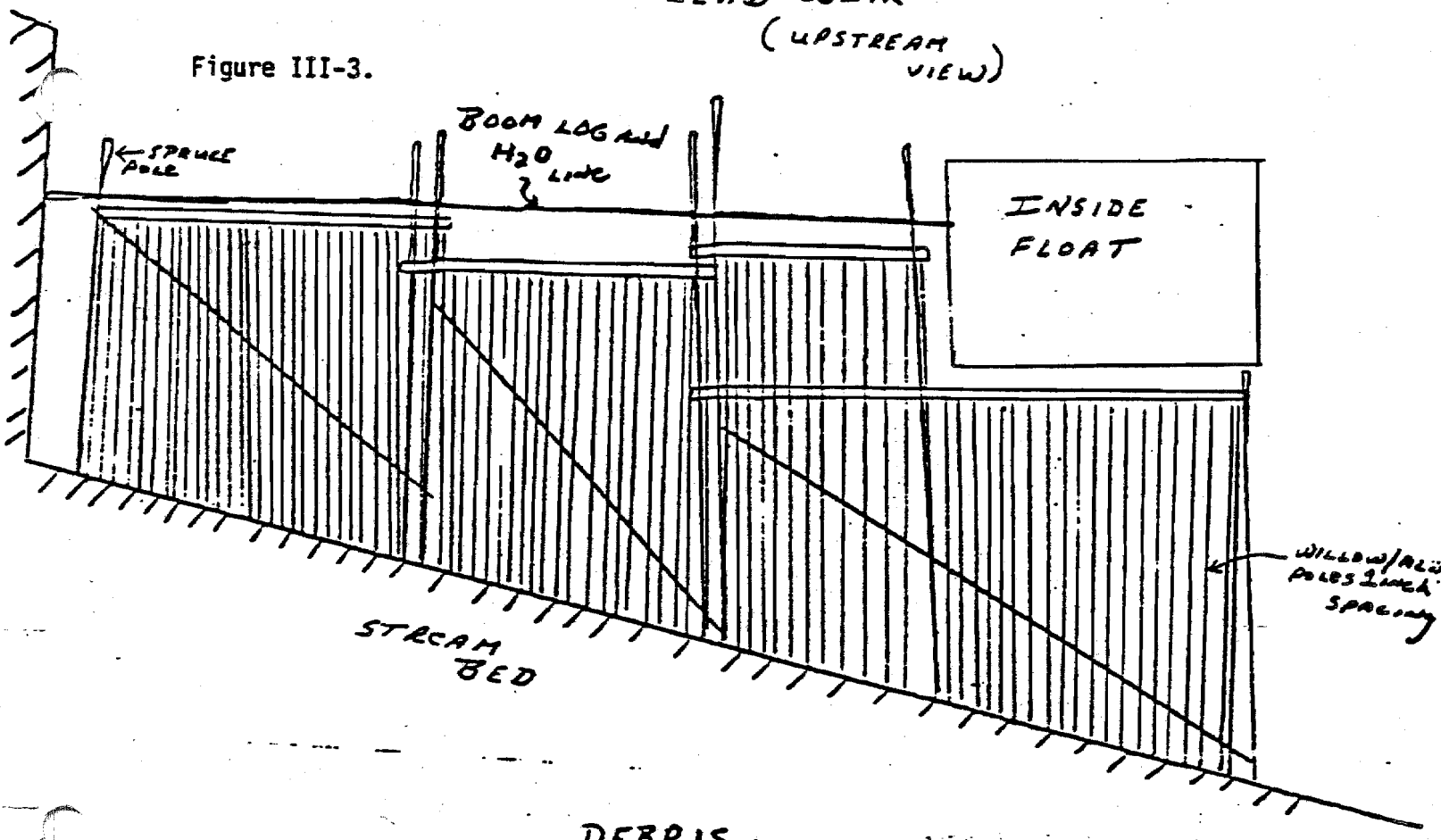


Figure III-2. FISHWHEEL (TOP VIEW)

FISHWHEEL LEAD WEIR

(UPSTREAM VIEW)

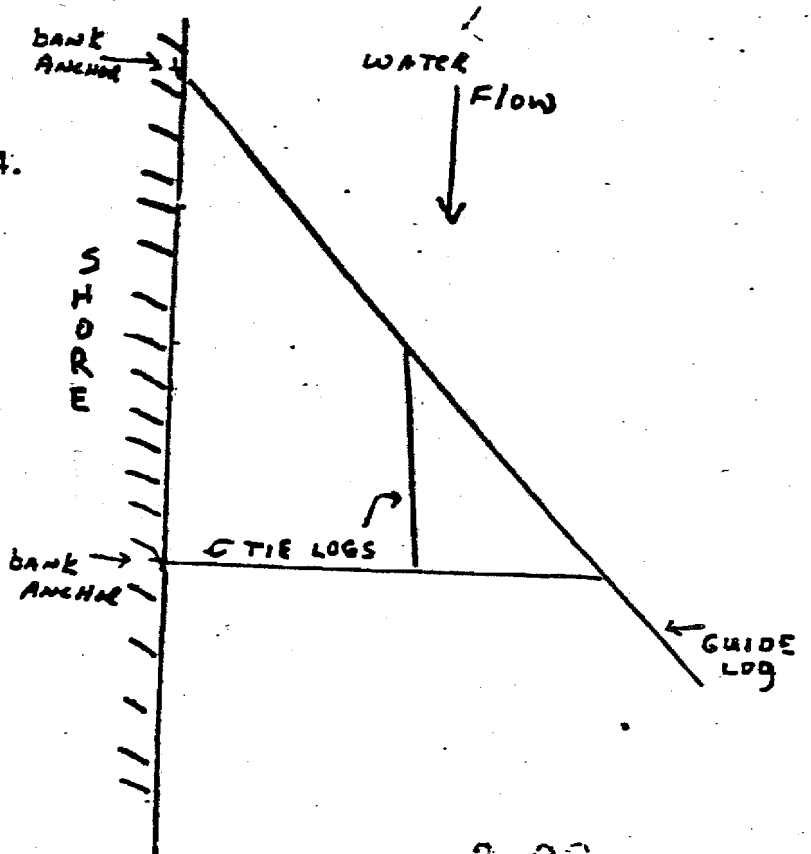
Figure III-3.



DEBRIS DEFLECTOR

(TOP VIEW)

Figure III-4.



APPENDIX IV

A. ADULT ANADROMOUS FISHERIES STUDIES

Fish Tagging (ADF&G, 1976)

Development of Marking of Fish

A mark can be defined as a brand, label, seal or tag which identifies an object to show the maker or owner. Early tagging of fish was begun by land owners along streams who were interested in conserving salmon and trout runs. Charles Atking tagged Atlantic salmon in 1873 in Maine's Penobscot River and several recoveries were noted in following years. T.W. Fulton of Scotland (1893) and C.G.J. Petersen of Denmark (1894) both used numbered buttons or disks on plaice (flatfish) and other fish species in the Atlantic Ocean. The Petersen disk has been one of the most successful types of tags and most widely used over the years.

Exact figures on the rate of development of tagging are hard to accumulate, but there are estimates that by 1910 about 100,000 fish had been marked with tags. By 1936, the total was around 600,000 marked fish. Presently many millions of fish (also molluscs, crustacea and sea mammals) are being tagged every year for the purpose of studying population dynamics and migrations.

Ideal Fish Marks

Information on what constitutes an ideal fish mark, the types of marks, purposes of tagging and methods of tagging and recovery are spread through the fisheries literature.

Arnold (1966) suggested the following criteria for an ideal fish mark.

1. It should be retained essentially unaltered for life of fish regardless of the age at which applied.
2. It should have absolutely no effect of fish's behavior, reproductions, life-span, growth, feeding, movement, vulnerability to predation, angling or other external factors.
3. It should not tangle in vegetation or nets of any kind.
4. It should be inexpensive and easily manufactured.
5. It should be usable on any size fish without significant alteration.

6. It should not be found in nature nor should it be possible to confuse it with any other mark, natural or artificial.

7. It should be easily applied to fish in the field without the need for an anesthetic.

8. It should be easily detected in the field by untrained personnel or the public.

9. If the marked fish is preserved as a scientific specimen, or for later examination, the mark should not be affected by the preservation.

10. There should be enough possible variations of the mark so that many individuals or many small groups can be identified separately.

11. The marking substance should not present any health or safety hazard to the biologist, fish, or the public.

12. The mark should not cause adverse public relations by spoiling edible parts of the fish.

Obviously, no one mark satisfies all the above listed requirements and it generally only satisfies a few of them. One of the critical problems of a research project is to decide on the best mark for the particular circumstances.

Both Floy and Peterson disc tags have been utilized in the Susitna River drainage in the past and will be used to tag fish at the Sunshine, Talkeetna and Curry tag recapture sites.

Peterson Disc Tags

One (1) inch diameter, sequentially numbered Peterson disc tags will be utilized at the Curry site. The color code will be international orange.

Tagging procedures will be reviewed in the field as it is difficult to explain without having tags and a fish in hand. Generally, the following steps are followed:

1. Hold prepared tag (pin, disc, and numbered tag) with pliers and insert through the cartilage immediately under the dorsal fin.

2. Place a blank tag on the pin and cut off all but 3/8 inch of the pin with a cutting pliers.

3. Twist remaining pin in an inward and rolling motion so that the pin lies flat against the disc and forms a loop.

Here are a couple suggestions that will help:

1. Use a sharpening stone to make a sharp point on the tagging pins. This can be done ahead of time and will make penetration easier.

2. Prepare tags prior to making fishwheel checks. Assemble tags in sequential order and stick them in a piece of styrofoam: pin, clear buffer disc, tag.

Floy Tags

Sequentially numbered FT-4 Floy tags will be utilized at the Sunshine and Talkeetna sites. Color code for the Sunshine site will be international orange and yellow for the Talkeetna Site.

Tagging procedures will be demonstrated in the field; generally the following steps are followed:

1. Slide tag over barbed end of tagging needle. Run the needle completely through the fish in the anterior cartilage immediately below the dorsal fin.

2. Disconnect tube from the needle and tie-off with overhand knot.

Several suggestions are:

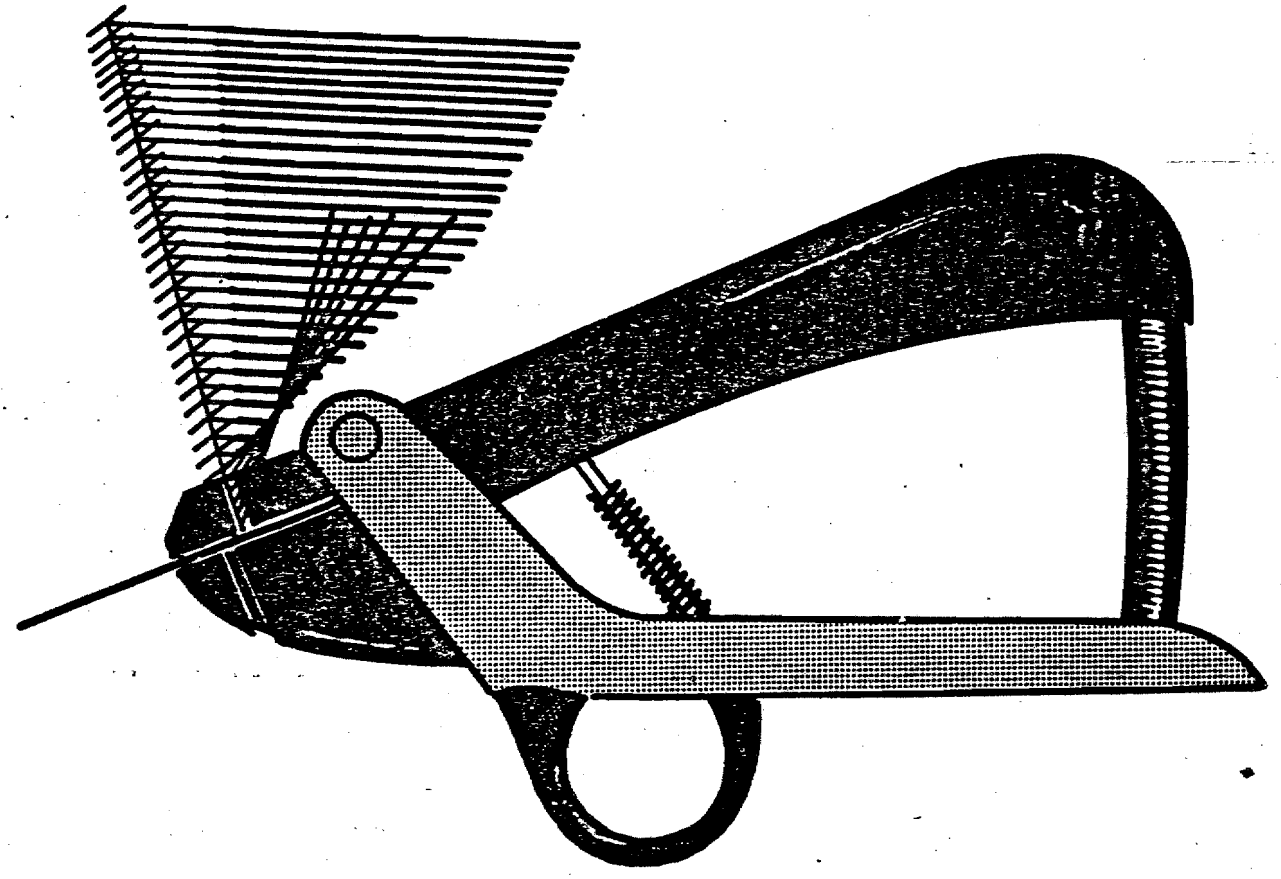
1. Keep two (2) or three (3) tagging needles available in the event of a loss.

2. Use a sharpening stone to maintain a sharp point on the tagging needle. This can be done ahead of time, making tagging easier.

3. Prepare tags prior to making fishwheel checks. Assemble tags in sequential order on a board and tape them in place, thus allowing them to be withdrawn easily.

B. RESIDENT AND ANADROMOUS FISHERIES STUDIES

Figure IV-1. FDM-68 TAGGING GUNS AND ANCHOR TAGS



(actual size)

MODIFIED GUN INSERTS TAG UP TO 1-1/8 INCH

THE FDM-68 MODIFIED GUN HAS PROVED TO BE VERY EFFICIENT IN TAGGING VERY SMALL FISH AS WELL AS LARGE FISH. THE LONGER NEEDLE MAKES IT POSSIBLE TO INSERT A TAG INTO A SMALL BODIED FISH AT THE DESIRED ANGLE. THIS ALLOWS THE TUBING BEARING LEGEND AND NUMBER TO "FLOW" ALONGSIDE THE FISH"S BODY AS IT SWIMS. THIS PLACEMENT OF THE TAG IS NOT AS POSSIBLE WITH A SHORT GUN. THE REGULAR NEEDLE IS .085 OD. THE HEAVY DUTY NEEDLE (RECOMMENDED FOR FISH 10 POUNDS AND UP) IS .096 OD. THE LIGHT NEEDLE IS .073 OD.

FDM-68 Tagging Guns and Anchor Tags

Operating Instructions

Loading Gun

1. Place gun in left hand with forefinger through the trigger ring.
2. Hold tag clip between the thumb and index finger of the right hand with the extension of the "runner" (the bar holding the tags) toward the gun.
3. Insert the runner into the feed slot of the gun. Press the runer down until the first tag engages the feed mechanism.

Suggested Tagging Procedure

1. A clip of blank tags is provided for practice tagging.
2. Make certain the fish is held FIRMLY or anesthetized when being tagged. A squirming fish may bend the needle.
3. Insert needle on the left side of the fish forcing it forward through the dorsal rays and toward the anterior of the dorsal. This placement will lock the "T-bar" firmly behind the interneural rays.
4. Once the needle has been inserted, hold the gun FIRMLY against the fish's body while compressing the handle. Do not release the compressed handle until the needle has been withdrawn.

Unloading Gun

1. Pull the release lever (the black metal lever in front of the trigger ring.) Withdraw clip.

If Gun Jams

1. DO NOT attempt to clear the jam by forcing the tags through the mechanism. This will cause damage.
2. Remove clip from gun.
3. Turn the plastic lock lever (right side near needle) 180 degrees so lever points forward and remove needle.
4. Remove jammed tag from from needle or gun. Inspect needle and ram.
5. The tag (if not damaged) can be re-used by inserting the T-bar into the needle two thirds back from the point of the needle. This can be accomplished only if the tag clip has been removed from the gun. BE CERTAIN TO LINE UP THE SLOT IN THE NEEDLE WITH THE SLOT IN THE GUN.

Care of Gun and Needle

1. Operate gun without tags in warm soapy water to remove dirt, slime and scales.
2. Rinse carefully in warm (not hot) water. Shake and wipe dry.
3. Store in warm area to remove moisture from inside gun.
4. Lubricate with "WD-40" which prevents rust, penetrates and displaces moisture.
5. WHEN TAGGING UNDER SALINE CONDITIONS, THE GUN SHOULD NOT BE EXPOSED TO AIR ANY LONGER THAN ABSOLUTELY NECESSARY. A PAN OF FRESH WATER SHOULD BE KEPT AT HAND TO "SLOSH" OFF THE GUN CONTINUALLY. IF TAGGING IS INTERRUPTED, THE GUN (INCLUDING TAGS) SHOULD BE KEPT IMMERSED IN FRESH WATER.

Disk-Dangler Type Tag

The disk-dangler type tag is attached to the body of the fish beneath the dorsal spine with two strands of wire. A small, viselike clamp holding two hypodermic needles of size number 18 is used to pass the wires through the fish's body. The needles are put in place and pushed through the body in one motion. The tag wires are then inserted into the hollow needles and the clamp pulled outward. Tags are attached with one wire anterior and one posterior to the origin of the dorsal fin. The needles are spaced so that their points are approximately one-half inch apart. A spacing strap may be placed between the wires to keep them from pulling together and tearing flesh when the wires are twisted together. If a single person is tagging, however, such a strap may be impossible to hold in place. If care is used in twisting the wires, excess injury to the fish may be avoided without the use of such a spacer. Excess wire is cut off the twisting end, and the exposed wire and tag are bent back.

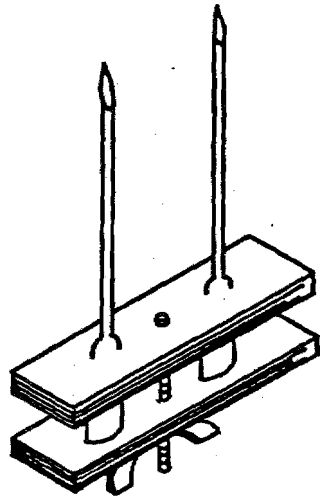


Figure IV-2. Tag clamp holding two hypodermic needles (from Pelgen, 1954)

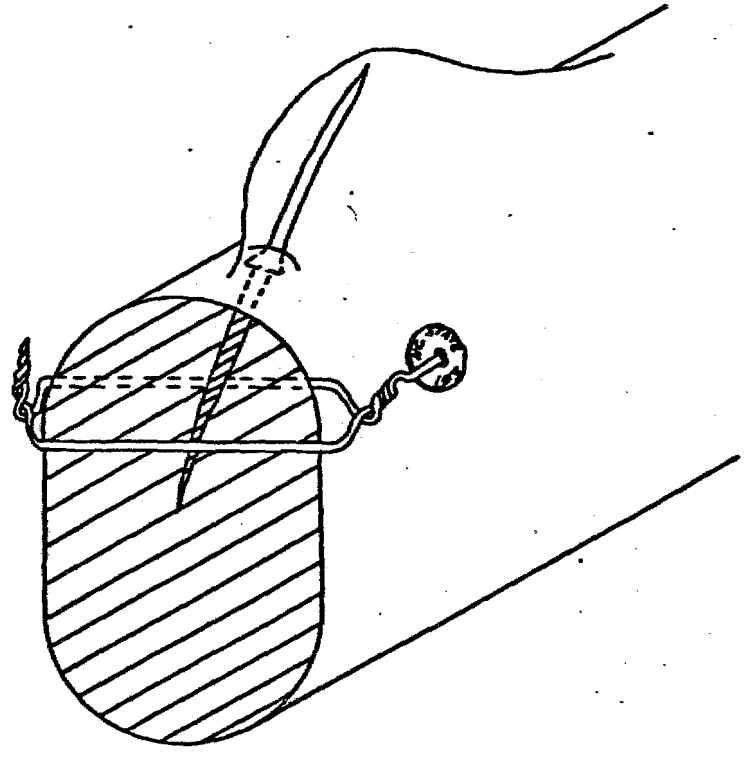


Figure IV-3. Disk-dangler tag in place (after Pelgen, 1954)

APPENDIX V

A. ADULT ANADROMOUS FISHERIES STUDIES

Electro-Shocking Boat Operations

Safety Precautions

These procedures must be adhered to for the safety of all operators of this equipment.

1. A minimum of two (2) persons is required to safely and efficiently operate the unit, provided the control box can be easily monitored by the boat operator. For two (2) man operations, the boat operator should be capable of adjusting voltage and amperage, activating the power switches on the control box, and shuting down the generator without having to leave his station as outboard operator.

   Should these conditions not be met, then a minimum crew would be three (3). One (1) person should monitor the control box at all times.

2. All personnel should be thoroughly familiar with the equipment and its operation. Personnel should be briefed as to emergency procedures should the situation arise.

3. All equipment, connections and wiring should be checked before each day's operation. Particular attention should be payed to the platform railing and safety foot switch. The railing should be strong and secure enough to support a man's weight. The safety switch must be free of rust and corrosion. It would be advisable to have the metal railing insulated with foam pipe insulation or plastic electrical tape. Wiring should be left exposed to facilitate inspection of the insulation.

4. Only dip nets with fully insulated handles will be used.

5. Personnel will wear only hip boots or chest waders that are completely leak proof. The platform surface should be of a non-skid type. Rubber gloves are advisable as an added safety measure.

6. All personnel will wear life jackets or other adequate floatation devices. Should anyone fall overboard, it is unlikely that he will have enough muscle control to swim.

7. Never start the generator until all connections for the particular mode of operation are complete. While traveling between points of operation, the electrodes should be disconnected from the electrical source if the generator is to be left running, i.e., for night operations.

8. Never change the position of the boom or handle the electrodes unless the leads are disconnected and all switches on the control box are in the "off" position.

9. When disconnections are made or lines left disconnected, all switches on the control box should remain in the "off" position to preclude any load on the wiring.

10. All personnel should be familiar with first aid treatment for shock victims and be trained in artificial respiration. At least one (1) member of the crew should have completed a recognized first aid course (hopefully he will not be the one injured).

11. The equipment shall not be operated in such a manner so as to endanger the public. The current shall be turned off anytime the public is in the immediate proximity of the aparatus, be it on shore, in the water, or in a boat.

In an emergency, the electrical current into the water may be broken in three ways:

1. By releasing the foot pedal switch which is located on the platform and controlled by the dip net operator.

2. By turning off all switches on the control box. One (1) man must be operating the control box at all times.

3. By actuating the grounding switch effectively killing the generator. If possible, switches should be located both on the dipping platform and near the motor operator and wired so that activation of either switch will kill the generator.

First Aid for Victims of Electrical Shock

Should anyone fall overboard or receive an electrical shock, the unit will be immediately shut off. Rescue the victim from the water or free him from the electrical circuit as quickly as possible. Act quickly, as any delay in removing the person from the electrical field or circuit will lessen the chance of resuscitating him. Do not endanger yourself attempting to rescue someone with the power on.

If the victim is not breathing, begin artificial respiration at once. Mouth-to-mouth resuscitation is recommended. Continue resuscitation until you are certain breathing is restored. Frequently, after a temporary recovery, a victim will stop breathing again. If natural breathing stops, resume artificial respiration at once.

Physical shock is a serious complication that is likely to occur after electrical shock. Shock can interfere with the normal action of the heart, respiration and circulation, so every precaution should be taken to prevent this condition from further weakening the victim. The victim should be lying flat and it is most important that he be kept as warm as possible, even during artificial respiration.

The following procedure is recommended in cases where it appears the victim's heart has stopped:

1. Place the victim on his back.
2. Position yourself on your knees beside his chest.
3. Find the lower end of his breast bone.
4. Place the heel of your hand one inch above that end.
5. Place your other hand on top of the first hand.
6. Press down firmly with about sixty (60) pounds of weight.
7. Repeat every second until heart starts.
8. If necessary, apply mouth-to-mouth resuscitation as follows: one (1) operator - 15 compressions, two breaths or two (2) operators - one breath every fifth compression.

The above procedure would be life sustaining should the victim go into ventricular fibrillation.

Admittedly, the above first aid procedures are brief, but due to lack of more competent means to deal with electrical accidents, this should serve as a guide for emergency treatment until the patient can be taken to medical facilities.

NOTE: A COPY OF THIS PROCEDURE MUST BE ONBOARD THE SHOCKING BOAT AT ALL TIMES!!!!

B. RESIDENT AND JUVENILE ANADROMOUS FISHERIES STUDIES

Model XV-BPG Self-Contained Gas Powered Electrofisher
(Backpack Mounted)

Since the introduction of the lightweight, quiet and reliable TAS-300 alternator, Smith-Root, Inc. now offers the type XV-BPG, a gasoline powered backpack electrofisher. Designed for very low to medium conductivity waters, the Type SV-BPG delivers a high 1100 volt peak DC for the very low conductivity waters and as much as 2.5 amps for the higher conductivity waters.

Both the electrofisher and alternator are mounted on a comfortable, reinforced plastic pack frame. The new pack frame not only outlasts aluminum packs, it provides an extra margin of safety from electric shock providing an insulation between the operator and the electrical apparatus. The pack frame harness has been designed to provide instant release should it become necessary to quickly drop away the complete pack frame from the operator.

SPECIFICATIONS:

Power Source	TAS Model QEG-300 Watt gas-powered generator
Recommended Conductivity Range	Approximately 10 to 200 micromhos/cm2 max. Useable to 400 micromhos
Input Power	300 watts, 450 watts intermittent (all voltage ranges)
Output Modes:	
AC	130-390 VRMS in 130 volt steps
Pulsed DC	180-550 VDC peak fast rise, slow decay
Pulsed DC (x 2)	360-1100 V
Metering	Output current 0 - 2.5 amp
Voltage Selection	Rotary Switch
Circut Protection	Electronic circuit breaker with reset
Safety Protection	Tilt switch kills engine if shocker is tilted beyone 45 degrees
Engine Kill	Push-button switch mounted on pack frame

Backpack Frame	Lightweight, comfortable frame with padded shoulder straps, padded hip belt and emergency quick release
Weight	36 lbs.

Standard Equipment: TAS-300 Generator, Anode Pole with Pull-Behind Cathode: optional Cathode pole available.

Specifications Subject to Change Without Notice

1/81

APPENDIX VI

A. ADULT ANADROMOUS FISHERIES STUDIES

Habitat Site Locations

B. INTEGRATED RESIDENT AND JUVENILE ANADROMOUS FISHERIES AQUATIC HABITAT AND INSTREAM FLOW STUDIES

Habitat Site Locations

System of Specifying Geographic Locations

For conciseness and for use in the computer processing, it is convenient to use a modification of the General Land Office method of specifying locations as developed by federal and state agencies in Montana (MDFWP, 1979).

In this report, locations of features such as sampling points are specified by using 12 characters. The first three characters of the location give the township, the next three characters the range. The next two give the section number within the township, and the next tract, the quarter-quarter section (40-acre tract), and the quarter-quarter-quarter section (10-acre tract). These subdivisions of the 640-acre section in the northeast quadrant. If there is more than one feature in a 10-acre tract, consecutive digits beginning with 2 are added to the number. For example, if a sample was collected in Section 21, Township 9 North, Range 20 West, it would be numbered 09N20E21DAA2. The letters DAA indicate that the site is in the N1/4 of the N1/4 of the SE1/4, and the number 2 following the letters DAA indicates there are at least two sampling locations in this 10-acre tract.

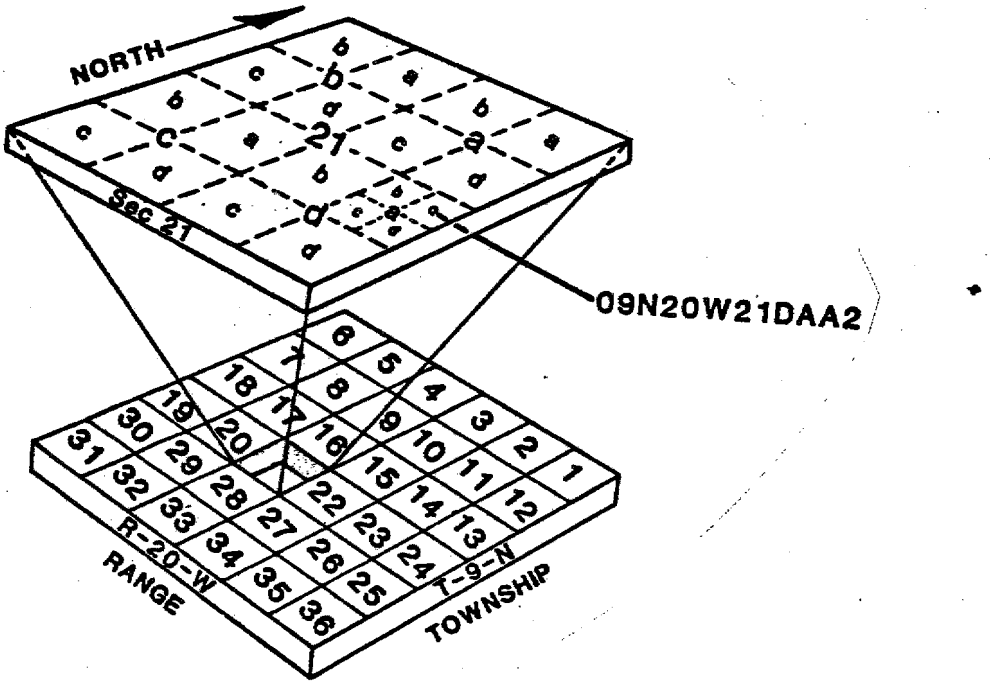


Figure VI-1. System used by ADF&G in this study to specify geographic locations.

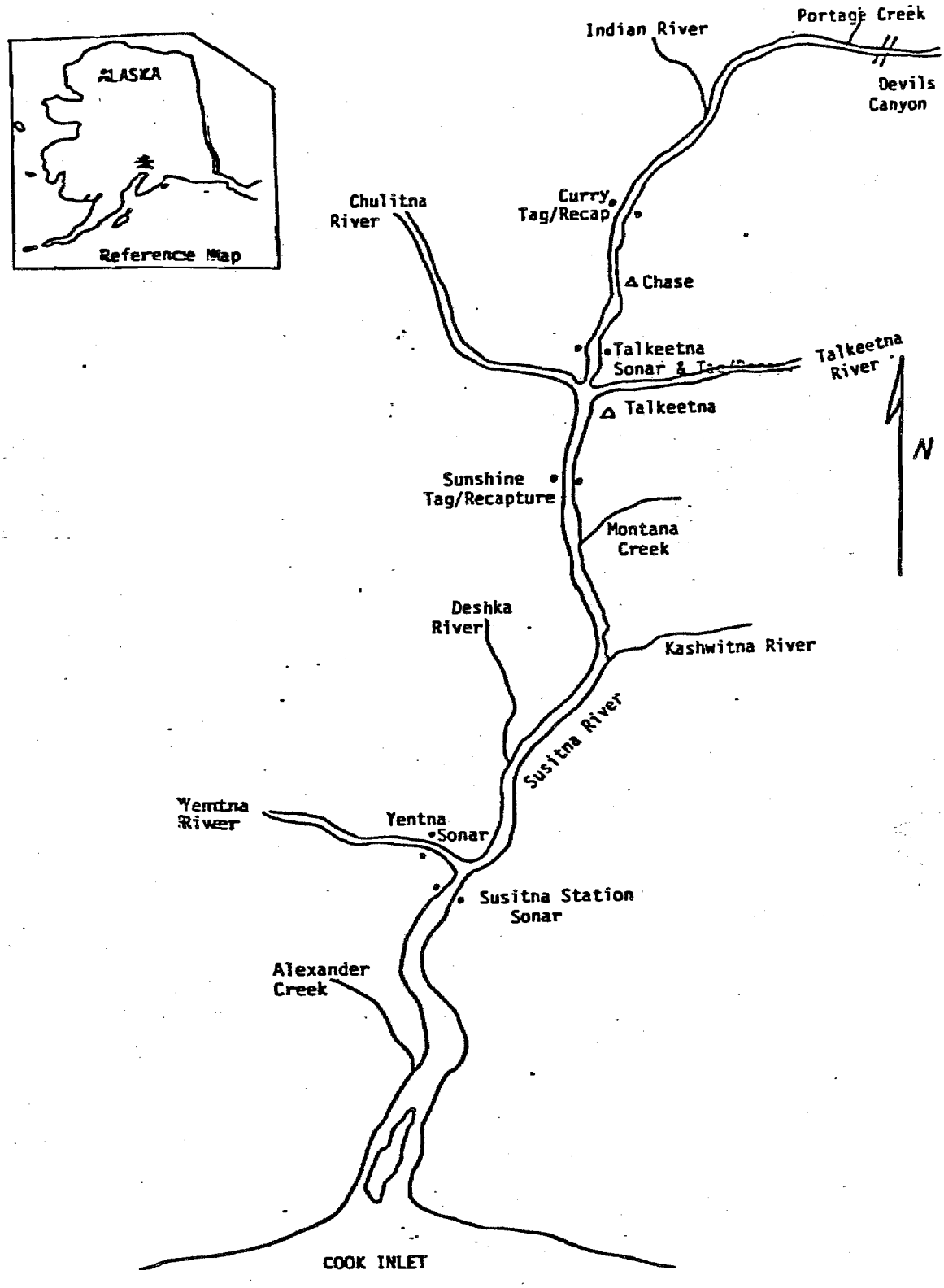


Figure VI - 2. Anadromous Adult Project Study locations, 1981.

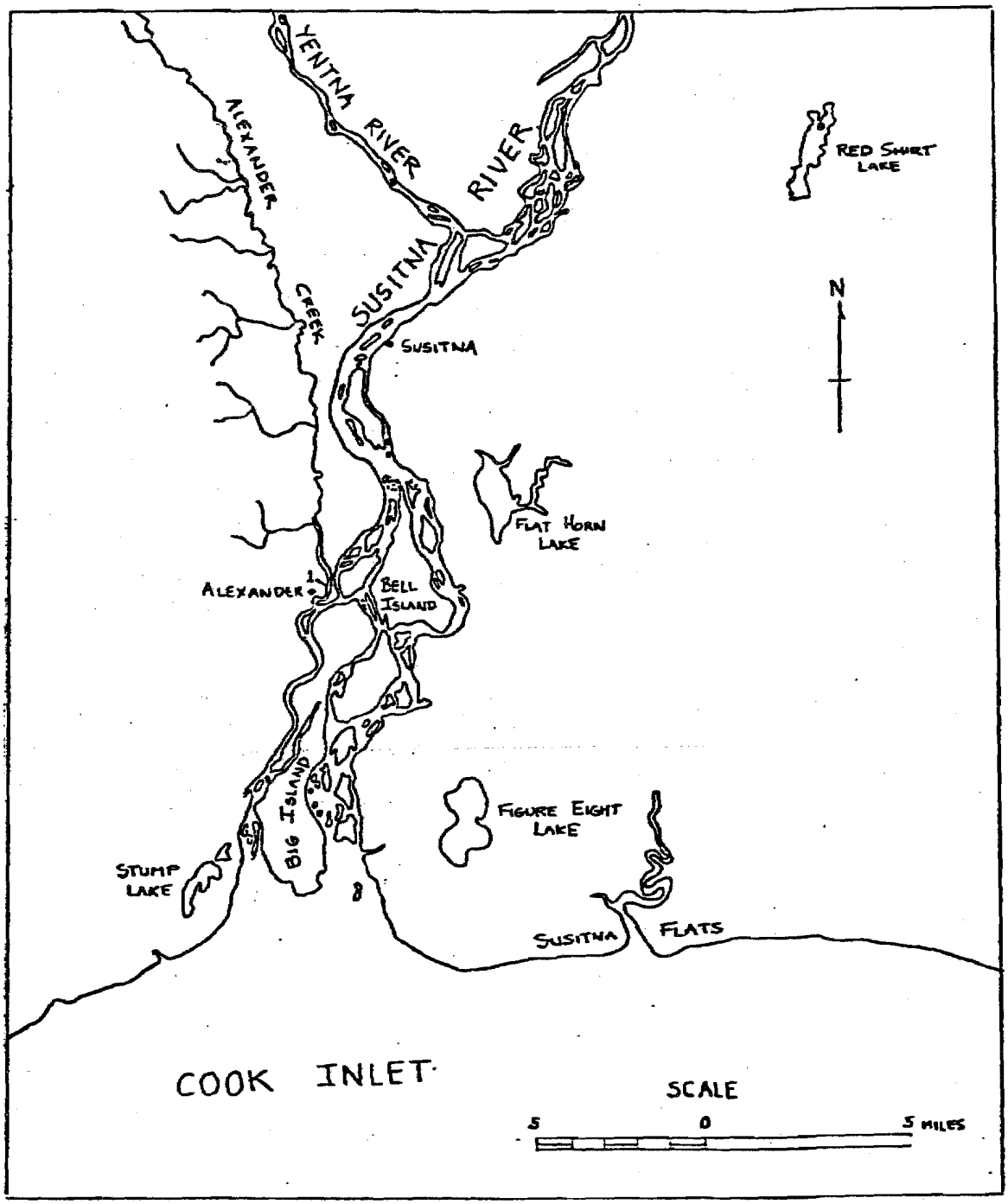


Figure VI - 3. RJ and AH sampling locations, 1981.

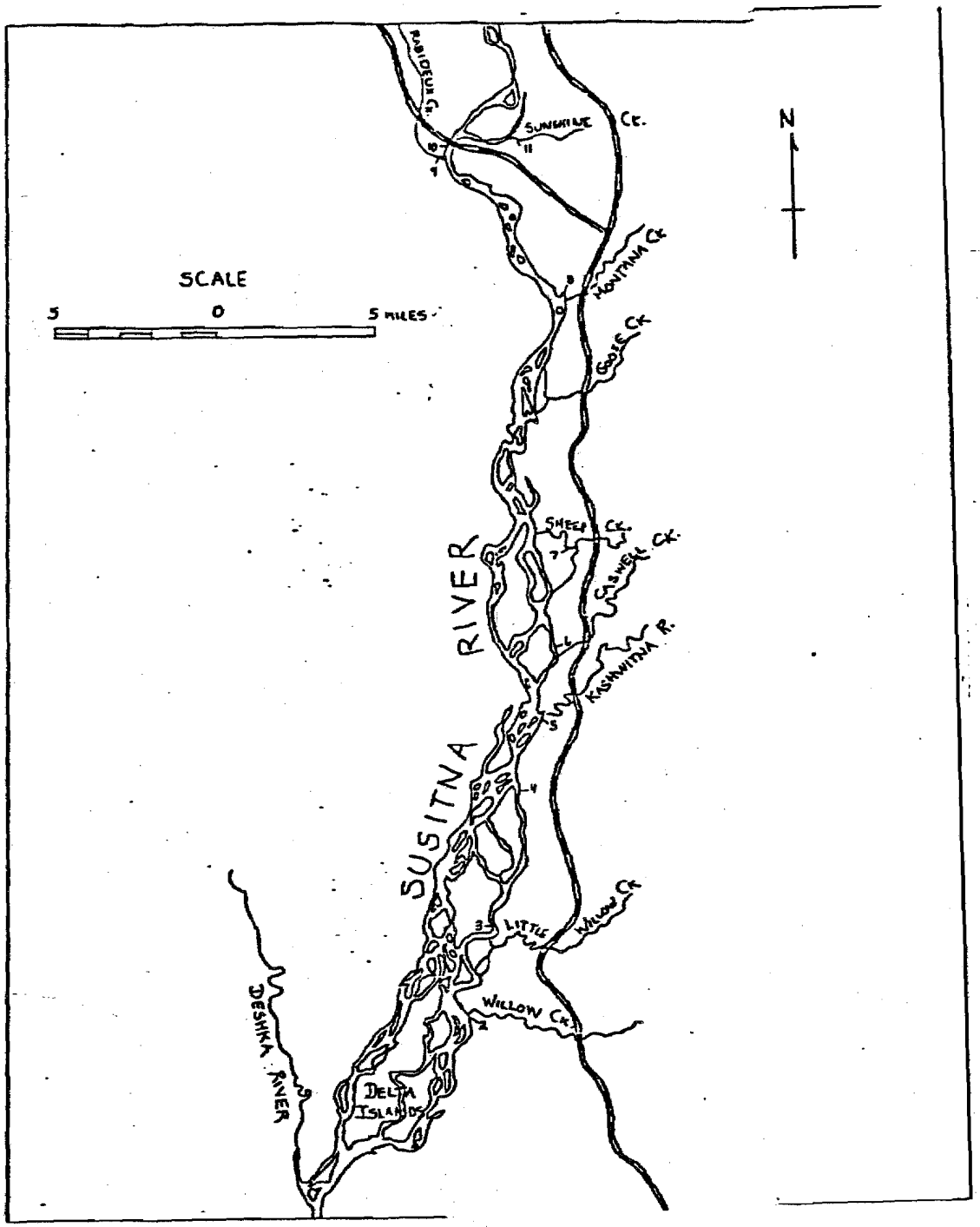


Figure VI - 4. RJ and AH sampling locations, 1981.

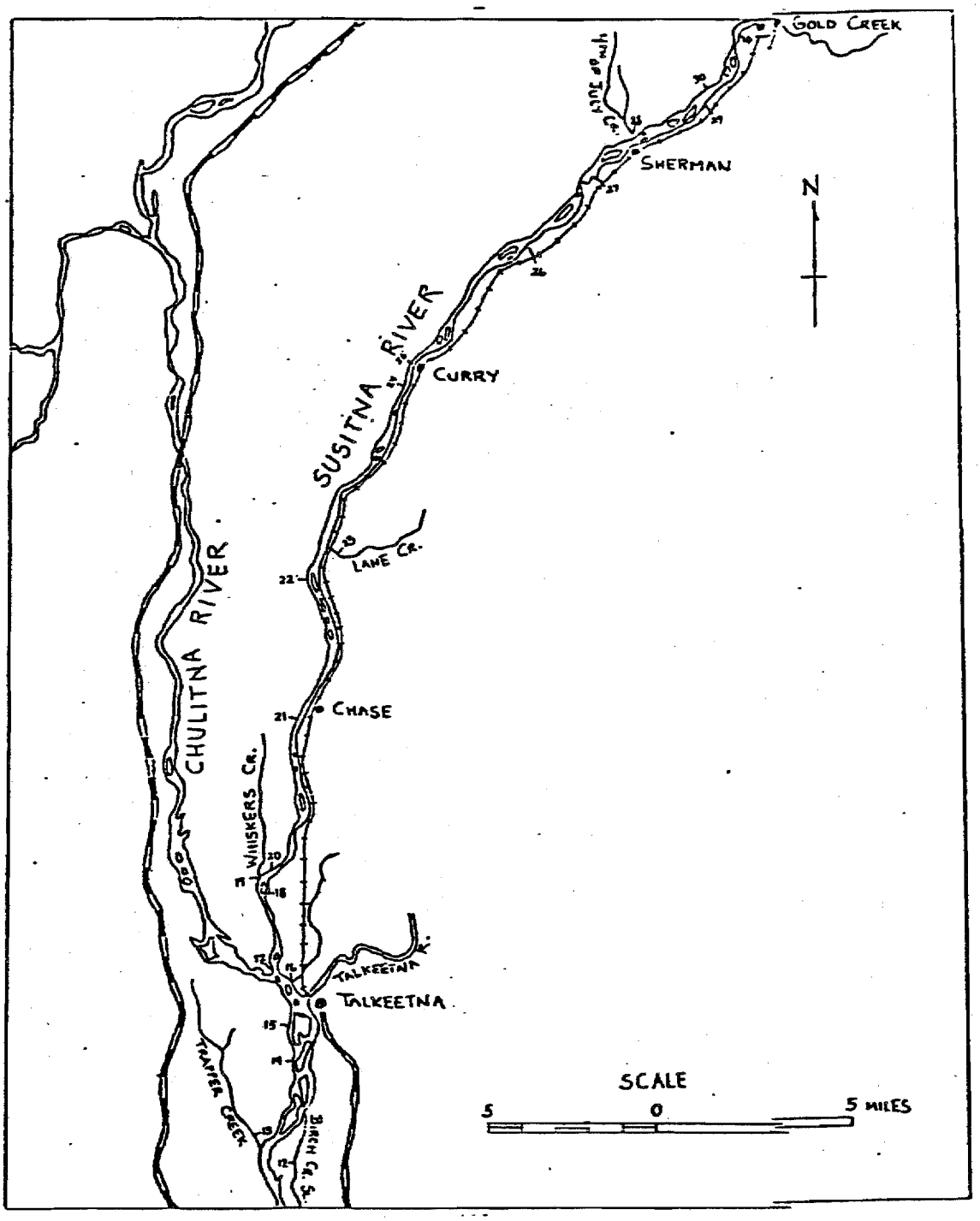


Figure VI - 5. RJ and AH sampling locations, 1981.

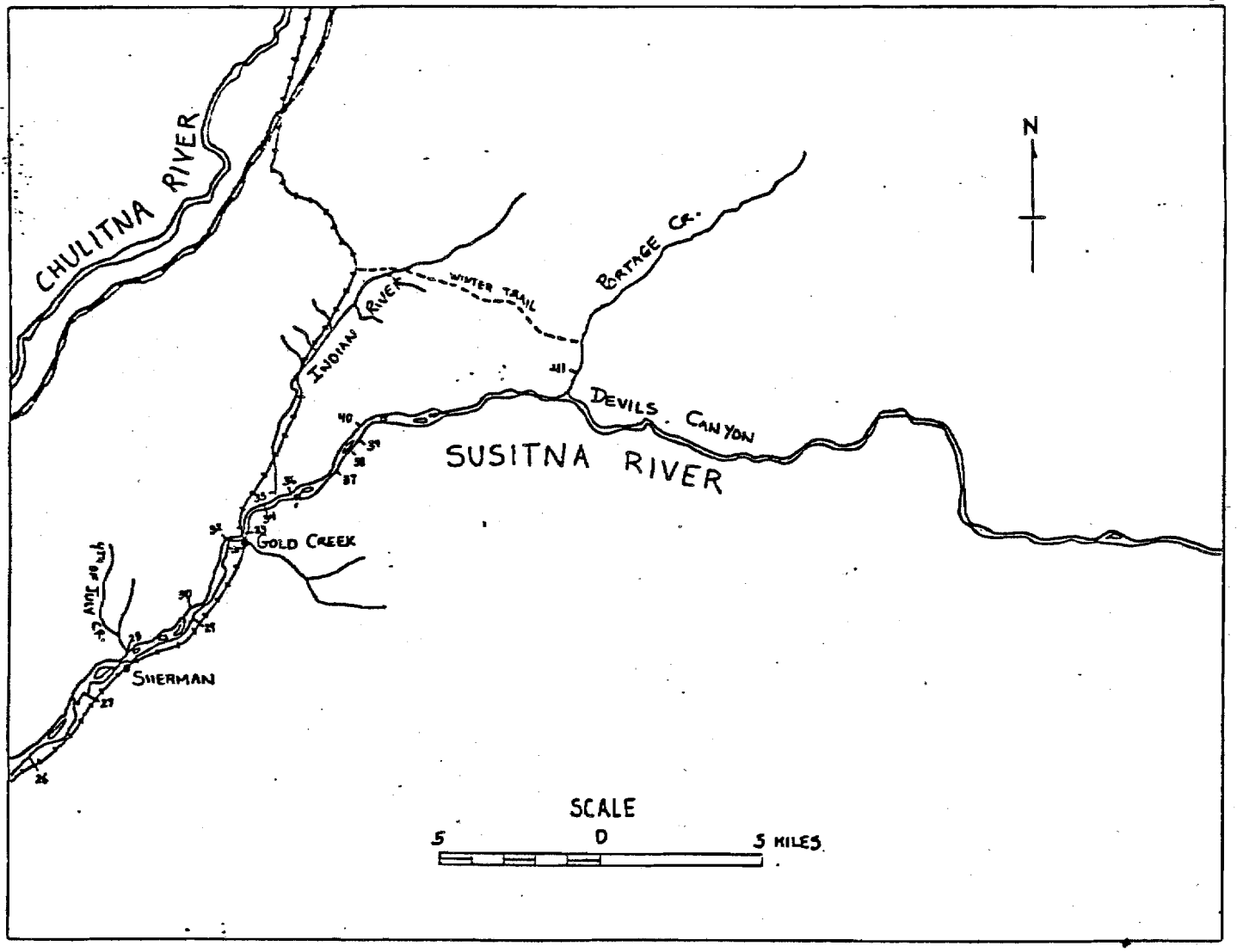


Figure VI - 6. RJ and AH sampling locations, 1981.

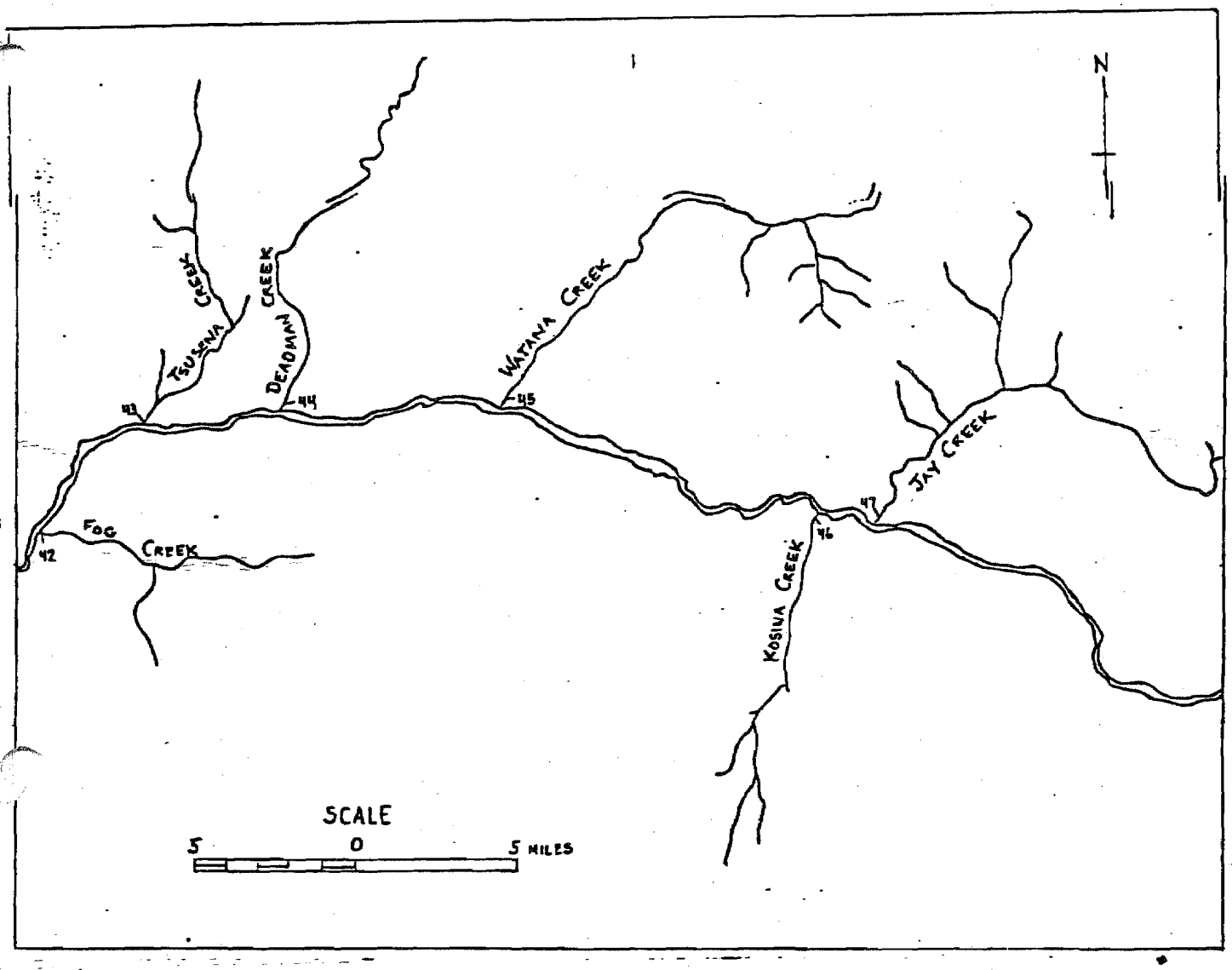


Figure VI - 7. RJ and AH sampling locations, 1981.

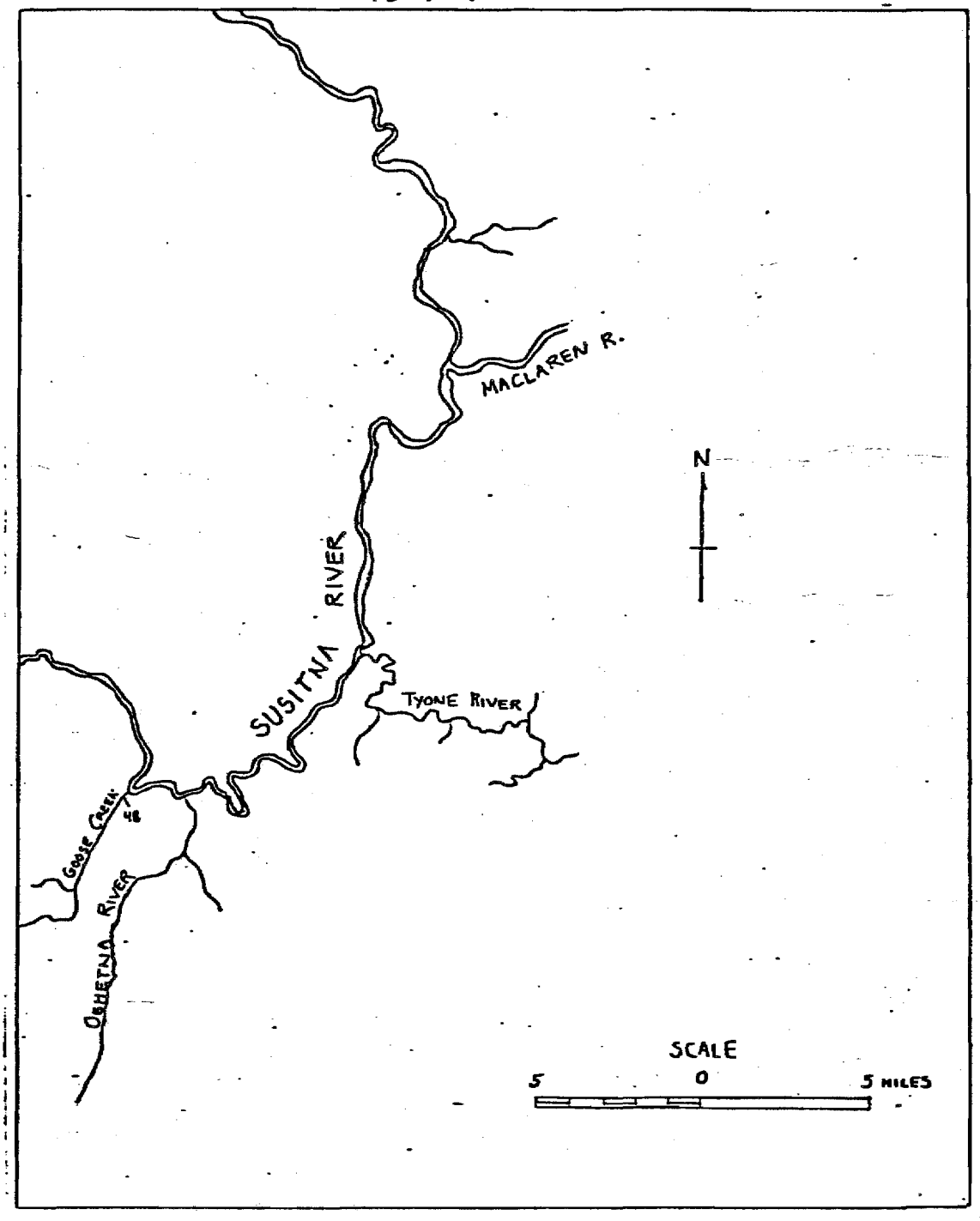


Figure VI - 8. RJ and AH sampling locations, 1981.

Table 1. Susitna River Resident and Juvenile Anadromous Fish Sampling Locations, 1981.

MAP CODE	SAMPLING LOCATION	LOCATION			
		TOWNSHIP	RANGE	SECTION	GRID
	Estuary to Talkeetna:				
1	A. Mainstem Susitna (.75 mile south of				
	Alexander River Mouth)	15 N	07 W	07	
	B. Alexander River				
	(Mouth)	15 N	07 W	07	AB
	(.75 Mile Upstream)	15 N	07 W	05	
	(1.5 Mile Upstream)	16 N	07 W	31	
	C. Mainstem Susitna				
	(Side-Channel Opposite Alexander R. Mouth)	15 N	07 W	07	
	D. Mainstem Susitna (1.0 mile North of				
	Alexander River Mouth)	15 N	07 W	05	
2	A. Mainstem Susitna (Willow Creek Mouth)	20 N	05 W	34	CA
	B. Willow Creek (Mouth)	20 N	05 W	34	
	(Parks Highway)	19 N	04 W	06	AC
3	A. Mainstem Susitna (100 yards Above Little				
	Willow Creek)	20 N	05 W	27	BA
4	A. Slough A (Rustic Wilderness Subdivision)	21 N	05 W	25	CB
	B. Mainstem Susitna (East Bank, 700 yards				
	above Slough A)	21 N	05 W	23	DD
	C. Mainstem Susitna (West Bank, Opposit Sl.A)	21 N	05 W	23	DA
	D. Mainstem Susitna (East Bank, below Slough				
	E Head)	21 N	05 W	24	BA
	E. Slough E (.25 mile above Rustic Wilderness				
	Subdivision)	21 N	05 W	25	BC

Table 1 - Cont'd.

MAP CODE	SAMPLING LOCATION	LOCATION			
		TOWNSHIP	RANGE	SECTION	GRID
5	A. Mainstem Susitna (West bank, adjacent to				
	Susitna Landing) (C)	21 N	05 W	13	BC
	(West bank, Slough Mouth) (A)	21 N	05 W	12	CC
	B. Mainstem Susitna (.25 mile, West of				
	Kashwitna River Mouth)	21 N	05 W	13	AB
	C. Mainstem Susitna (100 feet below				
	Kashwitna River Mouth)	21 N	05 W	13	AC
	D. Kashwitna River (Mouth)	21 N	05 W	13	AAC
6	A. Caswell Creek (Mouth)	21 N	04 W	06	BA
/	A. Mainstem Susitna (Site A, below Sheep				
	Creek Slough Mouth)				
	(Site B, below Sheep Creek Slouth Mouth)				
	B. Sheep Creek Slouth (Mouth)	22 N	05 W	25	DD
	C. Mainstem Susitna (East channel, .5 mile				
	above Sheep Creek Slough Mouth) (D)	22 N	05 W	24	DD
	(East channel, .6 mile above Sheep Creek				
	Slough Mouth) (E)	22 N	05 W	24	DA
	D. Slough (.50 mile NW of Sheep Creek				
	Slough Mouth) (F)	22 N	05 W	24	DB
	(.75 mile NW of Sheep Creek Slough				
	Mouth) (H)				
	E. Mainstem Susitna (Center Channel, .9 mile				
	across from Sheep Creek Slough Mouth) (I)	22 N	05 W	23	DB
	(Center Channel, .9 mile above Sheep				
	Creek Slough Mouth) (G)	22 N	05 W	24	BC

Table 1 - Cont'd.

MAP CODE	SAMPLING LOCATION	LOCATION			
		TOWNSHIP	RANGE	SECTION	GRID
7	E. Mainstem Susitna (Cont'd.)				
	(Center Channel, 1.0 mile above Sheep				
	Creek Slough Mouth) (J)	22 N	05 W	23	AB
	F. Slough L (West Center Channel, below				
	Echo Island) (L)	22 N	05 W	14	CD
	G. Mainstem Susitna (Below Echo Island) (M)	22 N	05 W	14	CD
	(Adjacent to Echo Island) (K)	22 N	05 W	14	DC
8	A. Mainstem Susitna (Below Montana Creek				
	Mouth) (B)	23 N	04 W	07	AB
	B. Mainstem Susitna (West Channel, Slough				
	Mouth, 1.25 mile above Montana Creek) (F)	23 N	05 W	13	DC
	C. Side-Slough (West Channel, small slough				
	1.0 mile below Montana Creek) (G)	23 N	05 W	13	AD
	D. Side-Slough (West Channel, slough .25 mile				
	below Montana Creek) (E)	23 N	05 W	12	DB
	E. Montana Creek (Mouth) (A)	23 N	05 W	07	AB
	F. Mainstem Susitna (East Channel, .25 mile				
	above Montana Creek) (C)	23 N	04 W	06	CD
	(East Channel, .50 mile above Montana				
	Creek) (D)	23 N	04 W	06	CD
	G. Beaver Pond (West Bank, 1.0 mile above				
	Montana Creek Mouth)				
	H. Mainstem Susitna (West bank, slough				
	Mouth above Montana Creek)				
	(East Bank, 1.0 mile above Montana Creek)				

Table 1 - Cont'd.

MAP CODE	SAMPLING LOCATION	LOCATION			
		TOWNSHIP	RANGE	SECTION	GRID
8	H. Mainstem Susitna (Cont'd.)				
	(Center Channel, 1.25 mile above				
	Montana Creek)				
	I. Slough (West bank, 2 miles above Montana				
	Creek)				
9	A. Rabideux Creek	24 N	05 W	16	AAB
	(Mouth)				
	(500 feet Upstream)				
10	A. Mainstem Susitna (.25 mile below				
	Parks Highway Bridge)	24 N	05 W	15	BA
	B. Mainstem Susitna (Parks Highway Bridge)	24 N	05 W	15	BA
11	A. Mainstem Susitna (1.0 mile South of				
	Sunshine Creek Mouth)	24 N	05 W	10	
	B. Mainstem Susitna (.75 mile South of				
	Sunshine Creek Mouth)	24 N	05 W	14	
	C. Mainstem Susitna (At Sunshine Creek)	24 N	05 W	14	AA
	D. Sunshine Creek	24 N	05 W	14	AA
	(Mouth)				
12	A. Birch Creek Slough (Mouth)	25 N	05 W	25	
	(.25 mile below Birch Creek Mouth)	25 N	05 W	25	
	(Birch Creek Mouth)	25 N	05 W	25	
	(Head)	25 N	05 W	12	
13	A. Trapper Creek (Mouth)	25 N	05 W	15	
14	A. Slough Fed by Cache Creek (Mouth), 1.5 mi.				
	South West of Birch Creek Slough Head	25 N	05 W	14	

Table 1 - Cont'd.

MAP CODE	SAMPLING LOCATION	LOCATION			
		TOWNSHIP	RANGE	SECTION	GRID
14	B. Slough-Susitna (1.0 mile South West of				
	Birch Creek Slough Head	25 N	05 W	11	
	C. Mainstem Susitna (.25 mile below head of				
	Birch Creek Slough)	25 N	05 W	12	
	D. Mainstem Susitna (South West side of				
	Island, 1.5 mile South of Cache Creek Mouth)	25 N	05 W	01	
	E. Mainstem Susitna (South West side of island				
	1.0 mile South of Cache Creek Mouth)	25 N	05 W	01	
	F. Mainstem Susitna (West channel, .75 mile				
	South of Cache Creek Mouth)	26 N	05 W	35	
	G. Mainstem Susitna (Below Mouth of Cache				
	Creek Slough)	26 N	05 W	36	CB
	(Mouth of Cache Creek Slough)	26 N	05 W	35	DA
15	A. Cache Creek (Mouth)	26 N	05 W	36	CB
	(Inside Mouth)	26 N	05 W	35	ABC

Table 1 - Cont'd.

MAP CODE	SAMPLING LOCATION	LOCATION			
		TOWNSHIP	RANGE	SECTION	GRID
	Talkeetna to Devil's Canyon:				
16	A. Mainstem Susitna (Billian Slough Mouth)	26 N	05 W	23	AAD2
	B. Billian Slouth (Mouth)	26 N	05 W	23	AAD3
	(Open Lead Below Railroad Trestle)	26N	05 W	13	CCD
17	A. Mainstem Susitna (West side of Island,				
	Chulitna River Confluence)	26 N	05 W	14	
	B. Mainstem Susitna (East side of Island, .25				
	mile North of Chulitna River Confluence)	26 N	05 W	14	
	C. Mainstem Susitna (.75 mile North of				
	Chulitna River Confluence)	26 N	05 W	14	
	(1.0 mile North of Chulitna R. Confluence)	26 N	05 W	11	
	(1.25 mile North of Chulitna R. Confluence)	26 N	05 W	11	
18	A. Mainstem Susitna (Side-Channel Below				
	Slough 2 Mouth)	26 N	05 W	02	CBD
	B. Mainstem Susitna (Side-Channel above				
	Slough 2)	26 N	05 W	02	BCD
19	A. Mainstem Susitna (Below Mouth of Whiskers				
	Creek Slough)	26 N	05 W	03	ADC
	(Adjacent to Mouth of Whiskers				
	Creek Slough)	26 N	05 W	03	ABC3
	B. Whiskers Creek Slough (200 yards				
	above Mouth)	26 N	05 W	03	ADB
	C. Whiskers Creek (Mouth)	26 N	05 W	03	
	D. Mainstem Susitna (Side-channel, 1.0 mile				
	east of Whiskers Creek)	26 N	05 W	02	

Table 1 - Cont'd.

MAP CODE	SAMPLING SITES	LOCATION			
		TOWNSHIP	RANGE	SECTION	GRID
20	A. Mainstem Susitna (.25 mile NW of Whiskers				
	Creek Mouth)	26 N	05 W	02	
	B. Slough 3 (Above Whiskers Creek Slough)	27 N	05 W	35	CCC2
	C. Slough 3B (Mouth)	27 N	05 W	35	CCB
	D. Mainstem Susitna (Side Channel Adjacent				
	to Slough 3)	27 N	05 W	35	CCA
21	A. Mainsetm Susitna (Adjacent to Slough 5)	27 N	05 W	01	CCA
22	A. Slough 6A	28 N	05 W	13	CAB3
23	A. Lane Creek (Mouth)	28 N	05 W	12	ADD2
	A. Oxbow II-(Mouth)	29 N	04 W	16	CAD4
25	A. Mainstem Susitna (Curry)	29 N	04 W	10	CBB2
26	A. Side Channel Below Slough 8A (Above Mouth)	30 N	04 W	25	DBA
	(Below Mouth of Slough 8A)	30 N	04 W	25	DAB
	B. Slough 8A (Mouth)	30 N	03 W	30	CBB
	(Above Mouth)	30 N	03 W	30	BCD
	(Beaver Pond)	30 N	03 W	30	AAA
	C. Mainstem Susitna (Above Slough 8A)	30 N	03 W	20	ACB
27	A. Slough 9 (Mouth)	30 N	03 W	16	CBB
	(Above Mouth)	30 N	03 W	16	CBAB
	(Below Bend)	30 N	03 W	16	CBAA
28	A. Mainstem Susitna (300 yards below 4th of				
	July Creek)	30 N	03 W	03	DCAB
	(200 yards below 4th of July Creek)	30 N	03 W	03	DCAA
	B. Mainstem Susitna (Side channel, adjacent				
	to 4th of July Creek)	30 N	03 W	03	DAD

Table 1 - Cont'd.

MAP CODE	SAMPLING LOCATION	LOCATION			
		TOWNSHIP	RANGE	SECTION	GRID
28	C. Side Channel (Beaver pond outlet, above				
	4th of July Creek)	30 N	03 W	03	ADD
29	A. Slough 9A (Above Mouth)	31 N	03 W	36	DCB
	(First Pool)	31 N	03 W	36	DCA
	(Open Lead)	31 N	03 W	36	DBDC
	(Second Pool)	31 N	03 W	36	DBD
	B. Mainstem Susitna-Between 9A & 10				
	(Lower, Lead)	31 N	03 W	36	DBC
	(Middle, Lead)	31 N	03 W	36	ACD
	(Upper, Lead)	31 N	03 W	36	ADC
30	A. Mainstem Susitna-Below Slough 10	31 N	03 W	36	AAC4
	B. Slough 10 (Lower, Pool)	31 N	03 W	36	AABD2
	(Middle, Pool)	31 N	03 W	36	AABA
	(Tributary Stream)	31 N	03 W	25	DDC
31	A. Slough 11 (Lower Reach)	31 N	02 W	19	DDD
	(Middle, Reach)	31 N	02 W	20	CBA
	B. Mainstem Susitna (Above Slough 13)	31 N	02 W	19	ADB3
	C. Side-Channel (Above Slough 13)	31 N	02 W	19	ADA
32	A. Slough 14 (Lower Bend)	31 N	02 W	19	ACA
	(Beaver Pond)	31 N	02 W	19	ABD
33	A. Mainstem Susitna (Beneath Gold Creek				
	Railroad Bridge)	31 N	02 W	20	BAC2
	B. Mainstem Susitna (Tributary Creek				
	Above Gold Creek)	31 N	02 W	20	BAA
	C. Mainstem Susitna (North Bank above Gold Creek Railroad Brodge)	31 N	02 W	17	CDD

Table 1 - Cont'd.

MAP CODE	SAMPLING SITES	LOCATION			
		TOWNSHIP	RANGE	SECTION	GRID
34	A. Slough 16 (Mouth)	31 N	02 W	17	ABD
	(First Lead)	31 N	02 W	17	ABD
	(Second Lead)	31 N	02 W	17	ABD
35	A. Indian River (Mouth)	31 N	02 W	09	DD2
	B. Indian River (Approx. 3 miles Upstream)	32 N	02 W	33	ABD5
	C. Indian River-Beaver Pond (Approx. 7 miles				
	Upstream)	32 N	02 W	11	ADC2
	D. Mainstem Susitna (Above Indian River)	31 N	02 W	09	DCB2
36	A. Slough 17 (Mouth)	31 N	02 W	09	DCA
	(Above Mouth)	31 N	02 W	09	DBD
	B. Mainstem Susitna (Above Slouth 18)	31 N	02 W	10	CBD
37	A. Slough 20 (Mouth)	31 N	02 W	10	ADA
	(Middle Reaches)	31 N	02 W	11	BBD
	(Upper Tributary)	31 N	02 W	11	BBA
38	A. Side Channel Below Slough 21 (Lower)	31 N	02 W	02	CAC
	(Middle)	31 N	02 W	02	CAA
	(Upper)	31 N	02 W	02	ABD
39	A. Slough 21 (Mouth)	31 N	02 W	02	AAB
	(Middle)	31 N	02 W	02	AAA
	(Upper)	32 N	02 W	36	CCC
40	A. Mainstem Susitna (Above Slough 21)	32 N	02 W	36	ACD
41	A. Portage Creek (Mouth)	32 N	01 W	25	CDB4
	B. (8 miles Upstream-Below Thoroughfare Creek)	33 N 33 N	01 E 01 E	25 25	DBA4 ACD2
	C. (11 miles Upstream-Mouth of Thoroughfare				
	Creek)	33 N	02 E	17	CCB3

Table 1 - Cont'd.

MAP CODE	SAMPLING LOCATION	LOCATION			
		TOWNSHIP	RANGE	SECTION	GRID
	Devil's Canyon to Tyone River:				
42	A. Fog Creek (Mouth)	31 N	04 E	16	DBB
43	A. Tsusena Creek (Mouth)	32 N	04 E	36	ADB
44	A. Deadman Creek (Mouth)	32 N	05 E	26	CDB
45	A. Watana Creek (Mouth)	32 N	06 E	25	CCA
46	A. Kosina Creek (Mouth)	31 N	08 E	15	BAB
47	A. Jay Creek (Mouth)	31 N	08 E	13	BCC
48	A. Goose Creek (Mouth)	30 N	11 E	32	DBC
49	A. Oshetna River (Mouth)	30 N	11 E	34	CCD

Appendix III. IDENTIFICATION AND BIOLOGY OF PACIFIC SALMON

The fishes of the family Salmonidae include the species which are of greatest importance to the commercial and sport fishermen in this part of Alaska.

Pacific salmon are placed in the Genus Oncorhynchus which includes five species: sockeye, chum, pink, coho, and chinook. They are characterized by a comparatively large anal fin with 13 to 19 rays, small cycloid scales and a fleshy adipose fin (Figure 1).

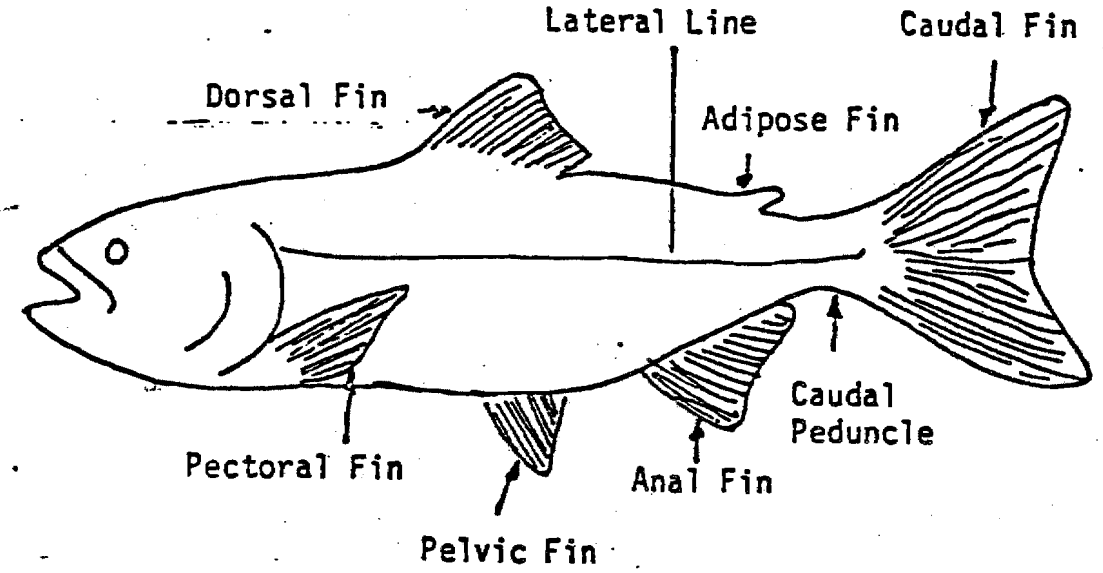


Figure 1. Salmon showing external features.

Identification

To help in the identification of the five species of salmon, the following key is presented. This key is made of a series of alternate statements. To use the key, the first statement is examined; if this is correct for the fish in question continue; however, if the statement does not apply, pass to an alternative statement. Continue in this way until an identification is obtained.

Key to Pacific Salmon

I. Distinct large black spots on back and caudal (tail)

1a. Oval black spots on caudal fin and back; slender caudal peduncle; small size (18 to 20 inches in length and average weight of 3 pounds).--Pink Salmon (Oncorhynchus gorbuscha).

1b. No oval spots on caudal fin and back (see 2a).

2a. Large irregular black spots on back, dorsal fin and both lobes of caudal fin; black gum line: large size (average about 36 inches in length and 10 to 25 pounds).--Chinook Salmon (Oncorhynchus tshawytscha).

2b. Irregular black spots on back and upper lobe of caudal fin only; white gum line; medium size (average about 28 inches in length and 8 pounds).--Coho Salmon (Oncorhynchus kisutch).

II. No distinct black spots on back or caudal fin (there may be faint spotting on the margins of the caudal fin and along the back).

1a. Gill rakers on first arch number 30 to 40, are long and slender, rough, and closely set; fairly thick caudal peduncle; spawning fish show red on sides and back; medium size (average about 24 inches in length and 6 pounds).--Sockeye Salmon (Oncorhynchus nerka).

2a. Gill rakers on first arch number 19 to 26, are short, stout, smooth, and more widely spaced; very slender caudal peduncle; spawning fish show calico marks on sides; medium size (average about 26 inches in length and 7 pounds).--Chum Salmon (Oncorhynchus keta).

Biology

Pacific salmon all have somewhat similar life histories. They spawn in freshwater from summer to late fall and die shortly thereafter. The eggs are deposited in gravel beds and the young hatch the following spring and remain in the gravel until their yolk-sacs are absorbed. At the time of emergence these small salmon are called fry. The fry of some species proceed to the sea almost immediately and are popularly called smolts, but in other species the freshwater period may vary from a few weeks to one or more years. Ocean residence also varies with the species and may be anywhere from 1 1/2 to 6 years.

Sockeye Salmon

Sockeye or red salmon commonly run from 20 to 24 inches in length and weigh from 4 to 7 pounds, rarely to 30 inches and 15 pounds.

Distinguishing characteristics are the absence of black spots, the presence of a large number (30 to 40) of long, slender, closely set gill rakers, a fairly thick caudal peduncle and the red color on the back and sides of the spawning fish.

Adult sockeye begin appearing in the spring around late May in some of the Cook Inlet streams. They spawn principally in the rivers between the lakes and along the lakeshore beaches, although the streams draining into the lakes are also important.

Fry appear in the lakes and streams in the spring and usually spend one, frequently two, and occasionally three years in fresh water, eventually passing to the sea as smolt where they mature. They return as adults after two or three winters in the sea, when they are 4 or 5 years of age. A few, for the most part males, mature one year ahead of their year class and are frequently referred to as "jacks."

Chum Salmon

Chum or dog salmon commonly run from 22 to 28 inches in length and weigh 7 to 10 pounds, rarely to 18 pounds.

Distinguishing characteristcs are the absence of distinct black spots on the back and fins, 19 to 26 smooth, widely spread gill rakers, a very slender caudal peduncle and colored bars or mottling on the sides of the spawning fish. Chum salmon are often referred to as "calico salmon" because of these vertical markings.

Chum salmon appear somewhat earlier than the sockeye salmon and in most cases confine their spawning activities to the mainstem streams.

Fry migrate to the sea shortly after emerging from the gravel, at less than 1 1/2 inches in length. Maturity is reached in the third or fourth year of life.

Pink Salmon

Pink or humpback salmon commonly run from 16 to 22 inches in length and weigh 3 to 5 pounds, rarely to 10 pounds.

Distinguishing characteristics are the large oval black spots on the back, adipose fin and both lobes of the caudal fin, dark markings that extend down the sides in irregular patterns, a slender caudal peduncle and a prominent hump behind the head in the male fish.

The fry usually hatch in the late spring and migrate almost at once downstream to the sea. They return to freshwater in the fall of the succeeding year as 2 year old adults.

Chinook Salmon

Chinook salmon, or king salmon as they are more commonly called in Alaska, run from 5 to 45 pounds, but usually fall between 10 and 25 pounds, with the exception of the numerous jacks.

Distinguishing characteristics are the presence of black spots on the back, dorsal fin, and both lobes of the caudal fin and a black gum line, as opposed to the white gum line of the coho salmon.

This species of salmon usually spawn in the larger tributaries. They enter into the streams to spawn somewhat earlier than the sockeye salmon, usually commencing the spawning migration the first week in June. The young may go to sea during the first year or remain at least a year in the streams or lakes. The major growth takes place in the sea, the fish maturing in 3 to 7 years. Males maturing sexually in their second or third year are commonly called "jacks."

Coho Salmon

Coho or silver salmon run from 24 to 30 inches in length and usually weigh about 8 to 10 pounds.

Distinguishing characteristics are the presence of fine black spots along the back, dorsal fin, and the upper lobe of the caudal fin and the presence of a white gum line.

Like the chinook salmon, the coho usually spawn in the larger tributaries, entering into the streams to spawn in late July.

The fry remain in freshwater for varying periods, the majority apparently migrating to the sea in the spring of their second year of life. They return as adults in their third or fourth year, spawn and die.

GENERAL CHARACTERISTICS OF SALMON SPECIES

SOCKEYE:

Thick caudal peduncle (not as thick as a coho)
Tail and fins transluscent green
Gill rakers fine and many
Flesh bright red
Head green in color

CHUM:

Narrow caudal peduncle
Caudal fin more forked than sockeye
Silver color in caudal fin occuring in radiating rays
Pupil of eye usually large
Gill rakers thick, few in number

CHINOOK:

Large size
Much spotting on back and caudal peduncle
Silver color in tail very evident

COHO:

Blocky caudal peduncle, more than sockeye
Very little fork to tail
Spotted, less spots in tail than in chinook
Much silver color in tail with black fringe
Eye pupil usually small

PINK:

Small size
Spots in tail
Scales very small

13a Scales small, 170 or more in first row above lateral line; large spots on caudal fin and back. Range: Arctic Alaska-California; Japan. Oncorhynchus gorbuscha (Walbaum) (pink or humpback salmon)

13b Scales not small, 155 or fewer in first row above lateral line; spots absent or small in size.

14a Gill rakers 19 to 28 on first arch, short and stout.

15a No distinct spots on back or caudal fin, only speckling present; 19 to 26 scale rows above lateral line. Range: Arctic Alaska-California; Kamchatka. Oncorhynchus keta (Walbaum) (chum or dog salmon)

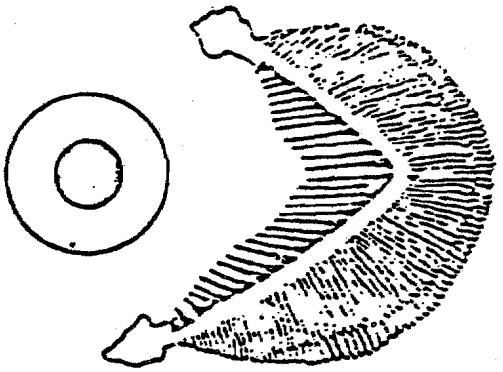
15b Spots small, irregular; 25 to 31 scale rows above lateral line.

16a Anal rays 15 to 17; pyloric caeca 140 to 185; black spots on both lobes of caudal fin. Range: Bering Sea-California; Japan. Oncorhynchus tshawytscha (Walbaum) (king, chinook, or spring salmon)

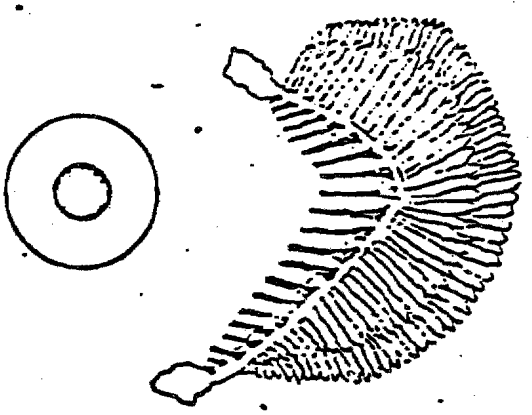
16b Anal rays 13 to 15; pyloric caeca 45 to 80; black spots, when present, only on upper lobe of caudal fin. Range: Bering Sea-California; Japan. Oncorhynchus kisutch (Walbaum) (silver or coho salmon)

14b Gill rakers 30 to 40, long and slender. Range: Bering Sea-California; Japan. Oncorhynchus nerka (Walbaum)11/ (sockeye or red salmon)

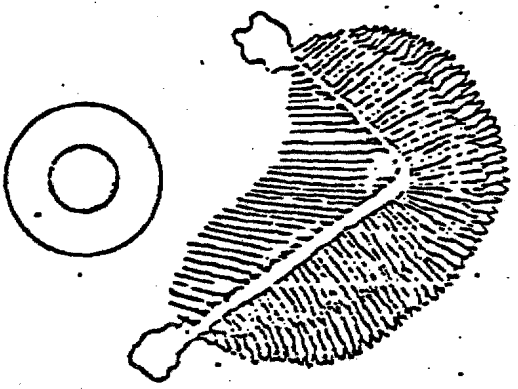
11/ The breeding landlocked form of Oncorhynchus nerka is usually given a subspecific designation, Oncorhynchus nerka kennerlyi (kokanee or little red fish). The range of the kokanee parallels that of the typical subspecies. Apparently, the landlocked form has been repeatedly developed from parent sea-run stocks.



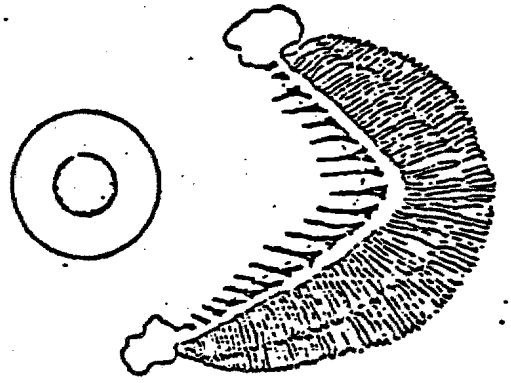
PINK



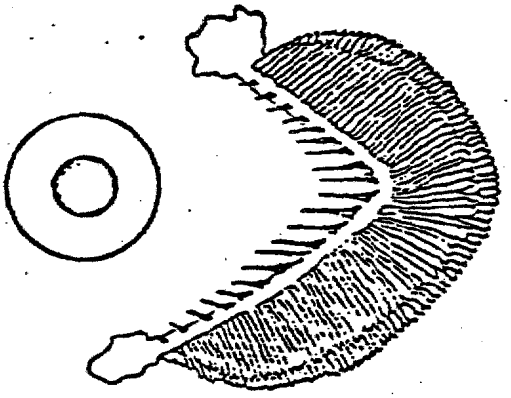
CHUM



SOCKEYE



CHINOOK



COHO

Figure 2.—First gill arch and eye for comparison with longest gill raker length of five species of Pacific salmon.

EQUIPMENT AND CAMP MAINTENANCE

Camp Maintenance

Maintaining a clean and efficient camp site is all that will normally be required of each field station crew. A few of the things to check are:

1. Maintenance of cabins and other installations will be performed as necessary. All materials necessary will be provided.
2. Grounds will be kept free of liter. All garbage will be burned, then buried in garbage pits perferably located on sandbars. Special precautions should be observed whenever burning trash or garbage to insure against the fire getting out of control.
3. The project leader is responsible for completion of all forms and reports.
4. Upon completion of the summer season, all camp equipment will be cleaned preparatory to winter storage or return to headquarters.
5. All sampling nets, tents, and tarps must be dry before being stored.
6. A complete inventory will be taken by the project leader or by permanent personnel at the close of the field season.
7. All equipment will be brought in when the field station is disbanded in the fall.

Equipment Maintenance

Equipment maintenance is perhaps one of the most important operations you will perform during the field season. The outboard motors and generators must be kept in good operating condition or the whole program will suffer.

It will be the projects leader's responsibility to assign the most knowledgeable member of the crew to the job maintaining and servicing the equipment. It will be this persons responsibility to see that all of the equipment is kept in operating condition.

Outboard Motors

Your outboard motor will perform longer and give less trouble if these suggestions are followed:

1. The correct fuel mixture is printed on each outboard motor in the vicinity of the fuel attachment point. Always pour the oil into the tank first, then add 2 or 3 gallons of gas and mix thoroughly, then fill tank to capacity always using large funnel and chamois filter.
2. When mixing gasoline or filling the tanks of the generator, stove or lantern, keep the following in mind:

a. Always mix fuel tanks or equipment under cover to prevent introduction of water. Always use a funnel and filter.
b. Fill camp stoves and lanterns outside of cabin or tent, as the danger of fire is very real.
c. A little extra effort toward cleanliness will pay big dividends in hours of trouble free operation.

3. Always place outboard in neutral when starting.
4. The motor will be adjusted and should require no further adjustment.
5. Check daily the clamp screws that hold the outboard to the transom. Also check daily, the motor for loose screws and bolts, cracks, and break, especially in the area of the lower unit.
6. Never run the outboard at a tilted position for more than a few seconds (as when pushing through weeds or shallow water) as the water pump will not draw. Adjust tilt of motor so that the shaft is nearly perpendicular to the surface of the water when operating.
7. In the normal operation of a water pump, a "tell-tale" stream of water is discharged from a hole in the bottom edge of the cowl or from the back of the shaft. If this stream of water stops, the water pump is not working and the motor should be shut off. The side plate over the water intake can be removed for temporary relief as it may be plugged. If the pump continues not to function, the outboard should not be run, and a report to base camp should be made.
8. Check the grease in the lower unit of prop outboards once a week. Jet units must be greased daily. This is crucial. Special grease guns will be provided.
9. If the skeg or jet unit hits bottom, check the screws for tightness and housing damage.
10. If your outboard will not start, check the following:
    a. Check to see if fuel line is connected to the motor and the tank or pinched or kinked.
    b. Check to see if there is water in the gasoline.
    c. Check to see that the engine is not flooded.
    d. Check the spark plugs as they may be fouled or defective (replace if needed). If no spark, report to base camp.

Lastly, it should be emphasized that the salmon enumeration counts and sampling must continue, as they are very important to the program. All stations will be provided with a spare outboard and the base camp will replace all inoperative outboards as soon as possible.

Generators and Batteries

Portable generators will be supplied to all field camps. Their maintenance follows the same line as for the outboards. Since the generators have 4-cycle engines, mixed gas must not be used. The crankcase oil reservoir should be checked daily and maintained at the full level. After 25 hours of operation the oil should be changed. Spark plugs should be checked every five (5) hours of operation.

Food Orders

Grocery orders will be placed with the Anchorage office once a week. A grocery request list will be supplied to each camp. Please order all food by corresponding numbers. This saves alot of time on the radio and/or telephone and also lessens the chances of mix-ups of orders.

Appendix V.

COOK INLET
(Order by Numbers)

BEANS

1. baked beans
2. chili
3. kidney beans
4. pinto beans
5. pork and beans
6. small red beans, packaged
7. small white beans, packaged

BEEF - CANNED

8. corned "Dinty Moore"
9. hash
10. roast with gravy
11. sloppy joes
12. stew, "Dinty Moore"

BEER (pay from personal account)

13. case
14. 6-pack

BEVERAGES

15. canned soda
16. coffee, instant
17. coffee, regular grind
18. tea, bags
19. tea, instant

BREAD AND CRACKERS

20. pilot bread
21. ritz crackers
22. soda crackers
23. white, loaf
24. whole wheat, loaf

CAKE AND MUFFIN MIXES

25. blueberry muffins
26. brownies
27. chocolate
28. corn bread muffins
29. snack-n-cake
30. white
31. yellow

CEREALS

32. cream of rice
33. cream of wheat
34. quick rolled oats
35. variety pack
36. wheaties

CHEESE

37. Parmesan
38. monterey jack
39. swiss
40. tillamook, mild
41. tillamook, sharp

CHOCOLATE

42. hot instant Nestles
43. Nestles baking chocolate
44. Swiss Miss

CONDIMENTS

45. cucumber pickles
46. dill pickles
47. honey
48. horseradish
49. ketchup
50. mayonaise
51. mixed nuts
52. mustard
53. olives
54. sweet pickles
55. syrup, Log Cabin
56. vinegar

DAIRY

57. "Coffeemate"
58. evaporated milk
59. Milkman

DESSERTS (cookies, jello, candy, gum)

60. candy bars
61. chocolate chip cookies
62. chocolate cream filled cookies
63. fig newtons
64. gum, assorted
65. Jello gelatin

Jello pudding

66. Chocolate
67. Vanilla
68. Butterscotch
69. Banana cream

70. marshmallows
71. oatmeal cookies
72. vanilla cream filled cookies

DETERGENTS AND CLEANSERS

73. Ajax
74. bar soap
75. bleach
76. Boraxo
77. cold water "All"
78. green soap
79. liquid Ivory
80. scouring pads (Brillo & S.O.S.
81. sponges

FLOUR

82. bisquick
83. krusteaz
84. white
85. whole wheat

FROSTING MIX

86. chocolate
87. white

FRUIT-FRESH

88. apples
89. bananas
90. grapes
91. melons
92. oranges
93. peaches
94. pears
95. other, in season

FRUIT-CANNED

96. applesauce
97. apricots
98. fruit cocktail
99. grapefruit slices
100. mandarin oranges
101. peaches
102. pears
103. pineapple
104. raisins

GRAIN PRODUCTS

105. egg noodles
106. elbow macaroni
107. shell macaroni
108. spaghetti

JUICE

109. apple
110. grape
111. grapefruit
112. lemon
113. orange
114. pineapple
115. tang
116. V-8

MEATS

117. bacon
118. ham
119. hamburger
120. hot dogs
121. pork chops
122. pot roast
123. sandwich meats
124. sausage
125. steak
126. veal cutlet

MIXES (packaged)

127. dream whip
128. frying mix
129. pie crust
130. sour cream
131. spaghetti sauce

NON-EDIBLE

132. aluminum foil
133. "Cutters"
134. lye
135. matches
136. paper towels
137. pic or buhach
138. sandwich bags
139. toilet paper
140. toothpicks

OIL AND BUTTER

141. butter, canned
142. margarine
143. olive oil

Peanut butter

144. creamy
145. chunky

146. shortening, canned
147. "Wesson"

POULTRY

148. chicken, fresh
149. chicken, prepared
150. chicken, canned
151. eggs, 1 dozen

PRESERVES

152. apple butter
153. apricot
154. blackberry
155. boysenberry
156. grape
157. raspberry
158. strawberry

RICE

159. brown, long grain
160. minute
161. misc. mixes
162. white, long grain

SAUCES

163. A-I
164. barbeque
165. soy
166. tobasco
167. Worchestershire

SOUP

168. bean with bacon
169. bullion cubes, beef
170. bullion cubes, chicken
171. clam chowder
172. chicken noodle
173. cream of mushroom
174. minestrone
175. onion

SPICES

180. allspice
181. baking powder
182. baking soda
183. basil, sweet
184. bay leaves
185. chili powder
186. cinnamon
187. garlic salt
188. garlic powder
189. onion salt
190. oregono
191. paprika
192. pepper, black
193. table salt
194. vanilla

SUGAR

195. brown, light
196. granulated
197. powdered
198. raw

VEGETABLES, CANNED

199. asparagus
200. beets
201. carrots

Corn
202. cream style
203. whole kernal
204. on the cob

Green beans
205. french style
206. cut

207. mushrooms
208. peas
209. sauerkraut
210. spinach
211. tomatoes, stewed
212. tomatoes, solid pack
213. tomato sauce
214. tomato paste

VEGETABLES, FRESH

216. lettuce
217. mushrooms
218. onions
219. potatoes, 10 lb. sac
220. radishes
221. tomatoes
222. misc, in season

HEALTH AND SAFETY

I. Introduction

This is a brief summary of some of the important things to remember when working on various field projects. This manual is in no way a substitute for common sense and experience, but can help you survive the season. You are responsible for familiarity with its contents.

Some new employees have competence in outdoor skills while others do not. If uncertain, ask the assistance of trained people to learn the safe approach to field work. Here are some general reminders before listing the safety rules you will be required to follow.

1. Field camps are generally remote simple facilities with rather uncertain communications and transportation if emergencies arise.
2. With few exceptions, the work is on water where temperatures range from 32.5o to perhaps 45oF. Survival for the average individual is a matter of minutes in water at these temperatures.
3. Bears and moose are common. Don't taunt wild animals and be especially wary of foxes, skunks, dogs or cats that show unusual behavior, including tameness, as these animals may have rabies.
4. You will be constantly involved with mechanical jobs from which injuries could result. Learn the safe way and take the time to do them right.
5. Most important, and most general of all, if it can't be done safely, don't do it.

II. Public Safety

1. State work areas

a. While employed by the State, you are its representative to the people. Work areas are generally open to public inspection and should be presentable.

b. Work areas should be maintained so as not to pose a hazard to visitors or camp occupants.

(]) Paths and walkways should be clear of obstructions.

(2) Buildings or other living facilities should be both safe and neat.

c. State crews should render assistance in emergencies such as result from overturned boats, or physical injuries. State equipment cannot be used to ferry non-staff personnel about under other than emergency situations.

d. Food stores, gas and oil, equipment and commodities are the property of the State, and as such, cannot be dispersed except in obvious emergencies.

III. Project Work

.]. Firearms

a. Federal law prohibits carrying firearms on scheduled airlines.

b. Firearms may be carried on State charter and State aircraft if consistent with state business.

(]) Firearms must be unloaded and bolt or cylinder removed is possible.

(2) Tell the pilot of any firearms you are carrying.

c. Firearms are not encouraged in field camps for recreation.

d. No firearm should be taken to a State facility without approval of hiring authority.

e. A firearm should be maintained on each field site for emergency use on rabid animals or bears.

(1) An emergency weapon for areas where bears are common should be no smaller than 30.06 caliber with 150 grain ammunition.

(2) A bear should never be fired upon unless it is considered a threat to life or is incurring substantial property damage. If possible, check with your supervisor before taking action against a bear.

(3) Any bear activity in your area should be reported on your regular radio schedule.

(4) Never stand between a sow bear and a cub, or between a bear and its direct route of escape or travel.

(5) Don't consider a bear as friendly and attempt to approach it for purposes of feeding or photographing it.

(6) Rabid animals are common in the Alaska Peninsula, Bristol Bay, and the interior of Alaska.

2. Field projects

a. Before transfer to a field station, be sure any special health problems are brought to the attention of your supervisor.

b. Take adequate quantities of special supplies such as decongestants with you since these will not be available in the field and complicate routine field ordering if requested by radio.

c. Think through work assigned to you. Be certain you understand directions, and prepare for safety hazards that are likely to occur.

d. Learn to use the correct method of lifting; keep back upright and knees bent.

e. Don't carry overly heavy or bulky objects alone. A fall could injure you, the item carried, or both.

f. Drunkenness, falsification of data or records, and lack of compliance with work or safety standards set by this leaflet and your supervisor are cause for immediate termination. Awareness of these standards is the responsibility of each employee.

g. Always be sure someone is aware of your location and work schedule so if you are not back on time, a search can be initiated.

h. Wear gloves when working on sharp or heavy objects.

3. Gilnetting

a. Temperatures may fluctuate. Learn to dress properly to prevent overheating and chilling.

b. Take care of your hands. Avoid continued wetness or use of wet gloves. Skin dries out rapidly, causing splitting and severe chapping which is difficult to cure.

c. Become familiar with skiffs and their usage as described in Section III(4).

4. Skiffs and motors

a. Before a skiff is put in the water, it should be inspected for rot, loose screws and nails and open seams. Make repairs before using. An unsafe skiff which cannot be

repaired should not be put in the water. Report it to your supervisor and seek a replacement.

b. Be sure you have a line attached to the skiff before sliding it into the water.

c. Complete the check of necessary equipment before using the skiff. Normal gear on skiffs with outboards includes:

(1) Outboard tank, filled without leaks.

(2) Gas hose for tank and outboard connection. Check for breaks in rubber, and missing or damaged seals in tank and motor connector. Air leaks cause motor failure.

(3) Repair kit containing flashlight, appropriate spark plugs, wrench and shear pins, screwdriver, pliers, and cotter pins for the propeller shaft cap.

(4) A pair of oars and oarlocks, or no less than one oar for use as a paddle.

(5) Anchor and adequate line.

(6) Safety chain from skiff to motor.

(7) Sturdy tie-up lines

(8) Bumper cushions if applicable.

(9) Bailing can or bucket.

d. For long trips, special equipment should be added as needed.

(1) Portable two-way radio, if available.

(2) Extra tank, gas, and spare hose.

(3) Spare motor.

(4) Spare propeller.

e. In shallow or unknown water, speed should be reduced to a safe level to prevent skiff or motor damage.

(1) Walk the boat through shallows where motor or skiff damage might occur.

(2) Be certain motor is in unlocked position so it can ride over obstructions.

(3) Move or load foreward to reduce the draft at the stern.

(4) Place an observer forward to watch for obstructions.

(5) Be certain all persons are seated on seats, or floor.

f. Never attempt to carry an outboard while climbing over the side of a skiff from shore or from another skiff.

g. Never attempt to mount an outboard while standing in a floating skiff. Take the skiff ashore, and with necessary manpower, wade to the stern and mount the motor.

h. Check engine mounting clamps frequently to be sure they are tight.

i. Always use a safety chain on the motor to prevent loss in the event of a hard shock such as striking bottom at high speed.

j. In the event of engine failure, row ashore first, if on river, then check for the problem. You may otherwise be too far down river to walk back if you cannot restart the engine.

k. Do not "tinker" with the engine if it is operable. Endless problems result from mis-directed energies of persons who know nothing about engines. Get assistance from a mechanic or your supervisor.

l. When draining the water from a skiff equipped with transom

drain plug, hold the plug in your hand until replaced in the transom. Laying it down might make you forget that it was removed, and the skiff will flood when forward motion ceases.

m. Floorboards may become slick from a spill of gas or oil. Put some soap in the bilge water and scrub it out immediately.

n. No one shall sit on gunnels or transom while a skiff is in motion.

o. While moving around a work area in a skiff, the crewmen may need to stand to observe lines, anchors or such. Crew should keep low and inboard, and have a hand on the boat. The boat in such circumstances should be operated at low speeds.

p. Life vests or coats will always be worn on the water, unless the crewman is wearing a wet suit.

q. Use special care when using ropes and lines for lifting, towing or anchoring.

(1) Remember the sailors axiom, "don't get in the bight o' the line." A foot in a coil of rope that is being used can have disastrous results.

(2) Stand aside of the whiplash path of any line or cable under stress.

(3) When towing lines, don't wrap them around your arm, leg, or body. Tie them to the skiff.

(4) When towing a heavy load, everyone in the boat must sit or kneel in a braced position. If the line should break, the skiff will lurch violently forward and may

cause injury or loss overboard.

(5) Keep lines coiled, sorted and dry when out of service. Tangled lines are useless if an emergency arises.

(6) Don't leap ashore from a skiff in deepwater. Wait until the boat is held ashore by the motor before climbing out to tie up.

5. Water Safety

a. The waters of Alaska, in general, are cold enough to cause very rapid body-heat loss, which commonly results in shock and death. Reducing heat loss increases chance of survival in water.

(1) "Long johns," heavy socks and snug-fitting cloths act as a wet suit, reducing exchange of water next to the skin.

(2) Tight cuffs, collar, and water-proof clothing help reduce cooling.

(3) <u>Do not</u> flail, kick or swim in very cold water to increase circulation. This merely increases the rate of heat loss and reduces chance of survival.

(4) Don't attempt to swim ashore unless it is within a few yards. If you are with a boat, stay with it. Rely on your life jacket, and walk out when your feet touch bottom. If you have followed established procedures, someone will know you are in trouble and soon be looking for you.

(5) Once ashore, attain the warmest situation possible and remain quiet until help arrives. Possibly lying

down in a sheltered spot and remaining immobile in your wet gear will be the warmest. This must be determined by the weather.

b. Duration of survival in Alaskan seas is estimated at 15 minutes by the Coast Guard. Inland waters are both warmer and colder than the seas.

c. Become familiar with approved first air techniques for shock and artificial resuscitation described in Red Cross and State Industrial safety manuals.

d. At the first indication of an emergency which might require evaluation, report to Soldotna main office so transport to Soldotna and Anchorage hospitals can be arranged.

e. A basic of water safety is that a rescuer should not go in the water after a victim, thereby risking his own life. A rope, pike pole oar or other device should be reached out to the person.

IV. Permanent Buildings

a. Kitchen safety rules:

(1) Keep walls, ceilings and appliances free from grease build-up.

(2) Empty paper and rubbish daily.

(3) Keep floors free of slippery material. Wipe up spills or any kind immediately.

(4) Provide ventilation to keep air reasonably fresh.

(5) Stay alert for oil or gas leaks near or in the structure and repair immediately.

(6) Keep a good fire extinguisher available which is rated for

paper, grease and oil. Such extinguisher should be at least the 2 lbs. size.

b. Living area rules:

(1) Do not permit build-up of oily or damp material. Keep areas trash free.

(2) Provide ventilation to preclude vapor build-up from stoves and similar sources.

(3) Develop strict habits against smoking in bed.

(4) Report problems such as broken chairs, protruding nails or other unsafe conditions to your supervisor and correct promptly.

c. Shops and storage rules.

(1) Keep gas, oil, thinners, paints and other flammables stored away from living and sleeping areas.

(a) Storage should be marked as containing flammables.

(b) Constant ventilation should be provided.

(c) All containers should be tightly covered.

(d) Where separate permanent storage is not available, maintain storage under canvas, or plastic as necessary.

(e) Smoking is prohibited in storage areas.

(2) Remove all trash, oil rags and similar waste to prevent a built-up of flammable material.

(3) Keep walkways and work areas orderly and clear of obstructions.

(4) Return picks, axes, shovels and other tools to their storage area after each work period. In most areas, night crews must also use the work areas.

d. Saunas and smoke houses have caused numerous fires in field camps resulting in unnecessary property loss. Neither will be built nor

operated without the approval of the permanent area supervisor. If

(1) They will not be built or used within 100' of any fuel or flammables, living, work, or storage areas, or other state facilities or equipment.

(2) If operation or use of a sauna or smokehouse results in the loss of state property, replacement may be charged to members of the crew at the camp.

2. Fire and heating.

a. Inspect, clean and repair all appliances prior to each season.

b. Always fill portable appliances out-of-doors, preferably on the ground.

c. Non-portable stoves should be filled with a funnel and nozzle-type can. Care should be taken to prevent any spillage, but if it occurs, wipe up the fuel immediately from floor or appliance.

d. Test all portable appliances out-of-doors with adequate ventilation until proper operation is assured.

e. Be certain your clothing and skin surfaces are free of fuel before striking a match or approaching an open flame.

f. Stove installations in a tent or permanent structure must conform with items listed under part IV (1) and (2) as they apply to stoves and lanterns.

g. Heating stoves in tents and permanent installations require:

(1) A metal drip pan for space heaters.

(2) An asbestos wall shield if placed near a wall.

(3) Asbestos and metal ceiling or tent wall shields.

(4) Stove pipe that is in good repair and adequately supported.

V. Equipment Use and Maintenance.

1. Handtools, including power tools should be inspected annually for general condition and repaired use. Tools that cannot be repaired should be returned to the area office.

   a. Hand tools

      (1) Do not stand, or permit anyone else to stand directly in front or in back of a person swinging a tool such as an axe, sledge or pick.

      (2) Do not swing an axe, sledge, or similar tool where limbs or brush are in the sweep of the tool.

      (3) Use tools for the job they were designed to do. It saves tools, is more efficient, and prevents injuries caused by breakage, chipping or other malfunction.

      (4) When transporting or carrying tools, be sure cutting edges are covered to prevent injury if a fall occurs.

      (5) Don't walk with tools over your shoulder.

      (6) Lay tools flat and in a safe location when not in use. Don't strike them into the ground or other surface which leaves one edge or surface upright.

      (7) Put tools away at the end of each work day.

   b. Power tools

      (1) Keep power tools and cords away from water where an electrical short might result in electrocution.

      (2) Wear safety goggles when cutting hard material with a power saw or grinder.

      (3) Be sure cords and wiring are clear of the tool path when cutting or drilling with power equipment.

(4) Be sure blades are securely mounted and free from cracks before using a power saw. Frequent inspection is required of metal cutting blades.

(5) Always unplug equipment before leaving it unattended.

2. Generators and pumps

a. Generators supply the power in most field camps, including that for radios. Maintain them as directed and report serious problems immediately.

b. Don't leave power wires or extension cords plugged in when not in use.

c. Be sure gear is protected from the weather and kept dry.

d. Pumps, generators and other engine-powered equipment should be operated away from any flammables.

e. Shut all such equipment off before fueling.

f. Never add fuel when smoking or while near an open flame.

g. Be certain any spilled fuel is wiped up or allowed to evaporate before restarting engine.

h. Don't permit operation if gas leakage is observed. Make repairs first.

3. Safety equipment

a. Fire extinguishers should be present in each facility, permanent or temporary.

(1) Be sure crew knows extinguisher locations.

(2) Be certain extinguishers are charged at the start of each season.

(3) Read instructions to familiarize yourself with method of usage and type of fires for which the gear is suited.

b. Safety goggles should be supplied at all camps where power tools are used, or brushing work is required.

c. First aid should be reviewed in the industrial safety manual by all camp personnel.

d. First aid kits should be checked and filled before each field season begins. Each kit should contain the following as a minimum.

(1) Burn ointment

(2) Eye ointment

(3) Merthiolate

(4) Band-aids

(5) Gauze eye pads

(6) Aspirin

(7) Adhesive tape

(8) Triangular bandages

(9) Insect repellent

(10) Gauze compresses

Safety (adapted in part, from A-Y-K manual)

All crew leaders are required to have a current First Aid card. Although not required, it is helpful if everyone assigned to remote field camps have current first aid training.

ALWAYS BE CAREFUL, IT MIGHT BE QUITE A WHILE UNTIL THE NEXT PLANE CAN GET IN. BESIDES, WE DO NOT LIKE SENDING YOUR BODY HOME TO YOUR MOTHER, IT MAKES FOR A BAD IMAGE.

1. Water operations. When operating in or over water more than ankle deep, temporaries are REQUIRED to always wear personal floatation devices (PFD's). This way when you goof your body will be easier to find.

Drowning, exposure or shock from falling in the water has been a great killer of Fish and Game employees.

Whenever you fall in cold water, your only goal for survival is to get out of the water. Don't try to breathe, if the water is real cold you will not be able to anyway. You have to get out of the cold or get your body warmed up before you will be able to get a breath.

Do not rely on your Coast Guard approved personal floatation device to save your life because seldom can anyone get to you in time to do anything more than to recover your body.

Generally your only chance to survive is to swim as hard and as fast as you possibly can. This way your body generates a little heat to offset the extremely rapid heat loss that so quickly kills. Also, with the heavy exercise, sometimes you will be able to catch a breath or two.

Hanging onto an overturned boat while your body is in the cold water will not extend your life more than a few minutes. When your boat overturns, the first thing towards righting it is to get the motor off. Undo the safety line first. Be careful that when you unscrew the motor from the transom that your hand or sleeve does not get hung up when the motor drops off as it is hard to swim with a 136 pound anchor hooked to one arm. Pass the anchor line or tie-up line through the oar lock hole, throw this line across the bottom of the boat to the other side where you use it to pull yourself onto the bottom of the boat. Stand up using your weight with the rope to maintain your position and to pull the boat over. If the boat is too large to turn over, you use the rope to tie yourself on to the bottom. Once upright, one gets into a swamped boat over the stern.

If you fall out of a moving boat that keeps moving, the boat will generally start circling in a diminishing circle as the unattended motor turns itself too hard over. With rare exceptions it will never be possible for one to catch a spinning boat without getting caught by the propeller first. Since the boat will travel in a right hand or clockwise circle if the motor is loose enough to turn itself, you should always try to swim to the outside of the circling boat.

Following is an arcticle on cold water drowning that everyone should read!

2. First Aid Kits. Kits will be provided to all camps. They should be maintained at all times. When something is used it should be replaced immediately.

Water

Water at Susitna Station is obtained from a clearwater spring in the area. We have never had any problems with contamination and local residents have had water tests conducted and have found nothing wrong with it.

If you are in an area where water quality is questionable you may purify it by one of the following methods.

1. Boiling. This method is satisfactory if adequate fuel is available. Boil the water vigorously for at least one full minute. If necessary, strain the water through a clean cloth to remove floating matter before boiling. If muddy, the water can be allowed to settle overnight before pouring off the clear water to boil.

2. Liquid Chlorine. Laundry bleach (like Clorox or Purex) can be used according to the following table:

Gallons of Water	Add this many teaspoons of bleach Clear Water	Cloudy Water
5	1/4 tsp.	1/2 tsp.
10	1/2 tsp.	3/4 tsp.

Mix thoroughly by stirring or shaking the water and bleach and let stand for 30 minutes.

3. Chlorine, Iodine or Halazone tablets: Follow the instructions on the bottle.

Rabies

Although not common in the Susitna area there is always a possibility of becoming exposed. A temporary AYK employee had to have the rabies preventive series of shots as a result of skinning a dead fox he found. Tests showed the fox to be rabid.

If you think you have been exposed to rabies, report the incident immediately as it is important to begin medical treatment at once. Only one person is known to have survived rabies once the symptoms have shown up, and it then took the full facilities of a large hospital to save the 6 year old boy.

Rabies may be transmitted by contact with an infected animal through cuts or nicks on the hands, face, etc., besides the more common method of being bit by the infected animal. Normal incubation time for rabies is three to five weeks, but it may be as long as one year.

Treatment for rabies should begin as soon as possible after possible exposure. Treatment is usually effective, but again its effectiveness is dependent primarily on timeliness.

THERE IS NO METHOD OF DIAGNOSING RABIES UNTIL THE ACTUAL SYMPTOMS DEVELOP AND THEN IT IS TOO LATE.

Only the head of the animal is needed for testing to determine if the animal was rabid. If the animal is determined to be not rabid it will save you a very painful series of rabies shots. If a rabies test on an animal is desired, sever the head from the body and place the head in a tight container, a plastic bag is ideal. The carcass should be burned. AVOID direct contact with the animal, use waterproof gloves or plastic bags on your hands and then burn them (the gloves or bags, not your hands you dope).

Over-wintering and freezing of the carcass does not kill the rabies virus. Animals other than members of the dog family may carry rabies. Ground squirrels have often been found carrying rabies antibodies.

Cuts

When using an axe or any other tool that may cut or mash, THINK THINK, what if I slip, what if that piece of wood flies up and hits me in the face, what if the tree falls the wrong way, what if I got my finger in the wrong place and it gets hit with a hammer, what if. . . . . ?

Fire

Luckily, we have not lost any field camps due to fires in Cook Inlet, but it has happened in other areas and some of the people involved lost all their gear except for the clothes they had on. They lost cameras, sleeping bags, everything, and the Department lost a large amount of camping gear, outboard motor and hard to get fuel. The State of Alaska lost the irreplaceable biological data the temporaries were hired to obtain.

There are a few simple rules to follow which lessen the chance of fire:

1) Never leave a lit stove or lantern unattended. Always turn everything off when leaving camp, even if for only a few minutes.

2) Store all fuel at a distance from camp. Pressure appliances and kerosene stoves should be refueled away from camp so that spilled fuel will not have a chance of being ignited.

3) Never, never, not EVER loosen the fill cap or fill any appliance or stove while it is lit.

4) Do not fill the outboard fuel tank while it is in the boat. The spilled fuel in the bottom of the boat has a bad habit of catching fire.

5) Fire extinguishers should be maintained in all camps. Extinguishers should be placed just outside the main door of a tent. If an extinguishers is used, even if only a small amount of it is to be replaced. If an extinguisher is empty or not available, then water will be kept available at all times in case of a fire. Gas cans with their tops cut out make good water containers.

Personal firearms

Rifles or shotguns are never allowed in camp unless authorized by the superviser. Pistols are never allowed.

Boating safety

The tie-up line should never be long enough to get caught in the propeller. The motor is always attached to the boat with a safety chain or rope strong enough to hold the motor should it come off while running. Always have a pair of oars, an anchor and enough anchor line to hold the boat in the deepest water you will be in. The anchor rope should be about four times as long as the maximum depth of the water. Always securely tie or anchor a boat after docking. Unattended boats have drifted away and it is a long walk back to camp across the water.

PFD's are made to wear, not to sit on. You can be terminated on the spot if you are not wearing your PFD when in water deeper than ankle deep.

Shotgun

The shotgun is for protection from bears and therefore it should be ready to use at all times. Keep the shotgun in an area where it is protected from the weather and yet is very easily accessible in case of problems. The shotgun is to be kept loaded at all times. Be sure you know exactly how to use the shotgun. Make sure you take a gun to the sonar shacks each time you go.

A bear is to be shot in the HEAD ONLY, use a body shot for rabid animals other than bears as the brain is needed to diagnose rabies.

Bears are seldom a problem unless you cause them to be one. An animal that becomes use to people, especially through encouragement by feeding, tends to become somewhat civilized and then as with any civilized animal, problems will occur. Other problems can occur when you or the bear suddenly come upon each other at close range, when you get too near a mother with cubs, when you get too close to a bear's food, and when you act afraid and run from a bear.

Since food will attract a bear, keeping any attraction out of camp is very important. Food or the odor of food, including garbage should never be where any bear can get it. Never clean fish near camp, try and keep fish slime out of your boat and keep all spawned out fish away from camp. Dirty clothes, especially if they have a strong smelling grease like bacon or grease fish were fried in on them, can attract bears.

To run and/or show fright around any carnivorous animal, be it a pet dog or a wild bear can cause it to come after you. The best thing you could do when close to a bear that does not run from you as soon as it sees you is to charge towards the bear to the nearest tree and get your self about 15 feet (5 meters) above the bear. The direction of your charge can be almost at a right angle from the bear, but never should it be in the least amount away from the bear. Do not get too high in the tree as you need to see what the bear is doing at all times. Brown bears, except for the young, do not climb trees. Black bears do climb, so they need more care if one chases you up a tree. Try and pick a small tree without large branches.

A bear attacks with its mouth and almost never will it strike or hold with its claw until it has a hold with its teeth. Bears most always come after another animal, man, caribou, salmon, or each other with their head low. Even with the largest of the brown bears, it is an easy shot into the top of its skull. Even 7 1/2 bird shot in a 20 ga. has killed a charging mother brown bear.

Camp is supplied with a 12 ga. shotgun and slug and buckshot shells. When you have to shoot a bear, shoot for the skull. The buckshot will easily penetrate the skull, killing it immediately. Any other place, even a heart shot, will not kill a bear quick enough to prevent it from mauling a person.

Never try to scare a bear away by shooting it in the hind end. It just makes for a sore and mad bear. Often a shot near the bear will do the job of scaring it away. Any bear in camp more than twice should be removed with extreme prejudice.

Since bears have poor eyesight, they will often stand up on their hind legs to get a better look. Never shoot a standing bear, they are curious and are only trying to see what is there. It is not the curious bear that charges unless you give it cause to, like running from it.

If you have to kill a bear, a full report normally must be written. The skull and hide, if any good, is to be saved and turned into the office. The skull is to be boiled and cleaned before it rots.

Since the shotgun is only for protection, it is to be in a handy location and loaded at all times. Be sure that you and everyone else in camp knows how to use the shotgun, it might save your life.

Always let someone know or leave a note as to where you are going if you leave camp and when you will be back. Do not deviate from your route so if you do not return we will know where to start looking for you.

For more information on Boating Safety, contact the nearest Coast Guard Office:

USCG BOATEAM 1
[illegible] Commercial Street
[illegible], MA. 02109

USCG BOATEAM 2
1520 Market Street
ST. LOUIS, MO. 63102

USCG BOATEAM 3
Governor's Island
NEW YORK, NY. 10004

USCG BOATEAM 5
431 Crawford Street
PORTSMOUTH, VA. 23705

USCG BOATEAM 7
33 W. Flagler, Suite 700
MIAMI, FL. 33130

USCG BOATEAM 8
1319 Patterson Road
NEW ORLEANS, LA. 70114

USCG BOATEAM 9
103 Wall Street
HURON, OH. 44839

USCG BOATEAM 11
Coast Guard Base Terminal Is.
Building 6
SAN PEDRO, CA. 90731

USCG BOATEAM 12
U. S. Navy Communication Sta.
STOCKTON, CA. 95203

USCG BOATEAM 13
NSA Sand Point
SEATTLE, WA. 98115

USCG BOATEAM 14
677 Ala Moana Blvd.
HONOLULU, HI. 96813

USCG BOATEAM 17
P. O. Box 2471
ANCHORAGE, AK. 99510

OR, U. S. Coast Guard Director of Auxiliary:

150 Causeway St.
BOSTON, MA. 02114

[illegible] Air Force Base
FALMOUTH, MA. 02542

[illegible]68
[illegible], MN. 55111

[illegible] Street
CINCINNATI, OH. 45202

1300 Olive Street
ST. LOUIS, MO. 63103

400 N. 12th St.
ST. LOUIS, MO. 63101

109 9th Avenue, S.
NASHVILLE, TN. 37203

Governors Island
NEW YORK, NY. 10004

Bldg. 2, GSA Depot
SCHOTIA, NY. 12303

Bldg and Cumberland Sts.
GLOUCESTER CITY, NJ. 08030

P. O. Box 782
HARRISBURG, PA. 17108

431 Crawford Street
PORTSMOUTH, VA. 23705

51 SW. First Ave.
MIAMI, FL. 33130

Hale Boggs FOB
NEW ORLEANS, LA. 70130

1240 E. 9th St.
CLEVELAND, OH. 44199

601 Rockwell Ave.
CLEVELAND, OH. 44114

Box 480 Castle Station
Warren & E. Genesee Sts.
SAGINAW, MI. 48606

2420 S. Lincon Memorial Dr.
MILWAUKEE, WI. 53207

400 Ocean Gate Blvd.
LONG BEACH, CA. 90822

2721 N. Central Ave.
PHOENIX, AZ. 85004

530 Sansome St.
SAN FRANCISCO, CA. 94126

350 S. Main St.
SALT LAKE CITY, UT. 84101

915 Second Avenue
SEATTLE, WA. 98174

300 Ala Moana Blvd.
HONOLULU, HI. 96850

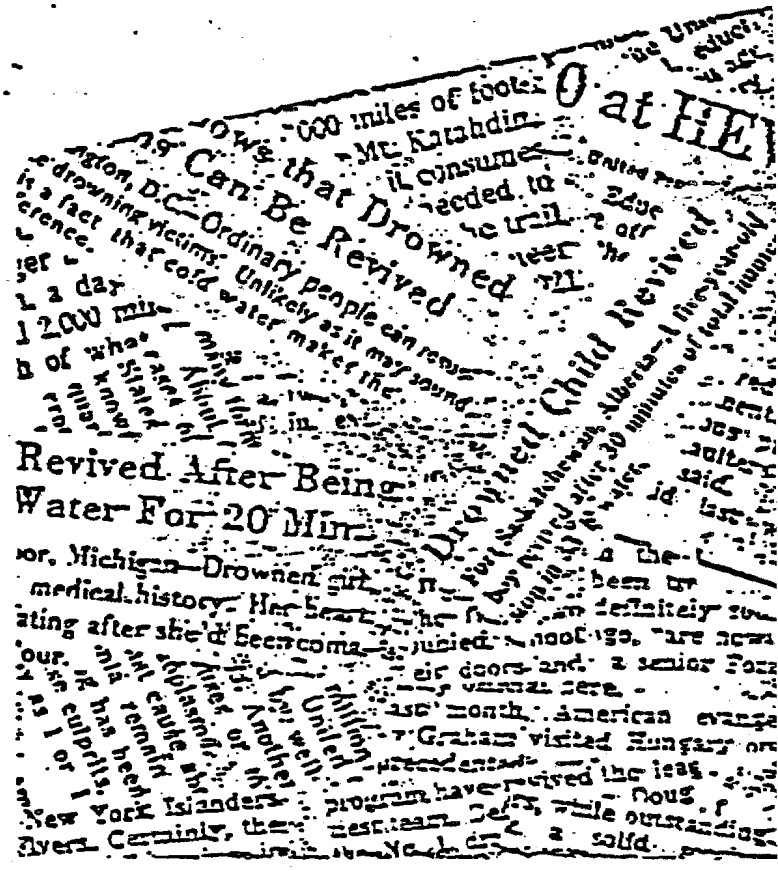
Federal Bldg.
P. O. Box 3-5000
JUNEAU, AK. 99801

U.S. Department
of Transportation

November 1977

Cold Water Drowning

A New Lease on Life

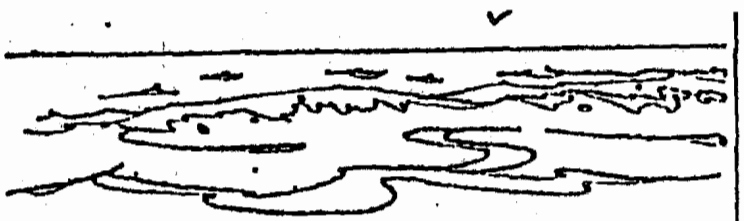


MICHU-SG-77-10

CG-51

This pamphlet is based, in part, on information provided by Dr. Martin Nemirof, Assistant Professor Pulmonary Division, University of Michigan Medical School. It is published as a cooperative effort of the United States Coast Guard and the Michigan Sea Grant Program. For additional copies and further information, contact:

Nearest Coast Guard Office
or
Michigan Sea Grant
Publications Office
2200 Bonisteel Blvd.



COLD WATER
DROWNING
VICTIMS
MAY LIVE

"EVERY YEAR APPROXIMATELY 8,000 PEOPLE DROWN, MAKING DROWNING THE THIRD LEADING CAUSE OF ACCIDENTAL DEATH IN THE UNITED STATES." (National Safety Council)

That statistic is made even more tragic because many of those deaths may have been avoided. Recent medical research has indicated that victims, who in the past have been considered beyond help, may be saved despite long submergence and the absence of any sign of life. This is particularly true if the water is cold (70°F or lower) and the victim is young.

This pamphlet is intended to provide the infor-

student skidded off the road and plunged into an ice-covered pond. The car rolled over, eliminating all air bubbles. The young man struggled, inhaled water, and lost consciousness. After 30 minutes, rescuers pulled him out of the water. Since he showed no signs of life, he was declared dead at the scene.

While being loaded into the ambulance, the supposedly lifeless body gasped. Startled rescuers immediately began revival efforts. After a high-speed ambulance run to the University of Michigan Hospital, doctors resuscitated him for two hours. Following 13 more hours of respiratory support, the young man woke up and recognized his mother sitting at his bedside.

Later, this same young man pulled in A-grades at college. He has surprised doctors who expected to see irreversible brain damage in anyone deprived of oxygen for more than four minutes.

WHY CAN SOME COLD-WATER DROWNING VICTIMS SURVIVE?

Sudden face contact with cold water (below 70°F) sometimes touches off a primitive response called the "mammalian diving reflex." This complex series of body responses shuts off blood circulation to most parts of the body except the heart, lungs, and brain. Thus, what little oxygen remains in the blood gets transported to the brain where it is needed the most. Even though there may be very little oxygen in the blood, it can be enough since the cooled brain requires much less oxygen than normal.

While we know little about the human diving [re]flex, scientists know that diving mammals like whales, porpoises, and seals depend on a similar

- The age of the victim
- How well the rescuers do their jobs

WHAT TO DO IN A COLD WATER EMERGENCY

I. Clear the air passage and begin mouth-to-mouth rescue breathing and external heart massage (CPR) *IMMEDIATELY. DO NOT* worry about getting water out of the victim's lungs . . . the body will absorb it quickly.

II. Prevent the victim from losing more body heat, but DO NOT rewarm the victim. Improper rewarming may harm the victim.

III. Get the victim to the nearest medical facility *QUICKLY.* CPR must be continued uninterrupted until the victim is under the care of competent medical personnel.

IV. Do not give up. *DROWNING VICTIMS LOOK DEAD.* Their skin is blue and cold to the touch. There is no detectable heart beat or breathing. The eyes are fixed and dilated, and there is no other sign of life. However, if the water was cold there is still a good chance of survival.

V. Children and young people are the most frequent drowning victims. However, they are also good candidates for resuscitation since they have a more pronounced "Diving Reflex." In research at the University of Michigan Hospital, two-thirds of the cold water drowning victims that were successfully resuscitated were 3½ years old and younger. the colder the water and the younger the victim

NORMAL CIRCULATION

MAMMALIAN DIVING REFLEX

RESUSCITATION OF DROWNING VICTIMS

Resuscitation is a general term which covers all of the measures taken to restore life or consciousness to an individual who is apparently dead. These measures include artificial respiration to restore normal respiratory function, and external heart massage to restore normal heartbeat. Mouth-to-mouth or mouth-to-nose artificial respiration should be started at once in any case where breathing has ceased.

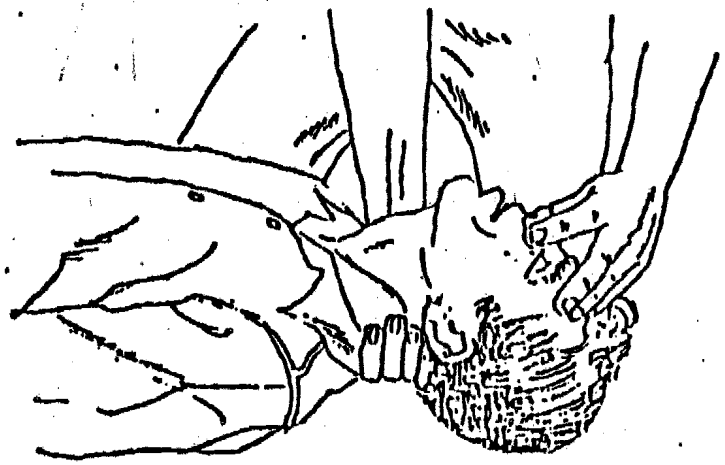
Only after artificial respiration has been initiated and after it has been determined that the heart has stopped, should external heart massage be started and combined with artificial respiration to give cardiopulmonary resuscitation.

The following techniques should govern cardiopulmonary resuscitation (CPR) procedures:

Mouth-to-Mouth Breathing

1. This is *ALWAYS* started first, and then the necessity for external heart massage is determined.
2. Place victim on his back.
3. Kneel beside the victim's shoulder.
4. Clear the victim's mouth and air passages of foreign objects by sliding

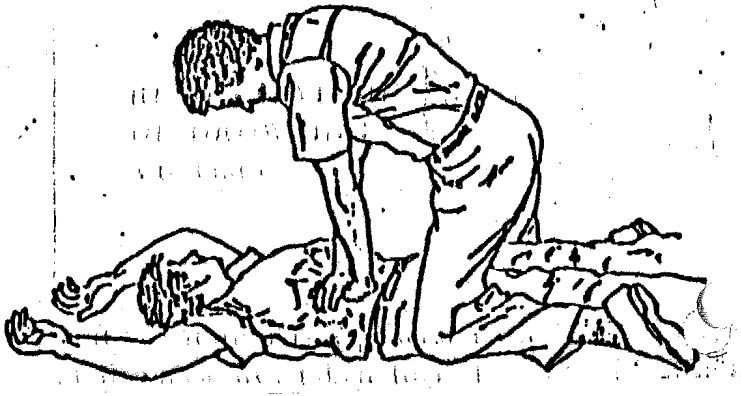
5. Place one hand under victim's neck.
6. Place other hand on victim's forehead so that thumb and forefinger can close the nose.
7. Lift gently with hand under neck while pushing down with hand on forehead. This will extend the neck and open the air passages in the vast majority of cases.



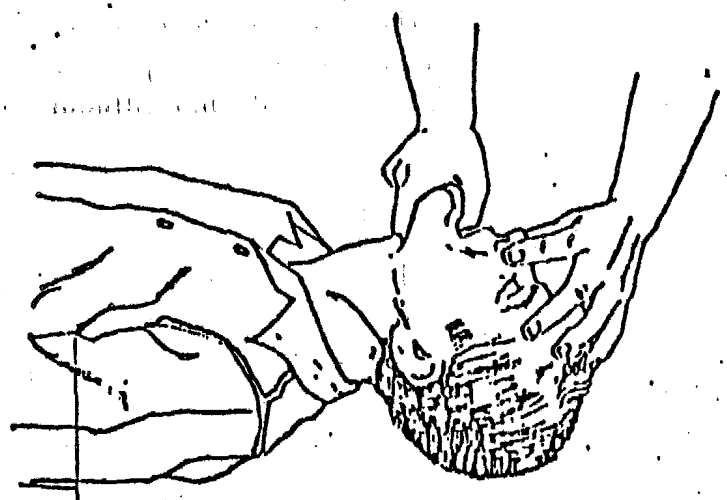
8. Initially, give the victim four (4) quick breaths without interruption, then take a deep breath (about twice the normal), open your mouth wide, place your mouth over the victim's mouth, and blow.

a minute for children and infants.

11. If the chest does not rise, one or more of the following conditions exists and must be corrected:
    a. Airleak.
        (1) Make sure that there is an airtight seal between your mouth and the victim's and that the seal on the victim's nose is secure.
    b. Airway obstruction (more likely).
        (1) Insert your finger in the victim's mouth and remove any foreign objects (false teeth, etc.), vomit, and/or blood clots.
        (2) For adults: With the victim on his back, straddle his pelvis and, with one hand on top of the other, thrust forcefully into the upper abdomen. This compresses the lungs and expels the residual air in the lungs. The foreign object will often pop out of the victim's windpipe like a cork from a bottle. A second person, if available, should be ready to remove the foreign matter from the mouth. If the victim vomits, his mouth should be cleaned out immediately by turning the head to one side and wiping out the mouth with your fingers or a cloth.



mouth and grab lower jawbone between the thumb and finger, lift jawbone upward, holding it in this position while you continue to perform mouth-to-mouth breathing.

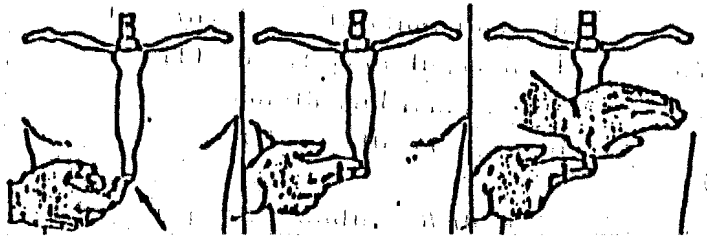


13. In children and infants, a lesser amount of air is necessary. In infants, the amount of air that can be held in your cheeks may be sufficient. The rescuer must cover both the mouth and nose of the infant or child with his mouth. Inflate the lungs once every three seconds (10-20 per minute). Forceful backward tilting of the infant's head may obstruct the breathing passages. Therefore, do not exaggerate the head tilt position.
14. Mouth-to-nose breathing may be carried out using much the same technique as for mouth-to-mouth, except, of course, the victim's mouth is held closed while your mouth is placed over the victim's nose.
15. If you are hesitant to place your mouth over the victim's, satisfactory mouth-to-mouth breathing may be carried out through a handkerchief. Airways and tubes should not be used. Not only are they dangerous when use

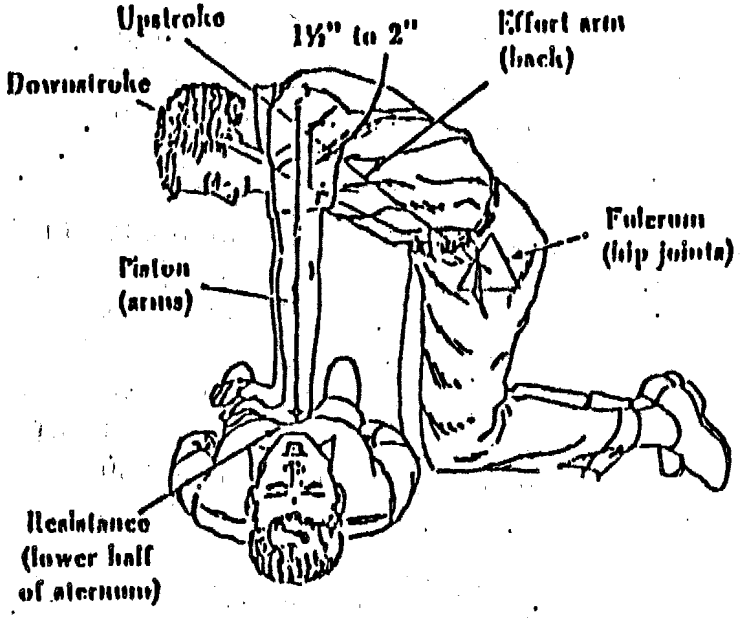
to see if external heart massage should be started.

a. It is needed only if the heart has stopped.
b. In many cases, the initiation of artificial respiration will be sufficient to cause resumption of the heartbeat.

2. Check for pulse.
   a. The best pulse to check is the carotid in the neck. This is a large artery lying close to the surface on either side of the Adam's apple. Practice feeling your own carotid pulse.
3. Check the pupils.
   a. If the pupils are dilated and do not constrict (get smaller) when light hits them, the blood flow to the brain is insufficient.
4. If there is no pulse and/or the pupils are dilated and do not constrict, start external heart massage.
5. For external heart massage to be effective, the victim must be on a firm surface, i.e., ground, spineboard, or floor.
6. Locate notch at top of breastbone.
7. Locate the lower end of the breastbone. Great care must be exercised *not* to place your hand over the tip of the breastbone (xiphoid process).
8. Measure two fingerwidths up from the xiphoid process, and place the heel of one hand over the lower one-third of breastbone, and the other hand on top of the first.



pressure vertically downward to depress the lower breastbone.



10. Then release pressure immediately. Compression and relaxation must be of equal duration. Do not remove the heel of your hand from the victim's chest when the pressure is released. Be sure that the pressure is completely released so that the breastbone returns to its normal resting position between compressions.
11. The breastbone should be compressed 1½ to 2 inches for adults. For small children only the heel of one hand is used; for infants, only the tips of the middle and index finger are used to compress the sternum. In small children and infants, the heart lies higher in the chest and external compression should be applied over the mid-sternum.
12. The cycle is repeated 60-80 times per minute in adults, 80-100 times in children, and *should be in a smooth, rhythmic fashion.*
13. Keep your fingers away from the victim's ri to avoid fractures. Fingers may be interloc during this procedure to assist in keeping them

still be administered. This can be managed by interrupting external heart massage every 15 beats to give two (2) deep lung inflations. Because of the interruptions for the lung inflation, the single rescuer must administer each series of 15 chest compressions at a more rapid rate, 80 compressions per minute, in order to achieve an actual compression rate of 60 compressions per minute. The two deep inflations must be administered in quick succession, within a period of 5 seconds. *DO NOT* allow full lung exhalation between breaths.

A. Ventilation

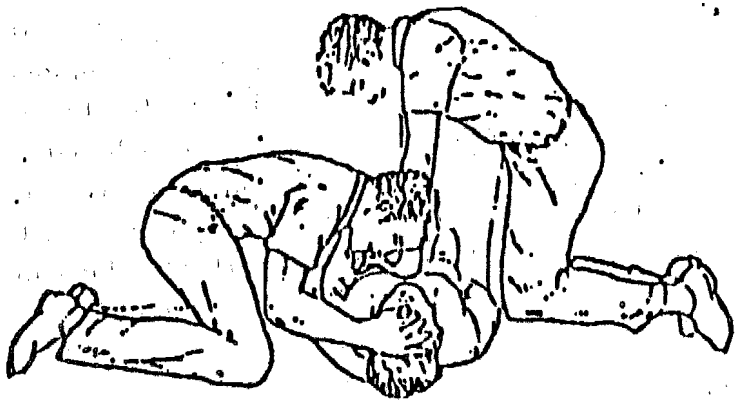
B. Compression

15:2 Ratio
15 Chest Compressions
Rate of 80/min
2 Quick Lung Inflations

1. If two rescuers are present, they should work as follows:

begins external heart massage.

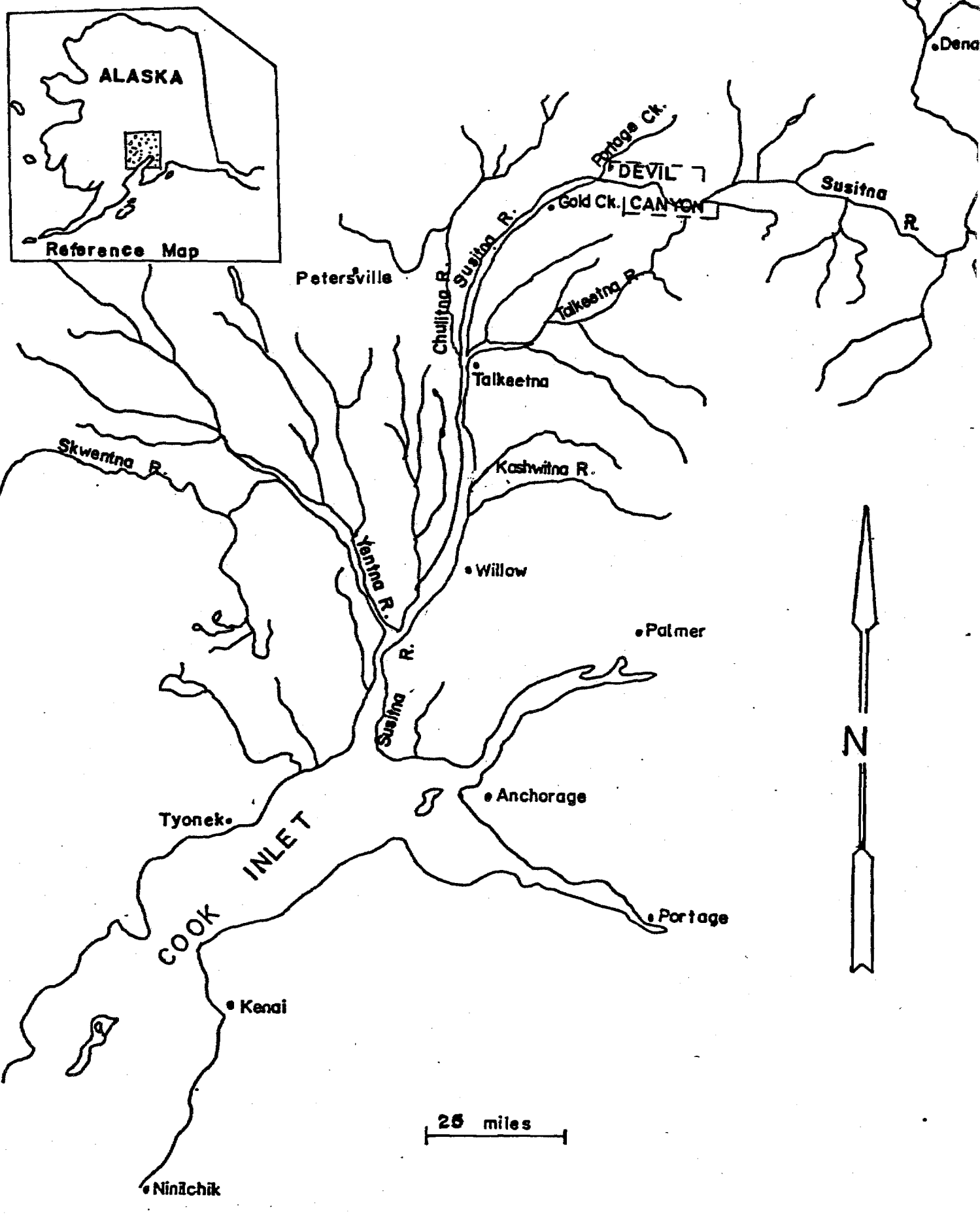
5:1 Ratio
5 Chest Compressions
Rate of 60/min
1 Full Lung Inflation

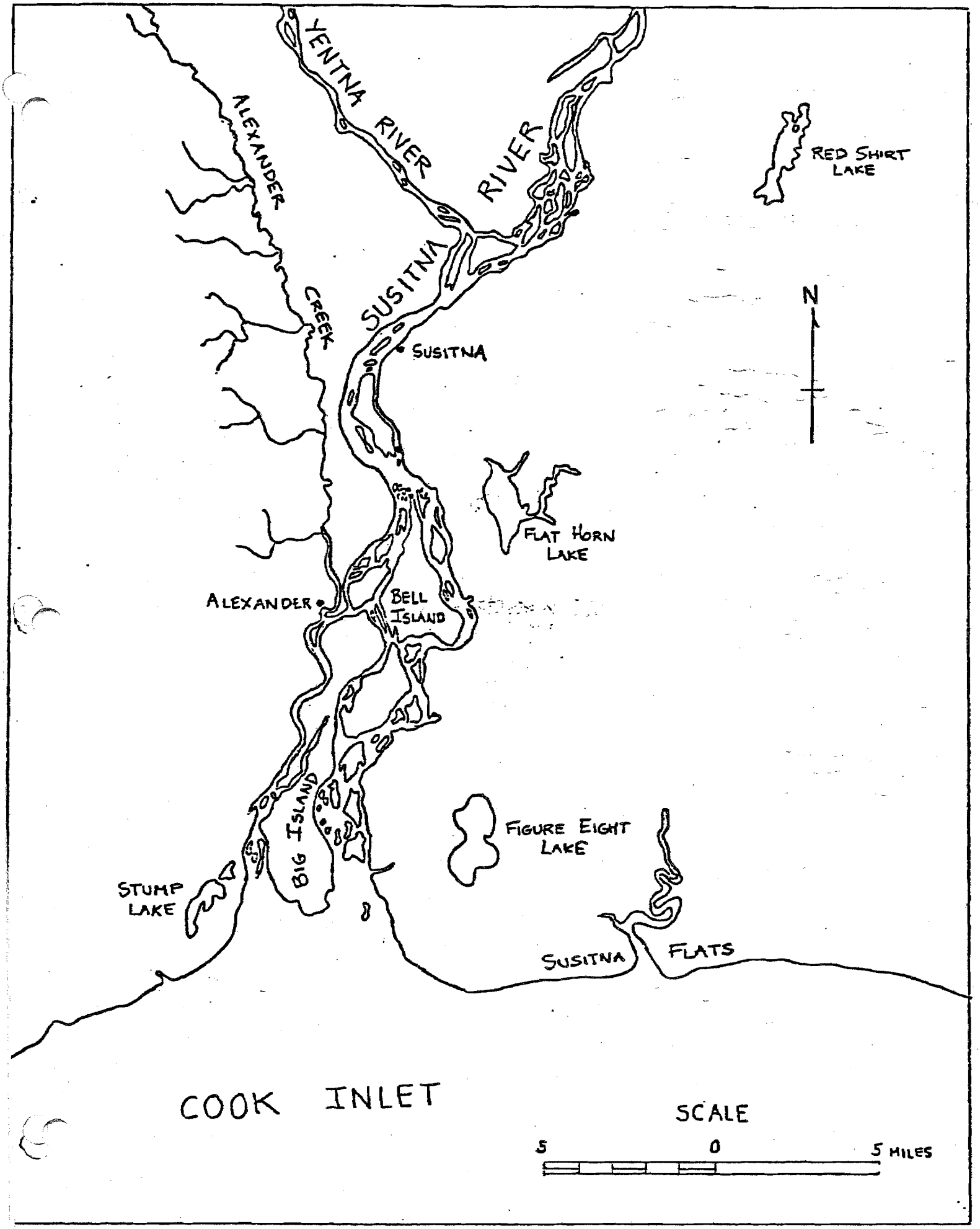


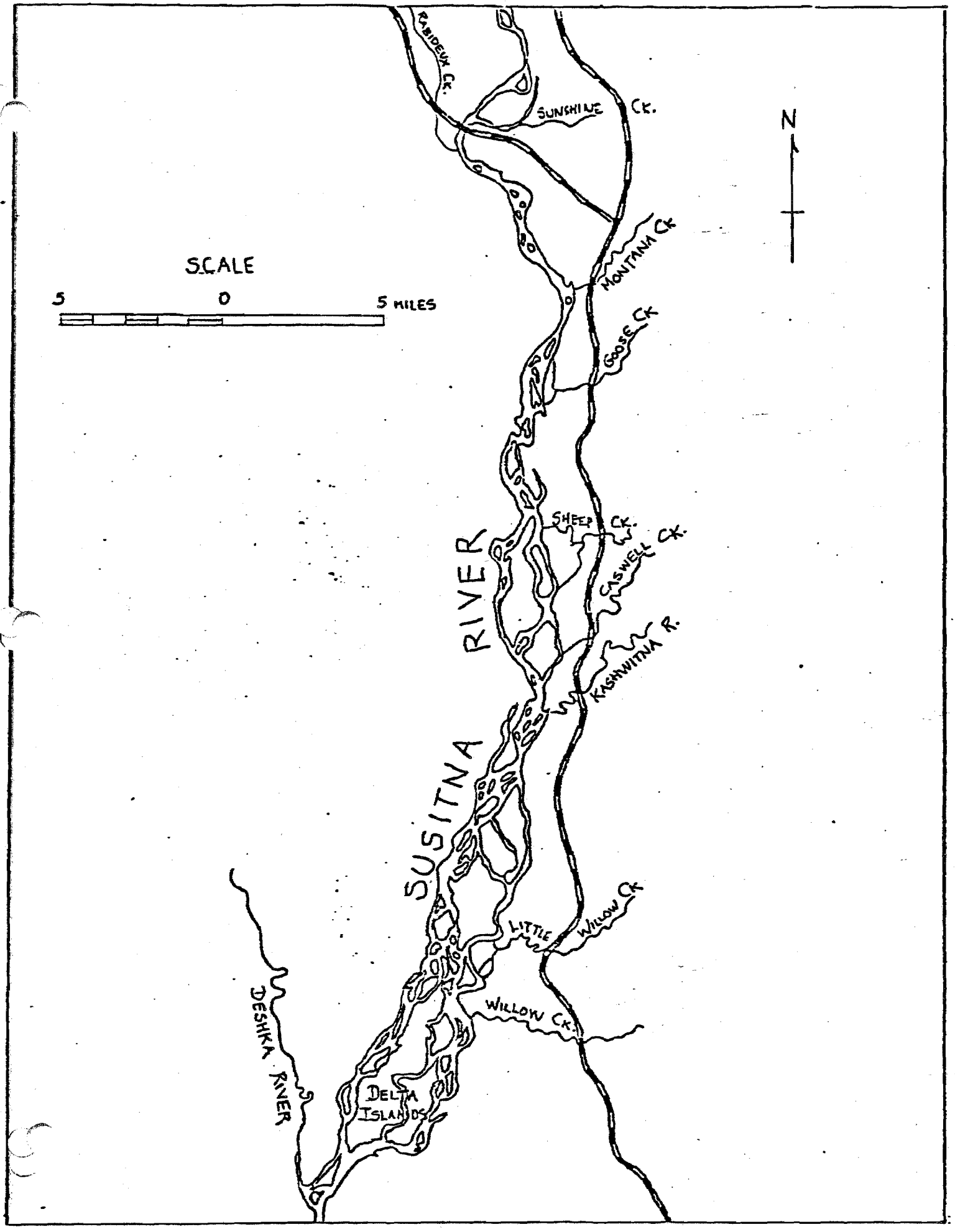
Some Additional Factors in Cardiopulmonary Resuscitation

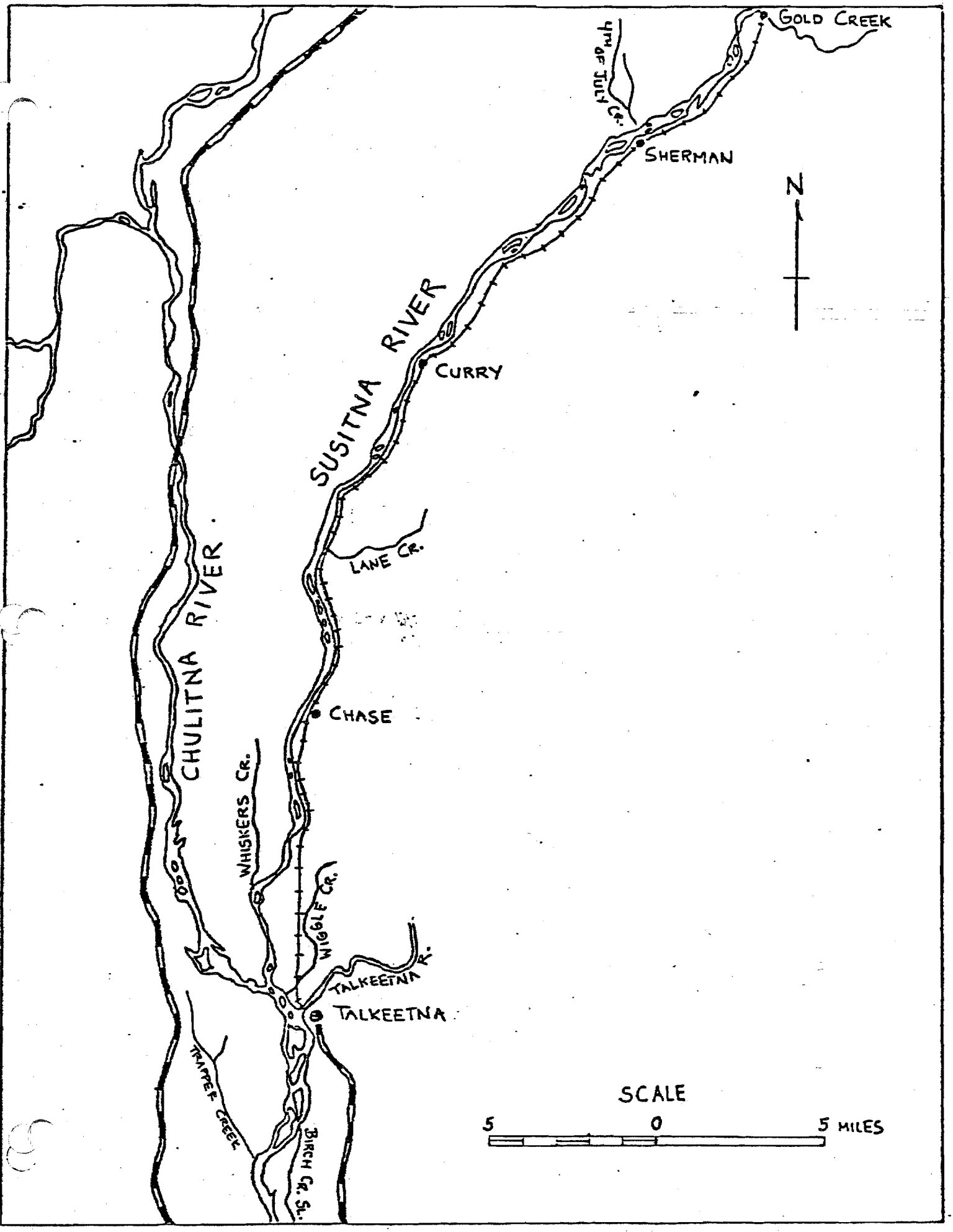
1. The victim's stomach may become distended with air. Although this is not dangerous, it may interfere with lung inflation. It may also indicate a blocked airway. It can be remedied by applying pressure over the stomach with the palm of your hand. This expels the air but may also lead to regurgitation of the stomach contents, so you must be ready to turn the victim's head to one side and clean out the mouth with your fingers or a cloth.

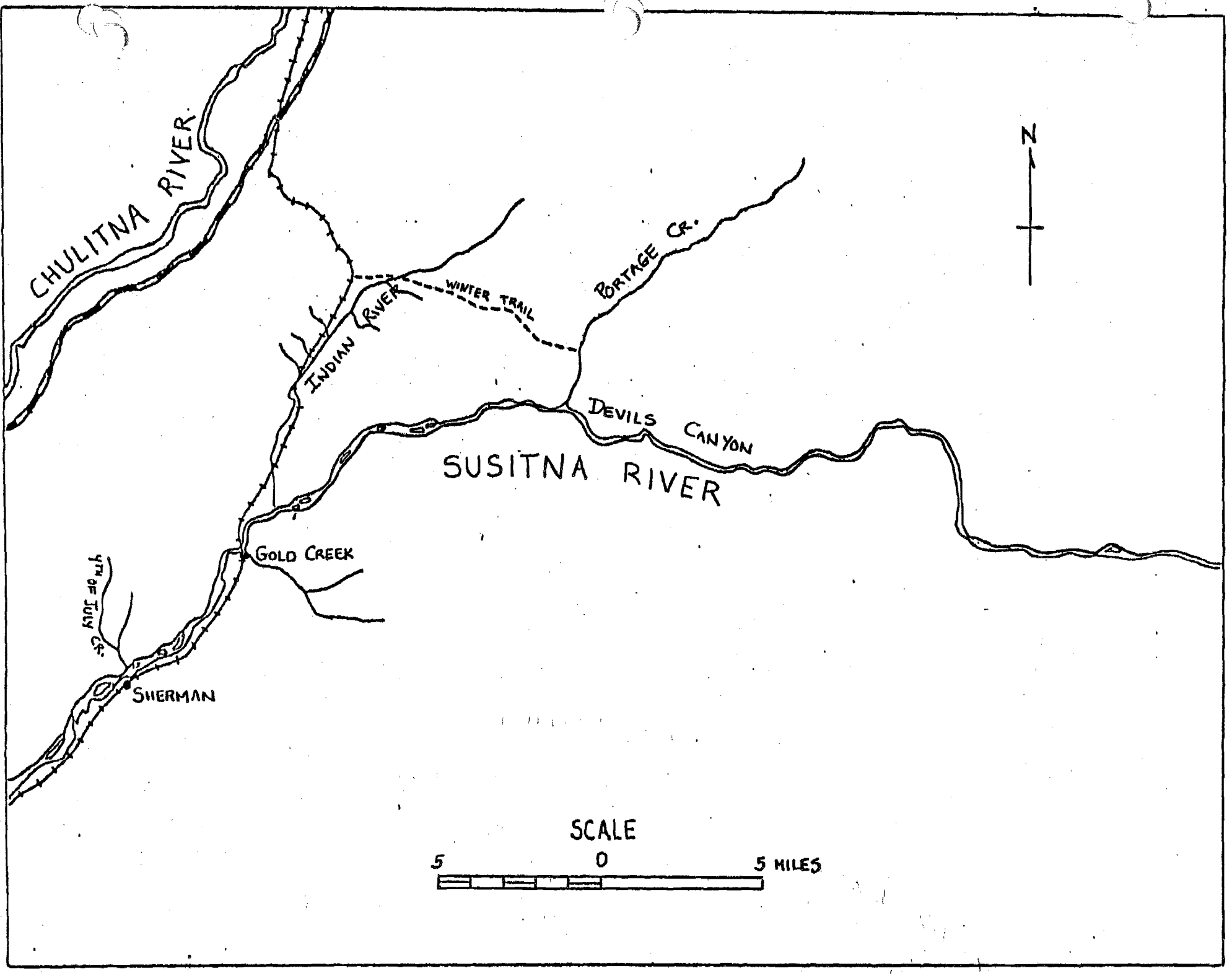
2. Cardiopulmonary resuscitation, once started, must be continued until spontaneous breathing and heartbeat occur or until the victim is turned over to a physician. In many cases, this will mean that the procedures must be continued while the victim is being transport

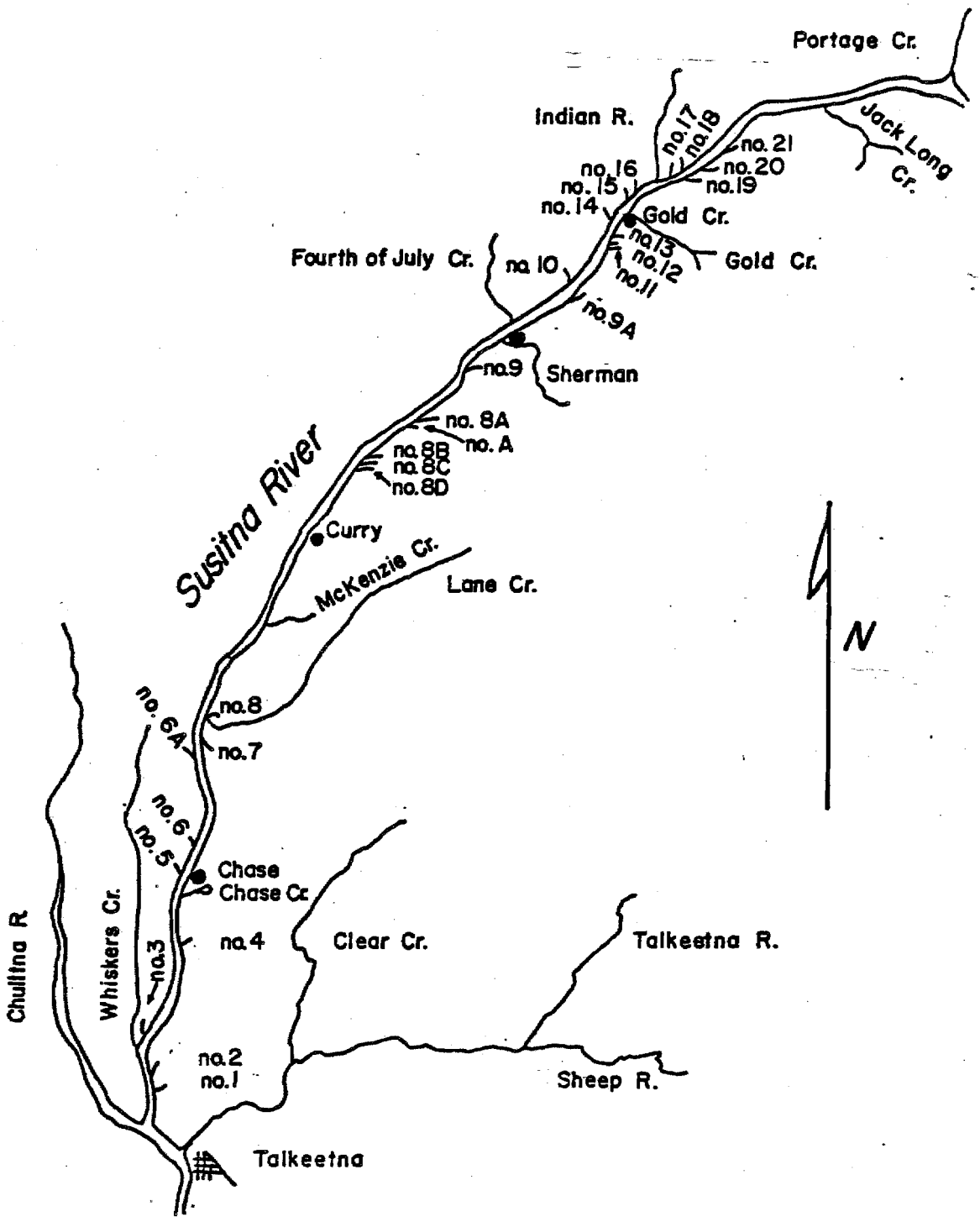

ALASKA
Reference Map
Dena
Portage Ck.
DEVIL
CANYON
Gold Ck.
Susitna R.
Susitna R.
Petersville
Chulitna R.
Talkeetna R.
Talkeetna
Skwentna R.
Kashwitna R.
Yentna R.
Willow
Palmer
Susitna R.
Anchorage
Tyonek
COOK INLET
Portage
Kenai
Ninilchik
N
25 miles


YENTNA RIVER
ALEXANDER
SUSITNA RIVER
RED SHIRT LAKE
CREEK
SUSITNA
N
FLAT HORN LAKE
ALEXANDER
BELL ISLAND
BIG ISLAND
FIGURE EIGHT LAKE
STUMP LAKE
SUSITNA FLATS
COOK INLET
SCALE
5 0 5 MILES


RABIDEUX CK.
SUNSHINE CK.
N
SCALE
5 0 5 MILES
MONTANA CK
GOOSE CK
SHEEP CK.
CASWELL CK.
KASHWITNA R.
SUSITNA RIVER
LITTLE WILLOW CK
WILLOW CK.
DESHKA RIVER
DELTA ISLANDS


GOLD CREEK
4TH OF JULY CR.
SHERMAN
N
SUSITNA RIVER
CURRY
LANE CR.
CHULITNA RIVER
CHASE
WHISKERS CR.
WIGGLE CR.
TALKEETNA R.
TALKEETNA
TRAPPER CREEK
BIRCH CR. SL.
SCALE
5 0 5 MILES

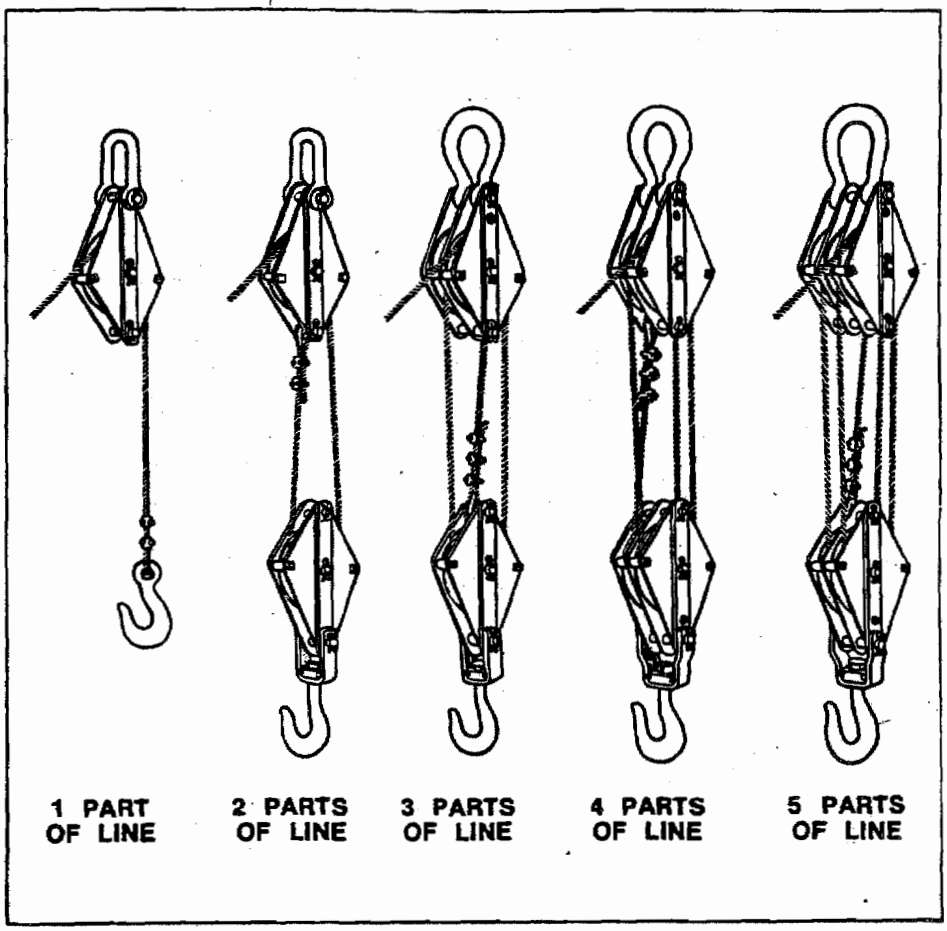

CHULITNA RIVER
INDIAN RIVER
WINTER TRAIL
PORTAGE CR.
DEVILS CANYON
SUSITNA RIVER
GOLD CREEK
4TH OF JULY CR.
SHERMAN
N
SCALE
5 0 5 MILES


Portage Cr.
Indian R.
no.17
no.18
no. 21
no.20
no.19
Jack Long Cr.
no.16
no.15
no.14
Gold Cr.
no.13
no.12
no.11
Gold Cr.
Fourth of July Cr.
no. 10
no.9A
no.9
Sherman
no. 8A
no. A
no.8B
no.8C
no.8D
Susitna River
Curry
McKenzie Cr.
Lane Cr.
N
no. 6A
no.8
no.7
no. 6
no. 5
Chase
Chase Cr.
Chulitna R
Whiskers Cr.
no.3
no.4
Clear Cr.
Talkeetna R.
no.2
no.1
Sheep R.
Talkeetna

HOW TO FIGURE LINE PARTS

To help figure the number of parts of line to be used for a given load or the line pull required for a given load, the following ratio table is provided with examples of how to use it.

Number of Parts of Line	Ratio for Bronze Bushed Sheaves	Ratio for Anti-Friction Bearing Sheaves
1	.96	.98
2	1.87	1.94
3	2.75	2.88
4	3.59	3.81
5	4.39	4.71
6	5.16	5.60
7	5.90	6.47
8	6.60	7.32
9	7.27	8.16
10	7.91	8.98
11	8.52	9.79
12	9.11	10.6
13	9.68	11.4
14	10.2	12.1
15	10.7	12.9
16	11.2	13.6
17	11.7	14.3
18	12.2	15.0
19	12.6	15.7
20	13.0	16.4
21	13.4	17.0
22	13.8	17.7
23	14.2	18.3
24	14.5	18.9



USING THE RATIO TABLE RATIO FORMULA

$$\frac{\text{TOTAL LOAD TO BE LIFTED}}{\text{SINGLE LINE PULL IN POUNDS}} = \text{RATIO}$$

Example:

To find the *number of parts of line* needed when weight of load and single line pull is established.

Sample Problem:
72,480 lbs. (load to be lifted)
,000 lbs. (single line pull) = 9.06 RATIO

Refer to ratio 9.06 in table or number nearest to it, then check column under heading "Number of Parts of Line" . . . 12 parts of line to be used for this load.

Example:

To find *single line pull* needed when weight of load and number of parts of line are established.

Sample Problem:
68,000 lbs. (load to be lifted)
6.60 (ratio of 8 part line) = 10,300 lbs. (single line pull)

10,300 lbs. single line pull required to lift this load on 8 parts of line.