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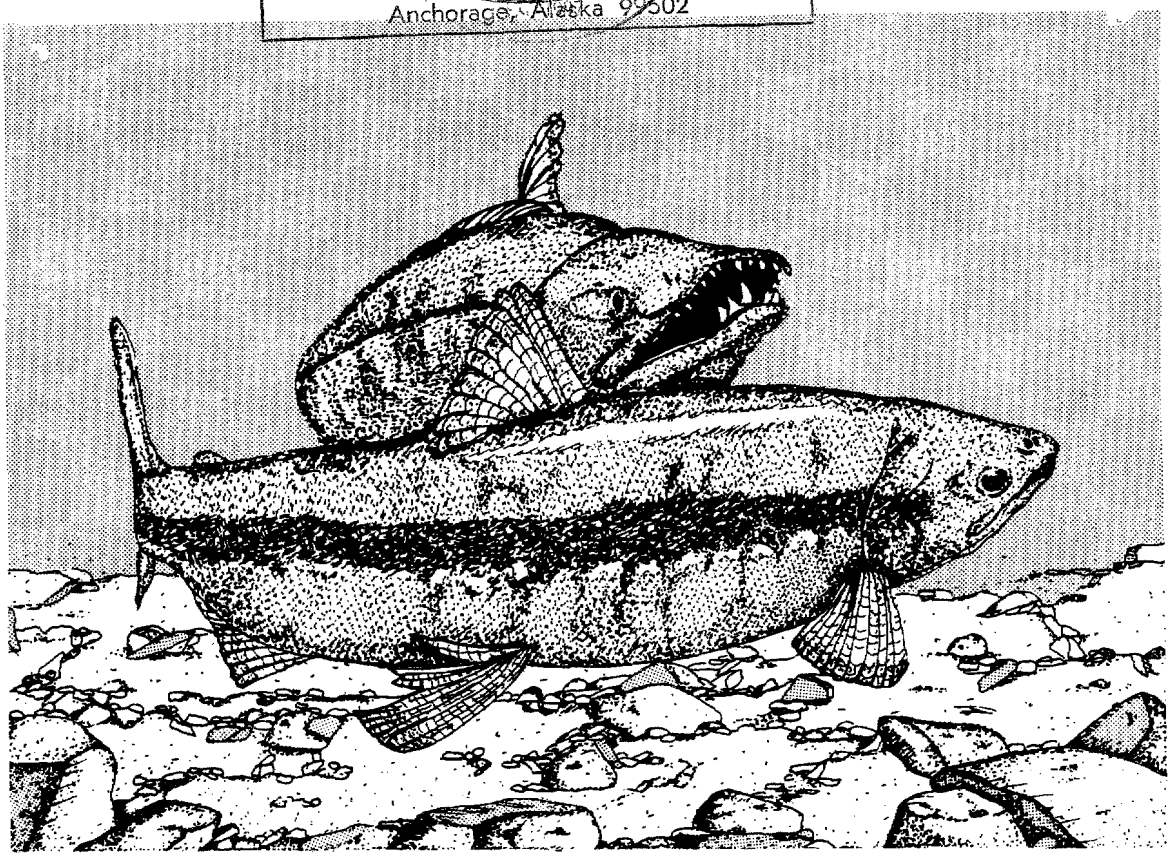

Subtask 7.10

AQUATIC STUDIES PROCEDURES MANUAL

PHASE II - Final Draft

1982 - 83 (FY 83)

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AQUATIC STUDIES PROCEDURES MANUAL

PHASE II - Final Draft

1982 - 83 (FY 83)

-by-
Alaska Department of Fish and Game
Susitna Hydro Aquatic Studies
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TABLE OF CONTENTS

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TABLE OF CONTENTS (Continued)

LIST OF FY 83 APPENDIX ADDENDUMS Page

LIST OF FIGURES

LIST OF FIGURES (Continued) Page

LIST OF FIGURES (Continued)

LIST OF TABLES

LIST OF TABLES (Continued) Page

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 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 aquatic and terrestrial habitat upsteam of Devil Canyon. Regulation of the mainstem river will substantially alter the natural flow regime downstream. Historically, the long and short term environmental impacts of hydroelectric dams have adversely altered the sport and commercial fisheries of affected drainages (Baxter and Glaude, 1980; Hagen et. al., 1973; Hocutt, 1980; Keller, 1980; Ward and Stanford, 1979). 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 and their seasonal relationships to discharge 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 River drainage fisheries (FWS-ADF&G, 1978).

The extensive studies being carried out by the Alaska Department of Fish and Game's Su Hydro Aquatic Studies Team entail the collection of large quantities of field data. These data are concerned with the distribution and abundance of fish populations, and the aquatic habitat associated with these fish populations in the portions of the Susitna River drainage which would be impacted by the proposed hydropower development. The Data Processing Support Unit of the study team was created to provide the expertise and manpower necessary to catalog, summarize, analyze, and manage these data.

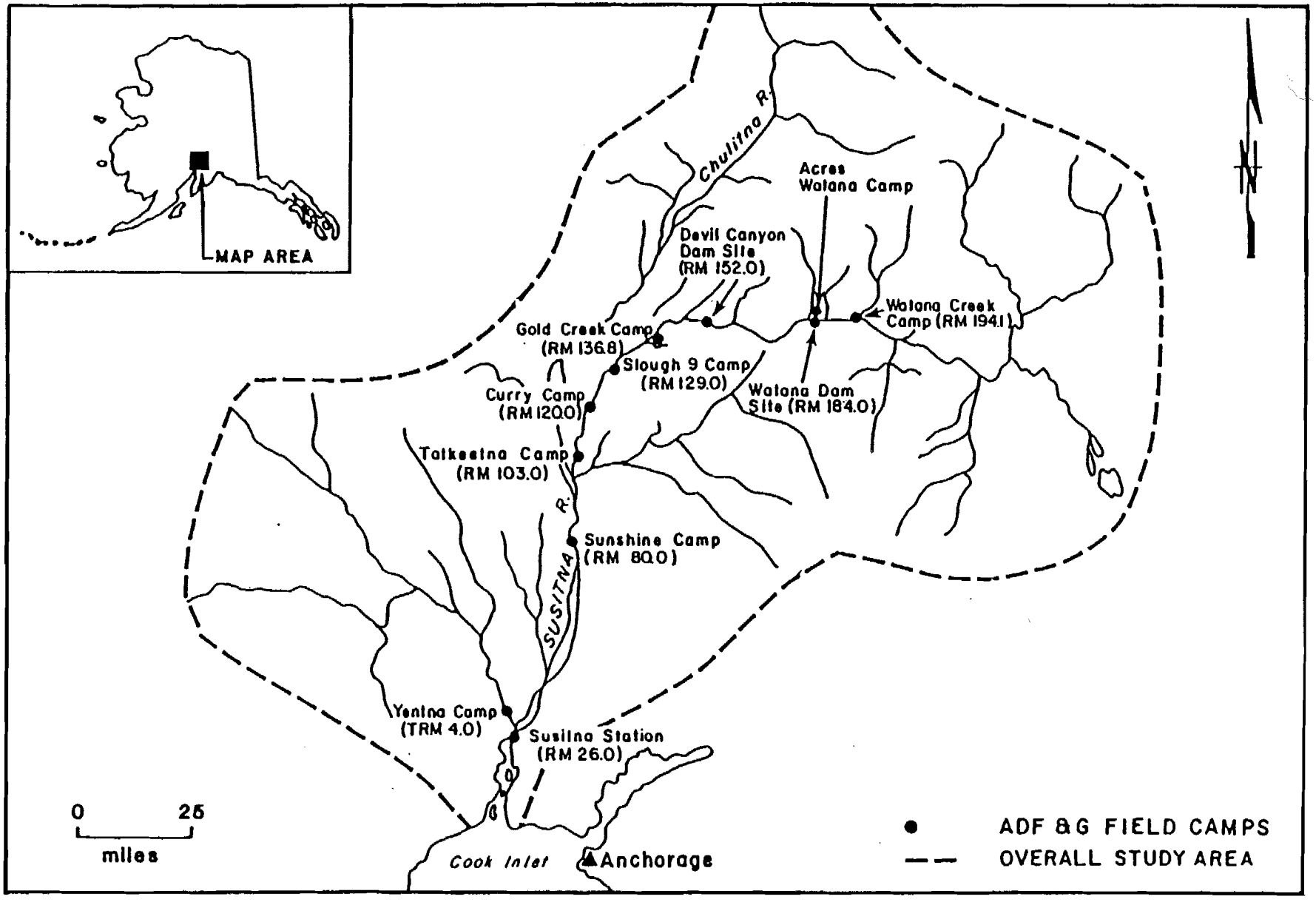

Figure 1. Susitna Hydroelectric Project study area, 1982-83.

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 Phase II (July 1, 1982 to June 30, 1983) procedures manual addresses changes, deletions, and additions to the Phase I (July 1, 1981 to June 30, 1982) procedures manual to be conducted within those study areas outlined in Figures 2 and 3. Modification (e.g. revisions, deletions, additions, or corrections) to the program during Phase II will be addressed in future revisions of this manual.

The following basic objectives initially proposed during FY 82 for the Phase I and II field study programs remain unchanged in FY 83. These objectives and related study tasks include:

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.

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

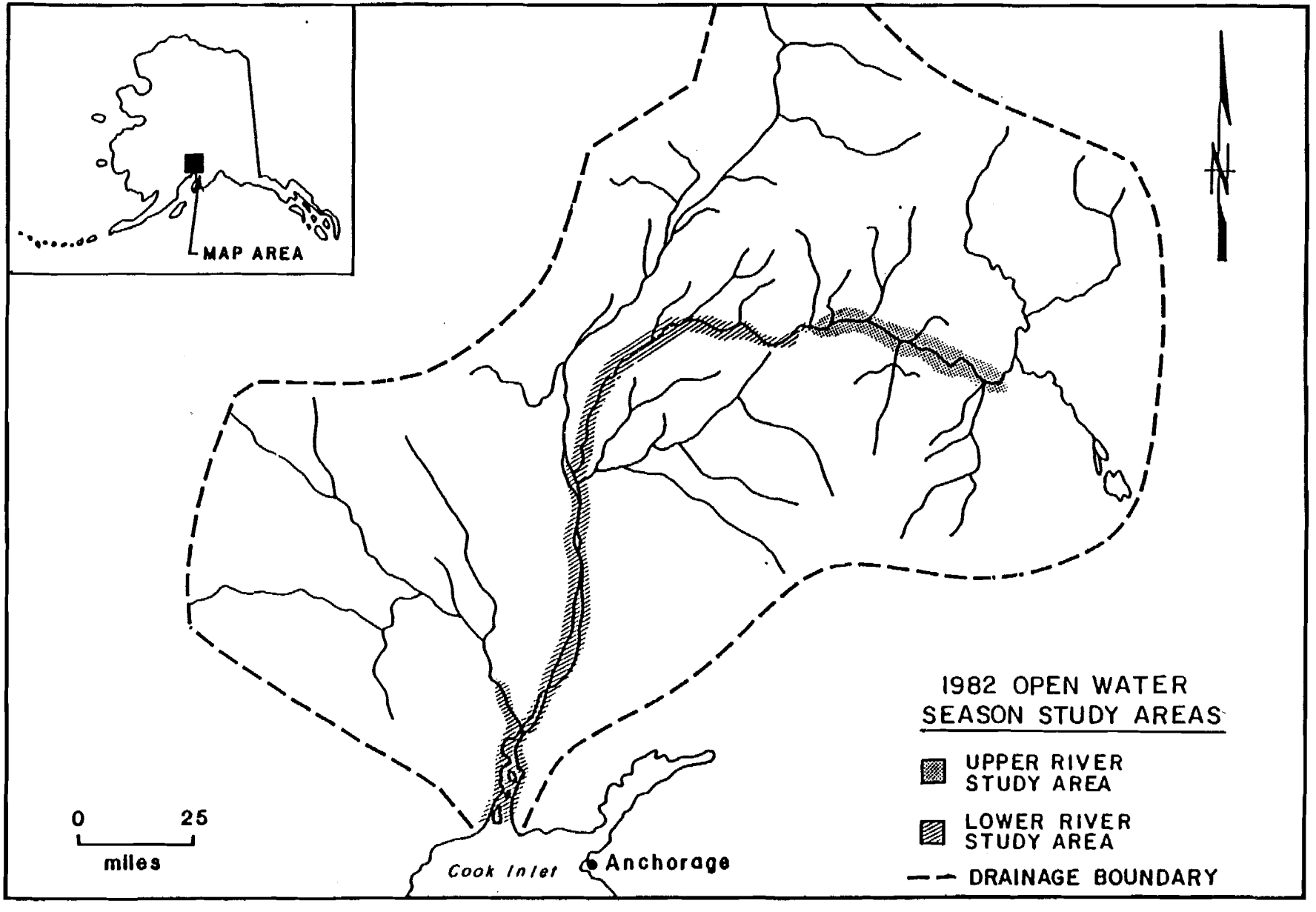

Figure 2. FY 83 ADF&G open water field season study areas, 1982-83.

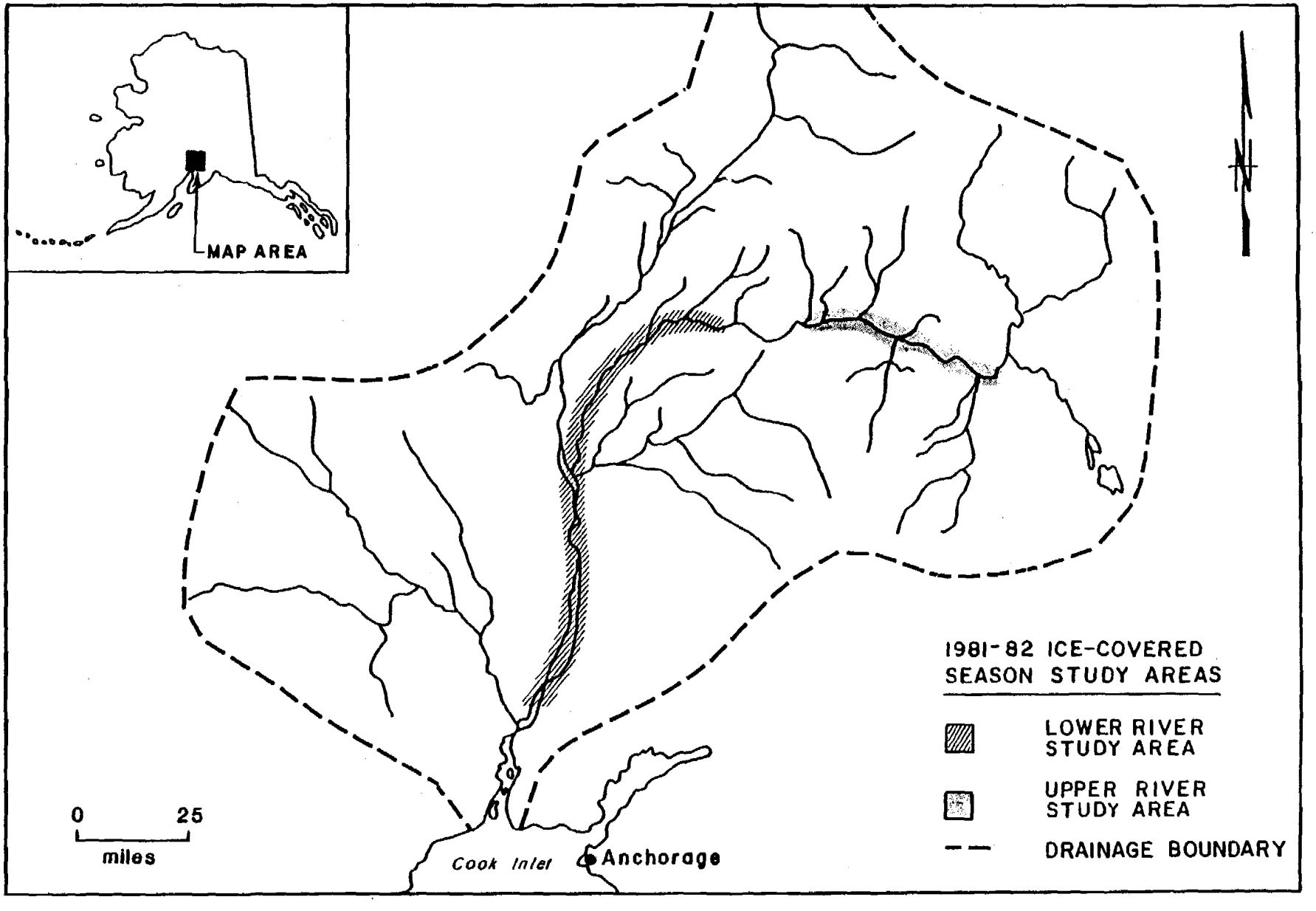

Figure 3. FY 83 ADF&G ice-covered field season study areas, 1982-83.

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 and their relationship with the mainstem river discharge.

Task 3.1 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 Characterize the physical and chemical parameters of the various seasonal habitat types found in the study area as they relate to mainstem discharge.

To meet the above objectives, the study program is separated into three sections; Adult Anadromous Fisheries (Objective 1), Resident and Juvenile Anadromous Fisheries (Objective 2), and Aquatic Habitat and Instream Flow Studies (Objective 3). The operations of the Anadromous Adult and Resident and Juvenile Anadromous field investigations will be interrelated and conducted in cooperation with Aquatic Habitat and Instream Flow studies. The specific objectives and procedures for completion of each section of the program for FY 83 are described in this manual.

The objectives of the Data Processing Support Unit of the ADF&G Su Hydro Aquatic Studies Team remain separate from the field study program. The objectivies of this unit are:

OBJECTIVE I — Provide data processing and data base systems management support to the field program elements. The tasks under this objective are:

Task 1.1 — Computerization of all data collected in the field studies, this computerization into retrievable data base systems allows for easy and accurate retrieval of data for analysis and summarization.

Task 1.2 — Development and mainteance of a computer-based data base management system.

Task 1.3 — Production of summary report tables and computer plotted graphics, with simple univariate statistics (e.g. minimums, maximums, means, and confidence intervals).

Task 1.4 — Programming and execution of programs to provide computer quality execution of statistical analyses.

Task 1.5 — Provide numerical and statistical analyses of scientific and technical data collected by the field program elements.

Task 1.6 — Provide advice on experimental sampling design of the field study programs, to ensure that the field studies will yield the type and quantity of data needed to meet their objectives.

Task 1.7 — Provide biometric evaluation of the study team's scientific reports, to ensure that all conclusions are founded upon sound statistical analyses and interpretation of the collected field data.

II. TECHNICAL PROCEDURES

A. ADULT ANADROMOUS FISHERIES STUDIES

1. Study Description and Rationale

Three principal methods will be used to ascertain distribution, abundance, timing and migrational activity of adult anadromous salmon in the study area (Tasks 1.1 and 1.2). They are: (1) side scan sonar (SSS) counters, (2) tag and recapture with fishwheels and (3) aerial surveys. The SSS are expected to accurately monitor sockeye and pink salmon escapement, and be reasonably effective on chum and coho salmon. Tag and recapture operations using fishwheels should effectively establish timing and escapement of chinook, sockeye, pink, chum and coho salmon. Aerial surveys will also provide escapement data and distribution information on chinook salmon.

Electroshocking and other various 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 define the extent of anadromous fish 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).

For the Bering cisco, fishwheels and electrofishing equipment will be used to define migrational abundance, timing and spawning activity (Tasks 1.1 - 1.3). Eulachon will be monitored for relative abundance, timing and migrational characteristics by the use of set nets and electrofishing gear (Tasks 1.1 - 1.3).

Lastly, standard scale pattern analysis techniques will be used to define the separatability of Susitna River spawning sockeye salmon stocks north of Talkeetna from two major sockeye salmon stocks in the Talkeetna and Chulitna rivers (Task 1.1).

2. Sonar Counters

Operation Periods:

Field operations for mainstem enumeration with side scanning sonar (SSS) counters will begin and terminate on the following dates:

Susitna Station	1 July to 5 September
Yentna Station	1 July to 5 September
Sunshine Station	7 July to 12 September
Talkeetna Station	7 July to 14 September

Methods:

Two Bendix SSS counters will be deployed at each mainstem station, one off each river bank. These counters will be operated by trained personnel in accordance with the 1980 Side Scan Counter Installation and Operation Manual, Bendix Corporation (Appendix 1).

Counter accuracy will be monitored four or more times daily by hand tallying fish related echos displayed on an oscilloscope (Appendix II). The ratio of visual counts to SSS counts will be used to adjust the counter as defined in the above cited manual.

A fishwheel will be operated daily in the immediate vicinity of each SSS counter to provide species composition data for apportioning SSS counts. The fishwheel will be sited so that its presence does not conflict or bias sonar counter performance.

Each sonar crew in addition to other duties will collect age, length and sex data (III Data Procedures) from daily fishwheel interceptions:

Chinook Salmon: Age, sex and length samples from all chinook salmon.

Sockeye Salmon: Age, length and sex samples from 40 fish daily, except that at Talkeetna Station where all sockeye salmon will be sampled for age, length and sex data.

Pink Salmon: Length and sex samples from 40 fish daily.

Chum Salmon: Age, length and sex samples from 20 fish daily.
Coho Salmon: Age, length and sex samples from 20 fish daily.

The number of fish sampled for age, sex and length data is adequate to define escapement characteristics and variability based on previous ADF&G Susitna River investigations. Age samples will not be collected from pink salmon due to there being only one age class apparent in the adult return.

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

3. Tag/Recapture

Operation Periods:

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

Sunshine Station	7 June to 12 September
Talkeetna Station	7 June to 14 September
Curry Station	10 June to 18 September

Methods:

Fishwheels will be operated continously, 24 hours per day, at each sampling station. Two fishwheels will be deployed on each side of the Susitna River at Sunshine and Talkeetna stations. At Curry Station, a single fishwheel will be operated off each bank. Fishwheel design is described in the Phase I ADF&G/Su Hydro Adult Anadromous Report (1981) and operation is described

in Appendix III. Each fishwheel will be checked five or more times daily for catch and required maintenance. All adult salmon will be tagged and released with the exception that at Sunshine Station and Curry Station 90 percent and 50 percent respectively of the daily pink salmon catch will be released without being tagged. Tagging procedures are defined in Appendix IV. Tag type and color by sampling station and species are defined below:

	Tag	
	Type	Color
Sunshine Station		
Chinook Salmon	1" dia. Petersen Disc	White
Sockeye Salmon	FT-4 Spaghetti	Int. Orange
Pink Salmon	FT-4 Spaghetti	Int. Orange
Chum Salmon	FT-4 Spaghetti	Int. Orange
Coho Salmon	FT-4 Spaghetti	Int. Orange
Talkeetna Station		
Chinook Salmon	1" dia. Petersen Disc	Yellow
Sockeye Salmon	FT-4 Spaghetti	Yellow
Pink Salmon	FT-4 Spaghetti	Yellow
Chum Salmon	FT-4 Spaghetti	Yellow
Coho Salmon	FT-4 Spaghetti	Yellow
Curry Station		
Chinook Salmon	1" dia. Petersen Disc	Int. Orange
Sockeye Salmon	1" dia. Petersen Disc	Int. Orange
Pink Salmon	1" dia. Petersen Disc	Int. Orange
Chum Salmon	1" dia. Petersen Disc	Int. Orange
Coho Salmon	1" dia. Petersen Disc	Int. Orange

All tags will be consecutively numbered by respective color code.

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

The tagging crew at Curry Station will also collect age, length and sex data (III Data Procedures) for each species as follows:

Chinook Salmon: All chinook salmon will be sampled for age, sex and length.

Sockeye Salmon: All sockeye salmon will be sampled for age, sex and length.

Chum Salmon: Age, length and sex samples from 20 fish daily.

Coho Salmon: Age, length and sex samples from 20 fish daily.

Pink Salmon: Length and sex samples from 40 fish daily.

The Sunshine and Talkeetna Station tagging crews will be responsible for collecting adult salmon age, length and sex samples as defined in the methods section under sonar monitoring until such time as the sonar installations are operating.

All non-adult salmon interceptions in the fishwheels will be identified by species and recorded in the Daily Fishwheel Catch Log form (III Data Procedures).

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

4. Mainstem Surveys

Operation Period and Survey Reach:

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

Susitna Station Survey crew	1 August to 1 October
Sunshine Survey crew	1 August to 7 October

Talkeetna Survey crew 7 August to 7 October

The geographic area of responsibility for each crew is:

Susitna Station Survey - Estuary to Kashwitna River
Sunshine Survey - Kashwitna River to Talkeetna
Talkeetna Survey - Talkeetna to Devil Canyon

The Susitna Station crew will perform mainstem surveys six days a week during the survey period. Talkeetna Station and Sunshine Station survey crews will sample the mainstem for spawning fish five days a week throughout the survey period.

Additionally, the Talkeetna and Sunshine Survey crews will cooperatively conduct tag and recapture surveys on selected tributaries below RM 99 as listed:

SPAWNING AREA	RIVER MILE	SAMPLING PERIOD	SURVEY FREQUENCY
Birch Creek	88.4	8/7 - 8/25	weekly
		9/15 - 9/28	weekly
Fish Creek	97.1	8/15 - 8/28	weekly
Byers Creek	97.8	8/21 - 9/7	weekly
Troublesome Creek	97.8	8/27 - 9/15	weekly
Answer Creek	84.1	9/15 - 9/28	weekly
Question Creek	84.1	9/15 - 9/28	weekly
Cache Creek	95.4	9/15 - 9/28	weekly
Swan Creek	97.8	9/21 - 9/28	once

Methods:

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

1. Electroshockers
2. Drift gillnets
3. Egg deposition pump

Each mainstem survey crew will be assigned a 20 foot river boat powered by a 75 h.p. engine with a jet unit.

Mainstem survey crews will assess mainstem spawning in the three sections of river primarily using electroshocking equipment. The variability of habitat to be sampled both between and within the three sections necessitates the use of two electrode systems. A mobile electrode system will be used when electroshocking in areas of restricted boat maneuverability, and a stationary or boom electrode system, with a larger shocking field, will be used in areas of unrestricted boat maneuverability. Specific operational and safety procedures are outlined in Appendix V. Catch data will be recorded on the appropriate forms (III Data Procedures). Salmon caught by electroshocking 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. Additional electroshocking effort produces fish meeting criteria 1 through 3 above.

All adult non-anadromous species caught, will be identified, sampled for length and sex, and tagged. Tagging methods are outlined in the Resident and Juvenile methods section of this Procedures Manual.

Drift gillnets will be used as contingency gear in the event of an electrical malfunction to the electroshocking units. If used, drift gillnets will be fished in the mainstem 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. Mainstem areas fished by this method should be substantially free of surface and subsurface debris and shallow enough to allow the net to reach within a foot (or less) of the bottom. The same criteria outlined under electroshocking will be used to ascertain whether gillnet captured fish are spawning at the catch location. Catch data will be recorded on the appropriate sampling form (III Data Procedures).

Where water depth allows, suspected mainstem spawning areas will be sampled for egg deposition. A backpack mounted water pump and two circular standing screen cod end 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 on the appropriate sampling form (III Data Procedures).

Mainstem survey crews will be comprised of one member from each project (Adult Anadromous (AA), Resident and Juvenile (RJ) and Aquatic Habitat (AH)). In addition to AA assessment of mainstem spawning, survey crews will be addressing RJ and AH project objectives. These objectives are outlined in the RJ and AH technical procedures.

5. Slough and Tributary Surveys

Operation Period and Survey Reach:

A crew will survey weekly all known and suspected anadromous fish spawning sloughs and tributaries between RM 99 and Devil Canyon from 3 August to 7 October. The crew will base their operation from Gold Creek Station.

Sloughs will be surveyed in their entirety and tributary streams will be surveyed from their confluence with the Susitna River mainstem to survey distance outlined in the following chart:

TRIBUTARY STREAM	RIVER MILE	SURVEY DISTANCES (MILES)
Whiskers Creek	101.4	0.5
Chase Creek	106.4	0.75
Gash Creek	111.6	0.75
Lane Creek	113.6	0.5
Lower McKenzie Creek	116.2	0.5
McKenzie Creek	116.7	0.5
Dead Horse Creek	120.9	0.5
5th July Creek	123.7	0.25
Skull Creek	124.7	0.25
Sherman Creek	130.8	0.25
4th July Creek	131.0	0.25
Gold Creek	136.7	0.25
Indian River	138.6	1.0
Jack Long Creek	144.5	0.25
Portage Creek	148.9	0.25

Once weekly from 7 August to 7 September, the Gold Creek survey crew will fish a set gill net for two hours off each bank of the Susitna River between a point one mile upstream of Portage Creek and Devil Canyon.

Methods:

Sloughs (spring fed) and tributary streams listed in the preceding section will be surveyed on foot in their entirety except as indicated. Stream surveyors will wear polarized glasses and use hand-held tally counters to record live tagged and untagged adult salmon and carcasses. Survey data will be recorded on the appropriate forms (III Data Procedures) and forwarded to the Anchorage office every two weeks.

Set nets used to sample the river reach between Devil Canyon and a point one mile upstream of Portage Creek will be uniform and will be fished perpendicular to the river channel from the shore. Each net will be 50 feet long, 5 feet deep, and have a stretched mesh size of 5.2 inch. Set net locations are shown in Appendix III. Catch information will be recorded on the appropriate form (III Data Procedures).

6. Chinook Salmon Aerial Surveys

Operation Period And Survey Reach:

Chinook salmon escapement surveys will be conducted on known and suspected spawning tributaries between Talkeetna and Devil Canyon between 21 July and 7 August by the Adult Anadromous Project Leader or his assistant. Additionally, surveys will be conducted drainage wide if survey data normally collected by Region II ADF&G Sport Fish Division and shared with the Su Hydro project is not collected.

Methods:

Chinook salmon surveys will be conducted via helicopter. The observer will wear polarized glasses and use tally counters to enumerate live and dead chinook salmon. Survey data will be recorded on the appropriate form (III Data Procedures).

7. Eulachon Survey

Operation Period and Survey Reach:

Field activities will begin immediately following ice-out (15 May, approximately) and will terminate at the completion of spawning (10 June, approximately).

Survey reach will extend from the intertidal estuary to the upper spawning limits (Kashwitna River confluence, approximately)

Methods:

A standard set gill net (1.5 inch stretch mesh, 25 ft long, 5 feet deep) will be fished at two field selected sites in the Susitna River estuary every third high tide for the first seven days and thereafter, every fifth high tide except when the fifth high tide occurs during non-day light hours wherein the preceding high tide will be considered the frequency end and will be fished accordingly.

Fishing time will be monitored to the nearest minute and shall extend to thirty minutes on each set except when observation indicates a 300 plus eulachon catch at which time fishing will be discontinued until the next scheduled fishing tide.

The two field selected set net sites will be fished independently and repetitively in the same order. Fishing time at the first site will begin 45 minutes prior to high tide and at the second site, 15 minutes following high tide. Daily high tides in the Susitna River estuary will be determined by applying a minus 36 minute correction factor to the 1982 high tide table for the Anchorage District (U.S. Coast Guard, 1982).

An electroshocking boat will be operated on the Susitna River from the estuary (RM 6) to the upper limit of migration (RM 60, approximately) to define spawning areas. This boat will be operated daily when the sampling crew is not involved in set net related duties in the estuary. Specific operation and safety procedures on the electroshocking gear are outlined in Appendix V. Eulachon intercepted by electroshocking gear will not be assumed spawning at a catch location unless all of the following criteria are met:

1. Fish are freely expelling eggs or milt.

2. Fish are in vigorous free-swimming condition.

3. Twenty or more fish are caught in the initial or subsequent site sampling effort which meet criteria 1 through 2 above.

One hundred eulachon will be sampled daily from the electroshocking catch to determine sex ratio. Morphological characteristics (and if necessary internal examination) will be used to determine sex. Ten age (two otoliths per fish), weight (0.1g) and length (snout to fork of tail) samples per sex will also be collected daily. Otolith collection procedures will be demonstrated in the field by the AA Project Leader or his assistant.

Set netting, AWL and electroshocking data will be recorded as defined on the appropriate forms (III Data Procedures) and transferred to the Anchorage office every two weeks.

8. Bering Cisco

Operation Period:

Investigations will be conducted at Susitna, Yentna and Sunshine stations in conjuction with scheduled adult salmon sampling activities. Additionally at Sunshine Station, the lower east bank fishwheel will be operated to 26 September; 14 days beyond the close of the sonar and tagging operation.

Timing of mainstem spawning surveys on Bering Cisco will be identical to that defined in the previous section titled: Mainstem Surveys

Methods:

Mainstem sampling stations will use fishwheels to intercept adult upstream migrant Bering Cisco. Catches will be recorded on the Daily Fishwheel Catch Log form (III Data Procedures). Twenty age (scale) and length

(tip-of-snout to fork-of-tail) samples will be collected daily at each mainstem station.

Mainstem spawning areas will be surveyed by the three survey crews outlined in the previous section under Mainstem Surveys in this Procedures Manual . These crews will identify mainstem Bering Cisco spawning areas by the criteria and methodology used for adult salmon in the above referenced section of this manual.

9. Radio Tagging

Operation Dates and Survey Reach:

Field investigations will begin 16 June and terminate 1 October, approximately. Attention will focus in the river reach between Talkeetna (RM 98) and Devil Canyon (RM 150).

Methods:

Project personnel will radio tag approximately 48 adult salmon (16 chinook, 16 coho, and 16 chum salmon) and monitor their migrational movement to completion of spawning. Radio tagging will be conducted at both Talkeetna and Curry stations with equal emphasis on each location. Fish will be intercepted by fishwheels operating at these as defined below:

Species	Number Tagged		Tagging Period
	Talkeetna Station	Curry Station	
Chinook	8	8	15 June - 15 July
Chum	8	8	15 July - 7 Sept.
Coho	8	8	15 July - 7 Sept.

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 mile.

There will be no attempt to bias selection of radio fish other than no fish will be tagged with a transmitter that has been tagged previously with either Floy or Petersen 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. The fish will be ready to tag within about two minutes.

The cigar-shaped radio transmitter to be used is next tested for signal reception in water. Then, it is coated with water soluble glycerin, and with the help of plexiglass tubes, is slid through the mouth and esophagus 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 it forcefully swims away. Preliminary tracking 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 three times weekly. Two 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 radio tracking equipped boat, fish will be pinpointed to ±20 feet of their actual locations.

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

10. Stock Separation

Operation Dates:

Field operations will begin 1 July and terminate 7 September. Scale reading data analysis performed by the Department's Stock Separation Section will begin 1 October and finish 1 December, approximately.

Methods:

Forty sockeye salmon will be sampled for age, length and sex daily at F.R.E.D. Division weirs at Byers (Chulitna River) and Larson (Talkeetna) lakes for a targeted sample size of 500 per weir site (III Data Procedures). Age sampling will entail removal of two scales from the "preferred zone" of each fish; length measurements will be taken from mid eye to fork-of-tail; sex determination will be ascertained by morphological evaluation.

As previously outlined in this Procedures Manual, Talkeetna and Curry stations staff will collect an age, length and sex sample from all sockeye salmon intercepted by the fishwheels operating at these sites.

Samples collected at Larson Lake, Byers Lake, Talkeetna Station, and Curry Stations will be analyzed by the Department's Stock Separation Section using standard separability techniques.

B. RESIDENT AND JUVENILE ANADROMOUS FISHERIES STUDIES

1. Study Description and Rationale

The proposed work plan for the 1982-83 fiscal year provided a basic outline of the field components proposed for the upcoming field season. Much of this work is a continuation of the program implemented in 1981 and is currently continuing through the 1982 season. This section will further describe the purpose of these studies and the rationale behind the approach proposed for this coming field season.

2. Study Design by Objective

The overall scope of the studies relative to the major objectives for the Resident and Juvenile addended program are:

1. Define the seasonal distribution and relative abundance of resident and juvenile anadromous fish and estimate the comparative value of the habitats utilized by each group.

2. Characterize the seasonal habitat requirements of selected juvenile anadromous and resident species within the study area.

The following section addresses sub-objectives and the experimental design component necessary to complete the general objectives outlined. In addition, the field study is outlined along with the analytical approach to be used in the preparation of reports.

3. Sub-objectives and Study Design

The reach of river between the Chulitna confluence and Devil Canyon and the reach between the Chulitna confluence and Cook Inlet estuary will experience seasonal discharge, water quality, and temperature changes to different degrees as the hydro-electric project is developed. However, in determining the baseline resources of these lower reaches of the river the

same basic approach for the distribution and abundance surveys will be used as similar questions are being addressed.

The objectives identified are broken down into specific sub-objectives. In cases where particular questions are being addressed, the study sub-objective is further broken down into questions. In those instances when the primary goal is to collect baseline data to determine the resource base that may be impacted by the project, the study can be identified totally within the sub-objective. Each of the sub-objectives are identified and discussed by number.

1. Quantify the relative use of the different major habitat types over a seasonal basis in the reaches of river below Devil Canyon and the Chulitna confluence.

2. Determine, and estimate their relative importance of the factors which influence the use of these habitat locations and the distribution of fish within these habitats.

Within the framework of sub-objectives 1 and 2, the following questions will be addressed:

> Is the distribution and abundance of the selected fish species affected by natural occurring variations in the hydraulic conditions within each of these habitats?
>
> Are factors other than hydraulics dominating the distribution and abundance of fish at these sites?

To address these questions the following study plan will be employed.

Each of the habitat locations that are associated with a slough or tributary can be divided into several hydraulic zones. These zones can be identified by direct observation into the following categories:

1. Areas that have direct flow from tributaries, ground water, or mainstem overflow, with no influence of backwater from the mainstem Susitna.

2. Areas with backwater conditions created by elevated stages of the mainstem Susitna. At certain tributary mouths and during low discharges of the Susitna, these areas will be very limited or non-existent.

3. Areas with characterized as mixing zones of the tributary/slough where surface velocity is principally influenced by the mainstem flow.

The relative value of each of these zones will be measured by collection of field data that will provide estimates of relative populations of juvenile or resident fish within these zones over a limited time period. The experimental design includes the following assumptions; one, that populations of resident and juvenile fish using these habitats are transient populations over a seasonal period but remain constant for the duration of a single sampling period; and two, that the sampling methods employed are equally effective among the zones and reflect the relative abundance of the species within the zones.

To test if the fish distribution and abundance are affected by hydraulic conditions rather than other variables of the habitat, other measurements will be recorded at each site and the observations and opinions of the field biologists will be used to determine the validity of the experimental design. Other variables to be recorded include temperature, turbidity, substrate, cover, dissolved oxygen, ph, and conductivity. The techniques to be employed in the sampling procedure are outlined in the field sampling sections for the distribution study, and the electrofishing study.

If differences in abundance of the selected species are measured between these zones and it appears that other variables are not the factors influencing this distribution, data collected in cooperation with Aquatic Habitat personnel can relate the changes in surface area of the different

zones to changes in the discharges of the mainstem Susitna. The surface area changes will be mapped on high resolution aerial photographs during each sampling period. In addition, staff gages at the upper hydraulic zone will provide an indication of the discharge in the slough or tributary at different mainstem flows. Finally, readings from a staff gauge at the mouth of the slough or tributary can be correlated to mainstem discharge to provide information as to the relative depth at this location.

Analysis of the data will include a narrative description of the factors that appear to influence the distribution and abundance of juvenile and resident fish during different seasonal periods at each of the habitat locations. Within a sampling location, the relative catch per unit effort (CPUE) can be evaluated statistically to determine if significant differences occur between the sampling zones, at any given time period. The data will be converted to relative terms, rather than absolute numbers, to compare the relative values of the different zones during different sampling periods. Finally, the comparative value of the different sites can be evaluated on a seasonal basis by evaluation of the overall CPUE rates for each site. The surface area of the different habitat components at each location will be mapped and can be used to weight the CPUE data to determine the overall importance of each of the sites. Details of data analysis will be included in the data analysis section.

3. Examine a wider range of habitats, not previously studied in both the upper river (Above the Chulitna confluence) and in the lower river.

The distribution and abundance of resident and juvenile fish on the Susitna River has had only one year of intensive investigation (1981). In order to insure that an important component of the fisheries population has not been overlooked, a portion of the field program will look at habitats not previously sampled to determine if they contain significant populations of fish. Emphasis will be placed on examining those areas that can be affected by relatively small changes in streamflow rates and levels, temperatures, or water quality parameters and that have, in the opinion of the field biologist, potential for significant fisheries populations or

habitat. Areas identified as having significant biological potential and have the potential for being affected by changes in hydrology, temperature or water quality, will be identified for further detailed investigations. Sampling these components will involve the use of opportunistic gear by the distribution study team and the use of the boat electroshocker.

All of the crews will record observations made while completing the assigned activities and provide both narrative and quantitative data where possible to support observations as to the relative importance of certain areas and the sensitivity of these areas to environmental changes.

4. Determine the rate of development of eggs during incubation, and the timing of emergence and outmigration of juvenile salmon and resident species as a function of environmental conditions.

This program is designed to provide a data base that can be used to evaluate the effect of changes in the environment after the project comes on line, to these stages in the life cycle of the salmon.

After egg deposition, the relative survival rate of juvenile salmon is determined by the habitat conditions, such as temperature and water quality that are maintained in the redd. Changes in these conditions may increase mortality or alter the time of emergence so that juvenile salmon will experience hostile conditions upon emergence and have significantly lower rates of survival.

The rate of development of juvenile salmon under ambient conditions will be studied in situ, while monitoring simultaneously the environmental conditions of these redds through the winter until emergence.

The outmigration timing of the juvenile salmon species in addition to the downstream migration timing of resident juvenile species will be made by use of a smolt trap operated above the Chulitna confluence. The smolt trap will provide basic biological data to determine the relative condition and stage of development of the species collected.

The program outlined will provide answers to the following question:

> What are the baseline conditions with regard to timing and condition of outmigrating juvenile salmon and what are the baseline rates of development and emergence times of the early life stages of Susitna River salmon?

In conjunction with temperature data acquisition efforts and field studies of the Aquatic Habitat program, the following question can be addressed:

> How do these development rates, emergence times, and outmigration correlate with the natural changes in environmental conditions measured?

The subsequent analysis of this data should provide some insight as to the variability of the biological development and outmigrant behavior among the different species and within a given species.

This data base can subsequently be used to evaluate changes in development that the various species and life stages may display as a result of changes in the thermal conditions associated with the dam.

5. Determine the distribution and abundance of fisheries resources within the boundaries of the proposed impoundments.

The flooding of clearwater stream reaches, the mainstem Susitna, and nearby lakes will dramatically alter the aquatic environment that presently supports populations of resident fish. In order to assess the potential loss of this resource and to determine the mitigation activities necessary, the resource to be affected requires documentation to determine the nature and extent of these populations and their dependence on particular habitat conditions.

An active tag and recapture program was initiated during the 1981 field season to provide an inventory of fish populations within the impoundment zone. This coming field season will provide an opportunity to more

accurately estimate these populations, and to examine in further detail, the very large potential habitat within the impoundment zone that did not receive extensive study last year. The lower section of the clear water tributaries will be sampled again for tag recovery. The mainstem Susitna which was not sampled during the previous year, and at least one lake that will be inundated by the impoundment, (locally named Sally Lake) will be sampled in more detail with the goal of obtaining a population estimate. Sampling by use of gill nets or Fyke nets to provide adequate samples for tag and recapture estimates, or by the use of sonar equipment for survey counts will be employed.

In general, tag recoveries should provide an estimate of intra-system migration for the Arctic grayling tagged last year and some suggestion as to the constancy of the populations involved in the clear water tributary areas previously sampled.

To determine whether the reach of tributary immediately above the impoundment zone will contain habitat similar to the habitat at the mouths of the clear water tributaries, under present conditions, joint RJ and AH personnel will provide brief surveys of this reach of the tributaries to estimate relative abundance of fish present and to make compartive evaluations of the habitat that will be present after the impoundment is formed. The presence of barriers to fish passage or the inundation of existing barriers will be noted.

During the winter season, the distribution and migration of grayling will be monitored by use of radio telemetry. Previous efforts at overwinter sampling have produced very limited results because of difficult sampling conditions. Fish tagged during the fall will be monitored through the winter season in order to determine overwintering areas, and to subsequently follow spring migration and to identify spawning areas. Current information suggests that the fish spawn during ice out in the spring necessitating such techniques to identify key spawning areas.

This information should provide an indication of the dependency of the grayling populations on the mainstem Susitna for overwintering, and provide

an indication of how critical this habitat is for the spawning and survival of the tributary populations.

Data analysis will consist of estimation of populations in the tributary reaches, and evaluation of intrasystem movements using recaptured and radio tagged fish. Spawning areas will be identified and the basic biological data for all species collected will be summarized. New components of the biological community or finding different from the 1981 studies will be identified.

6. Determine the relative distribution of the invertebrate populations and the fish food preference for selected species.

Populations of juvenile chinook, coho, sockeye and chum salmon have been sampled in various slough habitats in the Susitna River. Because of the potential for dewatering these habitats and restricting the rearing habitat for these species, a preliminary study will be conducted to determine the relative distribution of the invertebrate communities and to determine which components of these communities are important for juvenile fish.

Of particular interest is the community occupying slow moving waters in the slough habitats in the spring that provide a food base for chum and sockeye salmon during their short fresh water rearing cycle. The invertebrate populations that exist during the open water season that provide a food base for the other salmon juveniles will also be studied. Because changes in the local hydraulic conditions of these habitats may eliminate the food source, or the fish may emerge earlier from the gravel because of elevated winter water temperatures, the availability and the relative importance of the food source for these species will provide insight into the survival of the species under post project conditions. In addition, examination of mainstem and tributary habitat should provide some information with regard to the overall distribution of these invertebrate species and an improved understanding of the possible distribution of invertebrates of the mainstem under post project conditions.

The major goals of this study are to provide an initial preliminary examination of the food base, its relative distribution, and the selectivity of chinook, coho, and chum salmon juveniles with regard to feeding habits. Depending upon the results of this initial investigation, the study will be directed during the 1983 field season to determine quantitive estimates of in the food base used by these species and to examine if the flow regimes and water quality under post project conditions will provide an alternative food supply or possible enhancement of the rearing potential of the system.

The study will be concentrated in the river reach above the Chulitna confluence with invertebrate samples taken from representative sloughs which have populations of rearing fish. Tributaries and mainstem sites will also be sampled to provide a comparative base for understanding the distribution of these populations.

The data will be analyzed by examination of the array of food items available versus those consumed as determined by stomach content analysis. This will be performed for each of the general habitat types. In addition to the invertebrate populations, three of the different habitat types will be compared.

4. Summary of Objectives

The previous discussion has outlined selected sub-objectives that the Resident and Juvenile Anadromous studies will be addressing. In addition to the activities listed, support will be provided to the Aquatic Habitat and Instream Flow programs and the Adult Anadromous programs. As much of the data collected from all three programs is necessary for each program segment to address the objectives established, both exchange of information and assistance on the various overlapping components of the study will be conducted throughout the summer and during preparation of the reports. The details of the analytical components will be addressed in the data analysis section of this procedure manual.

5. Fish Distribution Study

Methods:

The methods described reflect a change in emphasis from the 1981-82 sampling program from collection of broad-based distribution and biological data of resident and juvenile anadromous fisheries, to providing a more detailed study of the populations and factors affecting their distribution at a limited number of sites.

Critical habitat examined in the upper and lower river areas for juvenile and resident fisheries include the mouths of selected tributaries and side slough areas. Frequently, these sites are classified rather arbitrarily as there is often a slough associated with the mouth of a clear water tributary with the mainstem Susitna present at the mouth of the sloughs. At higher water levels, the slough often has mainstem Susitna water flowing through the upper end and the slough resembles a side channel of the mainstem Susitna.

Because of the transient nature of many of the populations of resident and juvenile fish in the Susitna river, catch rates at many of these sites reflect migratory behavior of the population present at any point in time. In certain areas, however, the population may have recently emerged from spawning beds near the sites and are rearing near their natal areas.

In order to evaluate the relative importance of the sites, the hydraulic conditions present at a sampling site have been classified into zones. The zones reflect areas of different surface velocity or orgination of water source in the case of tributaries. The zones are then sampled independently so that comparisions can be made in the utilization and importance of each of the zones as well as to characterize the physical changes in surface area, velocity, substrate, and other water quality parameters of each of the zones over time. These changes can subsequently be compared to the changes in discharge, water temperature, and water quality of the mainstem Susitna.

Each of the sites have been classified into separate zones that are illustrated in figure 4 as a typical example. The two separate illustrations depict a theoretical change in the spatial distribution of the zones over time, and can be correlated with corresponding changes in discharge, of the mainstem Susitna, tributary discharge, or ground water discharge to the sites. The number of zones will vary at each site, depending on the complexitity of the hydraulic conditions that occur at each site. Nine different habitat zones have been defined. Criteria used in defining these zones include water source (tributary, mainstem, or mixed), presence or absence of a breakwater zone resulting from mainstem stage, open/closed status of slough head, and water velocity (fast or slack and, if slack, due to mainstem backwater or bottom morphology).

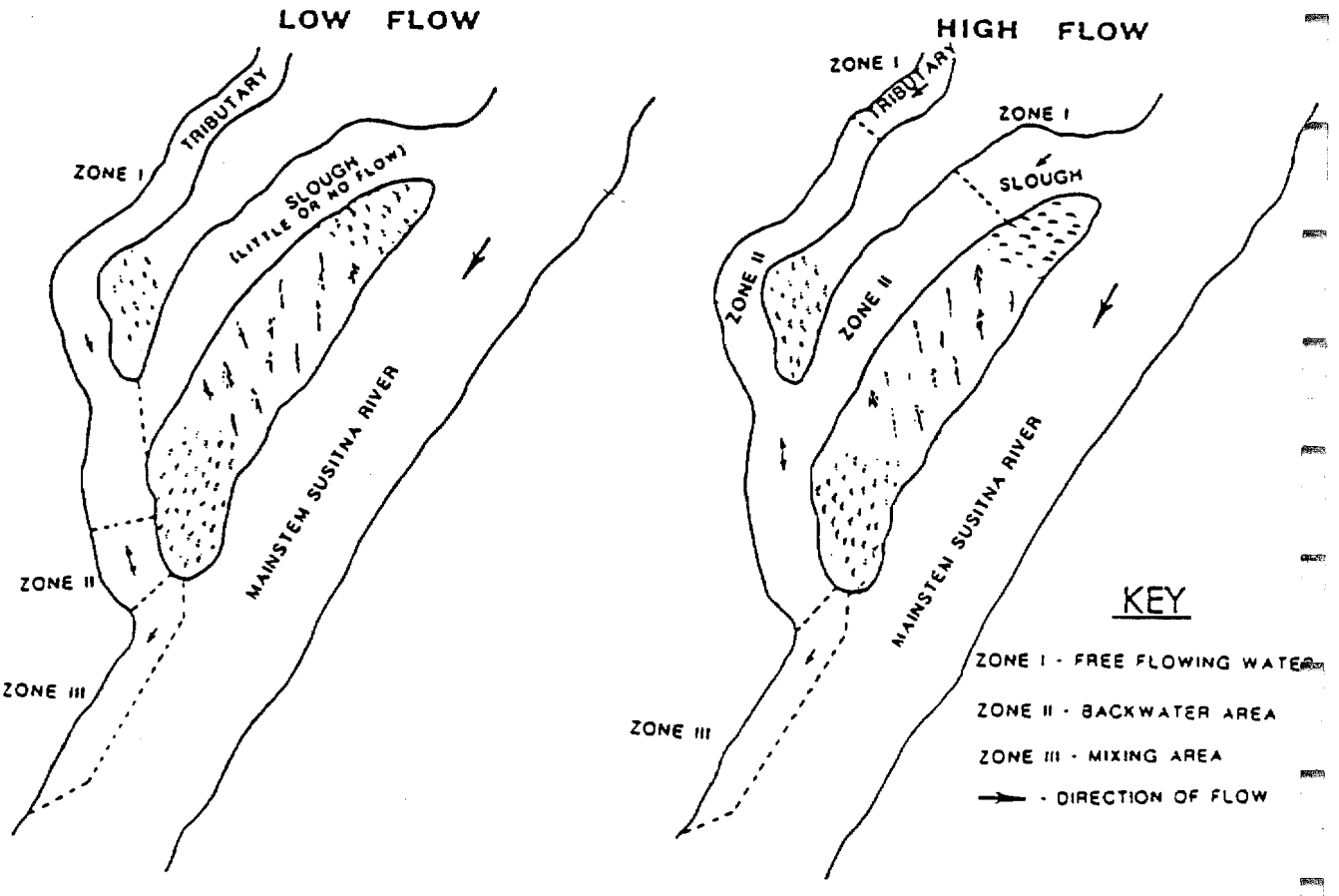

Figure 4. Hypothetical map of hydraulic zones of a typical Susitna River slough at high and low mainstem river discharge.

Fisheries Data Collection Techniques:

Standard gear to be used at each of the sites include the following:

1. Trotline
2. Five to 10 minnow traps.

The specific methods used in deploying this gear are outlined in the technical appendix.

Additional opportunistic gear will be employed on a site by site basis. These will include beach seines, back pack electrofishing gear, set and drift gill nets, fish traps, and hook and line sampling. The deployment of this gear is also outlined in the technical appendix.

The use of the opportunistic gear will depend upon site conditions and will be deployed to make observations as to the relative distribution of species and age classes of fish not collected by standard gear.

Biological measurements of each species will be made including scale samples from representative subsamples of the collected species. Adult resident species will be tagged and released, when possible, and recaptured tagged fish will be recorded. Details of the data to be recorded and field methods are included in the Data Procedures and the technical appendix.

Physical Habitat Measurements:

At each site, the surface area of each of the hydraulic zones will be delineated with the date and time noted. Delineations will be on high resolution aerial photographs or maps of the area. Time and date data will be used later to determine the discharge of the mainstem of the reach of river influencing the hydraulic conditions at the respective site.

Staff gages installed at each site will be recorded during each visit. Details on staff gage installation and data analysis are addressed in the

Aquatic Habitat procedures manual. These data will ultimately reflect the distribution of velocities of the water column in each zone.

Also the velocities of each zone that represent the areas fished by the minnow traps are estimated by a series of point measurements of velocities with a velocity meter. The areas being fished by the traps are occasionally examined by fluorescene dye placed in the traps to determine the dispersion of the scent of the bait in the traps. A single representative velocity is recorded for all of the replicate samples with in each zone. Velocity measurements are recorded in accordance within the procedures outlined in the Aquatic Habitat procedures manual.

The dominant substrate within each zone that is associated with the area fished by the minnow traps is recorded. If the substrate is compactly embedded in finer material,it is noted on the data form. Other comments on substrate are included in the field data.

The turbidity is also measured in the area being fished by the minnow traps. Other water quality parameters that are recorded for each zone include dissolved oxygen, pH, conductivity, air and water temperature. Details of these techniques are outlined in the Aquatic Habitat procedures manual.

The zones are also characterized as to the relative amount of cover present and type. The micro-habitat within the zones is to be sampled similarly among the different zones. When this is not possible because of the presence or absence of different types of micro-habitat, such as cover, the differences between the zones are noted in the field notes.

Field Notes:

Because of the wide diversity in characteristics between the different habitat locations being sampled, much of the interpretation of the data and important information is not subject to standardized data collection procedures. Therefore, the observations of the biologists and the formulation of hypothesis as to the factors influencing the distribution

and abundance of the important fish species in these areas will be performed by the field biologists conducting the surveys.

Detailed daily field notes to be kept will address at a minimum, the following items:

1. Hydraulic conditions.

   This will include preparation of a narrative that describes the different zones and factors that affect the hydraulic conditions and their distribution within each site. Changes between sampling periods and other phenomena such as changes in channel morphology caused by high water, or icing conditions will also be recorded. A description as to how the changes in discharge of the mainstem have affected the hydraulics of a site will also be noted in general terms. Problems with the data base recorded or keys to assist in its interpertation will also be noted.

2. Temperature, turbidity, and miscellaneous physical and water quality data.

   This section will discuss any needed information in interpreting the temperature data, turbidity data, and cover or substrate descriptions on the data sheets. Factors such as observed upwelling of ground water, unusual readings or other conditions that depart from the expected and hypotheses as to the cause of the anomalies will be described. Any other unusual physical conditions that may affect the distribution and abundance of the fisheries in the area will be included.

3. Biology.

   This section will include any observations that are pertinent to the objectives of this study with regard to the fisheries. Observed fish, that were not collected and their distribution within the zones and any additional intereptation required for the collected specimens will be included. The narrative should

also include departures in distribution from previous sampling periods and new phemomena observed that are of particular interest to the objectives of the study. Hypotheses as to the factors that are, in the opinion of the field biologist, influencing the abundance and distribution of the fisheries within the area will be described.

The notes will be recorded so a continual journal of the events occuring at a site through the open water season can be followed from one sampling period to another. The response of the fisheries and of the physical conditions within each site can be followed over time and can then be described with regard to hydraulic changes that differ from sampling period to sampling period.

Any other field notes that will assist in the interpetation of the data may also be recorded during the sampling periods. These field notes will provide the basis for preparation of the final reports on the fisheries of these areas and the response of the fisheries to changes in habitat that occur during the course of the field season.

Study Locations:

Tentative locations of the 1982/83 field season sampling program during the open water period are outlined on the following map of the Susitna river. (Figures 5 - 7). These sites have been chosen to reflect the following conditions.

1. Areas that will be affected by changes in discharge of the mainstem Susitna.

2. Sites identified from previous studies to have significant populations of resident and juvenile anadromous species.

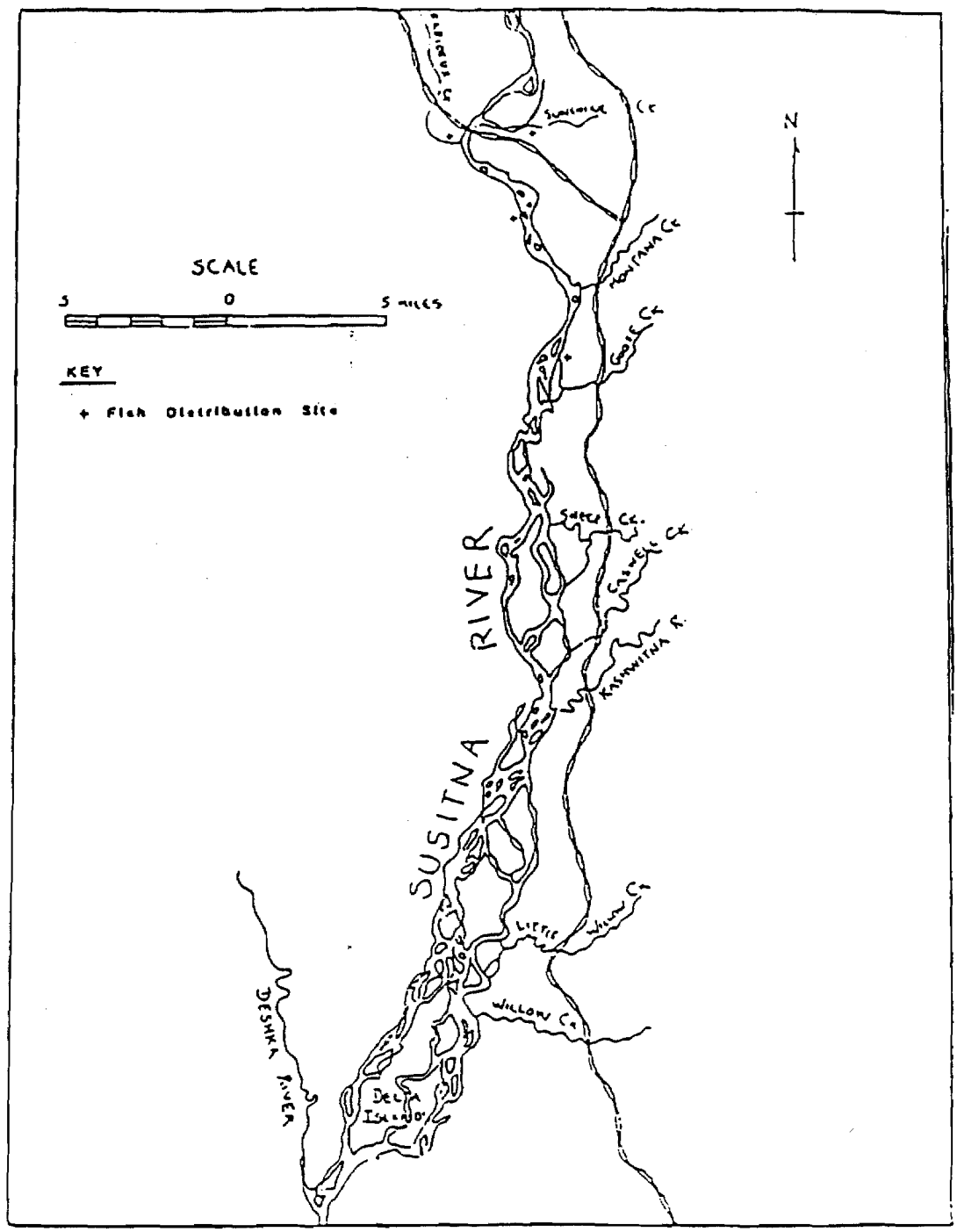

Figure 5. Susitna River Resident and Juvenile Anadromous fish sampling sites (Deshka River to Sunshine Creek), 1982.

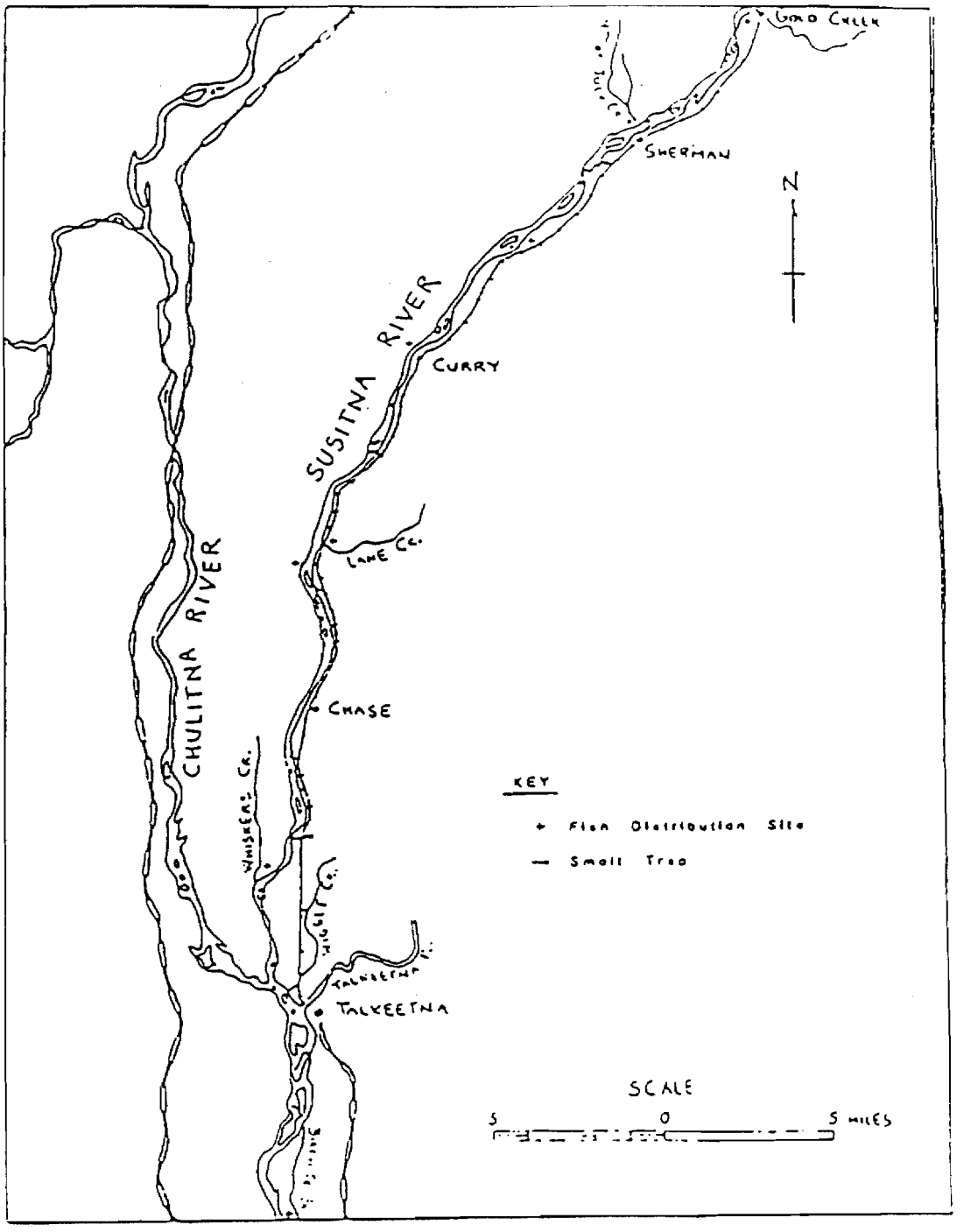

Figure 6. Susitna River Resident and Juvenile Anadromous fish sampling sites (Birch Creek Slough to Gold Creek), 1982.

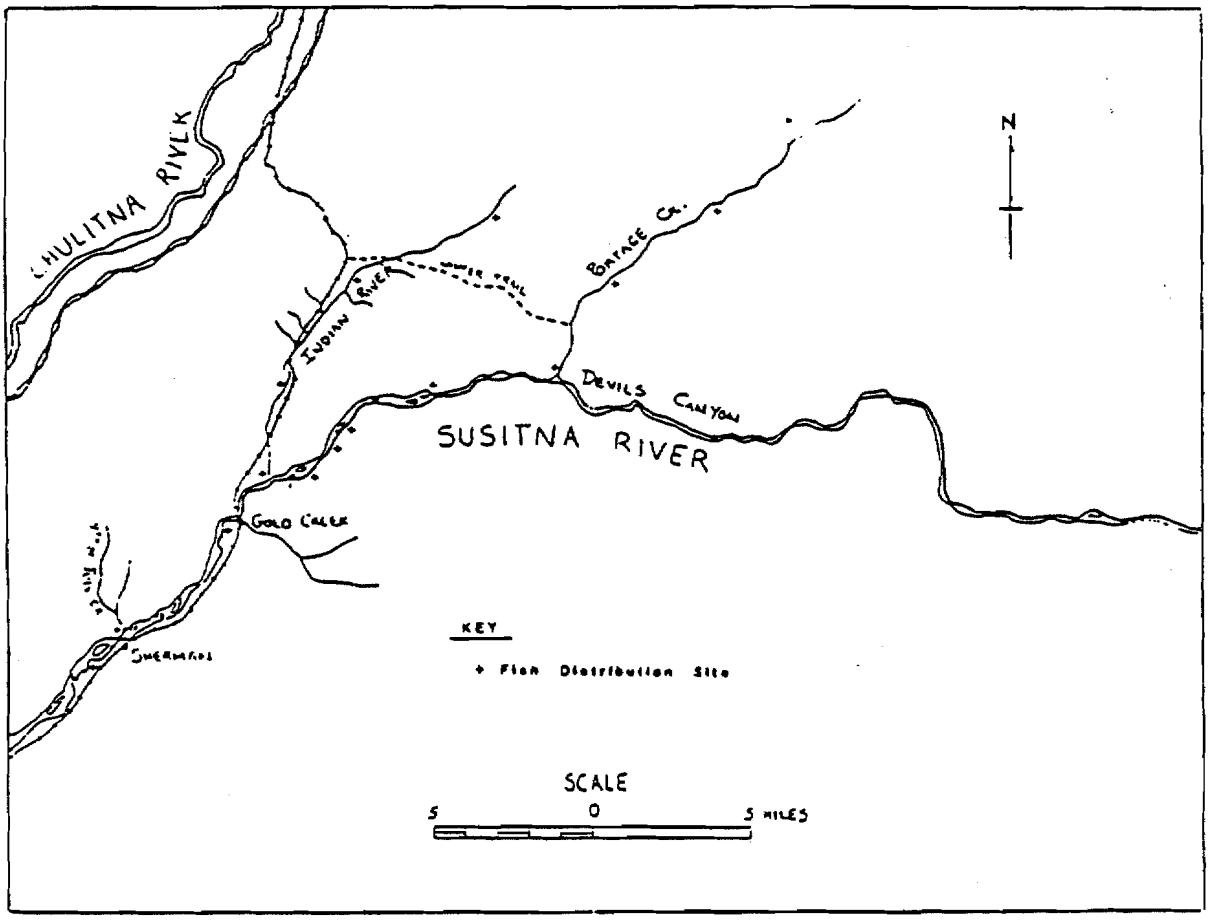

Figure 7. Susitna River Resident and Juvenile Anadromous fish sampling sites (Sherman to Portage Creek), 1982.

3. Access to areas will not create severe logistic problems and limit the overall scope of the studies.

4. Sites selected represent a cross section of critical habitat available to resident and juvenile anadromous fish of the Susitna River.

During the course of the field season, sites that have been selected may be altered or new ones added if such action will help in meeting the overall objectives of this investigation.

During the winter season, fish distribution patterns change significantly. The study sites planned for the coming winter will be more restrictive in number with more intensive investigations conducted as to absolute populations using certain areas. These sites will be based on observations of the distribution this fall and upon evaluation of previous years winter data. These sites will also meet the previously listed criteria.

Schedule of Activities and Frequency of Sampling:

Each of the habitat locations being sampled will be revisted on twice a month schedule, commencing during the first week in June, up until freeze-up. This will provide about eight to 10 sampling periods for each site. During the ice covered period, the sampling program will be limited to a smaller number of sites and a once per month schedule employed. Intensive sampling with the use of a variety of techniques will be employed during this period.

Processing of data will be an ongoing activity during the sampling period with data analysis, summarization, and report preparation commencing immediately after freeze-up. Field trip reports will be completed immediately after each sampling trip and will be limited to highlighting the findings of each sampling trip. Data forms will be reviewed and submitted to the data processing unit immediately upon completion of each sampling trip for entry into the project computer data base. The draft report will be completed by the 30th of January 1983.

Contingencies or Alternatives:

During the course of the summer field program, alternative methods for sampling or changes in study sites will be employed when it has been determined that the overall objectives of the fish distribution study can be best met through modifications of the existing program. On occasion, limited, one time experiments will be performed to test the limitations of sampling methods, or hypotheses as to the validity of assumptions regarding the importance of selected factors affecting the distribution and abundance of species. In addition, examination of additional selected sites will be performed on a limited basis when answers to specific questions regarding how important a site is for a species or other information regarding the overall objectives can be obtained with minimal additional effort.

Examples of such alternative studies include determination of the catch rate of minnow traps over a 24 hour set period; examination of the distribution of rearing coho or sockeye in the Gash Creek - Lake area, and noting and mapping the wetted area and dewatering of habitat locations beyond those included in the sampling program. Such incidental studies will be used to provide additional information for addressing the overall objectives of the planned investigation.

6. Electrofishing and Tagging Surveys

Three electrofishing boats will be utilized to conduct electrofishing on the Susitna River, between Cook Inlet and Devil Canyon from ice out to freeze-up, 1982.

During cooperative studies among the various project segments, the electrofishing boats will each be assigned to a defined reach of the river. Two or three Aquatic Habitat, Resident Juvenile and Adult Anadromous biologists will be assigned to each electrofishing crew, with possible exchanging of personnel. Field stations will be located at Yentna, Sunshine, Talkeetna, and Gold Creek.

Electrofishing will also be used to collect adult resident fish in the lower Susitna River during August and September for implantation of radio tags in conjunction with the Radio Telemetry Study.

Methods:

Using the boat mounted electroshocker, adult resident fish and juvenile fish will be systematically collected. Each specimen will be identified, measured for fork length, (or total length for juvenile salmon), tagged and then released. The sex will be recorded and a scale sample will also be collected, for adult specimens.

Scales will be taken from a subsample of each species of resident and juvenile anadromous fish caught during each sampling day. The subsample will consist of the first 20 fish of each species and 10 percent of those fish of each species thereafter.

Field notes will be recorded daily to document factors which influence the distribution and abundance of these species.

During 1981, 1,550 adult resident fish were tagged with Floy anchor and disk dangler tags between Cook Inlet and Devil Canyon. In addition, 713 Bering cisco were also tagged with Floy anchor tags.

During 1982 emphasis will be placed on tagging more fish than was tagged in 1981. This will be accomplished primarily by the addition, of three crews using electrofishing boats to capture more fish and put out a greater number of tags.

Tagging of adult resident fish will be accomplished by the following means:

1. Resident and Juvenile Anadromous fish distribution studies.
2. Study team using electroshocking boats.
3. Catches by fishwheel operations.

Two types of tags have been utilized, Floy anchor and disk dangler. Resident adult species which have been Floy anchor tagged are humpback and round whitefish, longnose suckers, rainbow trout, Arctic grayling, Dolly Varden and some burbot. Most burbot were originally tagged with disk dangler tags. However, after observing good tag retention on several recaptived burbot that were Floy anchor tagged in 1981, it was decided that all adult burbot will also be tagged with Floy anchor tags and the use of disk danger tags would be discontinued.

All adult resident fish that appear to have successfully recovered from the effects of capture and are longer than a minimum size will be Floy anchor tagged. Minimum fork length for adult resident fish to be tagged will be 150 mm. The minimum total length of burbot to be tagged will be 225 mm.

Floy anchor tags will be inserted by a Floy tagging gun into the adult resident fish between the lateral line and the posterior ray of the dorsal fin. Tagging of burbot will be accomplished with a disk dangler type tag using methods described by Mauney, (1965) and Rounsefell, (1963). Insertion of the disk dangler tag will be between the dorsal fin and the lateral line in the posterior 20 percent of the burbot. Abbreviated instructions for the attaching the disc dangler are in the Appendix IV.

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

1. Resident and Juvenile Anadromous distribution studies.
2. Electrofishing boats.
3. The angling public will be requested to return recovered tags or report the tag number to Fish and Game with information regarding catch date, location, and if the fish was released. The public will be informed of the tagging program by: 1) news released to the media. 2) RJ Susitna Hydro staff. 3) posters placed in locations frequented by anglers.
4. Adult Anadromous fishwheel operations.

Study Locations:

Areas to be electrofished will be field selected in the mainstem Susitna River and its side channels and sloughs between Cook Inlet to Devil Canyon when the conductivity is sufficient.

In addition to the selected sites sampled, specific locations will be sampled once every two weeks by the Resident Juvenile and Aquatic Habitat, electrofishing crews. During August 1 to September 15, all three crews will electrofish at these sites which include the designated habitat locations of the fish distribution studies. Sampling effort at each of the habitat location should not exceed one hour total time including handling of catch and data recording.

Schedule of Activities and Frequency of Sampling:

The field season will be broken into three time periods during which various project priorities such as resident fish or adult anadromous fish will be addressed. These three time periods will be ice out to July 31, August 1 to September 15, and September 16 to freeze up. During both the ice out to July 31 and September 16 to freeze up time periods, the individual project boats will be operated at the discretion of each of their respective project's leaders. From August 1 to September 15 all three boats and their crews will conduct slough and mainstem Susitna River anadromous spawning distribution studies.

7. Radio Telemetry Studies

Five rainbow trout and five burbot were each internally implanted with a model P40-500L,3V Smith Root low frequency radio transmitter in October, 1981 for an experimental radio telemetry program on the Susitna River.

The purpose of the program was to determine if resident fish could be successfully radio tagged internally and monitored on the Susitna River over the winter of 1981-82. The results from the data of this program provided a basis for determining the feasibility of expanding the program in 1982-83.

The data from this experimental radio telemetry program suggests expansion of the radio telemetry program in 1982-83 will be valuable to observe intersystem movement and establish overwintering habitat.

Methods:

During 1982-83, 80 radio tags will be deployed. Forty radio tags will be implanted in rainbow trout and burbot between Talkeetna and Devil Canyon, and 40 in Arctic grayling captured in the proposed impoundment area. Rainbow trout will be captured by electrofishing and hook and line. Burbot will be captured by trotlines and hoop nets. Arctic grayling will be captured by hook and line. Implantation of the 80 radio tags will utilize the same techniques and procedures that were used in 1981.

Study Locations:

The study sites will be between the Chulitna confluence and Devil Canyon or the reach of river above the Devil Canyon dam site or tributaries within these areas.

Tagging crews will radio tag healthy adult resident species collected from within the mainstem or tributaries. Actual selection of tagging sites will be based on the other distributional data collected during 1981 and 1982 field seasons.

Schedule of Activities and Frequency of Sampling:

The fish in the Susitna River below Devil Canyon will be captured by electrofishing during August and September and implanted with model P40-500L,3V Smith Root radio tags.

The 40 Arctic grayling to be radio tagged in the impoundment will be captured by hook and line during August and September. The radio tags to be implanted in these fish will have a tag life expenctancy of nine months.

Monitoring of the radio tagged fish to establish movement patterns will be conducted every ten to 30 days by boat, airplane, or snowmobile until the tag batteries are discharged.

Contingencies and Alternatives:

Beginning in March, attempts will be made to recapture the radio tagged fish with trotlines. This will be done in order to help locate overwintering habitats of resident fish and to observe and define these habitats.

Experimental use of hoop nets will be employed to determine if they can be used to collect adult residents during the summer.

8. Juvenile Incubation, Emergence, and Outmigration Studies

Methods:

The methods described outline the techniques to be used for the smolt trap and winter incubation and emergence studies only. Data collected from the fish distribution study and electrofishing surveys pertinent to this objective will be incorporated into the final reports.

The studies will address all juvenile anadromous species and selected juvenile resident species occurring in the reach of river above the Chulitna confluence, with the main emphasis on the salmon species (chum and sockeye) that spawn in habitats associated with the mainstem.

The study will be divided into two components; the outmigrant study during the open water period, and the incubation and emergence study which will be conducted during the winter season of 1982/83. Separate reports will be prepared which address these two elements.

Outmigration will be sampled by a 4.5 foot wide inclined plane mobile smolt trap, located in the mainstem Susitna near river mile 103. The trap will be begin operation in the middle of June and will continue operation until

freeze up or river ice conditions prevent further operation. Operation will resume in the spring of 1983 upon breakup. The trap is designed to operate at variable depths up to a maximum of four feet. Depth will be set by field experimentation. Placement in current and fishing position will also be determined by field experiment. Schedule for time fished while in operation will depend upon maintenance requirements.

Data collected at the traps will include the number of each species captured, lengths, fate of captured fish, representative age classification by scale samples, and the time, distance from shore, and depth the trap was fished. Variables that will be used in conjunction with outmigrant capture rates will include Susitna River discharge at Gold Creek, temperature, turbidity, time of day, time of season, horizontal and vertical distribution in the water column, and mean fish length. Data not collected at the smolt trap will be obtained from the Aquatic Habitat program or other Su Hydro study group responsible for collection of the particular data elements (R&M, USGS, etc.). Data will be analyzed primarily by species and age class.

Incubation and emergence studies will be conducted in the upper river habitat locations that have had redd locations identified or spawning determined to occur by resident species. The study will involve obtaining limited samples of developing eggs by redd pumping or excavation at sites being monitored for intragravel temperature by the Aquatic Habitat study group. Electrofishing gear will be used to sample emerging alevins in the spring. Thermal data and development information will be transferred to the group conducting a laboratory incubation study with the intragravel temperatures being transferred to this organization on a weekly basis.

Species to be included in the egg development study will include sockeye and chum, salmon if sufficient redds are located for a complete sampling program for each species in areas that may be affected by the mainstem or temperature changes. Data recorded will include numbers and percentages of eggs or juveniles at various stages of development at each sampling site, for each species.

Habitat data will be collected in accordance with the procedures established in the Aquatic Habitat procedures section. Data will include water quality, surface and intragravel water temperatures, air temperatures, dissolved oxygen levels, redd substrate composition, and surface velocities at the redd locations.

Field trip reports will be prepared on a regular schedule and will be the basis for data transfer from the field. Monthly summaries of significant findings will be prepared from these reports. The draft of the final report on the open water sampling period will be prepared by January 30th, 1983. A final report on the incubation and emergence studies, which will cover the winter field sampling period, will be submitted by June 30th, 1983.

Study Locations:

The study sites for the incubation and emergence study will be confined to the reach of river above Talkeetna pending final information on the thermal regime below the Chulitna confluence area. The outmigrants moving through the mainstem will be sampled with the smolt trap placed in the lower area of river near the Talkeetna Adult Anadromous sonar site (RM 103). A second trap may be installed in the spring of 1983, depending upon the success of the trap during the 1982 field season.

Incubation and emergence studies will be conducted during the fall and winter of 1982 through the spring of 1983 at selected study sites in the upper river above the outmigrant trap site. These sites will be selected based upon observations of adult spawners during the summer of 1982. Tentative sites include sloughs 21, 11, 9, and 8A. Additional sites will be included as determined by adult usage.

Schedule of Activities:

The smolt trap will be installed by mid-June 1982 and will continue fishing until freeze up. It will again be in place immediately after breakup in

the spring of 1983 and continue through the 1983 field season. The trap will be operated on a continuous schedule with intermediate down periods for personnel time schedules and for maintenance.

The incubation and emergence survey will commence immediately after the spawning season and will continue through the winter of 1982/83. Sampling intervals of twice a month will be employed during the late winter period.

Contingencies and Alternatives:

Depending on the success of the smolt trap, the alternatives that may be employed, include mid channel trawling for juvenile, Fyke netting at the mouth of selected sloughs or tributaries, small smolt traps on the mouths of tributaries, or modifications and improvements to the existing trap. Further, a juvenile mark recapture experimental program, designed to mark populations from selected slough habitats for later recapture may also be investigated as to its feasibility. This would be designed to obtain estimates of local populations of fry as well as information on the overall survival and contribution of these habitats to the overall stock of the Susitna River.

9. Food Habits Study Invertebrate and Distribution Study

Methods:

Juvenile chum, coho, chinook and sockeye salmon will be collected by minnow traps, beach seines, or electrofishing gear at selected sampling sites. Specimens will preserved in 70 percent ethanol solution for further analysis in the laboratory. Data to be collected include species, date of collection, length, and site location of collection. The stomachs will be removed and contents analyzed for invertebrate taxa. Taxonomic level of identification will be generally to the family level but will be reduced further when possible.

Invertebrates will be collected by three methods. A drift net set will be operated at each site for a time period which will be dependent on debris

loads and catch rates of drift invertebrates. Set locations will be in the approximate area of juvenile collection sites. "Kick" screen samples of invertebrates will be collected at each site. These samples will cover a sufficient segment of riffle habitat conditions to provide a representative makeup of the available taxa in sufficient numbers to describe frequency of occurrence. Finally, a plankton tow net will be used to collect zooplankton at sites with low velocity water and that have rearing juvenile chum or sockeye salmon. All samples will be preserved with a 70 percent ethanol solution.

Invertebrates will generally be identified to genus with the family Chironomidae identified to the family level only. All of the samples collected by different methods will be analyzed separately, obtaining frequency for each taxa with respect to the overall invertebrate community composition.

Study Locations:

Collections will be made from six study sites representative of three different general habitat types. These include clear water tributary sites, slough sites, and mainstem sites.

Tentative site selection include, the following primary sites located on the Susitna between the Chulitna confluence and Devil Canyon, Indian River, Fourth of July Creek, and Sloughs 8A, 11, 20 and 21. Limited sampling will also be conducted in the mainstem and side channel areas of Slough 21 and Fourth of July Creek.

Schedule of Activities and Frequency of Sampling:

Four sampling trips will be conducted between July and September, 1982. It is anticipated that the number of species collected will be sufficient for detailed analysis of coho and chinook juveniles only. Due to the late start up date of this study, chum and sockeye collections will be limited during the 1982 field season. During 1983, collection of chum and sockeye

juveniles are proposed to begin at breakup and be conducted weekly until July 1, 1983.

Whenever present, fifteen of each juvenile salmon species will be collected at each sampling site.

Contingencies and Alternatives:

Depending on the timing of sockeye and chum salmon emergence, these species may not be included in the 1982 open water analysis and will be intensively sampled only during the 1983 season. Plankton net tows will be discontinued if not proven effective.

Depending on information on the distribution and abundance of juveniles determined by the distribution study program, alternative sites may be selected, or changes in sampling frequency implemented. Limited collections during the winter season of juvenile coho and chinook may also be made for stomach content analysis if it is determined this will provide useful information. If preliminary sampling during the winter period indicates active feeding, the proposed study will extend through the winter months.

10. Impoundment Area Studies

The impoundment surveys during the ice free months (May to September) 1982 will be conducted primarily on foot utilizing helicopter, river boat, and raft support. The impoundment crew will consist of two Resident Juvenile biologists and two Aquatic Habitat biologists operating from fixed base camp located at the mouth of Watana Creek (R.M. 194.1). More sampling effort will be expended on the mainstem Susitna in 1982.

Methods:

At the eight major tributary study locations, all sampling above the confluence will be conducted by hook and line. At tributary mouths, mainstem sites, and lakes, gear fished will potentially include the following; minnow traps, trotlines variable mesh gillnets, seines, electroshockers, and hook and line. Set gear will be fished for 24 to 48 hours. The "habitat evaluation location" will include the reach of each tributary stream studied from the area of the major clearwater influence with the Susitna River upstream to the point at the proposed impoundment elevation.

This "habitat location" will be divided into three distinct types based on their physical characteristics:

1. The confluence habitat encompasses that area of the Susitna River below the mouth of the tributary which is influenced by the tributary stream flow, the mixing area, and that area of the tributary which is influenced by the rise/fall of the Susitna River.

2. The pool habitat is comprised of the large pools between the tributary mouth and the proposed impoundment elevation where the bulk of the resident fish have been observed to reside.

3. The riffle habitat will include those stretches of each tributary located between the major pool areas in the reach between the tributary mouth and the impoundment elevation. These areas are comprised of smaller pools, rock eddies, riffles, and whitewater.

The mouth area is self explanatory. The pool areas will be designated by the biologists in the field, permanently marked, recorded, and described.

The riffle areas will then be the stretches of stream between the designated pools.

Aerial photography of the entire habitat location correlated with map contours and elevations will then allow tributary river miles for each area to be calculated.

Pool habitat sites will be calculated on the basis of the total number identified. Riffles will be calculated as the total length of stream miles in which they are located.

Sampling will be conducted (for population estimate purposes) on a set percentage of pool and riffle areas, to be determined during the June trip. Succeeding trips will sample the same areas. The mouth area will be sampled in its entirety.

A population estimate will be conducted on Sally Lake for designated resident species in addition to collecting basic water quality data. Any other small lakes in the proposed impoundment area will be test netted to determine species present. Random sampling of the Clarence Lake system will be conducted to determine if there is any movement of grayling between the lake and lower Kosina Creek.

Study Locations:

The study locations for the summer 1982 impoundment surveys include: the eight major tributary streams (upstream) from their confluence with the Susitna River to the proposed level of impoundment; seven mainstem sites located between the mouth of Deadman Creek (R.M. 186.7) and the mouth of Jay Creek (R.M. 208.5); and Sally Lake.

Schedule of Activities and Frequency of Sampling:

Surveys of the proposed impoundment area will be conducted in May, June, July, August and September 1982.

Sampling will be conducted once a month at each of the study locations. Sampling trips are scheduled for 17 days per month.

Contigencies or Alternatives:

An alternative method of gathering the required data necessary for a viable population estimate in the lakes utilizing a boat-mounted sonar device is proposed for July or August.

Based on the relative lack of success encountered utilizing standard sampling procedures during winter 1980-81 and 1981-82 studies, and the high degree of success attained with winter 1981-82 radio telemetry studies, this program will be implemented in the impoundment area. Arctic grayling will be the target species. Radio transmitter implantation will be conducted in September before freeze-up and radio tracking at periodic intervals will continue through May 1983. Details of radio telemetry procedures are described in the radio telemetry section.

11. Level of Effort

A schematic of the administrative structure and manpower distribution of Resident Juvenile personnel for fiscal 1983 is given in Figure 8. The staff of Resident Juvenile currently includes one Fisheries Biologist III, six Fisheries Biologist II's, and five Fisheries Biologist I's. Three additional Fisheries Biologist I's are scheduled to be hired in July with fiscal 1983 funds. Personnel will be assigned as needed between the various sub-projects.

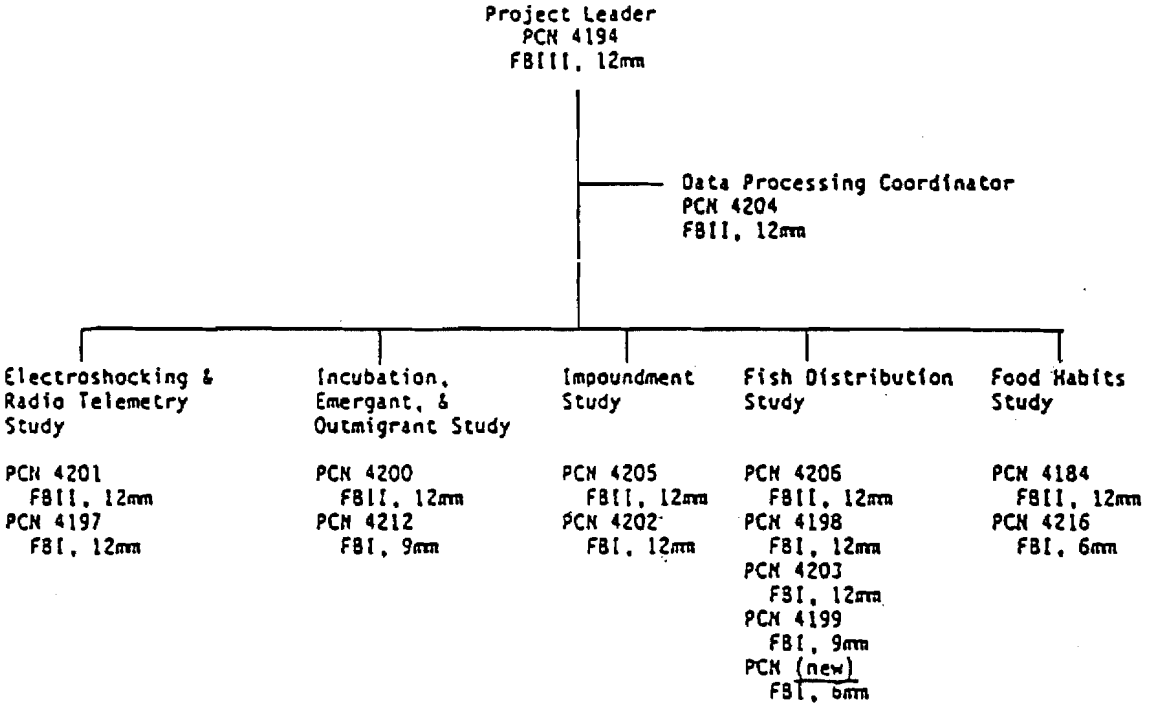

Figure 8. Phase II Resident and Juvenile Anadromous Fisheries Project, Adminsitrative Structure and Manpower Distribution F.Y. '83, July 1, 1982 to June 30, 1983.

C. AQUATIC HABITAT AND INSTREAM FLOW STUDIES

1. Study Description and Rationale

During FY 82 Aquatic Habitat and Instream Flow (AH) investigations were initiated to begin the process of identifying:

1. Fish habitats in the study area;

2. Seasonal relationships between mainstem discharge of the Susitna River and the physical and chemical characteristics of these fish habitats; and

3. Seasonal relationships between mainstem discharge of the Susitna River and fish distribution and abundance.

The FY 83 Reimbursable Services Agreement (RSA) provides a basic outline of the field studies proposed for the upcoming year. Much of this work is a continuation of that begun during the FY 82 program, and is expected to continue through FY 84. This section of the procedures manual will further describe the FY 83 AH component of these studies and the rationale behind the approach proposed for this field season. Methods described reflect only those changes from procedures established in FY 82.

AH data collected in FY 83 will be categorized as Fishery Habitat Utilization or Instream Flow data, the difference being in the application of the data. Physical and chemical data which will be related to fish will be defined as Fish Habitat Utilization Data. Physical and chemical data which are related to other physical and chemical data (e.g discharge vs. turbidity or stage vs. discharge) will be defined as Instream Flow Data. Fish Habitat Utilization studies are addressed in objective 1 and 2 and sub-objectives 1, 2 and 4 below. Instream Flow studies are addressed in objective 3 and sub-objectives 3 and 6 below. Aquatic Habitat studies in the proposed impoundment area addresses sub-objective 5, with all three objectives being addressed.

2. Scope by Geographical Reach of the Susitna River

The project study area includes those portions of the Susitna River that may be directly affected by the construction and operation of the Watana and Devil Canyon Dams. For purposes of the FY 83 ADF&G Aquatic Studies program, the project study area is sub-divided into three principal geographical areas. These are the reaches of the Susitna River from the Cook Inlet estuary to the Chulitna/Susitna River confluence (Talkeetna), Talkeetna to Devil Canyon, and Devil Canyon to the Tyone River. The first two are also referred to as lower river study areas and the third, the upper river or impoundment study area. All study sites referred to in this narrative are designated on a map (Figure 9).

3. Scope of FY 83 Program by Objective

The overall scope of the AH studies remains unchanged from the FY 82 studies. The principal objectives of the AH component are to:

1. Characterize the seasonal spawning, incubation, rearing, and passage habitats of selected anadromous and resident species within the study area (Fish Habitat Utilization Studies)*;

2. Identify the physical and chemical conditions associated with changes in mainstem discharge of the Susitna River which appear to be influencing the suitability of various habitat types for the species and life history stages of interest (Fish Habitat Utilization Studies)*;

3. Characterize the relationships between changes in mainstem discharge and the physical and chemical parameters of the various habitat types found in the study area (Instream Flow Studies).

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* Refer also to RJ and AA Procedures Manual Sections and addendums.

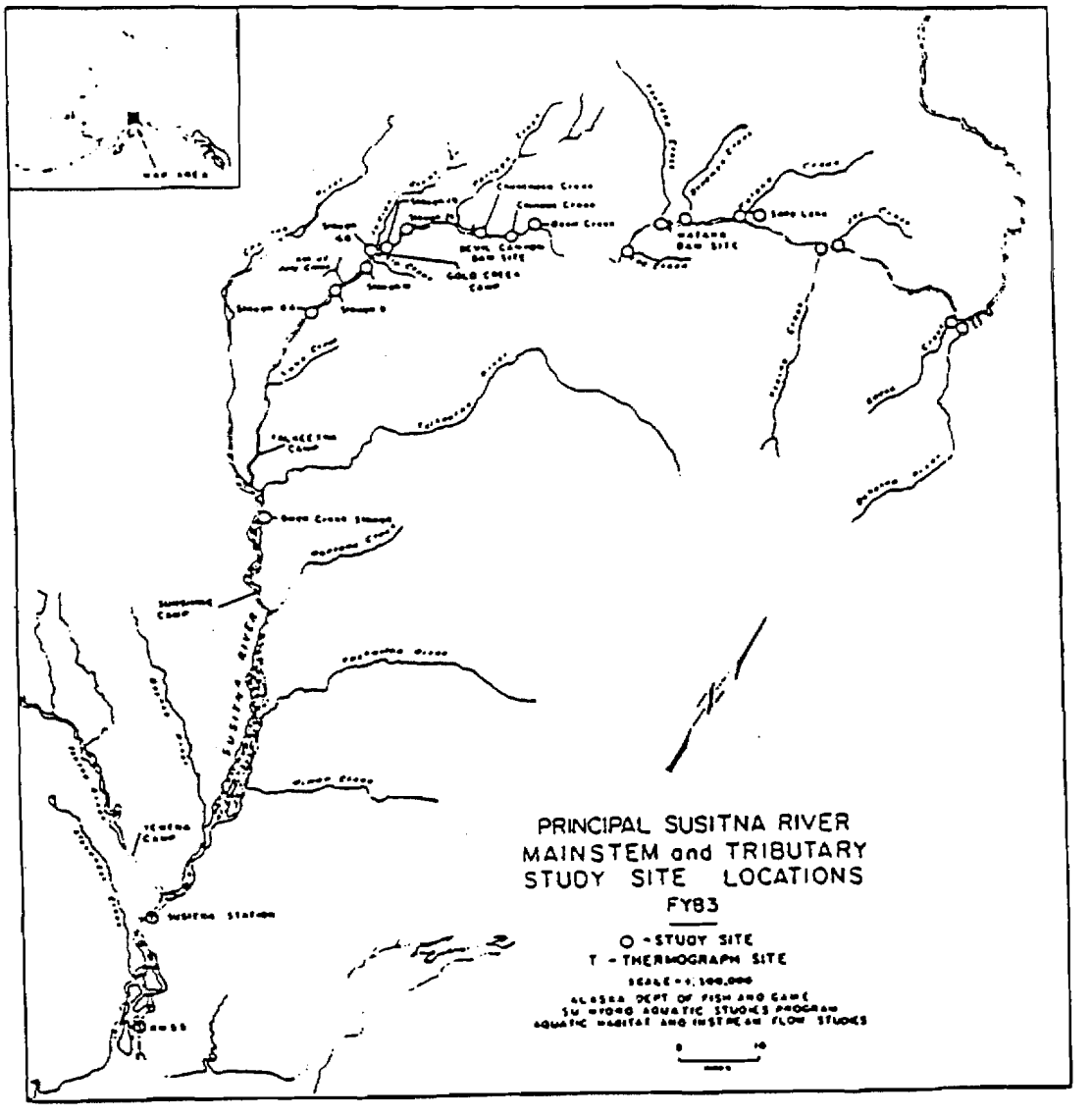


Figure 9. FY 83 Principal Aquatic Habitat and Instream Flow study site locations.

The following section outlines sub-objectives and field studies necessary to continue working towards meeting these general objectives in FY 83. Specific techniques to be employed in the sampling procedure are outlined in the FY 82 draft of this procedure manual and this addendum. It is anticipated that the following sub-objectives can be accomplished during FY 83 through an integrated ADF&G, R&M, and AEIDC program. These sub-objectives include:

1. Determine the influence that various mainstem streamflows have on selected mainstem spawning and incubating habitats between Cook Inlet and Devil Canyon during the open water and ice covered seasons;

2. Determine the influence that various mainstem streamflows have on the availability of spawning, incubation, rearing, and passage habitat in selected side slough habitats in the Talkeetna to Devil Canyon reach of the Susitna River;

3. Identify the ranges of point specific hydraulic and water quality parameters of spawning habitats used by adult anadromous fish populations;

4. Monitor the thermal regimes of the mainstem river, side channels and sloughs upstream of Talkeetna to define possible relationships between mainstem surface and intragravel water temperatures, or between mainstem surface water temperatures and the surface or intergravel water temperatures in the side channels and slough areas;

5. Identify and characterize the seasonal habitats utilized by the fish species present within the boundaries of the proposed impoundments;

6. Provide technical support to RJ habitat related studies.

Sub-Objective 1

The AH spawning habitat evaluations that will be undertaken on the Susitna River during the FY 83 open water field season between Cook Inlet and the Devil Canyon will principally focus on the river reach between Talkeetna and Devil Canyon.

Studies will focus on identifying the significant physical and chemical characteristics of mainstem habitats utilized by anadromous fish, principally salmon, and resident fish for spawning. Attempts will also be made to identify the relationship between changes in mainstem discharge and temperature and the extent, timing, and number of salmon present in the mainstem. Defining the actual responses of mainstem habitats utilized for spawning to incremental changes in mainstem streamflow is beyond the scope of this study.

Mainstem spawning habitats of the following anadromous species will be investigated: chum, pink, coho, and sockeye salmon, eulachon and Bering cisco. Spawning habitat of resident species (principally rainbow trout and burbot) will also be investigated (incidental observation of spawning by other species will also be evaluated).

Sub-Objective 2

FY 82 investigations indicated that the availability of various fish habitat and access to and from sloughs in this reach of river were related to mainstem discharge. Habitat relationships to juvenile anadromous fish will be evaluated by the RJ study team. AH FY 83 field studies which will be undertaken in the Talkeetna to Devil Canyon reach of the Susitna River during the FY 83 open water season, will principally focus on adult anadromous spawning in side slough habitats. Relationships will be determined between seasonal mainstem discharges at Gold Creek and the quantity and quality of salmon spawning habitat available to and utilized by adult spawners in the side sloughs. These relationships, when examined in conjunction with other information, will provide the basis for an incremental evaluation of project effects on side slough habitat.

Areas conveying flow in three side sloughs (8A, 9, and 21) will be intensively studied to determine the effects of changes in mainstem discharge on the physiochemical attributes of adult salmon habitat. Each slough will be subdivided into three habitat zones based upon prevalent hydraulic characteristics. These zones will be identified by direct observation as listed below:

1. Areas of sloughs that convey flow from tributaries, ground water, or mainstem overflow with no appreciable influence of backwater from the water surface elevation of the mainstem;

2. Areas of sloughs that are periodically influenced by backwater conditions attributable to changes in water surface elevations of the mainstem Susitna. At certain slough mouths and during periods of low flow in the mainstem Susitna these areas will be very limited or non-existent;

3. Areas at slough mouths that are mixing zones. Local velocity patterns in these areas are principally influenced by the mainstem flow.

Transects will be established in zone one at each study slough to characterize spawning habitat and hydraulic characteristics of the area. Headpins will be installed by ADF&G and cross-sections surveyed along each transect to describe the general shape of the slough channel. All elevations at a particular study site will be referenced to the project datum established by R&M Consultants.

Depth and velocity measurements at fixed intervals along the established transects will be obtained in accordance with standard field procedures required for IFG-4 type hydraulic analysis (Bovee and Milhouse 1978, Bovee 1982). These data will be reviewed shortly after collection and converted to the proper format for computer processing as outlined by Trihey and Wegner (1981). Pre-project hydraulic analysis will be computer generated by ADF&G as discussed in the Data Procedures section. The analytical methodology and techniques for the habitat model are based on the PHABSIM incremental flow methodology (Bovee 1982, Wesche et al. 1980).

Substrate composition and spawning redds will be visually evaluated and denoted on field maps. During late September, foot surveys will be conducted to identify areas of groundwater upwelling. This information will be used in conjunction with hydraulic measurements (stage, discharge, depth, and velocity) to determine the relationship between mainstem discharge and the availability of suitable spawning areas in these sloughs. Adult salmon passage conditions from the mainstem into and within the sloughs well be evaluated by establishing thaleweg profiles through all three zones. Study of juvenile anadromous fish in the three slough study zones are discussed in the RJ study section.

Sub-Objective 3

Point specific physical and chemical data will be collected and evaluated to determine the types and ranges of habitat characteristics which are utilized by adult anadromous spawners. These data will be required by the AEIDC for predicting the impacts of various flow regimes on fish habitat suitability. Point specific data will be collected from the Cook Inlet estuary to the Devil Canyon reach of the Susitna River at the slough and spawning locations previously discussed in sub-objectives one and two. Sampling methods will be employed which permit observation of the fish within in the habitat they are occupying. Further detail on field techniques is provided in the FY 82 Procedures Manual and this addendum (ADF&G 1982a).

Sub-Objective 4

Evaluation of FY 82 surface and intragravel water temperature data indicated the importance of collecting additional data on a year-round basis. These data are required to evaluate the ability of computer models developed by project engineers to calculate pre-project surface water temperature conditions and insure the models are properly calibrated. Eventually, the model will be important to the AEIDC impact analysis team for predicting post-project temperature related impacts.

The temperature of the mainstem Susitna River and its major tributaries will be monitored through the open water field season at several locations using Ryan model J-90 thermographs and Omnidata DP 2301 recorders. These data will principally be collected upstream of the Parks Highway bridge with additional emphasis given to the impoundment zone. These data will describe the thermal regime of the mainstem itself.

In addition, continuous surface and intragravel water temperature data will be obtained from several known spawning areas throughout the winter of 1982-83 and into the spring and summer of 1983. Temperatures will be monitored using Omnidata DP2301 recorders and calibrated thermister probes. Thermograph sites will be selected to meet the data needs of the ADF&G, Acres and R&M. Data will be transferred to the Data Processing Support Unit for analysis.

Sub-Objective 5

FY 83 AH and RJ impoundment studies are designed to assess the potential loss of the aquatic habitats within the proposed impoundment areas. This requires documentation to determine the temporal and spartial distribution of fish populations in this area, associated habitat conditions and whether there are alternate habitats to support them adjacent to the impoundment area. Fish populations will also be evaluated by species composition and species specific abundance.

A tag/recapture and habitat evaluation program was initiated by a joint AH/RJ team during the 1981 field season to provide an inventory of fish populations and habitat characteristics within the impoundment zone. Continuation of these studies into FY 83 will provide an opportunity to more accurately estimate fish populations. FY 83 studies will also enable project personnel to examine in further detail, other potential habitats within the impoundment zone that did not receive extensive study in FY 82. Sampling of the lower section of the clear water tributaries for tag recovery will be continued. The mainstem Susitna River will also be sampled in more detail during FY 83. At least one lake within the proposed

impoundment, Sally Lake will be sampled in more detail in FY 83 with the goal of obtaining a population estimate of the fish species present.

Joint AH and RJ crews will also conduct general habitat evaluations on selected major tributaries to determine whether the reach of tributary immediately above the proposed impoundment elevation (PIE) contains habitat similar to that below the PIE. To accomplish this task these reaches will be surveyed to estimate the relative abundance of fish and evaluate the existing habitat characteristics. The presence of fish passage barriers or potential inundation of existing barriers will be noted.

During the winter season, the distribution and migration of grayling will be monitored by use of radio telemetry. Previous efforts at overwinter sampling have produced very limited results because of difficult sampling conditions. Fish radio tagged during the fall will be monitored through the winter season in order to determine overwintering habitat, and to subsequently follow spring migration and identify spawning habitats. Current information suggests that the fish spawn during a period closely associated with breakup necessitating such techniques to locate key spawning areas. This information should provide an indication of the dependency of the grayling populations on the mainstem Susitna for overwintering, and provide an indication of how important this habitat is for the spawning and survival of the tributary populations.

Data analysis will consist of population estimations in the tributary reaches, and evaluation of intrasystem movements using recaptured and radio tagged fish. Any spawning areas located will be identified and the habitat characteristics evaluated. Basic biological data for all species collected will also be summarized. Any new components of the biological community or different findings from the 1981 studies will be identified.

Sub-Objective 6

AH personnel will provide technical support to RJ habitat related studies (e.g. fish distribution, invertebrate, and incubation) by:

1. Training RJ staff to maintain and operate habitat data collection instruments;

2. Calibrating habitat instruments for RJ staff;

3. Installing and maintaining staff gages at all RJ fish distribution locations;

4. Measuring discharges at fish distribution locations to develop stage/discharge curves;

5. Working with RJ staff members to develop plans for collecting habitat oriented data for the incubation and invertebrate studies.

The AH section will also cooperate with RJ and AA staff and other contractors to insure the timely exchange of information when working on overlapping activities. All efforts will be made to coordinate these activities to insure maximum results are derived from this year of study.

4. Administrative Structure and Manpower Distribution

The administrative structure and manpower distribution of AH personnel for fiscal 1983 is illustrated in Figure 10. The FY 83 AH staff includes one Fisheries Biologist III, five Fisheries Biologist II's, thirteen Fisheries Biologist I's, one Fishery Technician III, and two work study students. Personnel will be assigned as needed between the various sub-projects.

The following section contains a description of the work plans for achieving the preceding objectives and sub-objectives. Four work plans are presented:

a. Lower River Fish Habitat Utilization Work Plans
   Slough Spawning Habitat
   Mainstem Spawning Habitat

b. Instream Flow Evaluation Work Plan

c. Upper River Fish Habitat Utilization Work Plan

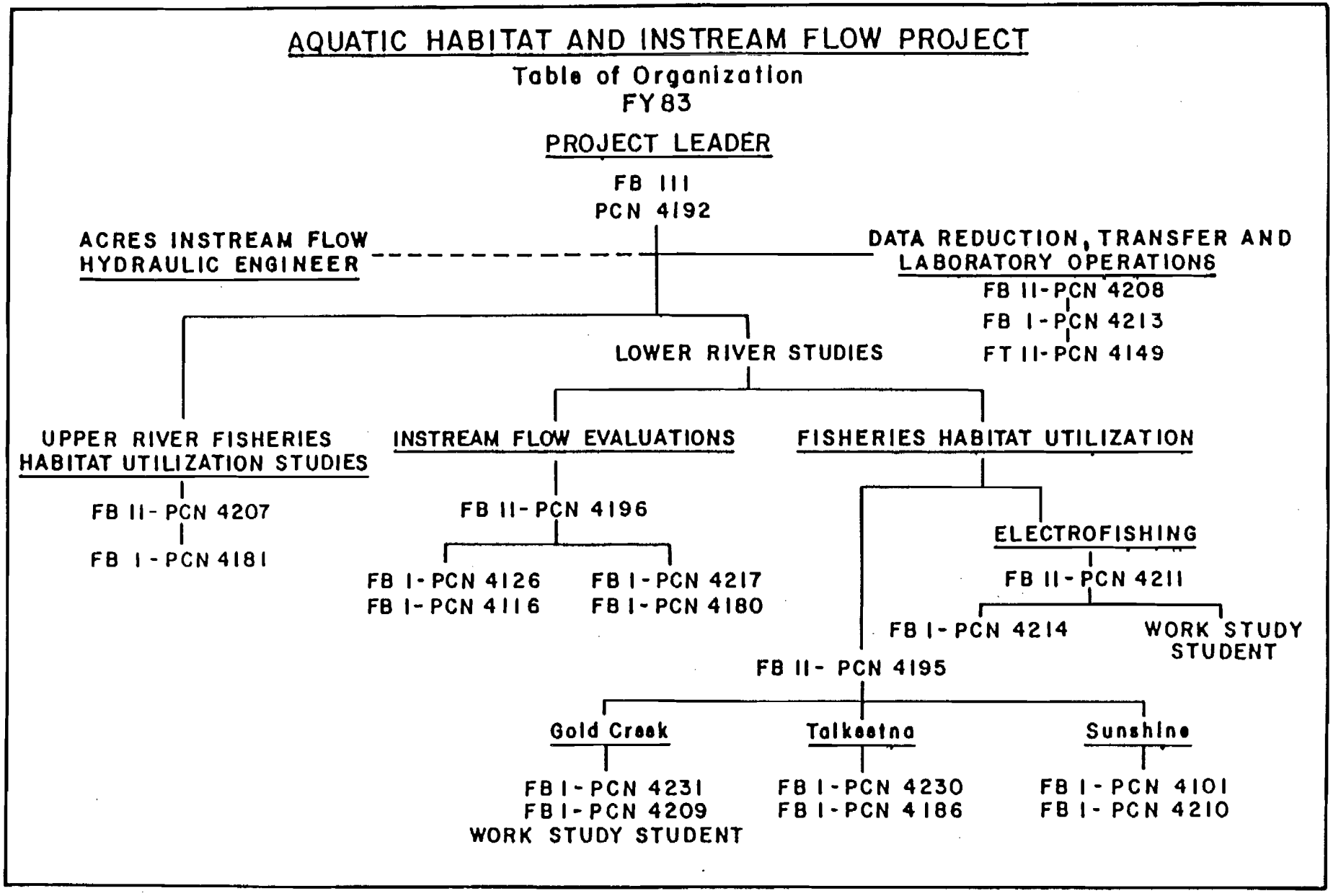


Figure 10. FY 83 Aquatic Habitat and Instream Flow Project table of organization, 1982-83.

5. Field Data Collection Work Plans

a. Lower River Fish Habitat Utilization (FHU) Work Plan

During the 1982 open water field season the Fish Habitat Utilization (FHU) section of Aquatic Habitat will concentrate on the characterization of adult salmon spawning preferences in slough and mainstem habitats in relation to hydraulic and other physical conditions of their habitat (Objectives 1 and 2; Sub-objectives 1, 2,3 and 4). The FHU studies are subdivided into two components: A) Slough Habitat Studies and B) Mainstem Habitat Studies.

i. Slough Habitat Studies Work Plan

Study Sites:

FHU data for adult salmon will be collected at sloughs 8A, 9, and 21. These sloughs were selected on the basis of studies conducted in FY 82. Additional slough sites may be added to this list if it is determined that sufficient manpower is available.

Methods:

Upon arriving at a slough study site, an overall familiarization will be made of the entire slough in order to obtain information necessary for mapping and to determine the location of spawning activity which is occurring. The locations of wetted areas upwelling zones, staff gage placements and water quality measurement sites will be recorded on one copy of the R&M blue line aerial photos (1"=400'). Substrate type will be recorded on a second copy. A third copy will be used to mark sites where specific redds are located. These same maps will be updated during subsequent visits using different symbols or colors and recording the date in order to differentiate visits. Stage will be recorded from staff gages installed by Instream Flow or R&M staff and discharge will be measured if necessary. Water quality data will be collected, using instruments and procedures described in the 1981 ADF&G Procedure Manual, in as many locations as are necessary to describe the water quality characteristics present.

Fish observation techniques for determining spawning sites in clear water systems are discussed in the 1981 Procedure Manual (ADF&G 1981). When these sites are determined they will be marked by a painted rock or surveying flag for subsequent measuring. After all active sites (for that days observations) are located, depth, velocity, and substrate data will be collected and the marker removed. A total of 10 flags marking redds will be left in each slough for later reference for incubation studies. Depth and velocity will be measured at the upstream end of the redds.

Level of Effort and Frequency of Sampling:

Two crews will be deployed in the river between Talkeetna and Portage. Each two person crew will work seven days in the field, three days in the office, with four days off. Slough sites will be sampled once per week.

ii. Mainstem Habitat Studies Work Plan

One AH Fish Habitat Utilization crew will be assigned to an electrofishing boat on a full time basis to work in conjunction with the other electrofishing boats (one each from RJ and AH). Their methods and multi-purpose duties are discussed below.

Methods:

Three standard mounted electrofishing boats, one for each of the three projects (RJ, AA and AH), will be utilized to conduct electrofishing on the Susitna River between Cook Inlet and Devil Canyon from ice out to freeze-up, 1982. The field season will be broken into three time periods during which various project (RJ, AA and AH) priorities will be addressed. These three time periods will consist of ice out to July 31, August 1 to September 15, and September 16 to freeze up. During both the ice out to

July 31 and September 16 to freeze-up time periods, the individual project boats will be operated at the discretion of each of their respective project leaders. From August 1 to September 15, all three boats and their crews will conduct Adult Anadromous mainstem Susitna River salmon spawning distribution studies under the supervision of the AA project leader. During cooperative studies among the various projects, each electrofishing boats will each be assigned to a separate defined reach of the river.

Two or three AH, RJ and AA biologists will be assigned to each electrofishing crew, with possible interchanging of project personnel during cooperative studies among the various projects. Field stations will be located at Yentna, Sunshine, Talkeetna, and Gold Creek camps.

Areas to be electrofished will be field selected in the mainstem Susitna River and its side channels, sloughs, and tributaries, between Cook Inlet and Devil Canyon where and when the physical parameters allow electrofishing to be conducted. In addition to the selected sites sampled, 27 specific habitat evaluation study locations will be sampled by the RJ and AH electrofishing crews once every two weeks when the physical parameters allow electrofishing to be conducted. During August 1 to September 15, all three electrofishing crews (AA, AH and RJ) will electrofish at these 27 sites which are the designated habitat evaluation study locations of the RJ Fish Distribution Studies in addition to conducting the AA salmon spawning distribution surveys in the mainstem. Sampling effort at each of the 27 habitat locations should not exceed one hour total time, including handling of catch and data recording.

A 20 foot by 5-1/2 foot flat bottom, aluminum riverboat powered by a 90 hp outboard jet and 18 hp outboard auxiliary engine will be modified for electrofishing operations on the lower river. The power source for the electrofishing apparatus (and possible supplemental lighting equipment for night shocking) will be a four cycle, 3.5 kilowatt, 120/240 volt, 60 Hz A.C. Homelite Voltamatic generator. Voltage and amperage regulation from the power source to the water will be through a Coffelt Variable Voltage Pulsator model VVP-15 (AH) and two Coffelt models VVP-3E (RJ and AA). Both models are designed to supply A.C., D.C., or pulse output voltages. The

output voltages from the VVP-15 can be varied continuously from 0 to 600 volts for all outputs (A.C., D.C., Pulsed D.C. and 0 referenced A.C. Pulsed). For the VVP-3E the output voltages can be varied from 0 to 300 volts for all outputs (A.C., D.C. and, Pulsed D.C., and Pulsed A.C.). The VVP-15 incorporates a 20 to 80 percent adjustable DC pulse width. The proper current type, voltage, amperage and electrode arrangement for efficient capture of fish will vary for different species of fish and according to water quality parameters such as water temperature, conductivity, depth and turbidity.

Electric current will be applied to the water through either single and dual anode systems, with the cathode comprising the boat surface in contact with the water. When a single anode is used, a single dip netting pole will be used both as the anode and a dip net. The single anode design will be utilized when probing in deep pools and confined areas and in searching for specific species. Under situations when a dual anode system will be utilized, each anode will be suspended into the water using a standard electrofishing boom design. A standard dip net will be used to capture stunned fish.

Due to the high voltages and potential hazards associated with electrofishing, several safety features will be designed into each electrofishing boat. Each boat will be fitted with a 36 to 40" high non-conductive coated railing enclosing a non-skid platform. Electrical units will be placed in covered boxes designed to prevent water from entering the unit and thereby preventing short-circuiting. In addition, a safety circuit incorporating foot pedals and kill switches will be included in the circuitry. All individuals working on the electrofish boat will wear hip boots, life preservers and rubber gloves and be trained in cardiopulminary resuscitation (C.P.R.) and basic first aid techniques (Appendix V).

Specific sampling procedures for each of the three projects are stated in each respective project's section of the Procedures Manual.

Level of Effort and Frequency of Sampling:

Electrofishing, using the standard boat mounted electrofishing unit previously described, will be conducted on the Susitna River from May 20, to freeze-up, 1982. Various electrofishing objectives in cooperation with each study section (AH, RJ and AA) will be addressed during this time period. Two to three AH biologists will be assigned to the AH electrofishing crew, with possible interchanging of project personnel during cooperative studies among the various projects. Field stations will be located and jointly shared by the RJ electrofishing crews at Sunshine, Talkeetna and Gold Creek.

1. Eulachon Study in conjunction with AA (May 19-June 15, 1982).

Objectives:

1. Determine the extent, timing, and numbers of the spawning runs of eulachon in the Susitna River.

2. Evaluate the physical and chemical characteristics of habitats utilized for spawning by eulachon.

3. Identify the relationship between changes in mainstem discharge and temperature and the extent, timing, and number of eulachon present.

Methods:

The first objective will be studied using methods described in the AA portion of this procedures manual.

The Susitna River will be sampled for spawning eulachon seven days a week from ice-out until the end of the spawning run by a three person joint AH/AA crew stationed at Susitna Station (RM 25.5).

Set and dip nets and boat-mounted electrofishing gear will be utilized to define eulachon spawning sites and the upstream limits of their migration.

Eulachon sampled at each site will be assumed to be spawning only if all of the following criteria are met:

1. Fish freely expel eggs or milt;

2. Fish are in a vigorous free-swimming condition;

3. Twenty or more fish are caught in the initial or subsequent site sampling efforts which meet criteria one and two above.

Since eulachon are known to be broadcast spawners and thus do not fan a nest (Morrow 1980), it may be difficult to observe the exact location and timing of spawning. Attempts will be made to identify deposited eggs in substrate samples by direct observations.

When a eulachon spawning site is identified, the habitat at the site will also be evaluated. Because this will be a first year attempt at evaluating the habitat characteristics of eulachon spawning areas, procedures and methods of study will have to be designed and modified in the field. Due to the similarity between eulachon and Bering cisco spawning behavior, adaptation of techniques similar to those used in the Bering cisco study will be employed in this study (ADF&G 1982b). The following procedures will be utilized.

1. The site will be assigned a name and the river mile, geographic code, and time of sampling will be determined and recorded.

2. A qualitative description of the general habitat characteristics of the site and the sampling methods and gear used will be recorded;

3. The overall substrate composition of the site will be determined using methods described in the Phase I Procedures Manual and recorded;

4. Representative measurements of the following water quality variables will be collected at each site using techniques described in the Phase I Procedures Manual and recorded: water and air temperature, pH, dissolved oxygen, specific conductance an turbidity;

5. A map of the area will be drawn and a sampling grid for the collection of depth and water velocity data will be developed based on procedures developed by Bovee and Cochnauer (1977);

6. Depth and water velocity data will be collected at all points in the grid and recorded;

7. Representative photographs of each site will be taken.

Two Peabody-Ryan model J-90 thermographs will be placed in the Susitna River to continuously monitor surface water temperature. These data will be used to determine if any correlation exists between the timing of eulachon spawning runs and surface water temperatures. Thermographs will be placed (using methods described in this manual) along the east bank of the Susitna River at RM 5.5 (at the east bank gill net site) and RM 25.5 (at Susitna Station) (refer to Figure 4I-2-1).

2. Resident species categorization, enumeration and tagging studies in conjunction with RJ (ice-out to freeze-up, 1983).

Objectives:

1. Identify, enumerate, and tag adult resident species.

2. When possible, collect data concerning the general habitat requirements of resident fish.

Methods:

Using the boat mounted electroshocker previously described, resident adult species will be systematically collected, identified, measured, age sampled, sex determined (when possible), tagged and then released using methods described in the RJ portion of this Procedures Manual. Habitat characteristics that will be studied, when possible, to characterize the general habitat requirements of these resident fish include the physiochemical variables comprising air and water (surface and intragravel) temperature, pH, specific conductance, dissolved oxygen and turbidity, substrate, water depth, and, mean water column velocity. At significant study sites, a map may be drawn of the site and immediate surrounding area. Specific methods for the collection of the above parameters are given in the Fisheries Habitat Utilization portion of the AH Procedures Manual.

3. Adult salmon spawning site evaluations in conjunction with AA (June 15 - Aug. 30, 1982).

Objectives:

1. Determine the extent, timing, and number of chum, pink, coho, and sockeye salmon spawning in the mainstem Susitna River and its associated side channels.

2. Evaluate the physical and chemical characteristics of mainstem habitats used for spawning.

3. Define the relationship between changes in mainstem discharge and surface water temperature to the extent, timing, and numbers of salmon present in the mainstem.

Methods:

The first objective will be studied using methods described in the AA portion of this procedures manual.

Boat-mounted and backpack electrofishing gear, drift nets, and foot surveys will be utilized to identify spawning sites in the mainstem Susitna River below Devil Canyon (RM 152.0) from August 1 to September 15, 1982. The "mainstem" in this study will be defined to include the main channel of the Susitna River and associated side channels. It will not include tributary-mainstem confluence zones or slough habitats. The mainstem Susitna River will be sampled for spawning salmon five days each week throughout the survey period. The sampling area will extend from the estuary (RM 0.0) to Devil Canyon (RM 151.0) and will be sampled by the following three crews working in the defined reach of river:

1. Yentna crew - estuary (RM 0.0) to Kashwitna River (RM 61.0),

2. Sunshine crew - Kashwitna River (RM 61.0) to Talkeetna (RM 97.0), and,

3. Gold Creek crew - Talkeetna (RM 97.0) to Devil Canyon (RM 151.0).

Salmon will be assumed to be spawning at a catch site only if all of the following criteria are met:

1. Fish exhibit spawning maturation colors and morphology;

2. Fish expel eggs or milt when slight pressure is exerted on the abdomen;

3. Fish are in vigorous condition, with 25% or more of the eggs or milt remaining in the body cavity;

4. Additional sampling efforts produce fish that meet criteria one through three above.

When a mainstem spawning site is identified, the habitat of the site will also be evaluated. This will be a first year attempt at evaluating habitat characteristics of mainstem salmon spawning areas and the study design,

procedures and methods of study will be modified in the field as necessary. The following procedures will be utilized as a guideline.

1. The river mile, geographic code (GC) and time of sampling will determined and recorded.

2. A qualitative description of general habitat characteristics of the site and sampling methods and gear will be recorded;

3. The overall substrate composition of the site will be determined using methods described in this manual and recorded;

4. Representative measurements of the following variables will be collected at each site using techniques described in this manual: air temperature, surface and intragravel water temperatures, pH, dissolved oxygen, specific conductance, and water depth and velocity.

5. A map of the area will be drawn indicating salmon spawning sites and areas of data collection.

6. Representative photographs of the site will be taken.

4. Fisheries Habitat Utilization Slough Habitat Studies (ice-out to freeze-up, 1983)

Objective:

1. Assist AH fisheries habitat utilization slough habitat study crews to achieve the objectives outlined in that section's plan of study.

Methods:

Using the basic boat mounted electrofishing unit previously described, adult anadromous and resident fish will be located for study by the AH fisheries habitat utilization study crews. The AH electrofishing crew will

aid the fisheries habitat utilization crews in the collection of fisheries habitat data and will process all collected fish as previously described.

5. Radio Telemetry Studies in conjunction with RJ (Sept. 1 - Nov. 15, 1982)

Objectives:

1. Collect resident species for radio telemetry studies and aid in the tracking of tagged fish.

2. Characterize the habitat utilized by radio tagged fish.

Methods:

Using the basic boat mounted electroshocker previously described, adult resident fish will be collected in conjunction with the RJ electrofishing crew for implantation of radio tags. Tracking of these tagged fish will be done in conjunction with the RJ project by boat and aircraft. Spawning or milling areas identified for these fish will be studied for their general habitat characteristics as discussed previously in the resident species categorization, enumeration, and tagging studies section.

6. Bering Cisco Study in conjunction with AA (September 1 to freeze-up, 1983)

Bering cisco (Corregonus laurettae Bean), and anadromous member of the whitefish family, were first discovered to utilize the Susitna River basin for spawning in 1981 (ADF&G 1982b). A total of 747 fish were sampled during 1981 using fishwheels, gillnets, and electroshocking gear. Habitat evaluation surveys were also conducted at three major spawning areas located between RM 75 and 80 during 1981.

Objectives:

1. Determine the extent, timing, and number and size of spawning runs Bering cisco in the Susitna River.

2. Evaluate the physical and chemical characteristics of habitats utilized for spawning by Bering cisco.

3. Identify the relationship between changes in mainstem discharge and surface winter temperature to the extent, timing, and number of Bering cisco present.

Methods:

The first objective will be studied using methods outlined in the AA portion of this procedures manual.

Sampling will be conducted from September 1 to freeze-up, 1982 in the mainstem Susitna River and its associated side channels and sloughs to ascertain the the degree of spawning of Bering cisco. In addition, tributary mouths will be occasionally sampled. Sampling will be conducted utilizing fishwheels and standards boat-mounted electrofishing gear.

Bering cisco are believed to be broadcast spawners (Morrow 1980). This makes it difficult to determine the exact timing and location of spawning. Bering cisco captured by the above gear will not be considered to be spawning at a catch site only if all of the following criteria are met.

1. Fish freely expel eggs or milt;

2. Approximately 20 or more fish, with a mixture of both sexes, are captured at a catch site;

3. Ripe or spent fish are present at the same site 24 hours after the initial sampling effort.

When a catch site is determined to have Bering cisco spawning, the habitat of the site will be evaluated. To assure consistency of data, procedures similar to those employed during the 1981 study of Bering cisco spawning

grounds (ADF&G 1981a) will be employed during this year. The following procedures will be utilized.

1. The site will be assigned a name and the river mile, geographic code and time of sampling will be determined.

2. A qualitative description of the general habitat characteristics of the site and sampling methods and gear used will be recorded.

3. The overall substrate composition of the site will be determined using methods described in this procedures manual and recorded.

4. Representative measurements of the following water quality measurements will be collected at each site using methods described in this procedures manual and recorded: air temperature, surface and intragravel water temperatures, pH, dissolved oxygen, and specific conductance.

5. A map of the area will be drawn and a sampling grid for the collection of depth and water velocity data will be developed based on procedures developed by Bovee and Cochnauer 1977).

6. Depth and water velocity data will be collected and recorded.

7. Representative photographs of each site will be taken.

b. Instream Flow Work Plan

Instream flow data will be collected during the open water and ice covered field seasons (Objective 3; Sub-objectives 5 and 6). Data collected will include: stage, discharge, surface and intragravel water temperatures, DO, pH, conductivity and water surface elevations.

Study Site Selection:

Combinations of stage, discharge and water quality measurements will be collected at RJ Fish Distribution Study (FDS) site locations, at selected mainstem anadromous salmon spawning sites, and FHU slough sites. In addition, stage data will be collected at each AA sonar/fishwheel site. Surface water temperature data will be collected on a continuous basis using Model J-90 Ryan thermographs at selected mainstem, tributary, and slough sites to determine the thermal characteristics of these sites. In addition to collection of surface water temperatures, intragravel water temperatures will also be continuously monitored using Omnidata DP 2301 recorders to characterize the relationships between surface and ground water temperatures at six spawning sites to be selected in the field.

Methods:

1) Stage

Staff gage placement at RJ Fish Distribution Study (FDS) study , AA mainstem study, and FDS and FHU slough study sites will be determined on a site use basis to monitor water surface elevations. Gages will be located so as to monitor the accessibility of the study site from the mainstem for access into and passage within the study sites of both resident and anadromous adult and juvenile fish. Gages will also be placed within the study location to develop discharge rating curves in an effort to determine total discharge through the study area. In addition, gages will also be installed at the head portion of each study site that are adjacent to the mainstem and within the mainstem to evaluate the influence of flow into the study area from the mainstem and the mainstem discharge required for breaching of these head portions.

Staff gages will also be installed at each AA fishwheel/sonar station to monitor changes in mainstem water surface elevation and to develop to mainstem discharge rating curves at these sites.

A cross section profile will be made perpendicular to the direction of streamflow at each staff gage site except those located within the mainstem. Each gage will be numbered (refer to staff gage numbering procedures Table 1 and Figure 11), on the back and a painted float will be attached which will also include the gage number. Each staff gage site will consist of a set of gages tiered to insure that the entire range of flows will be monitored at each site (refer to AH FY 82 Procedures Manual for staff gage installation instructions). The top of each gage and the water surface elevation will be surveyed to a temporary bench mark (TBM). A compass reading on true north to the TBM from each gage will be determined as well as the distance from the gage to the TBM. This is done to insure accurate replacement of gages lost during high flows etc. True north was determined from magnetic north by using the approximate mean declination information available on USGS topographic quadrangles, 1:63360 series. For example, an approximate mean easterly declination of 25.5° for USGS topographic quadrangles of the Susitna River from RM 0.0 to 22.0 would be subtracted from the magnetic north bering (360°) to determine the true north bearing (360° - 25.5° = 334.5°). Staff gages at FDS study sites will be monitored at least twice monthly; at the fishwheel/sonar site gages read daily and at the FHU slough and mainstem sites once per week.

Table 1. Staff gage numbering procedures.

Staff gages will be numbered with a four part, seven place alpha-numeric code.

EXAMPLE: Mainstem gage at River Mile 101.2, set number one, second gage from shore

1	0	1 .	2	M	1	B
Rivermile				Placement Code	Set #	Gage

River Mile (first four places of code) - to be determined to the nearest tenth mile from the bluelines in the Instream Flow Evaluation office.

Placement Code (fifth place) - indicates whether a gage is placed in a slough (or side channel) (S), at the head of a slough (H), in a tributary (T), in the mainstem (M), at an R&M cross-section (X), or W for mouth of slough.

SET (sixth place) - a single digit which identifies a group of staff gages within a site which were set to measure the full range of stage fluctuations at a given point.

GAGE (seventh place) - a letter identifying a gage within a set. Letters will be assigned alphabetically, beginning with the gage nearest shore.

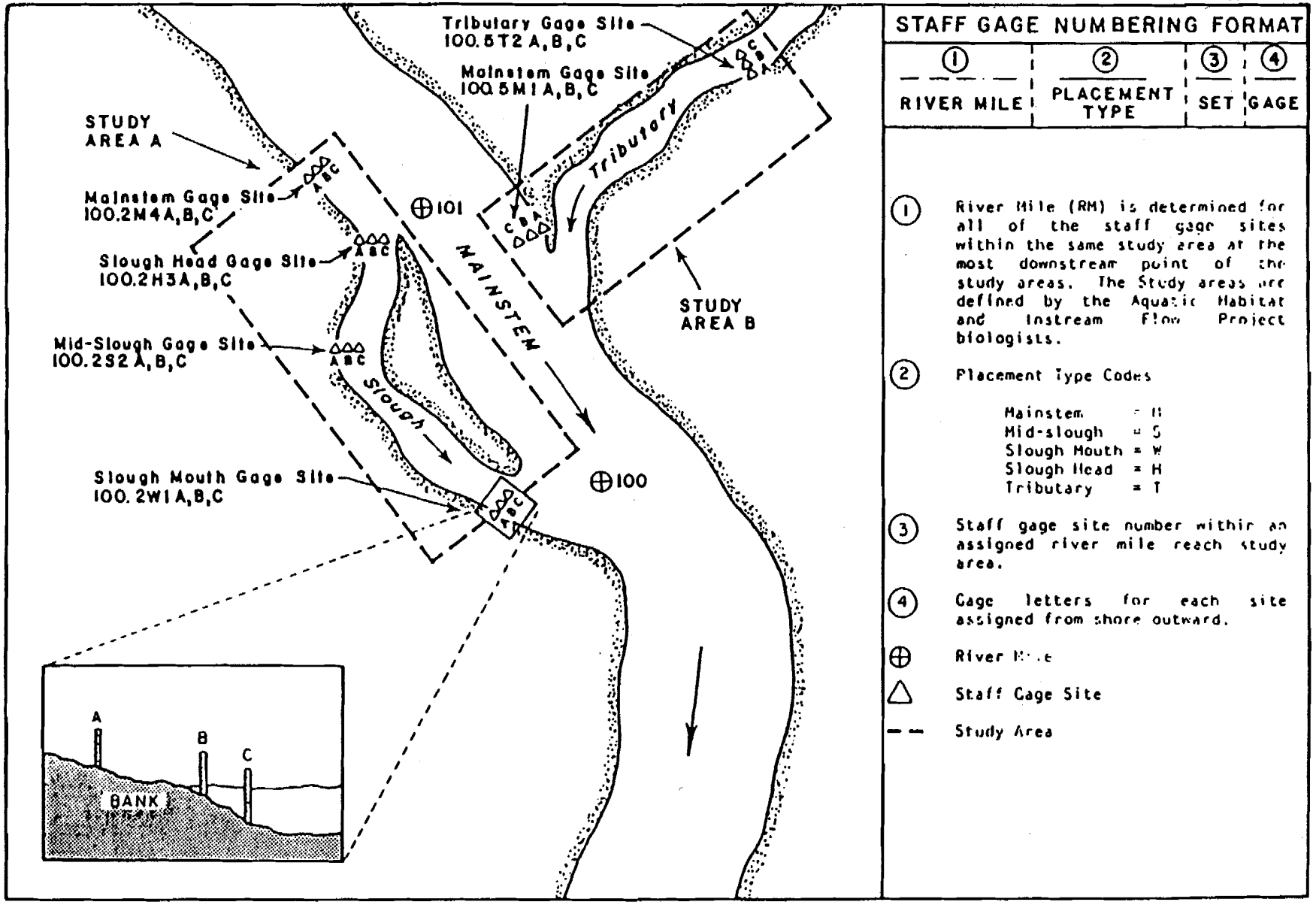


Figure 11. FY 83 All staff gage placement and identification system, 1982-83.

2) Discharge

Discharge data will be obtained at transects to be surveyed by R&M Consultants. A set of staff gages will be installed at each discharge site and read before and after collecting the discharge data. R&M Consultants will initiate the discharge measurements at each site by obtaining the first of at least three discharge measurements to be used to develop stage/discharge rating curves. Upon coordination with R&M, ADF&G will collect further discharge data at specified study sites to continue rating curve development. These sites will be determined and gages installed, when possible by R&M, to also estimate reach specific streamflows. Mainstem discharge information will be obtained from the closest USGS gaging station as a control. Refer to the Aquatic Habitat and Instream Flow Phase I Procedures Manual for discharge measurement procedures.

Daily discharge information from Gold Creek and Sunshine USGS gaging stations will be broadcast to all field camps to familiarize field staff with the flow levels they are observing.

3) Water quality

Water quality will also be recorded at each discharge site on transect at intervals necessary to characterize the water quality present. Methods are described in the 1981 Procedures Manual (ADF&G 1981).

4) Temperature

The two types of instruments employed in the continuous measurement of temperature are the Peabody-Ryan model J-90 submersible thermograph (surface water) and the Omnidata recorder (datapod) with associated thermistors (surface and intragravel). For both the thermograph and the datapod, the temperature sensor is placed on the bottom of the stream to record the water temperature of the lower portion of the water column adjacent to the stream bed. Peabody-Ryan model J-90 thermographs continuously monitor and record temperature with an error of 0.6°C on 90-day charts. The Peabody-Ryan thermographs, after installation, are monitored and serviced (if necessary)

twice monthly, except those located above Devil Canyon which are monitored on a monthly basis. To ensure accuracy of temperature data collected, each Peabody-Ryan is screened at two temperatures (0°C and between 11-16°C) prior to installation using a calibrated Brooklyn or American Society for Testing and Manufacturing (ASTM) thermometer as a standard. Thermographs found to be in error by more than 3°C at either screening temperature are not used and are returned to the manufacturer for calibration. To ensure proper calibration of temperature readings, surface water temperatures are obtained using a calibrated thermometer at the time of installation and removal of the thermograph from each site. A unique calibration factor is then determined for each thermograph, calculated as the difference in the readings between the surface water temperature obtained with the thermograph and the calibrated thermometer at the time of thermograph removal. The calibration factor is determined from data at the time of thermograph removal rather than the time of installation because response time after installation varies for each thermograph. The calibration factor is then used to correct 2-hour point temperature readings from each recording chart. From these corrected 2-hour point temperatures mean, maximum and minimum temperatures are computer calculated for each 6-hour period. The installation and service methods for Peabody-Ryan thermographs are outlined in the Procedures Manual (ADF&G 1981a).

Intragravel and surface water temperatures will be monitored at selected sloughs and spawning sites by Omnidata DP 2301 recorders (datapods). The datapods and associated thermistors used to continuously monitor surface water temperatures are capable of simultaneously recording both surface and intragravel water temperature with an error of $\pm$ 0.1°C. The datapod incorporates a non-volatile, ultraviolet (UV) erasable, solid state data storage module (DSM) to record data. The DSM is capable of storing approximately three months of data, recorded in 6 hour intervals as minimum, maximum, and mean water temperatures. The datapods are virtually maintenance-free but will be periodically checked for low battery charge and disturbance by wildlife.

To obtain surface water temperatures with a datapod, the associated thermistor is attached to a weight and placed upon the substrate of the stream channel. Each thermistor probe is calibrated prior to field installation by Dryden and LaRue Consulting Engineers (distributors of the instruments) and assigned a calibration factor. The surface water temperature probe is placed immediately adjacent to an intragravel temperature probe associated with the same recorder. The associated intragravel thermistor is secured within a steel, slotted tube and inserted approximately 18 inches into the substrate. The thermistor probe wires are connected to the Omnidata recorder which is stored in a waterproof container secured on the stream bank out of the range of flood flows and eroding banks. Immediately after installation of the recorder and prior to removal of the DSM, a surface water temperature is obtained with a calibrated mecury thermometer. In addition, surface and intragravel water temperatures are obtained from a "short data dump" which the recorder is programmed to yield. The "short data dump" is a listing of data which also includes errors accumulated, numbers of data points stored, and minutes to next recording. The two temperatures (one from the datapod and the other from the mercury thermometer) are compared, taking into consideration probe calibration factors, to ensure accuracy of the instrument.

At each surface water monitoring temperature station, instantaneous water temperature measurements will be made at 1.5 feet beneath the water surface at approximately 100 foot intervals along a transect once per month through October. This was done to ensure that each temperature statin is located in an area of uniform temperature. If the temperature station is being influenced from a tributary or other water source beside mainstem water, the temperature station is to be relocated to a site of uniform mainstem water temperature. Instructions for placement of thermographs are included in the Phase 1 AH Procedures Manual.

Level of Effort and Frequency of Sampling:

Two crews of two people will be deployed from the Yentna River to Portage Creek. One crew will be assigned the reach extending from the Yentna River

(RM 27.0) to Lane Creek (RM 113.6) and the other crew will be assigned the reach extending from Lane Creek (RM 113.5) to Portage Creek (RM 148.0). Both crews will also share those areas between the Yentna River and Portage Creek when necessary. The standard schedule will consist of seven days of field duty, three days in the office and four days off. Each site will be inspected two times per month.

C. Upper River Fish Habitat Utilization (Impoundment Study) Work Plan

The flooding of the mainstem Susitna River, clearwater tributaries reaches, and nearby lakes by the proposed impoundments will alter the aquatic environment that presently supports populations of resident fish. To assess the potential loss of these habitats and to determine the mitigation activities necessary, the resources to be impacted require documentation to determine the nature and extent of these populations and their dependence on particular habitat conditions. A more detailed background description of these studies is presented in the sub-objectives section (Sub-objective 5).

Study Design:

The 1982 Aquatic Studies program in the proposed impoundment study area will be conducted during the open water field season (May-October) on a monthly basis with field activities lasting from 14 to 18 days per month. Additional field trips will be conducted in late April and early May to determine timing, location, and extent of Arctic grayling spawning activities.

The 1982 impoundment study area will include the aquatic habitat within the boundaries of the proposed Devil Canyon and Watana reservoirs and a five mile study reach immediately upstream of the PIE of selected tributaries.

The study area will be further divided into three categories grouped by habitat type: including tributary, mainstem Susitna River (including mainstem sloughs) and lake locations. Those portions of tributaries, the mainstem Susitna River and lakes that lie within the proposed impoundment boundaries will be designated as habitat evaluation locations. Specific study sites within these habitat evaluation locations will be designated as habitat evaluation sites.

Eleven major tributaries will be investigated during 1982, including the eight major tributary streams within the proposed impoundment area that were studied during 1981 (Fog, Tsusena, Deadman, Watana, Kosina, Jay, and Goose Creeks and the Oshetna River). In addition, three streams (Cheechako, Chinook, and Devil Creeks) within Devil Canyon will be examined for the first time this year.

The "habitat location" of each of the major study tributaries will include that portion of the stream from the major clearwater influence with the Susitna River, upstream to the PIE. This area will be divided into three distinct habitat types where possible based on their physical characteristics. These are:

1. The confluence habitat which encompasses the area of the Susitna River below the mouth of the tributary which is influenced by the tributary stream flow, the mixing area, and the area of the tributary which is influenced by the rise/fall of the Susitna River.

2. The pool habitat which is comprised of the large pools within the tributaries between the mouth and the proposed impoundment elevation where the majority of the resident fish have been observed to reside.

3. The riffle habitat which includes those stretches of each tributary located between the major pool areas in the reach between the mouth of the tributary and the impoundment elevation.

These areas are comprised of smaller pools, rock eddies, riffles, and whitewater.

Quantification of pool habitat will be by direct enumeration while riffles will be quantified by length in each stream. Surface area of tributary reaches to be impounded will be determined using 1:400 blue line maps and a Numonics digitizer. Surface area of tributary pools will be estimated from on-the-ground observations. Surface areas of riffles within a stream will be determined by subtracting the estimated pool habitat surface area from the total surface area determined for each tributary below the PIE.

The following Aquatic Habitat data referred to in this section will be collected according to procedures presented in the Procedures Manual (ADF&G 1982a) and Volume 4 unless indicated otherwise.

General water quality parameters (dissolved oxygen, pH, specific conductance, water temperature, and turbidity) will be measured at least once per month during the open water field season at designated tributary, mainstem and lake sampling sites. The selected sites will be representative of those habitat evaluation locations under study. Tributary sites will be located immediately above the mouth of Fog, Tsusena, Deadman, Watana, Kosina, Jay and Goose Creeks and the Oshetna River. Mainstem Susitna Rivr sites will be located immediately above the confluence of the above-mentioned tributaries and the Susitna River with the exception of Jay Creek, where the sampling site will be located immediately above the confluence of Upper Jay Creek Slough and the Susitna River. Sally Lake will be sampled once a month at a site at the west end of the lake. Sites one mile above the PIE of selected tributaries will be sampled once during the field season. Ryan Model J-90 thermographs will be placed near the mouth of Tsusena, Watana, Kosina, and Goose Creeks, and the Oshetna River to continuously monitor surface water temperatures.

Discharge data will be collected as time permits to obtain baseline data for reservoir modeling and to determine relative differences in discharge for comparisons of fisheries habitat in tributaries under study.

A depth contour map of Sally Lake will be developed and this map will be used to determine surface water area and other morphometric data.

Any documented spawning areas of Arctic grayling or other selected species within these study areas will be identified and the general habitat characteristics will be assessed. These characteristics include velocity, depth and substrate data in addition to basic water quality.

Based on the relative lack of success encountered utilizing standard sampling procedures during the winter 1981-82 studies, and the high degree of success attained with winter 1981-82 radio telemetry studies in the lower river, this type of program will be implemented in the impoundment area during FY 83. Arctic grayling will be the target species. Radio transmitter implantation will be conducted in September before freeze-up and radio tracking at periodic intervals will continue through May 1983. During this period, overwintering habitats of Arctic grayling will be identified and the general habitat characteristics (water quality, velocity, depth, etc.) will be assessed.

Level of Effort:

The impoundment crew will consist of two AH biologists and two RJ biologists operating out of a camp located at the mouth of Watana Creek (RM 194.1). Surveys of the main Susitna River and selected tributaries will be conducted primarily on foot using helicopter and river boat support. Lake studies will be conducted by rafts or on foot with helicopter support to and from the study area.

Contingencies

During the course of the summer field program, alternative methods for sampling or changes in study sites will be employed when it has been determined that the overall objectives of these studies can be best met through modifications of the existing program. Occassionally, limited one-time experiments may be performed to test the limitations of proposed

sampling methods or to validate assumptions used in a population estimation technique. In addition, examination of additional selected sites will be performed on a limited basis when a specific question as to the importance of a site can be answered with minimal additional effort. Additions to Appendix 8 and instrument instructions, will be made as new equipment is obtained.

D. DATA PROCESSING

1. Workplan

The work plan for meeting the data processing and data base management objective of the data processing support unit is based primarily on the procedures developed during fiscal year (FY) 1982. During this time period, data collected from the winter of 1980 through the spring of 1982 was cataloged, summarized, and analyzed. Data base management consists of a four step process which can be summarized as:

1. Data entry, including coding and keying.

2. Data verification, i.e. checking keyed data for accuracy and validity.

3. Error correction.

4. Loading of corrected data into a computer data base management system, for subsequent retrieval, reformatting and report production.

Step two and three above are generally implemented in a recursive manner until all mistakes are "caught" and corrected.

Data Entry:

Entry of data into the computer was primarily accomplished during FY 1982 through a three step process:

1. Hand coding of data from field data forms onto computer key punch forms.

2. Keypunching of data from keypunch forms to computer punch cards.

3. Loading of data from cards to computer disk storage and eventually onto computer tapes.

The procedure of coding, keypunching, and loading of the data was necessary due to vast quantities of data which needed to be processed in a short period of time, and the availability of only one microcomputer during FY 1982. The addition of two microcomputers and additional staff to the data processing support unit will allow for direct entry of data from field data forms into the microcomputer during FY 1983. A software package called DATASTAR (Micropro 1980a) is used for entry of data via a customized computer data "form".

Data entry via the software package DATASTAR is generally in the same format as the field data form upon which the data is recorded. Design of computer based forms for use in DATASTAR is via the companion software package called FORMGEN (procedures to be used during form design are detailed in the next section). The major exception to data entry via DATASTAR is in the case of wordy comments or notes, which have lengths (i.e. number of characters) which can not be anticipated or controlled. Notes or comments of this type will be coded, keyed, and punched in the same manner as the data was in FY 1982, except that keypunching will take place directly with the microcomputer's full screen editor (SCOPE, Vector Graphic 1981). Keypunch coding form design is detailed in the Coding Form Design section.

DATASTAR Form Design:

Computer-based forms for data entry via DATASTAR are designed via the companion software program called FORMGEN (MicroPro 1980a). Specific details of the operation of FORMGEN and DATASTAR are presented in the DATASTAR User's Guide (MicroPro 1980a). General principles to be used during form design is included in the following text.

Computer-based forms are designed to recreate as much as possible the arrangement and appearance of the field data form. FORMGEN is used to

create forms for the CRT (cathode-ray tube) screen of the microcomputer which have two major components:

1. Background text, that is text which is usually printed onto the field form and is not actual data.

2. Data fields, that is areas where data can be entered during the data entry stage via DATASTAR.

Background text can be formatted in any manner using all the "printable" characters of the CRT screen (except the underline), but is generally designed to duplicate the format of the field data form.

Data fields are positioned and created (by underline characters) in the same positions as those of the field data form. The number of characters for each data field is determined either directly from the field form or by consultation with field biologists, who know the scale and accuracy of measurements to be recorded in each data field. Additional characteristics (besides scale and accuracy) are associated with each data field. These characteristics include:

1. Order (order in which data entry will occur).

2. Padding (e.g. pad field with blanks or zeros).

3. Verification (verify data during data entry).

4. Edit mask:

    a. Entry control mask (e.g. enter or leave blank, constant value, constant decimal point).

    b. Content control mask (e.g. allowable characters, that is numbers or alphabetics, or both, etc.).

These data field characteristics are chosen to maximize ease, efficiency, and accuracy of data entry via DATASTAR. Note that all fields should be padded with either blanks, or zeros and these edit characters should be "recorded".

An additional "data field" is incorporated in each computer form. This field is not a data item on the original field data form. This item is termed Observation ID (OBSID). The OBSID serves three purposes:

1. A unique identifier for each individual page of a particular field data form.

2. A sorting and identifing variable for use by DATASTAR (i.e. a key field).

3. As a case identifier for the hierarchical data base system used on the Boeing mainframe computer system (this data base system utilizes a software package called Scientific Information Retrieval (SIR 1979), and is detailed in a later section).

Assignment of OBSID numbers is a sequential series of numbers (e.g. 1, 2, 3, etc), each series of numbers being unique to a particular field data form.

Forms created via FORMGEN can generally be designed to recreate the field data form on the CRT screen. However, in some cases, the number of data fields of the form exceeds the maximum number of fields (245) allowed by FORMGEN. In these cases the field data form is "divided" into two (or more) different computer based forms. Background text and data field items which are necessary for identification of a particular page (e.g. OBSID) of data is repeated in both computer-based forms.

Coding Form Design:

As previously mentioned notes and comments recorded on field data forms will not be entered into the computer via DATASTAR. These notes and

comments will be coded on keypunch coding forms for later entry via the microcomputer's editing system (SCOPE). The principles for design of forms for coding notes and comments are essentially the same as those principles used during FY 1982 for design of all keypunch coding forms. Each form consist of a legal-sized (8 1/2" X 14") piece of paper with 80 columns and 20 rows (Figure 12). The first 21 columns of every coding form is of a standard format. The first column is labeled card type and takes on a value of 1-9 and is used in cases where more than one type of card is needed to code data from field data forms (e.g. whole page comments on card type 1 and individual line notes on card type 2) (Note card type is equivalent to record type in SIR data base schema definition). The next eight columns (2-9) are for coding of four possible sort identifier variables (S.I.D. #'s 1-4) of two columns each, which can take on a value of 00 to 99. S.I.D. variables can be used for a variety of reasons, but are generally used to match up individual card images (80 column records) with each other. For example, S.I.D. #1 is always coded as 00 if the information to be coded in the data fields (columns 22-80) is of a whole page nature (that is heading information). If the information to be recorded in the data fields is related to a specific "line" of the field data form, then S.I.D. #1 is coded as the particular line number (e.g. 02 for line #2). Accordingly, S.I.D. #1 is used to match up information between information coded on more than one card type or individual card image (i.e. a continuation card). Note that S.I.D. #1 is always coded.

S.I.D. #2 is usually used to code a card image's continuation order. That is S.I.D. #2 is coded as 01 if it is the first in a series of card images which refer to a unique combination of OBSID (page number) and SID #1 (whole page, 00, or line number). SID #2 need not be coded if only one card image is needed to code for a particular type of information.

S.I.D. #3 and #4 are generally not used and are accordingly available for exceptional cases. One case in which S.I.D. #3 and #4 was used during FY 1982 is in the case of correlating data coded on different types of forms (e.g. point specific data with catch data). In this instance S.I.D. #3 and #4 are combined into one variable called catalog number. Catalog numbers are then used to relate the fish catch of a particular piece of

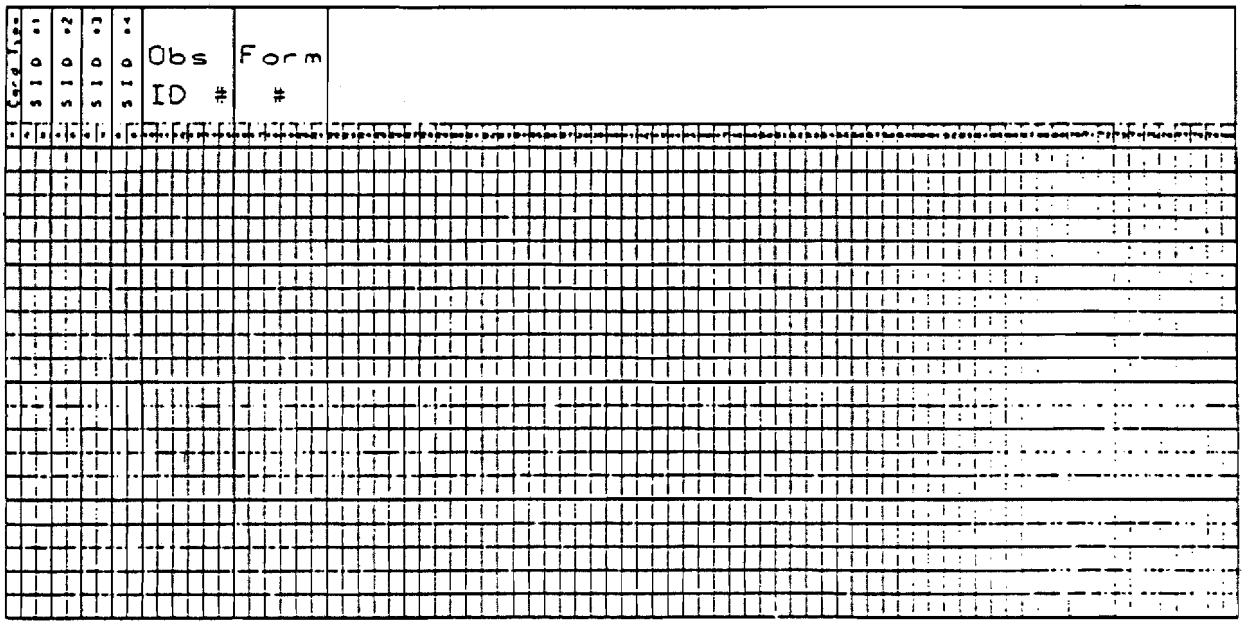


Figure 12. Facsimile reduced reproduction of keypunch coding form template.

gear with the water depth and velocity (and other pertinent data) associated with the habitat in which the gear was set. Catalog numbers are also used to relate biological data (e.g. length, age, and sex) of fish collected with point specific habitat data. Note that catalog numbers will be coded during FY 1983 via DATASTAR and not directly onto coding forms.

The next six columns (10-15) of the coding form is used to code OBSID, which as previously explained uniquely identifies a particular page of a particular field data form. This number is consecutively assigned by Data Processing and can take a value of 000001-999999. The next six columns (and optionally a 7th column) (columns 16-21 (22)) is used to code the form number which corresponds to the form number of the field data form (e.g. AH8206).

The final 59 columns (22-80) of each card image is used to code data, that is notes and comments. If a note or comment associated with a whole page or a particular line of the field data form can not be coded in 59 columns, then the data is continued in the next card image and SID #2 is used to order which card image is first, second, etc.

Data Entry via DATASTAR:

Procedures for data entry into the microcomputer via the software package DATASTAR onto computer-based forms generated via FORMGEN is detailed in the DATASTAR User's Guide (MicroPro 1980a). In addition to the procedures outlined in the user's guide, the software of DATASTAR provides "Help Screens" which allow for immediate access while on the microcomputer to instructions and explanations to the data entry (and modification) procedures of DATASTAR.

Coding of Notes and Comments:

Notes and comments recorded on field data forms need to be coded onto keypunch coding forms prior to data entry into the microcomputer. There are two basic types of notes or comments:

1. Whole page that is information recorded relates to the entire page of data

2. Individual line, that is information relates to an individual line of data on the page.

The coding procedure for both types of data is identical except for the coding of S.I.D. #1. The procedure to be followed for coding S.I.D. #1 is detailed in the Coding Form Design section. Coding of additional S.I.D. variables along with OBSID and other identifying information is also detailed in the Coding Form Design section. Coding of the note or comment information is generally exactly as it appears on the field data form onto columns 22-80 of the coding form for as many continuation cards as are needed (if continuation cards are used S.I.D. #2 needs to be coded to indicate order of the card images). Standard and well-recognized abbreviations can be used but should be avoided if at all possible. When continuing information from one card to the next care must be taken to allow for the proper separation of words. If the last character in a word is coded in column 80 of one card image then column 22 of the continuing card image should be left blank in order to separate the last word from the next. Conversely, if a word needs to be separately coded onto two card images columns 80 of the first and column 22 of the next card image should not be blank. Note dash (-) characters should not be used to indicate splitting of a word.

Data Entry of Coded Forms VIA SCOPE:

The microcomputers which Data Processing uses come installed with Vector Graphic's full screen editing software package called SCOPE. Specific details of the operation of SCOPE is included in the SCOPE Reference Manual (Vector Graphic 1981). SCOPE also provides on-line help screens which can be used when simple problems arise during data entry.

Data Verification:

Verification of data entered into the microcomputer entails checking for accuracy of data entered into the computer in comparison to data recorded on original field data forms. The verification process occurs in three distinct steps.

1. Initial or automatic verification, this is verification which occurs during the data entry phase; and entails checking data fields which uniquely identify a page (DATASTAR) or a card image (SCOPE) (e.g. OBSID, data S.I.D. #1 and #2, etc.).

2. Secondary verification, which entails checking of all keyed data fields from standardized computer printouts against field data forms.

3. Computerized data checking via customized computer programs, these programs are written to check for.

    a. Valid values using reference computer files (e.g. species codes).

    b. Valid ranges (minimum and maximum values).

4. "Final" check, which entails production of summary computer printouts with minimum and maximum values of keyed-in variables, which are then checked against field data forms and checked for "biological" validity.

The last three verification steps are implemented iteratively after the error correction procedure. Steps 2 and 3 above are sometimes followed in the reverse order. Step 4 above may require input from field biologists to complete.

Error Correction:

Correction of keying errors discovered during the verification process outlined above is accomplished in a similar manner as data entry. However,

only those data fields requiring correction need to be reentered. When using DATASTAR the particular page (as indentified by OBSID) is brought to the screen by scanning the data file by "key mode", making the appropriate correction and then filing that particular page (Note specific details of this procedure are included in the DATASTAR User's Guide (MicroPro 1980a). After all corrections are made in a DATASTAR file the "File Maintenance" procedure of DATASTAR should be followed.

When using SCOPE the particular card image line in the data file in which an error occurs, must be brought up to the screen (by scrolling or jumping) (note the line number is ascertained from the printout). The OBSID, and S.I.D #'s should be compared to ensure that the correct line has been found. The error should then be corrected in the same manner as during data entry. Finally when all corrections are made to the file needed, the editor should be commanded to exit and file the corrected data file (see the SCOPE Reference Manual (Vector Graphic 1981) for more details).

DATASTAR to SIR Data File Format:

The microcomputer data files produced by DATASTAR are not in a format which can be used in the hierarchical data base system of SIR, which is used on the mainframe computer system (see Data Base Management section). The files produced by DATASTAR are fixed length records with carriage return-line feeds ending each "record". The record length is determined by the number of positions in all the data fields of one page of data plus one comma to separate each data field. Each DATASTAR record contains information which is usually represented in multiple card image types for input to the SIR data base system. Accordingly, the data in one DATASTAR record needs to be reformatted into the appropriate SIR data card image types. The number and format of the new card images to be produced from each DATASTAR record is determined by referral to the appropriate SIR data base Schema defination (see Data Base Management Section). Data in each DATASTAR record is reformatted into card images which have a set format for the first 21 (22) columns. These first 21 columns are formatted exactly the same as was described in the Coding Form Design Section (i.e. card type in column 1, S.I.D. #'s 1-4 in coulmns 2-9, OBSID is columns 10-15, and

Form number in columns 16-21). Each DATASTAR record contains data which describes information, which pertains to the whole page and data which pertains only to an individual line of data.

Whole page information is reformatted into card image files which have S.I.D. #1 (columns 2-3) coded as 00. For one particular card type of whole page information (e.g. geographic location, i.e. geographic code, Susitna River mile, tributary river mile, and sampling location) one card image is produced from each individual DATASTAR record. However, more than one card image type may be needed to code all the whole page information due to there only being 59 columns on each card for data coding.

Information contained on an individual line of the original field form and in the DATASTAR record is reformatted into as many card image types as necessary (note only 59 columns available for data in each card image). In all cases S.I.D. #1 is coded as the particular line number corresponding to the original field data form.

When more than one DATASTAR form is required to code one field data form (see DATASTAR Form Design Section) information from all the types of DATASTAR forms needs to be combined. Whole page information only needs to be reformatted from one of the DATASTAR forms. However, whole page information from the other forms should be compared to the reformatted version to ensure accuracy. Individual line information is reformatted from all DATASTAR files and then combined according to card type. Note, that in these cases care must be taken that S.I.D. #1 is coded according to the line number of the original field data form <u>not</u> the line number of each individual DATASTAR form.

Reformatting of DATASTAR files to card image files is accomplished by execution of customized microcomputer programs written in one of the high-level programming languages generally PL/I-80 (Digital Research 1980) is used as it is a language ideally suited for reformatting and operates quickly and efficiently on the microcomputer. Reformatting programs need to be individually written for each DATASTAR form type. Accordingly, specific procedures to follow in creating the appropriate programs is

determined by the particular DATASTAR form type and the appropriate SIR data file format. When executing these reformatting programs the operator should confirm that DATASTAR's "File Maintenance" procedure has been followed.

2. Data Base Management

Data base management includes two major tasks:

1. Management of data storage media (e.g. field data forms and magnetic computer disks and tapes).

2. Management of the data itself (e.g. records or observations, variables, etc.).

The above tasks can be subdivided further by the two different computer systems utilized by the data processing support unit:

1. The microcomputer system with its associated computer diskettes.

2. The mainframe Boeing Computer Services EKS1-CDC 6000 computer with its on-line disk storage and off-line tape storage.

Microcomputer Data Storage Management:

Data is stored in four formats associated with the inhouse microcomputer system:

1. Original field data forms.

2. On-line hard magnetic disk files.

3. Off-line floppy magnetic disk files.

4. Paper computer printouts of data.

Management of original field data forms primarily consist of filing forms according to:

1. Project origin (i.e. AA-adult anadromous, AH-aquatic habitat, and RJ-resident and juvenile).

2. Form type (e.g. AH 8206-thermograph data).

3. Observation identification number (OBSID, see sections on DATASTAR and coding form design).

Computer disk files (both on and off line) are "managed" primarily by on-line software provided with the microcomputer or written inhouse. Specific details of operating the software are provided in various operating manuals. General utility programs along with their purpose and associated operating manuals are listed in Table 2.

Table 2. General microcomputer utility programs used for data base management.

Program Name	Purpose	Manual Reference
ERA	erase files	Vector Graphic (1979a)
DIR	list files	Vector Graphic (1979a)
REN	rename files	Vector Graphic (1979a)
TYPE	type files on CRT screen	Vector Graphic (1979a)
STAT	list status of files, disks, system	Vector Graphic (1979a)
PIP	copy files between disk/user area	Vector Graphic (1979a,b)
SC	data entry	Vector Graphic (1981)
SUBMIT/XSUB	operate in "batch" mode	Vector Graphic (1979a,b)
SUPSORT	sort/merge data within and between files	MicroPro (1980b)
CATALOG	catalog disk files	SRX Systems (1981)
DATASTAR/FORMGEN	data entry	MicroPro (1980a)

Data files are entered into the microcomputer via DATASTAR or SCOPE (SC) usually onto on-line hard disk files. During the data entry, verification, and error correction phase, these on-line files should be copied onto back-up off-line floppy disks on a daily basis.

An individual floppy disk is assigned to each data file type (i.e. DATASTAR files and SCOPE files associated with one field data form, e.g. AH8206). Each floppy disk in turn is also duplicated onto a back-up disk (this is due to the fragile nature of floppy disks).

Each data floppy disk is cataloged via the on-line CATALOG command. Specific details of operating CATALOG are listed in the CATALOG operating manual (SRX Systems 1981).

After daily backup to floppy disks, the catalog is updated for each individual cataloged disk with the associated date/time that the backup procedure occured.

After all data entry, verifications, and error correction has occurred the final version of each data file is copied onto the appropriate floppy disks, the catalog is updated to reflect the final nature of the data files, and the on-line hard disk versions are erased (ERA). Erasures of any files (on hard or floppy disks) should be approved by the DP unit's Systems Analyst or Biometrician. Approval to erase is not necessary for certain files which are automatically generated by the system (e.g. *.BAK files).

In addition to copying data files to off-line floppy diskette storage, any customized programs used to verify, list, correct, or produce reports for each type of data form should also be filed on the appropriate floppy disk (note that the catalog should reflect the purpose of each program).

Computer printout listings of data and source programs are filed separately according to field data form type (e.g. AA8214) in computer printout binders. Each listing should have the date and time of production listed on the first sheet of the printout.

Microcomputer Data Base Management:

Management of data (i.e. observations and variables) via the microcomputer system is essentially equivalent to data storage management outlined above. Essentially, most "true" data base management occurs on the mainframe computer system, as outlined in a later section. However, various procedures are carried out on the microcomputer system which is in support of the mainframe data base management system.

These procedures include:

1. Reformatting data files from DATASTAR format to SIR card-type files.

2. Creation and editing of "program" files to be used on the Boeing Computer system.

3. Transmitting and receiving files to and from the mainframe computer system.

Reformatting data is accomplished via customized computer programs usually written in PL/I-80 (Digital Research 1980). Program files are created/edited on the microcomputer's fullscreen editing system (SCOPE, Vector Graphic 1981).

Transmitting and receiving data, program, and printer files between the microcomputer system and the Boeing Computer System is via the software packages of BSTMS (Byrom Software 1980) and SEND (written inhouse).

Mainframe Computer Data Storage Management:

Data storage medium associated with the Boeing mainframe computer system is in two different formats:

1. On-line magnetic disk.

2. Off-line magnetic tapes (located in Bellevue, Washington).

Transfer of data to the on-line disk storage is via BSTMS/SEND as outlined in the previous section. Data and program files stored on-line should be backed up to tape on a daily basis, if they are modified in any manner. In addition any file which is not consistently used (or accessed) should be purged from on-line storage in order to reduce computer charges. Purging of files should only occur after the backup procedure to tape has occurred and only with permission of the Systems Analyst or Biometrician.

Transfer files between disk and tape storage formats is via the software packages of UDUMPIT/ULOADIT. Details of operating the Boeing Computer Systems on-line utility procedures are listed in the appropriate manuals. IFG-2 and 4 analyses are performed on the Boeing system following the procedures outlined by Milhous et al. (1981) as adapted by the Aquatic Habitat and Instream Flow Hydraulic Engineer and AH Project Leader.

Mainframe Computer Data Base Management:

Data manipulation, retrieval, listing, and reporting operations, on the mainframe computer will be managed via the software package of SIR(Scientific Information Retrieval, SIR 1979).

SIR is a hierarchical record-oriented data base management system (DBMS). Accordingly, information stored for a particular data base can be "tree-structured". For example, only one record/observation needs to be stored for information describing a whole page of data, while multiple records/observations are stored for information describing the individual lines of data on the original field data form. SIR has keys which allow for easy access to the appropriate whole-page type of data associated with each individual line of data. The majority of data bases created via SIR by the Data Processing Support Unit will be structured according to the format and nature of the field data form on which the data was originally recorded. However, some of the data bases will consist of combinations of separate data bases (e.g. catch of fish and aquatic habitat associated with the catch).

Specific details of data base creation, loading, updating, maintenance, and report production is included in the SIR User's Manual (SIR 1979). Interfacing of SIR to the statistical software of SPSS (SPSS 1970) and BMDP (Dixon and Brown 1979) is also outlined in the SIR User's Manual.

In addition to using SIR's built-in reporting procedures along with the statistical packages of SPSS and BMDP, customized reporting programs can be written in CDC FORTRAN (CDC 1980b) or CDC COBOL (CDC 1980a). Data files to be used in these programs can be original files as received from the microcomputer or files reformatted, combined, or sorted by SIR or CDC Sort/Merge (CDC 1980c).

Data listing and report printer files can be printed on the high-speed line printer located at Boeing's Remote Job Entry (RJE) site in Anchorage, However, letter quality printing can be accomplished by the microcomputer's printer via the following procedures:

1. "Save" printer output from various programs (e.g. SIR) in file format.

2. Wrap the file, i.e. run the FORTRAN program WRAP which formates the printer file for sending to the microcomputer.

3. Send the file to the microcomputer (via BSTMS).

4. Unwrap received file, i.e. run PL/I-80 UNWRAP program on microcomputer.

5. Print file with PL/I-80 PRINTCC command.

III. DATA PROCEDURES

A. ADULT ANADROMOUS FISHERIES STUDIES

1. Side Scan Sonar Operations

1. PRINTER TAPE STAMP: Each day's printer tape will be stamped (Figure 13) 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 to be removed from the counter, stamped on both sides of the tear and filled with the same information on each stamp.

2. DAILY LOG FOR SIDE SCAN SONAR COUNTER FORM: This is a summary of changes in controls which will be updated daily (Table 3). The information is necessary when interpreting sonar counts and calibration factor data.

3. SIDE SCANNER COUNTER LOG FORM: Details the mechanics of operation of the counter, substrate and related equipment (Table 4). 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. DAILY SONAR COUNTS FORM: Sonar counts from printer tapes are entered by hour and sector (Table 5). 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 will be used to interpolate for the debris or skip block. Counts should be totalled 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". After each day's counts are tabulated and reported, printer tapes and SSS count forms are to be placed in notebooks and sent to the main office every two weeks.

5. SIDE SCAN SONAR COUNTER FIELD COUNTER CALIBRATION LOG FORM: Raw counts will be calibrated in season by visual monitoring of the counters with an oscilliscope. Counters will be calibrated a minimum of four times daily. All calibration counts are to be recorded on the Side Scanning Sonar Counter Field Calibration Log form (Table 6).

Location:_____

Date:_____Time:_____

Beam Angle:_____

Velocity:_____

Dead Range:_____

Live Range:_____

Observer:_____

Remarks:_____

_____

Figure 13. Printer tape stamp.

Table 3. Daily log for side scan counter, AA-82-12.

Page ___ of ___

AA-82-12

DAILY LOG FOR SIDE SCAN SONAR COUNTER

_____ Station Rank: _____ S/N: _____

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

Table 4. Side scanner counter log, AA-82-13.

Page ___ of ___

AA-82-13

Side Scanner Counter Log

_____ Station

Bank: _____

Date	Time	Remarks (i.e. Substrate lifted, any controls reset, etc.)

Table 5. Daily sonar counts, AA-82-09.

AA-82-09

Page ___ of ___ Daily Sonar Counts

Bank: _____ Date: _____

Station: _____

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														
1600														
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 1-6) _____

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

COMMENTS ON BACK

Table 6. Side scan sonar counter filed calibration log, AA-82-10.

AA-82-10

SIDE SCAN SONAR COUNTER FIELD CALIBRATION LOG

_____ Station Bank: _____ S/N: _____

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

2. Tag/Recapture Operations

Daily Procedures:

1. Daily fishwheel catches will be reported on the Daily Fishwheel Catch Log form (Table 7 or Table 8). Each time a fishwheel is checked, the catch will be recorded along with the corresponding time in military hours. Following the last daily check, the catches will be summarized and entered in the appropriate space.

2. Fish tagged at each sampling station will be recorded on the Tag Deployment Log form (Table 9). This form may be used between fishwheels. Information recorded on each fish tagged shall include: date, tag number, fishwheel location, species and sex. A summary of the tagging data by species shall be entered in the space provided on the bottom of the form.

3. Tag recaptures from other sampling stations will be logged on the Tag Recapture Record form (Table 10). Recorded information shall include: fishwheel location; tag number, color and type; and species. A summary of recapture data by species shall be entered in the space indicated on the form. Fish recaptured at the sampling station where they were tagged will be released and will not be recorded on the Fishwheel Daily Catch Record form or the Tag Recapture Record form.

Table 7. Daily fishwheel catch log, AA-82-01A.

Page ___ of ___
Date (YY/MM/DD): ___/___/___
_____Station

AA-82-01A
Geographic Codes EBU __/__ __/__ __/__ __/__ __ __/__
EBL __/__ __/__ __/__ __/__ __ __/__
WBU __/__ __/__ __/__ __/__ __ __/__
WBL __/__ __/__ __/__ __/__ __ __/__

Daily Fishwheel Catch Log

Fishwheel		Salmon					Whitefish			Misc.		Total Catch
Location	Hours Operated	chinook	sockeye	pink	chum	coho	Round	Humpback	Bering Cisco	Species	No.	
Eastbank Upper												
Eastbank Lower												
EASTBANK TOTAL												
Westbank Upper												
Westbank Lower												
WESTBANK TOTAL												
DAILY TOTAL EAST AND WEST BANK												

Comments:

Table 8. Daily fishwheel catch log, AA-82-01B.

Page ___ of ___
Date (YY/MM/DD): ___/___/___
_____ Station

AA-82-01B
Geographic Codes NBU _/__ __/__ __/__ __/__ __/__
NBL _/__ __/__ __/__ __/__ __/__
SBU _/__ __/__ __/__ __/__ __/__
SBL _/__ __/__ __/__ __/__ __/__

Daily Fishwheel Catch Log

Fishwheel		Salmon					Whitefish			Misc.		Total Catch
Location	Hours Operated	chinook	sockeye	pink	chum	coho	Round	Humpback	Bering Cisco	Species	No.	
Northbank Upper												
Northbank Lower												
NORTHBANK TOTAL												
Southbank Upper												
Southbank Lower												
SOUTHBANK TOTAL												
DAILY TOTAL NORTH AND SOUTH BANK												

Comments:

Table 9. Tag deployment log, AA-82-14.

AA-82-14

Page ___ of ___ Tag Deployment Log

Project Location (camp): _____. __/__ __ __/__ __ __/__ __/__ __ __/

Date	Tag Number	Species	SEX M	SEX F	Fishwheel Location	Office Use Only

SHEET SUMMARY: No. Fish Tagged.
Chinook _____ ; Sockeye _____ ; Pink ____ ; Chum ____ ; Coho ____

Total

Table 10. Tag recaptured log, AA-82-19.

AA-82-19

Page ___ of ___ TAG RECAPTURED RECORD

Project Location (camp): _____. __/__ __/__ __/__ __/__ __/

Date	Fishwheel Location	Species	Tag			Leave Bank (office use only)
			Number	Color[1/]	Type[3/]	

SHEET SUMMARY/

	No. Recaptures
Chinook	
Sockeye	
Pink	
Chum	
Coho	
TOTAL:	

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

2/ Floy Spaghetti = S
Petersen Disc = P

3. Mainstem Survey Operations

The Electrofishing Catch Log form (Table 11) will be completed after each sampling drift. The Electrofishing Data Record for Spawning Fish form (Table 12) will be used to record mainstem anadromous fish spawning sites and the Adult Anadromous and Resident Spawning Site Map form (Table 13) will be used to map these spawning areas.

The Egg Deposition Log form (Table 14) will be used to record data collected in egg deposition sampling on suspected mainstem spawning areas. Information recorded will include: date, site, location, and number of eggs, live and dead, sampled.

4. Slough and Tributary Surveys

Foot surveys on streams and sloughs will be recorded on the Escapement Survey Log form (Table 15). Data recorded on each survey will include, date, stream or slough name, survey conditions, distance surveyed, live and dead fish counted by species and number of live tagged fish by tag type and color. The "Remarks" column, in particular will include names of survey staff and reference to any tag loss. Tags on carcasses will be removed as schedule permits and the information recorded on the back side of the Escapement Survey Log form.

Aerial escapement survey data on chinook salmon will be recorded on the Chinook Salmon Survey Log form (Table 16). Information recorded will include: survey date, conditions, distance (or reach), and method; number of live and dead chinook salmon counted; and surveyors name.

5. Mainstem Set Netting

Results of set netting by the Gold Creek survey crew will be recorded on the RM 150 Set Net Log form (Table 17). Information recorded will include: date, fishing time, location and catch.

6. Bering Cisco Monitoring

The Daily Fishwheel Catch Log form (Table 7) will be used to record fishwheel interceptions of Bering Cisco. Age and length samples will be collected as defined in Appendix XI, Age and Length Sampling Operations - Instructions and Coding except that lengths will be recorded to the nearest millimeter and will be taken from the tip-of-snout to fork-of-tail.

7. Eulachon Survey Operations

Set netting result will be recorded on the Eulachon -- Estuarine Set Netting Log form (Table 18). Recorded data will include site location, date, fishing time and catch by species.

The Eulachon Spawning Location Log form (Table 19). will be used to record where spawning is found in the mainstem. Information recorded will include a legal description of the location, estimate of abundance and dates.

Sex composition samples will be recorded on the Eulachon Sex Composition Log form (Table 20). Individual age (otoliths) samples will be stored in pre-labeled vials containing a 50 percent ethanol solution. Corresponding weight and length measurements, collectors name, date, and sampling location will be entered in the space provided on each vial label.

Table 11. Electrofishing catch log, AA-82-03.

AA-82-03

Electroshocking Catch Log

Crew: _____ Location: _____

Sample: _____ Upper River Mile: _____

Date (YY/MM/DD): ___/___/___ Trib. River Mile: _____

Time (military): _____ Geographic Code[1/]: _/_ _/_ _/_ _/_ _/_

Distance Shocked (yards): _____ Time Shocked (seconds): _____

Conductivity: _____ Surface Water Temperature: _____

Species	Catch	Remarks
Adult Anadromous		
Chinook (041)		
Sockeye (042)		
Coho (043)		
Pink (044)		
Chum (045)		
Resident		
Dolly Varden (530)		
Rainbow (541)		
Humpback Whitefish (582)		
Round Whitefish (586)		
Arctic Grayling (610)		
Longnose sucker (640)		
Burbot (590)		
Juvenile Anadromous		
Chinook		
Sockeye		
Coho		

1/ Geographic code for upper river mile

Table 12. Electrofishing data record for spawning fish, AA-82-02.

AA-82-02

Electroshocking Data Record for Spawning Fish

Crew: _____

Sample: _____

Date (YY/MM/DD): ___/___/___

Time (military): _____

Location

Geographic Code[1/]: __ /__ __ __ /__ __ __ /__ __ /__ __ __ /

Upper River Mile: _____

Trib. River Mile: _____

Local Description: _____

Distance Shocked (yards): _____

Time Shocked (seconds):_____

Electrode System: _____

Current Type: _____

Volts: _____

Amperage: _____

Frequency: _____

Pulse Width[2/]: _____

Conductivity: _____

Remarks:

1/ Geographic code for upper river mile

2/ Model VVFR-1S only

Table 13. Adult Anadrmous & Resident spawning site map, AA-82-05.

AA-82-05

Adult Anadromous & Resident Spawning Site Map

Sample: _____

Date (YY/MM/DD): _____

Crew: _____ Trib. River Mile: _____

Location: _____ River Mile[1/]: _____ GC[2/]: _/_ _ _ / _ _ _ _ / _ _ / _ _ _ _ / _

Description: _____

1/ Upper river mile

2/ Geographic code for upper river mile

Table 14. Egg deposition log, AA-82-17.

Page ___ of ___. AA-82-17

EGG DEPOSITION LOG

DATE[1/]: _____

LOCATION: RIVER MILE _____ GEOGRAPHIC CODE: __/__ __ __/__ __ __/__ __/__ __ __/

Plot Number (Sequential)	NUMBER EGGS			REMARKS[2/]
	LIVE	DEAD	TOTAL	
				TOTALS

1/ (YY/MM/DD)

2/ Include names of survey staff and substrate description

8/31/83 (Corrected)

Table 15. Escapement survey log, AA-82-18.

Page ___ of ___

AA-82-18

ESCAPEMENT SURVEY LOG

Slough No./Stream	Date[2]	Survey[3]		Species Surveyed	No. Observed			No. Live Tagged					Comments[5]
								Peterson Disc			Spaghetti		
		Cond.	Distance		Live[4]	Dead	Total	White	Yellow	Orange	Orange	Yellow	
				Chinook									
				Sockeye									
				Pink									
				Chum									
				Coho									
				Chinook									
				Sockeye									
				Pink									
				Chum									
				Coho									
				Chinook									
				Sockeye									
				Pink									
				Chum									
				Coho									
				Chinook									
				Sockeye									
				Pink									
				Chum									
				Coho									

[1] Stream/Slough confluence with mainstem Susitna River

[2] (YY/MM/DD)

[3] Survey conditions: poor, fair, good or excellent
Surveyed Distance: Note to nearest 0.1 mile

[4] Include all live tagged and untagged fish.

[5] NOTE: Survey Personnel, Predator Activity, and tag loss, etc.

Table 16. Chinook salmon survey log, AA-82-16.

Page ___ of ___.

AA-82-16

Chinook Salmon Survey Log

Stream Surveyed	Survey			Chinook Salmon Counted			Remarks[2/]
	Date 1/	Method	Conditions	Live	Dead	Total	

1/ (YY/MM/DD)

2/ Note: Surveyers Name, Survey reach or sub. reach if entire stream not surveyed.

Table 17. RM 150 set net log, AA-82-15.

AA-82-15

RM 150 Set Net Log

Page ___ of ___.

Site: No. 1, RM 150.4
No. 2, RM 150.2
No. 3, RM 150.1
No. _, RM _____

Date	Location		Netting Time2/			Catch					Remarks4/
	Site No.	River Mile	Begin	End	Total Hours	Sockeye	Pink	Chum	Coho	Other	

1/ Refer to 1981 map defining set net locations.
2/ Military hours.
3/ Note species composition in "Remarks" column.
4/ Include names of set net staff, river flow conditions, fishing conditions, and development stage of fish (i.e. pre-spawning, spawning or post spawning).

Table 18. Eulachon -- Estuarine set netting log, AA-82-07.

AA-82-07

Page __ of __

Site 1 __/__/__
Site 2 __/__/__
Site __/__/__

Eulachon -- Estuarine Set Netting Log

Date1/ Site No.	Tide		Fishing Time 2/		Catch			Comments
	Ht.	Time	Net IN OUT	Total (min.)	Eulachon Pre-spawners	Eulachon Post spawners	Other3/	

1/ YY/MM/DD
2/ Military Time
3/ Identify species in comment section

Table 19. Eulachon spawning location log, AA-82-06.

AA-82-06

Page ___ of ___

Eulachon Spawning Location Log[1/]

Date[2/]	Spawning Location: River Mile Limits (1/10) Lower	Spawning Location: River Mile Limits (1/10) Upper	Spawning Location: Midpoint (Geographic Code)	Habitat: Evaluated[3/] Yes (1) No (2)	Habitat: Site[4/] No.	Comments[5/]
			_/____/____/___/____/			
			_/____/____/___/____/			
			_/____/____/___/____/			
			_/____/____/___/____/			
			_/____/____/___/____/			
			_/____/____/___/____/			

1/ Complete form on those sites where all of the following criteria are met: A) Fish are freely expelling eggs or milt. B) Fish are in vigorous free-swimming condition. C) Twenty or more fish are caught in the initial or subsequent site sampling effort which meet criteria A through B.

2/ (YY/MM/DD)

3/ Indicate by numerical code for yes or no.

4/ If habitat evaluated, assign a site identification number (e.g., AH-1, AH-2)

5/ Include subjective estimate of spawner abundance (i.e., low, moderate, high) and where possible an objective estimate.

Table 20. Eulachon sex composition log, AA-82-08.

AA-82-08

Eulachon Sex Composition Log

Date [1/]	Location[2/] (River Mile)	No. Sampled			Remarks[3/]
		Male	Female	Total	

1/ (YY/MM/DD)
2/ Define to nearest 0.1 River Mile
3/ Note: collectors name, spawning condition, etc.

B. RESIDENT AND JUVENILE ANADROMOUS FISHERIES STUDIES

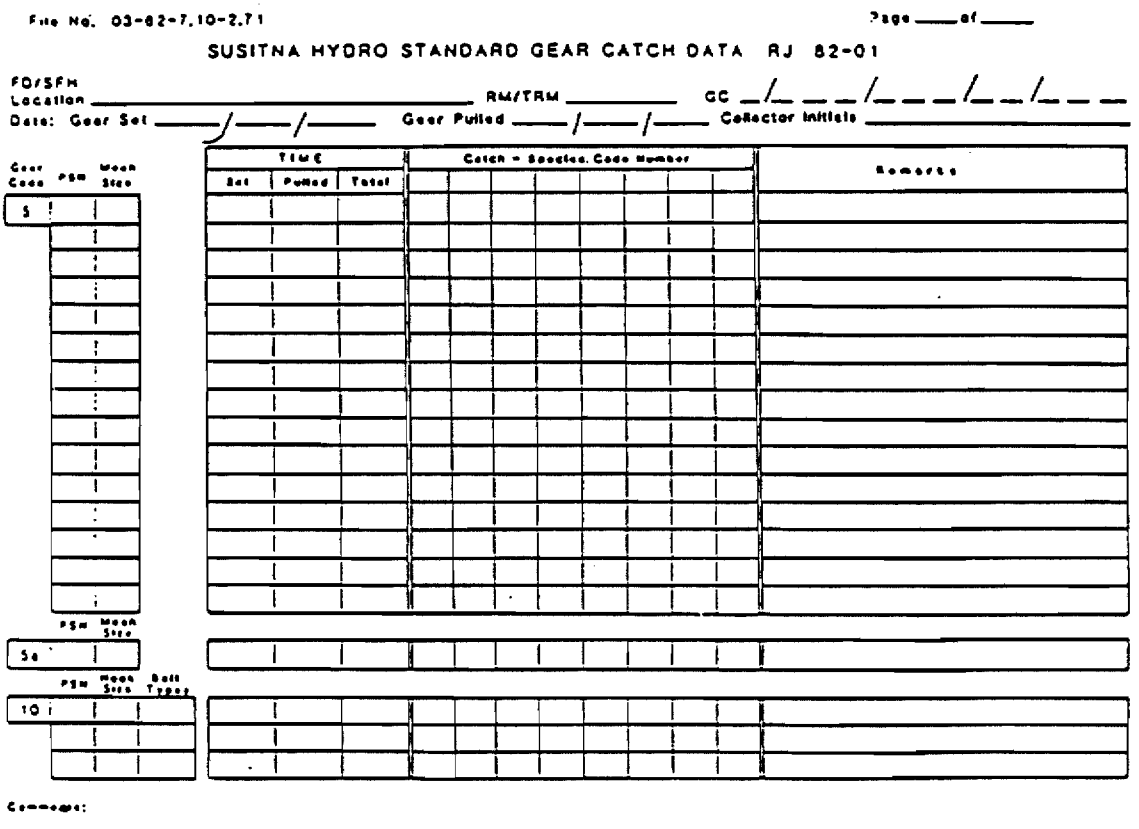
1. Data forms

Resident and Juvenile Anadromous Fisheries (RJ) study field data forms are presented in Figures 14 through 25.

Table 21 presents a summary of the data forms that will be used by each of the Resident Juvenile sub-projects.

The Phase I data forms have been modified and revised based on input from the project biometrician and several new forms have also been developed.

The new biological data form (RJ 82-02) will be used whenever fish are captured. The Phase I catch form was divided into two seperate forms (RJ 82-01) and (RJ 82-05). (RJ 82-01) will be used to record catches from standard gear (i.e. minnow traps, fish traps, and trotlines) which are fished at sampling sites on a regular basis. Catches from opportunistic gear (i.e. gill nets, hook and line, electroshockers, and beach seines) which are utilized less frequently or as time allows are recorded on (RJ 82-05). These forms will be used primarily by the fish distribution study crews on the lower river. In the impoundment, where hook and line sampling is the most used sampling technique, two different sampling forms (RJ 82-06) and (RJ 82-07) will be used to record catch by gear type. The electrofishing crew will log their catch data on (AA 82-03). All crews tagging fish will use the new tag deployment (RJ 82-03) and tag recapture (RJ 82-04) forms which replace the single tagging form used last year. Two new forms have been developed to record smolt trap catch data (RJ 82-08) and biological data (RJ 82-09) and form (RJ 82-10) was developed to record food habits study catch data. In addition a new form has been designed to record aquatic habitat data (AH 82-01) which will be collected by RJ fish distribution crews. This form contains information on water quality, staff gage measurements, and substrate data. Electroshocking crews will record data on (AA 82-02), (AA 82-05), (AH 82-ES-01) whenever they discover concentrations of spawning fish or identifiable spawning sites. (AA 82-02) will be used to record electroshocking data for spawning fish. Spawning


File No. 03-82-7.10-2.71 Page ____ of ____

SUSITNA HYDRO STANDARD GEAR CATCH DATA RJ 82-01

FD/SFH
Location _____ RM/TRM _____ GC __/__ __ __/__ __ __/__ __/__ __ __
Date: Gear Set ____/____/____ Gear Pulled ____/____/____ Collector Initials _____

Gear Code	PSM	Mesh Size	Time Set	Time Pulled	Time Total	Catch - Species Code Number	Remarks
5							
5a							
10							

Comments:

Figure 14. Susitna Hydro standard gear catch data form, RJ 82-01.

File No. 03-82-7.10-2.72 Page ___ of ___

SUSITNA HYDRO BIOLOGICAL DATA RJ 82-02

FD/SFH
Location _____ RM/TRM _____ QC __/__/__/__/__/__

Date collected ____/____/____ Collector initials _____
yr. mo. day

	Species Code	Length (mm)	Sex M	Sex F	Age	Scale Card No.	Gear Code	PSM	Mesh Size (in.)	Tag Number		Remarks
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												

Comments:

Figure 15. Susitna Hydro biological data form, RJ 82.02.

File No. 03-82-7.10-2.73

SUSITNA HYDRO TAG DEPLOYMENT DATA RJ 82-03

Tag Number	Gear Code	Date			Species Code	Length (mm)	Remaining Location	Habitat	Stock	River Mile
		yr.	mo.	day						
0										
0										
0										
0										
0										
0										
0										
0										
0										
0										
0										
0										
0										
0										
0										
0										
0										
0										
0										

Comments:

Figure 16. Susitna Hydro tag deployment data form, RJ 82-03.

File No. 03-82-7.10-2.74

SUSITNA HYDRO TAG RECAPTURE DATA RJ 82-04

Tag Number	Recapture Code	Gear Code	Date			Length (mm)	Sampling Location	Sex	Maturity	Other Info	Tag Code
			yr.	mo.	day						
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											
0											

Comments:

Figure 17. Susitna Hydro tag recapture data form, RJ 82-04.

File No. 03-82-7.10-2.75 Page ____ of ____

SUSITNA HYDRO OPPORTUNISTIC GEAR CATCH DATA RJ 82-05

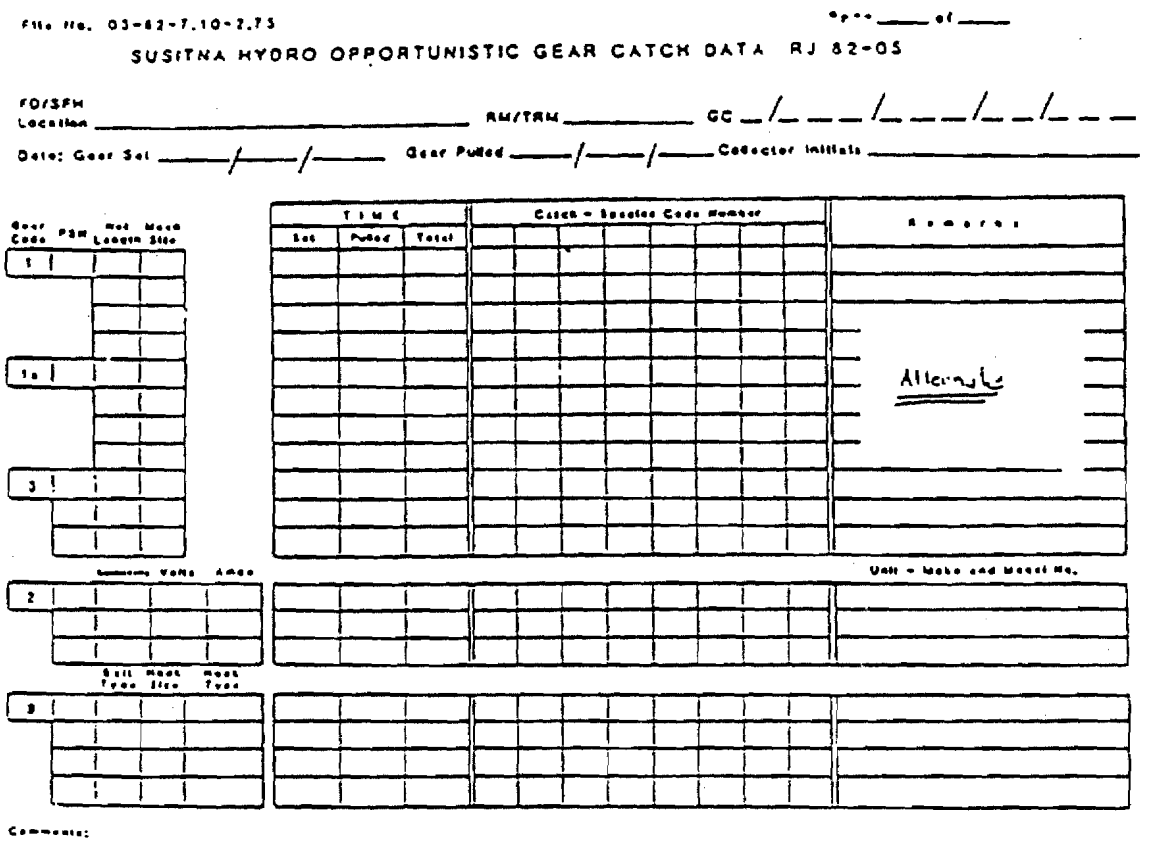
FD/SFH Location ________________ RM/TRM ________ GC _/_ _ _/_ _ _/_ _/_ _ _

Date: Gear Set ___/___/___ Gear Pulled ___/___/___ Collector Initials ________

Gear Code	FSM	Net Length	Mesh Size	TIME Set	TIME Pulled	TIME Total	Catch - Species Code Number								Remarks
1		7.5'	1.0"												
		7.5'	1.5"												
		7.5'	2.0"												
		7.5'	2.5"												
14		7.5'	1.0"												
		7.5'	1.5"												
		7.5'	2.0"												
		7.5'	2.5"												
3															
		[illegible]	Volts	Amps											Unit - Make and Model No.
2															
		Bait Type	Hook Size	Hook Type											
9															

Comments:

Figure 18. Susitna Hydro opportunistic gear catch data form, RJ 82.05.



File No. 03-82-7.10-2.75 Page ___ of ___

SUSITNA HYDRO OPPORTUNISTIC GEAR CATCH DATA RJ 82-05

FO/SFH Location _____ RM/TRM _____ GC __/___/___/___/__/___

Date: Gear Set ___/___/___ Gear Pulled ___/___/___ Collector Initials _____

Gear Code	PSM	Net Length	Mesh Size
1			
1a			
3			

TIME			Catch - Species Code Number								Remarks
Set	Pulled	Total									
											Alternate

Unit - Make and Model No.

	Boat Name	Make	Area
2			

	Skill Type	Mask Size	Mask Type
3			

Comments:

Figure 19. Susitna Hydro alternate opportunistic gear catch data form, RJ 82-05.

File No. 03-02-7,10-2,78 Page ___ of ____

SUSITNA HYDRO PROPOSED IMPOUNDMENT HOOK & LINE CATCH DATA
RJ 82-06

Location _____ RM _____ GC _/___/___/___/___

Date __/__/__ Collector's Initials _____

Reach	TRM	Total Time	Catch - Species					Remarks
			ste					
	0.0							
	0.1							
	0.2							
	0.3							
	0.4							
	0.5							
	0.6							
	0.7							
	0.8							

Comments

Figure 20. Susitna Hydro proposed impoundment hook and line catch data form, RJ 82-06.

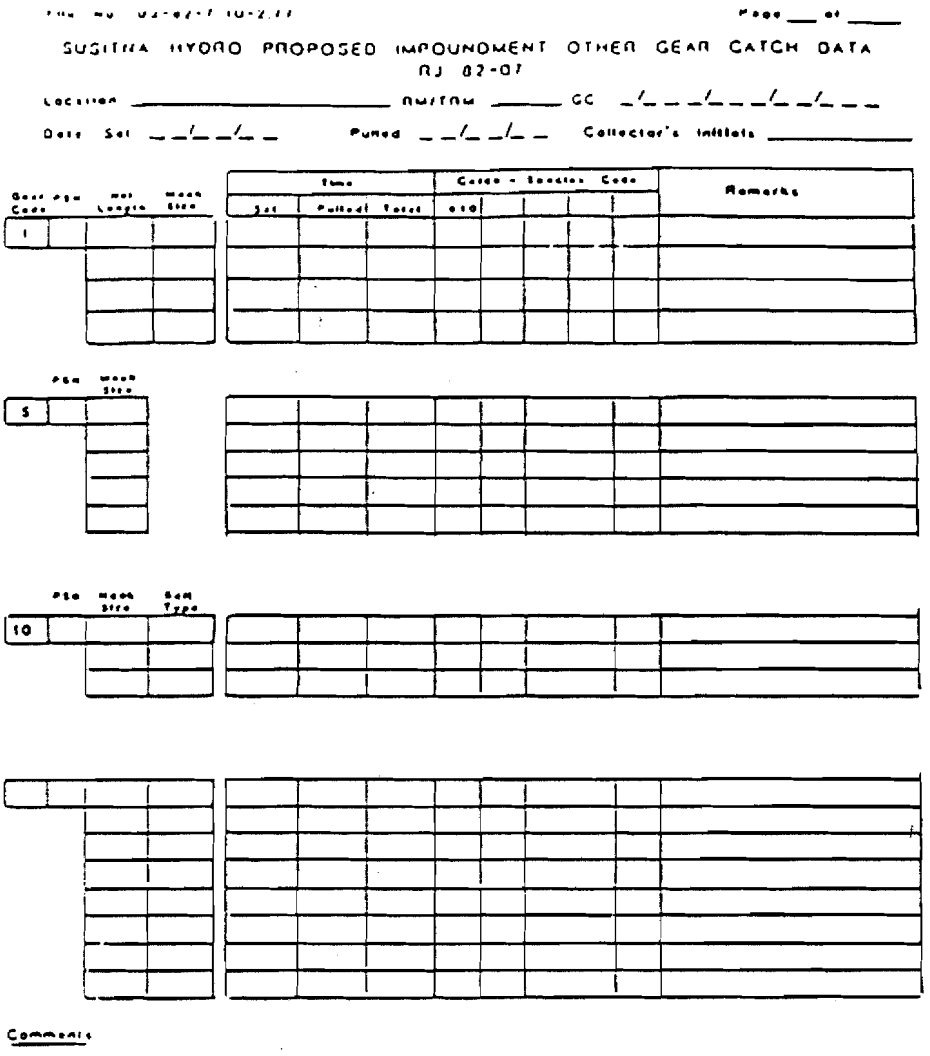


Figure 21. Susitna Hydro proposed impoundment other gear catch data form, RJ 82-07.

File No. 03-82-7.10-2.76 Page ___ of ___

SUSITNA HYDRO DOWNSTREAM MIGRANT TRAP CATCH DATA RJ 82-08

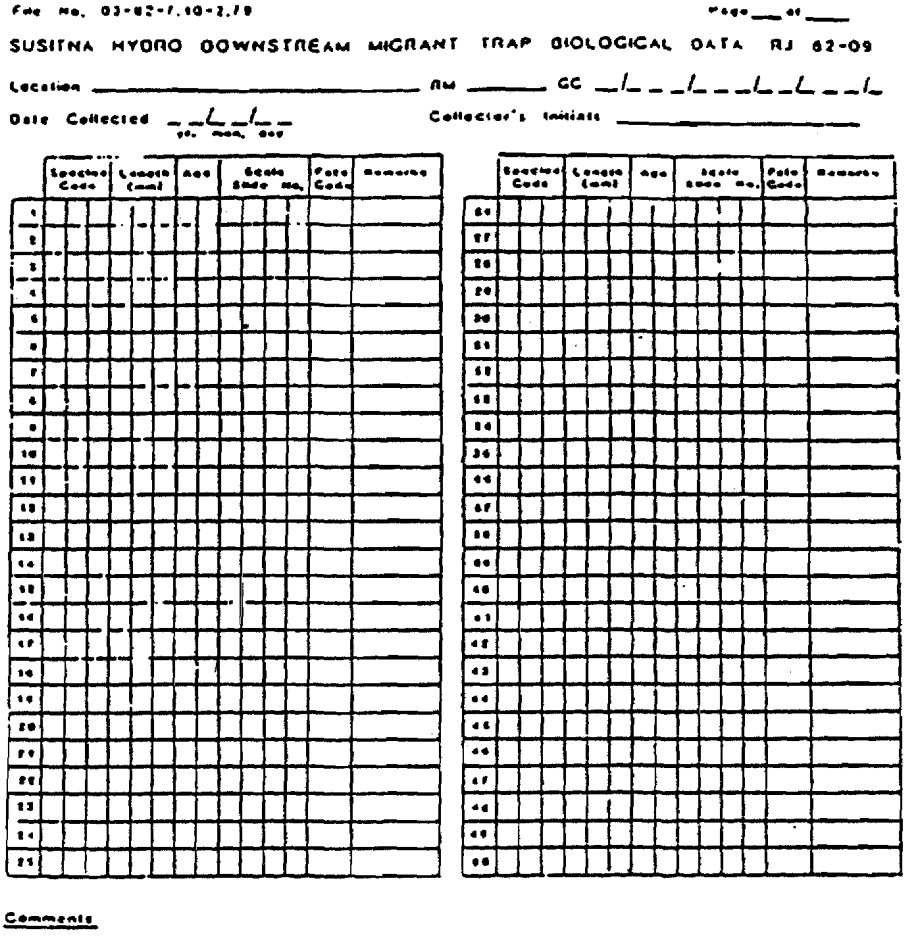
Location _____ RM _____ GC _/_ _/_ _/_ _/_ _/_ _/_

Date Collected _ _/_ _/_ _ (yr. mon. day) Collector's Initials _____

Time			Trap Depth	Velocity	Catch - Species Code												Remarks
Set	Check	Total			412	417	422	427	433	436	440	450					
Daily Total																	

Comments

Figure 22. Susitna Hydro downstream migrant trap catch data form, RJ 82-08.



File No. 03-82-1.10-2.19 Page ___ of ___

SUSITNA HYDRO DOWNSTREAM MIGRANT TRAP BIOLOGICAL DATA RJ 82-09

Location _____ RM _____ GC _/_ _/_ _/_ _/_ _/_

Date Collected _ _/_ _/_ _ (yr. mon. day) Collector's Initials _____

	Species Code	Length (mm)	Age	Scale Book No.	Page	Card Code	Remarks
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							

	Species Code	Length (mm)	Age	Scale Book No.	Page	Card Code	Remarks
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							

Comments

Figure 23. Susitna Hydro downstream migrant trap biological data form, RJ 82-09.

File N 03-82-7.10- Page ___ of ___

SUSITNA HYDRO FOOD HABITS STUDY CATCH DATA RJ 82-10

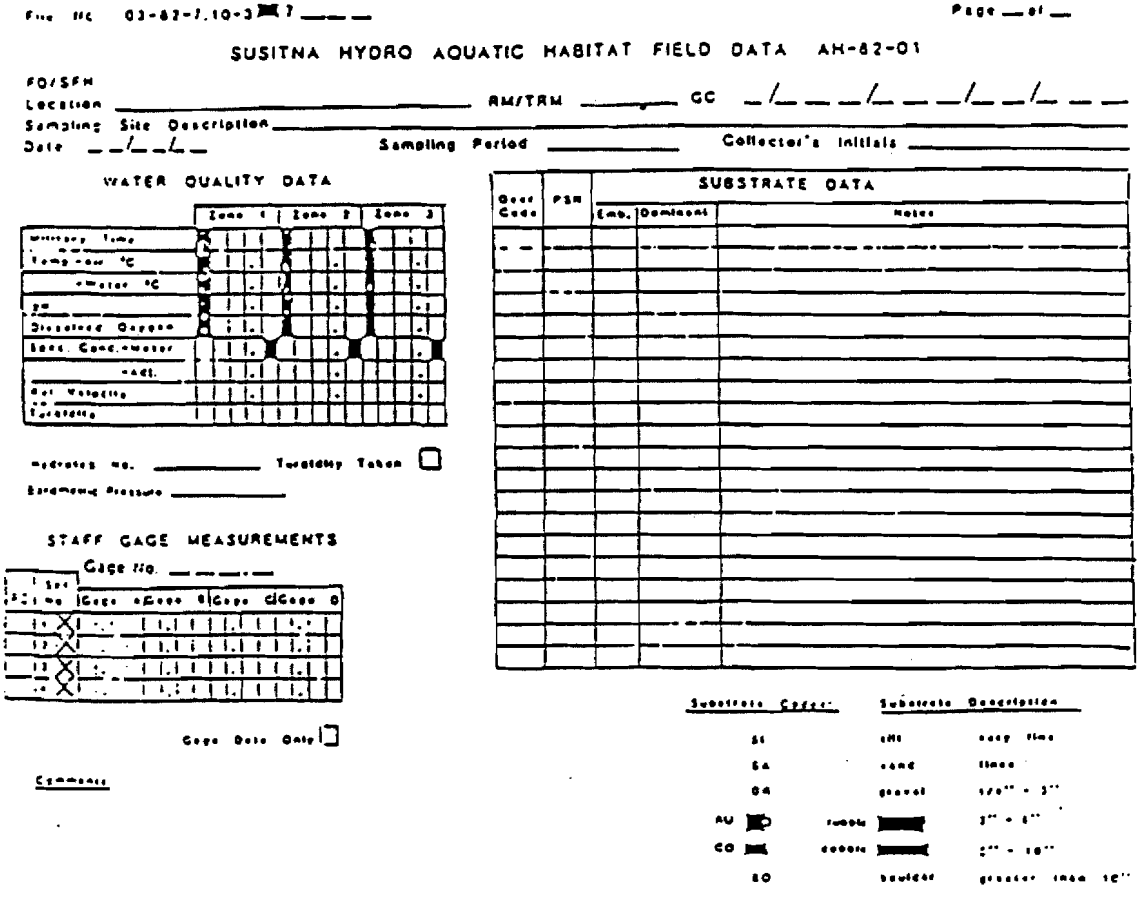
FD/SFH Location _____ RM/TRM _____ GC __/__ __/__ __/__ __/__ __/__

Date: __ __/__ __/__ __ yr. mon. day Collectors Initials _____

Gear Code	Military Time			Zone Code	Replicate	Remarks
	Set	Pulled	Total			

Comments:

Figure 24. Susitna Hydro food habits study catch data form, RJ 82-10.



SUSITNA HYDRO AQUATIC HABITAT FIELD DATA AH-82-01

WATER QUALITY DATA

STAFF GAGE MEASUREMENTS

SUBSTRATE DATA

Figure 25. Susitna Hydro aquatic habitat field data form, AH-82-01.

Table 21. List of 1982 Su Hydro field data forms utilized by RJ sub-projects.

Sub-project	Resident & Juvenile Anadromous Forms[1/]												Adult Anadromous[2/] Forms			Aquatic Habitat Forms		
	RJ 82-01	RJ 82-02	RJ 82-03	RJ 82-04	RJ 82-05	RJ 82-05 (alternate)	RJ 82-06	RJ 82-07	RJ 82-08	RJ 82-09	RJ 82-10		AA 82-02	AA 82-03	AA 82-05	AH 82-01[1/]	AH 82-05[3/]	AH 82-ES-01[3/]
Electroshocking and Radio Telemetry Study		X	X	X		X							X	X	X			X
Incubation, Emeregent, and Outmigrant Study									X	X								
Impoundment Study		X	X	X			X	X										
Fish Distribution Study	X	X	X	X	X											X	X	
Food Habits Study											X							

1/ Sample forms and discussion of specific data collection presented in RJ Appendix.
2/ Sample forms and discussion of specific data collection presented in AA
3/ Sample forms and discussion of specific data collection presented in AH

sites of adult anadromous and resident fish will be mapped on (AA 82-05). (AH 82-ES-01) is designed for recording aquatic habitat data at spawning sites discovered by electroshocking crews.

Detailed instructions for coding the forms dicussed in the preceding paragraph are explained in Appendix IX to this manual.

2. Specific data to be collected

Biological Data:

Biological data collected from each species will be the same as in the Phase I studies with the following exceptions:

1. Otoliths will be collected from Dolly Varden mortalities for age analysis instead of scales. Scales collected last year were too small to be readable.

2. Heads of all "humpback" whitefish mortalities will be collected in order to identify to species by gill raker counts.

3. Cottids will also be identified to species by collecting any cottid not readily identified as a slimy sculpin.

4. The electrofishing crew will take scale samples from the first 20 fish of each species captured and then 10 percent thereafter on a daily basis.

Catch and Effort Data:

Catch and effort data will be recorded for each species as it was in Phase I studies to help determine relative abundance.

Tag and Recapture Data:

Tag and recapture efforts have been increased during the 1982 ice-free field season with the aid of an expanded electroshocking program. Increased numbers of tagged and recaptured fish will generate a greater understanding of fish distributions and movements in the Susitna River drainage.

Aquatic Habitat Data:

Aquatic habitat parameters will be collected at all fish distribution sampling locations and suspected spawning sites. Water quality data such as temperature, pH, dissolved oxygen, conductivity, and turbidity will be recorded. In addition stage changes of the river will be monitored via staff gage measurements and general substrate and cover characteristics will also be recorded.

3. Report Format

The reports on the studies previously identified will be prepared upon completion of the 1982 field season, although various levels of data processing and reporting will occur during the field season. The field data will be transferred to the Anchorage office and filed under appropriate categories. In addition, a field trip prospectus and a field trip report will be submitted by each crew upon returning from the field. Detailed field notes will be also recorded by the field crew members and sub-project leaders.

The reporting format for the draft and final 1982 field season resident and juvenile reports will be altered somewhat from the previous years investigations. The reports will address each of the following sub-objectives:

A. The distribution and abundance of the resident and juvenile anadromous fish of the Susitna River below Devil Canyon.

   1. Factors influencing the distribution and abundance of each species.

2. Basic biological data on the distribution and abundance of Susitna River species.

B. The emergence and outmigration timing of salmon species occupying the river above the Chulitna confluence.

This report will encompass the outmigration work established by the smolt trap, incorporate applicable results of the juvenile distribution studies, and provide a report of the winter emergence data collected in the spring of 1982.

C. The development of eggs and juvenile salmon in the river reach above the Chulitna River confluence.

This report is separated from the previous report because this study will proceed throught the winter of 1982-83. The final report will not be submitted until the early summer of 1983 because of the study continuing through the entire 1982-83 winter. The 1982 and 1983 spring emergence data will be included in this report.

D. The distribution and abundance of fish within the boundaries of the proposed impoundment.

E. Food preference for selected species and invertebrate distribution in habitats associated with the mainstem Susitna above the Chulitna confluence.

In all of these reports, data collected from the different crews outlined in the field program will be integrated as necessary. This information will be used as appropriate to address the objectives outlined for each report.

C. AQUATIC HABITAT AND INSTREAM FLOW STUDIES

1. Data Forms

Processing of data will be an ongoing activity during the sampling period with data analysis, summarization, and report preparation commencing immediately after freeze-up. Field trip reports will be completed immediately after each sampling trip and will be limited to highlighting the findings of each sampling trip. Data forms to be completed in the field and reviewed in the office will be submitted to the data processing unit immediately upon completion of each sampling trip, for entry into the project computer data base. The draft report will be completed by the 30th of January 1983.

Thirteen data forms will be used during FY 83 field studies (Table 22 and Figures 25-37). Several of these forms were used during FY 82 field studies, several were adapted from FY 82 data forms and others are newly developed. These forms include:

1. AH-82-03 Planimetric Map Form (Figure 25). A map delineating the study site and important habitat characteristics is drawn on this form.

2. AH-82-04 Discharge Form (Figure 26). This form is used to record discharge measurements and respective calculations.

3. AH-82-05 Stage Data Field Form (Figure 27). This form is used to keep a complete record of all readings made on a specific staff gage.

4. AH-82-07 General Habitat Data Form (Figure 28). This form is used to record general habitat characteristics measured in the field at general study sites.

5. AH-82-ES-01 Aquatic Habitat Data Electroshocking Form (Figure 29). This form is used to record general habitat characteristics measured in the field at sites studied by the FHU electrofishing crew.

6. AH-ES-WINTER Aquatic Habitat Data Electrofishing Winter Form (Fiogure 30). This form is used to record general habitat characteristics measured in the field during winter at sites studied by the AH electrofishing crew.

7. AH-82-FHU-1 Salmon Spawning Habitat Utilization Form (Figure 31). This form is used to record hydraulic and other physical data measured by FHU slough study personnel at salmon spawning redds.

8. AH-82-FHU-2 Water Quality Form (FIgure 32). This form is used to record water quality data measured at FHU slough study sites.

9. AH-82-FHU-3 Available Habitat (Discharge) Form (Figure 33). This form is used to record discharge and transect survey data collected for use in hydraulic and availability modeling at FHU slough study sites.

10. AH-82-FHU-4 Intragravel/Surface Water Measurements Form (Figure 34). This form is used to record water quality data measured in intragravel standpipes and adjacent zones of surface water at FHU slough study sites.

11. AH-83-IFE-01 Water Quality Field Form (Figure 35). This form is used to record water quality characteristics measured at IFE study sites.

12. AH-82-IFE-02 Discharge Data Summary-Office Form (Figure 36). This form is used to record discharge and respective stage readings obtained at IFE stage/discharge gaging stations.

13. AH-83-IFE-03 Staff Gage Elevation Summary-Office Form (Figure 37). This form is completed in the office to summarize the top of staff gage elevation for each staff gage and the corresponding gage number, date, compass heading, distance from TBM and TBM I.D.#.

Table 22. Data forms used to record aquatic habitat data collected by the various AH sub-program elements during FY83.

FY83 AH Subproject Use	RJ-82-02	RJ-82-03	RJ-82-04	RJ-82-05 (ALT)	RJ-82-06	RJ-82-07 [1]	AA-82-02 [2]	AA-82-03	AA-82-05	AH-81-01	AH-81-02	AH-81-03	AH-81-04	AH-81-05	AH-82-03	AH-82-04	AH-82-05	AH-82-07	AH-82-ES-01	AH-ES-WINTER	AH-82-FHU-01	AH-82-FHU-02	AH-82-FHU-03	AH-82-FHU-04	AH-82-IFE-01	AH-82-IFE-02	AH-82-IFE-03
Lower River Fish Habitat Utilization SLOUGHS															X		X				X	X	X	X			
Lower River Fish Habitat Utilization MAINSTEM (Electroshock)	X	X	X	X			X	X	X						X		X		X	X							
INSTREAM FLOW															X	X	X								X	X	X
Upper River Fish Habitat Studies (IMPOUNDMENT)	X	X	X		X	X									X	X		X									
FY82 AH Project Use										X	X	X	X	X													

[1] Sample forms and discussion of specific data collection presented in RJ section.

[2] Sample forms and discussion of specific data collection presented in AA section.

File No. ① PLANIMETRIC MAP AH-82-03 Page ⑨ of ___

Date ⑧ Gage # ⑦ Height ___

Crew ②

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

Description ⑩

⑪

(ADF&G/Su Hydro, Habitat 5/81)

Figure 26. Planimetric map form, AH-82-03

File No. (1) DISCHARGE AH-82-04 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 Point	Velocity fps Mean Vertical	Velocity fps Mean Cell	Mean Cell Depth (ft.)	Cell Width (ft.)	Cell Area (ft.^{2})	Flow (ft^3/s)
(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)

(ADF&G/Su Hydro, Habitat 5/82)

Figure 27. Discharge form, AH-82-04.

STAGE DATA-FIELD FORM

FILE NO.: 03-83-7.10-3.7 ①

AH-82-05

PAGE : ☐☐ of ☐☐ ②

NO.	③ GAGE NO.	④ DATE yr.	mo.	day	⑤ TIME	⑥ GAGE READING	⑦ TOTAL DEPTH	⑧ INITIALS	⑨ NOTES & COMMENTS
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

⑩ ADDITIONAL NOTES & COMMENTS:

Figure 28. Stage data field form, AH-82-05.

GENERAL HABITAT DATA FORM

AH-82-07

File Number 03-82-7.10-3.7 (1)

Page (9) of

Crew (2)

Sampling Period (8)

Habitat Location (3)

R:M. (5)

GC (6) / / / / /

Sampling Site Description (10)

DATE	Military Time	GPSN	TEMP. °C		pH	DISSOLVED OXYGEN	TURB.	SPEC. COND.		ICE THICK.	WATER DEPTH	MEAN VELOCITY			SUBSTRATE		
			Air	Water				METER	ADJ.			0.2 / 0.8	0.6 or Mean		%-CLASS	%-CLASS	%-CLASS
(11)	(12)	(13)	(14)		(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)				(23)	

METER NOS. (Hydrolab) (24) ; (flow) (25) DISCHARGE (26) 5/9(°F-32)=°C

Comments, related data, notes

(27)

(ADF&G/Su Hydro, Habitat 12/28/)

Figure 29. General habitat data form, AH-82-07.

File No. ① AH-82-ES-01

Page ② of ___ Aquatic Habitat Data Electroshocking Form Sample # ⑥

Crew: ③ Location ⑦

Date (YY/MM/DD): ④ / / Rm: ⑧ Trib. River Mile ⑨

Time (military): ⑤ Geographical Code ⑩ / _ _ _ / _ _ _ _ / _ _ / _ _ _ _ / _

Sample #	Depth (ft)	Velocity (fps) 0.2	0.8	$\bar{X}$ 0.6	Substrate	Embeddedness	Air (°C) Temp.	Intragravel Temp. (°C)	Surface Water (°C) Temp.	pH	Dissolved Oxygen (mg/l)	Specific Conductance (umhos/cm)
⑪	⑫		⑬		⑭	⑮	⑯	⑰	⑱	⑲	⑳	㉑

comments ㉒

5/82

Figure 30. Aquatic habitat data electroshocking form, AH-82-ES-01.

AQUATIC HABITAT ELECTROFISH WINTER FORM
AH-ES-WINTER

File No. ① _____ Location ⑥ _____

Page ② of _____ Description ⑦ _____

Crew ③ _____ R.M. ⑧ _____ T.R.M. ⑨ _____

Date ④ _____ Time ⑤ _____ Geographic Code ⑩ / ____ / ____ / ____ / ____

Sample #	Depth (feet)	Ice Thickness (feet)	Velocity (feet/second) 0.2	0.8	x / 0.6
⑪	⑫	⑬		⑭	

SAMPLE #	AIR (°C) TEMP.	SURFACE WATER (°C) TEMP.	DISSOLVED OXYGEN (mg/l)	H.R. / C.R. SPECIFIC CONDUCTANCE (umhos/cm)	pH	SUBSTRATE DATA
⑮	⑯	⑰	⑱	⑲	⑳	㉑

Comments ㉒

Hydrolab # ㉓

Marsh-McBirney # ㉔

Figure 31. Aquatic habitat data electroshocking winter form, AH-ES-WINTER.

FILE NO.: 03-82-7.10-3.7 (1)

CREW: (2)

LOCATION: (3)

G.C.: (4)

METER TYPE (11) NO.

SALMON SPAWNING HABITAT UTILIZATION
AH-82-FHU-1

GAGE NO.: (5)

DIGISENSE NO. (12)

PAGE: (8) of

DATE: (9)

TIME: (10) to

HEIGHT START: (6)

END: (7)

NO.	TRANS (13)	DEPTH (ft.) (14)	REV. (15)	SEC. (16)	VELOCITY .2	VELOCITY .8 (17)	VELOCITY .6/mean	SUBSTR. 1 (18)	SUBSTR. 2	INTRAGR. TEMP(°c) (19)	WATER TEMP (°c) (20)	SPECIES CODE (21)	REDD NO. (22)	CHECK IF COMMENTS (23)
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														

NOTES & COMMENTS: (26)

AIR TEMP (24)

(25) DAILY REDD SUMMARY:

	SOCK.	CHUM	PINK	COHO	CHIN.
MEASURED:	Ø42	Ø45	Ø44	Ø43	Ø41
COUNTED:					

SPAWNING COMMENTS CODE: F = Active Fanning
Q = ♂ Quivering
A = Aggressive Behavior

(ADF&G/SU HYDRO, AH, 9/82

Figure 32. Salmon spawning habitat utilization form, AH-82-FHU-1.

FILE NO.: 03-82-7.10-3.7 (1)

CREW: (2)

LOCATION: (3)

WATER QUALITY
AH-82-FHU-2

METER NO. (4)

PAGE: (5) of

R.M.: (6)

G.C.: (7)

NO.	DATE YY	DATE MM	DATE DD	TIME	SITE	AIR TEMP(°C)	WATER TEMP(°C)	D.O. (mg/l)	% SAT.	pH	CONDUCTIVITY (umhos/cm) METER	CONDUCTIVITY (umhos/cm) ADJUSTED	TURBIDITY ✓ READING	✓ if D.O. < 5.0
1		(8)		(9)	(10)	(11)	(12)	(13)	(14)	(15)		(16)	(17)	(18)
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														

NOTES & COMMENTS: (19)

Barometric Pressure or Elevation (20)

(ADF&G/SU HYDRO, AH, 4/83)

Figure 33. Water quality form, AH-82-FHU-2.

FILE NO.: 03-82-7.10-3.7 (1)

CREW: (2)

LOCATION: (3)

GC: (4)

LENGTH REPRESENTED: (11) % U.S. % DS or ft. S = TOTAL ft.

AVAILABLE HABITAT
AH-82-FHU-3
(DISCHARGE)

PAGE: (8) of

DATE: (9)

TIME: (10) to

GAGE NO. (5)

HEIGHT START: (6)

END: (7)

NO.	DISTANCE (12)	ANGLE COEFF. (13)	DEPTH (ft.) (14)	WIDTH (ft.) (15)	REV. (16)	SEC. (17)	VELOCITY .2	VELOCITY .8	VELOCITY .6/mean (18)	FLOW (19)	SUBST. 1 (20)	SUBST. 2 (20)	CHECK IF COMMENTS (21)
0													
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													

NOTES & COMMENTS: (24)

TOTAL FLOW (22)

METER TYPE (23)

NO.

(ADF & G/SU HYDRO, AH, 9/82)

Figure 34. Available habitat (discharge) form, AH-82-FHU-3.

INTRAGRAVEL/SURFACE WATER MEASUREMENTS
AH-82-FHU-4

FILE NO 03-82-7.10-3.7 (1)
PERSONNEL. (2)
LOCATION (3)
DATE (4) TIME: (5)
R.M.: (6) . T.R.M.: (7) .
G.C.: (8)
BAROMETRIC PRESSURE: (9) .

PAGE. (10) of

FOR AH USE ONLY

D.O. CALIBRATION
m/s PAO x : (11) mg/l
m/s PAO x :
x̄ :

MEASUREMENT METHOD OR METER NO.
CONDUCTIVITY: (12) DISSOLVED OXYGEN: (12)
pH: (12) TEMPERATURE: (12)

NO.	SITE	STANDPIPE NO	INTRAGRAVEL						SURFACE					
			pH	WATER TEMP(°C)	D.O. (mg/l)	% SAT.	CONDUCTIVITY* FIELD (µmho/cm)	CONDUCTIVITY* ADJUSTED (µmho/cm)	pH	WATER TEMP(°C)	D.O. (mg/l)	% SAT.	CONDUCTIVITY* FIELD (µmho/cm)	CONDUCTIVITY* ADJUST (µmho/cm)
0	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														

NOTES & COMMENTS:
(27)

*FIELD CONDUCTIVITIES ARE ADJUSTED TO 25°c AS PER STANDARD METHODS IF NOT AUTOMATICALLY COMPENSATED BY THE METER.

Figure 35. Intragravel/surface water measurements form, AH-82-FHU-4.

WATER QUALITY - FIELD FORM
AH-82-IFE-01

FILE NO.: 03-82-7.10-3.7 (1) PAGE: (2) of

CREW: (3) DATE: (4)

LOCATION: (5) SITE: (6) TIME: (7)

G.C.: (8) GAGE NO.: (9) GAGE HEIGHT: (10)

METER TYPE: (11) NO.: (12) R.M.: (13) T.R.M.: (14)

NO.	DISTANCE from HEAD PIN (ft.) LB	RB	SAMPLE DEPTH (ft.)	MERCURY THERM. WATER TEMP (°C)	MERCURY THERM. AIR TEMP (°C)	(18) HYDROLAB WATER TEMP (°C)	HYDROLAB PH (units)	HYDROLAB D.O. mg/l	HYDROLAB SPEC. COND. METER	HYDROLAB SPEC. COND. ADJUSTED	LINE COMMENTS
1	(15)		(16)		(17)						(19)
2											
3											
4											
5											
6											
7											
8											
9											
10											

WHOLE PAGE COMMENTS:

(20)

(ADFBG/SU HYDRO, 9/82)

Figure 36. Water quality field form, AH-82-IFE-01.

DISCHARGE DATA SUMMARY-OFFICE FORM
AH-82-IFE-02

FILE NO.: 03-82-7.10-3.7 ①

PAGE: ② of

LOCATION: ③ SAMPLING SITE: ④

R.M.: ⑤

G.C.: ⑥

T.R.M.: ⑦

NO.	⑧ DATE YR.	MO.	DAY	⑨ GAGE NO.	⑩ GAGE HEIGHT START	END	DISCHARGE ⑪ (CFS)	METER TYPE ⑫	COMMENTS ⑬
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

ADDITIONAL COMMENTS:

⑭

(ADF&G/SU HYDRO, 9/82)

Figure 37. Discharge data summary-office form, AH-82-IFE-02.

STAFF GAGE ELEVATION
SUMMARY - OFFICE FORM
AH-82-IFE-03

FILE NO.: 03-82-7.10-3.7 (1)

LOCATION: (2) SAMPLING SITE: (3) R.M.: (4)

G.C.: (5) T.R.M.: (6)

NO.	(7) DATE YR.	MO.	DAY	GAGE NO. (8)	TRUE ELEVATION (9)	COMPASS HEADING from T.B.M. (10)	DISTANCE from T.B.M. (11)	T.B.M. I.D (12)
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								

COMMENTS:
(13)

Figure 38. Staff gage elevation summary-office form, AH-82-IFE-03.

2. Data Transfer

AH Crews:

Field crews are responsible for checking their data for completeness, accuracy, and proper format (as established by AH staff in conjunction with Data Processing (DP) staff). Miscellaneous data and notes recorded in field books should be entered on data sheets if they are to be incorporated into the computer data set. Raw field data (original forms) will be transmitted to the appropriate crew leader for review. This will provide crew leaders the opportunity to monitor the development of data trends on a more timely basis.

The AH data processing liaison will receive the original data after it has been reviewed by the crew leader. The liaison will check for obvious errors and proper format. The original will be filed and a photocopy will be transmitted to Data Processing.

DP will transmit a computer printout of data to the AH liaison who will in turn give it to the appropriate crew leader to check. All corrections to data files will be made through the AH liaison.

RJ Crews:

Habitat data collected by RJ crews will be given to the RJ data processing coordinator who will transmit it to the AH data processing liaison. Data will then be handled as AH data: reviewed, then transmitted to DP. Computer printouts from DP will be transmitted to the AH data processing liaison and then to the AH/Fisheries Habitat Utilization Crew Leader and the RJ data processing coordinator for review and editing. All corrections are to be coordinated through the AH data processing liaison.

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 comformance 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 (Langler, 1956; Sundstrom, 1957; and McClane, 1965). Personnel will be instructed to use proven lures. Natural baits, when used, will be changed regularly 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. Variations, if present, 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. Refer to the Phase II Basic Data Report for further information on thermograph calibration and quality control.

Hydrolabs will be calibrated and checked after each field trip. Whenever a question arises concerning the data collected, 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 methods of data collection and analysis techniques. The USFWS is periodically consulted to evaluate the methods 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.

D. 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 depicted below:

Field Crews - - - - - - - - - - - - - - - - - Data Forms

Field Crew Leaders - - - - - - - - - - - - - Data Folder

Project Leaders - - - - - - - - - - - - - - - Data Folder

Su-Hydro Office - - - - - - - - - - - - - - - Data Folder

Original File	Working File
	Data Processing
Acres American, Inc.	Monthly Report
Alaska Power Authority	Species/Subject
Alaska Department of Fish & Game	Report

V. REPORT SCHEDULE

Project scheduling is as outlined in Figures 38 and 39. 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 38. 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 39. These projects will operate year round from the estuary to Devil Canyon and from March 15 through October 15 upstream from Devil Canyon.

The schedule of planning and reporting events is as follows:

July 15, 1982	ADF&G Draft Procedures Manual FY 83 Field Programs. This is a basic internal ADF&G planning and field guidance document.
July 31, 1982	Woodward-Clyde (Proposed) Draft Mitigation Outline.
November 30, 1982	AEIDC (Proposed), Internal Working Document, conceptualizing and visualizing project impacts on a non-quantitive basis.
January 31, 1982	ADF&G, Draft Basic Data Report. This is an internal working document and also provides for data transmittal to AEIDC and Woodward-Clyde and others as appropriate. It basically presents what the data is, how and where it was collected. The report would include winter 81/82 data and data for the ice free season from May thru October 1983. This report does not include habitat versus fisheries relationship information for the winter of 82/83 data or incubation study data collected through the winter of 82/83.

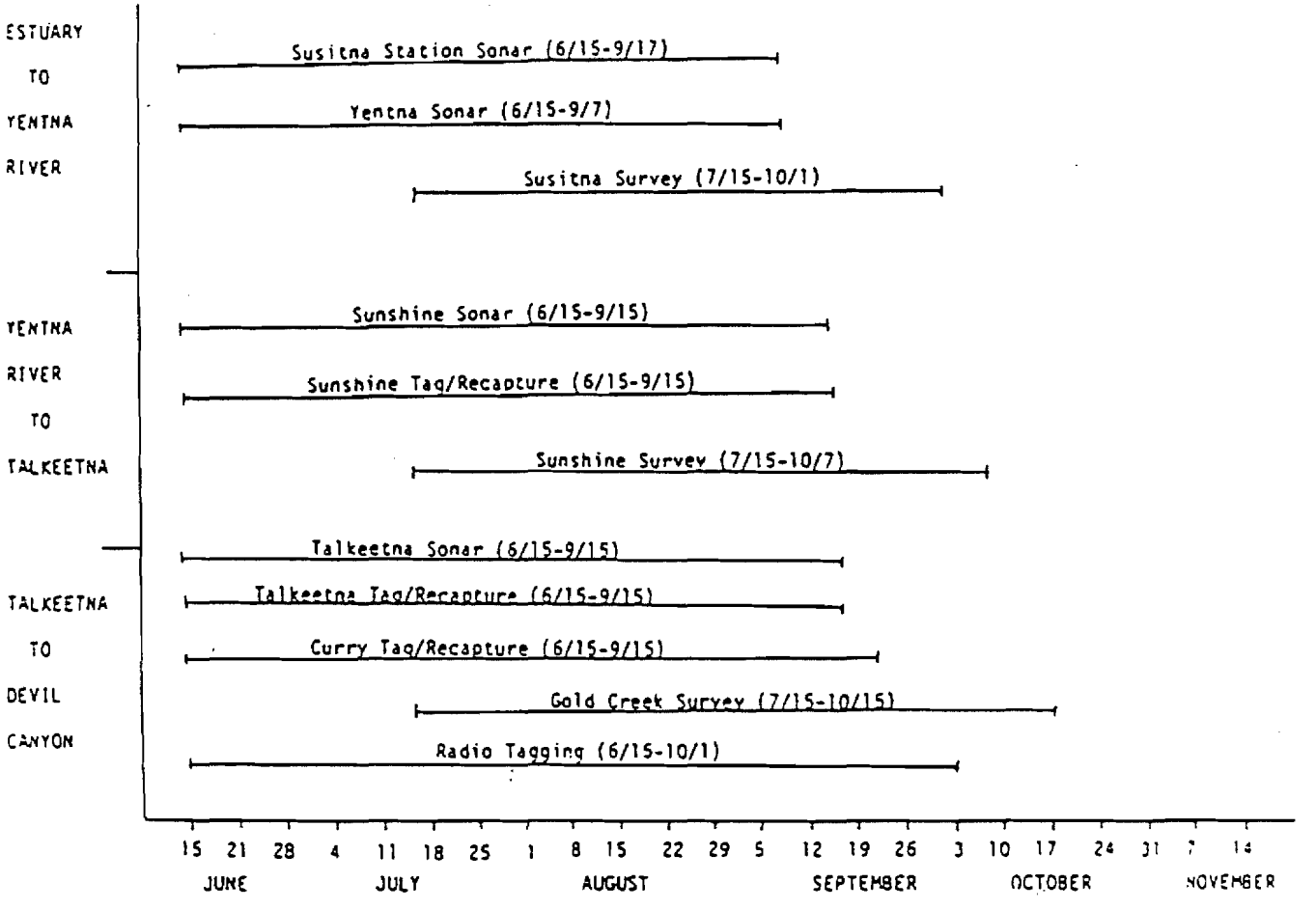


Figure 39. Adult anadromous project schedule, 1982.

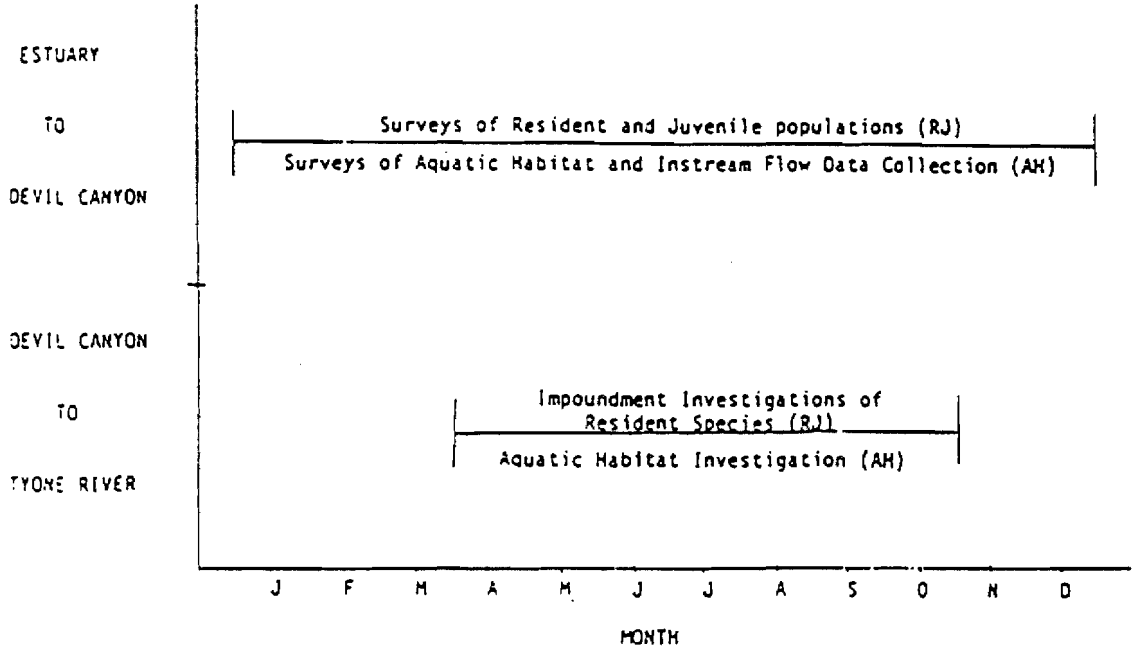


Figure 40. Activity schedule, 1982. Integrated Resident and Juvenile Anadromous Fisheries and Aquatic habitat and Instream Flow Project.

January 31, 1983	Woodward-Clyde (Proposed), Draft Exhibit E.
March 1, 1983	ADF&G, FY 84 Draft Plan of Study (POS).
April 1, 1983	APA-ADF&G, FY 84 RSA and POS Agreement. Contingent on approval of funding by the Legislature.
April 15, 1983	ADF&G, Revised Draft Basic Data Report.
May 1, 1983	ADF&G, Draft Fisheries and Habitat Relationships Report. An internal working document which functions as a data/information transmittal to AEIDC and other study participants.
June 1, 1983	ADF&G, FY 84 Procedures Manual.
June 30, 1983	ADF&G, Final Draft Fisheries and Habitat Relationship Report. This is a formal document available for broad distribution by the APA to study participants, agencies and the public.
June 30, 1983	ADF&G, Draft Basic Data Report. This would cover winter 82/83 work and include incubation study data. This is an internal working document and data transmittal to study participants.

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 regulatroy 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 on 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. Dana Schmidt Ph.D. replaced Mr. Kevin Delaney in April 1982 as Project Leader for the Resident and Juvenile Anadromous Fisheries Studies. Dr. Schmidt holds a doctorate degree in Fisheries from Oregon State University and from the University of Utah. He has directed numerous environmental impact studes in Montana and has past involvement with U.S. Fish and Wildlife Service radio telemetry studies in Alaska. He has worked as a consultant to the Susitna River fisheries since 1981.

Mr. Christopher Estes will lead the Aquatic Habitat and Instream Flow studies. Chrsitopher 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.

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.

Mr. Allen E. Bingham will supervise the Data Processing Support Unit. Allen holds a B.S. in Zoology from the Ohio State University, Columbus, Ohio and received a Master of Science Degree in Fisheries Biology from the Ohio State University in 1977.

Graduate research and course work continued at the University of Idaho. Allen's research at U of I was directed at reduced stream flow effects on juvenile steelhead trout while course work emphasized Fisheries Biology with a minor in Applied Statistics.

Allen joined the ADF&G in 1981 as a Biometrician II with the Su Hydro Aquatic Studies team.

VII. LITERATURE CITED

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FY 83 ADDENDUM TO APPENDIX IX: DATA CODING AND INSTRUCTIONS

FY 83 Addendum to the ADF&G Su Hydro
FY 82 Phase I Procedures Manual

ADULT ANADROMOUS FISHERIES STUDIES

Age and Length Sampling Operations - All stations

The following sampling procedures will be used to collect age and length data from fishwheel interceptions at Susitna, Yentna, Sunshine, Talkeetna and Curry Stations. These procedures will be followed for sockeye salmon stock separation sampling except that two (2) scales will be collected from the "preferred area" instead of only (1) scale.

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 1).

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 1). 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 five millimeters on all adult salmon except chinook salmon for which lengths are to be recorded to the nearest 10 millimeters.

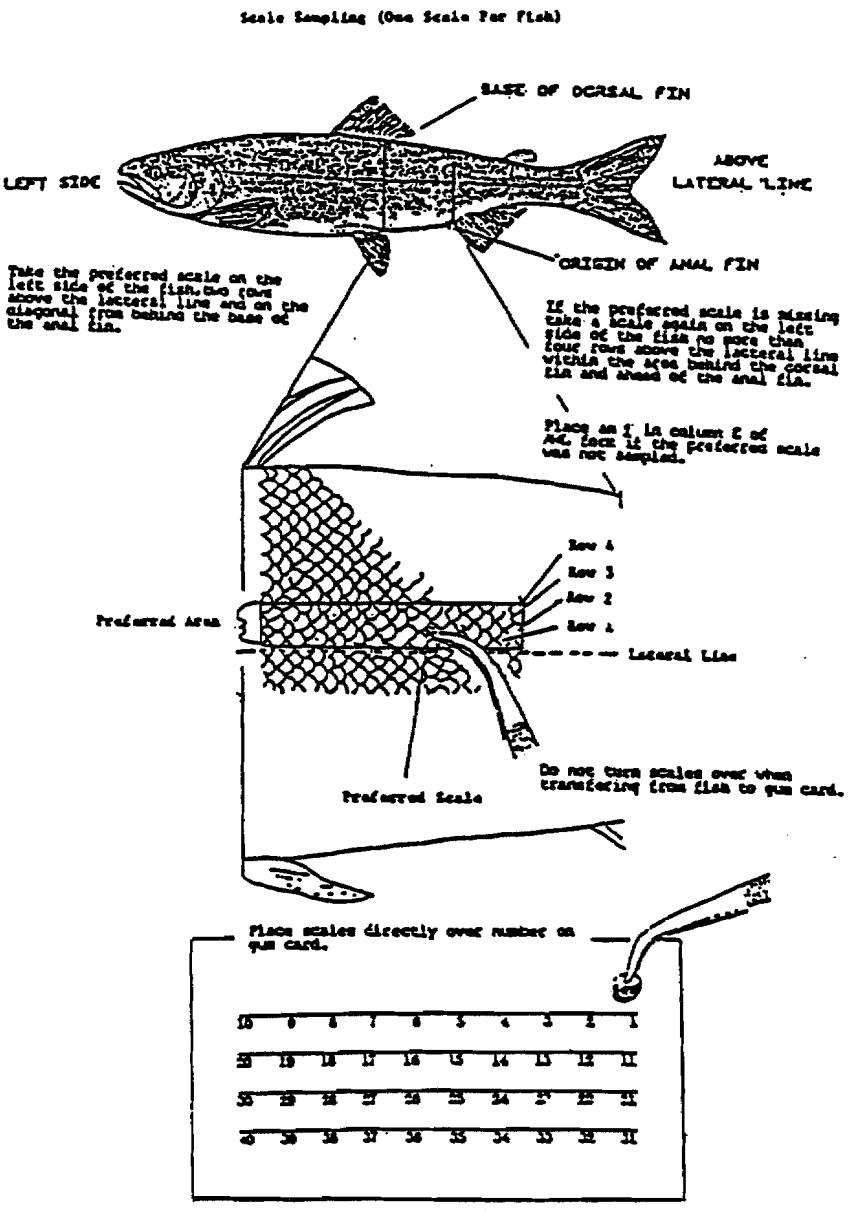

Figure 1. Scale sampling procedures for one scale per fish.

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 (Figures 2A and 2B). These have corresponding location, date, species, gear code and subsample number. None ever has more than a single location, species, gear code or subsample number.

A. Numbering

Numbering begins with 001 for each species at each escapement sampling location for the 1982 season. Each card, AWL and acetate for specific group is consecutively numbered throughout the season. It is a responsibility of collectors to check the numbers being used each sampling day to maintain correct sequence and omit duplication.

B. Gum Cards (see Figures 2A and 2B).

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

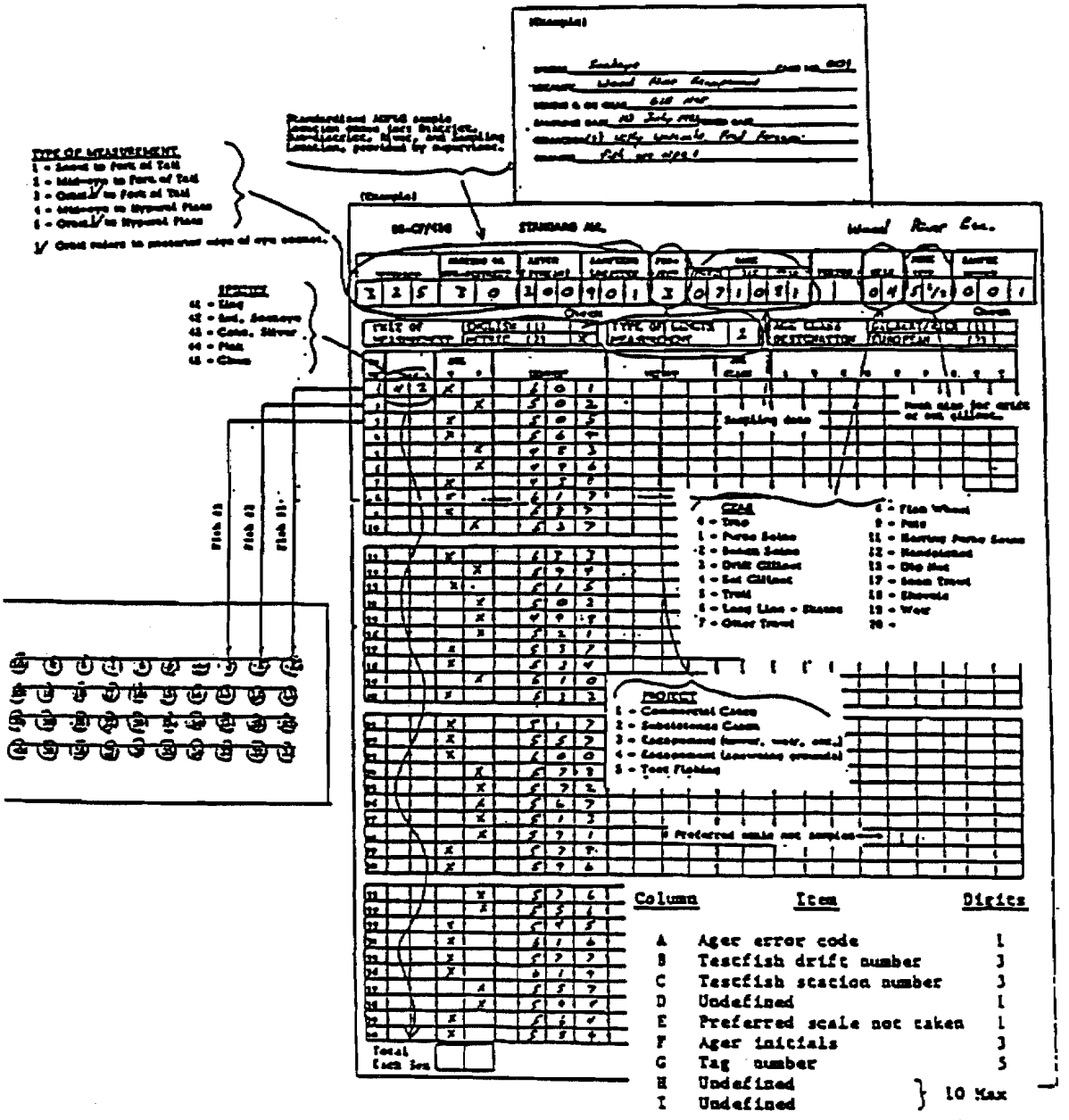

Figure 2A. Labeling of gum cards and AWL forms when sampling one scale per salmons.

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
41 - King
42 - 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 - Sheelfish
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 columns, 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 columns 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.

Figure 28. Gum card coding.

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 19)

d. Scow/Gear: Gear number code is listed on reverse of AWL for appropriate type used.

e. Sampling date: month/day/year that the scales were taken. Omit if the same as period date.

f. Period date: month/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.

C. Age Weight Length (AWL) Form (see Figures 3A and 3B)

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 19. Anadromous Adult Investigations - Susitna Hydro Statistical Codes and Code Samples.

DISTRICT	SUBDISTRICT	RIVER	LOCATION CODE	LOCATION NAME
247	41	100	100	Susitna Station
247	41	100	101	Yentna Station
247	41	100	102	Sunshine Station
247	41	100	103	Talkeetna Station
247	41	100	104	Curry Station

2. Information Explanation (See Table 19).

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 19 for proper codes.

c. Sampling location: See Table 19.

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. Figure 3B).

r. Columns D-H: Remarks.

RESIDENT AND JUVENILE ANADROMOUS FISHERIES STUDIES

FY-83 Field Data Forms:

FORM No.	TITLE
RJ 82-01	Susitna Hydro Standard Gear Catch Data
RJ 82-02	Susitna Hydro Biological Data
RJ 82-03	Susitna Hydro Tag Deployment Data
RJ 82-04	Susitna Hydro Tag Recapture Data
RJ 82-05	Susitna Hydro Opportunistic Gear Catch Data
RJ 82-05 (alternate)	Susitna Hydro Opportunistic Gear Catch Data
RJ 82-06	Susitna Hydro Proposed Impoundment Hook & Line Catch Data
RJ 82-07	Susitna Hydro Proposed Impoundment Other Gear Catch Data
RJ 82-08	Susitna Hydro Downstream Migrant Trap Catch Data
RJ 82-09	Susitna Hydro Downstream Migrant Biological Data
AH 82-01	Susitna Hydro Aquatic Habitat Field Data
AH 82-05[1/]	Stage Data Field Form
AH 82-ES-01[1/]	Aquatic Habitat Data Electroshocking Form
AA-82-02[1/]	Electroshocking Data Record for Spawning Fish
AA-82-03[1/]	Electroshocking Catch Form
AA-82-05[1/]	Adult Anadromous and Resident Spawning Site Map

1/ Use of these forms will be discussed in the AA & AH sections of the procedure manual respectively.

Data codes to be presented in filling out the above forms are presented in Figure 3.

Form Headings:

Many of the headings on the RJ data forms are similar and the following comments refer to these heading in general.

Page ____ of ___

Example (1) - If you fished Indian River for one 3 hr. sampling period with 15 minnow traps and you caught 20 chinook salmon age 0+. You would use the following page numbers.

Standard Gear Form - Page 1 of 1
Bio. Form - Page 1 of 1

Example (2) - If you fished Indian River for one 3 hr. sampling period with 30 minnow traps and you caught 41 chinook salmon age 0+. You would use the following page numbers.

Standard Gear Form - Page 1 of 2
and - Page 2 of 2
- Page 1 of 3
Bio. Form - Page 2 of 3
and - Page 3 of 3

FD/SFH
Location

FD = Fish Distribution
SFH = Selected Fish Habitat

Circle FD or SFH depending on what type of location is being sampled and write the locations name in the space

SU HYDRO DATA CODES, 1982

STANDARD GEAR CODES

5 minnow trap
5a fish trap
10 trotline

OPPORTUNISTIC GEAR CODES

1 set gillnet
1a drift gillnet
2 electroshock
3 beach seine
5 hook & line
C other (specify)

BAIT CODE

1 artificial
2 fish
3 egg
4 other
5 bacon

FATE CODES

0 mortality
1 released
2 tagged
3 tagged - hooked in mouth
4 tagged - swallowed hook
5 escaped
6 preserved

TAG CODES

00____ Floy Tag (000000 to 009999 series)
01____ Floy Tag (010000 to 019999 series)
0004___ Floy Tag (0004000 series with 7 digits-150 tags deployed in impoundment during 1981 season)
0d____ Dangler Tag (1100 to 3000 series)

RECAPTURE CODES

1 Su Hydro staff
2 ADF&G (other)
3 Sport Fishermen (specify name, address, and phone no. in comments)

RESIDENT SPECIES CODES

162	Slimy sculpin	586	Round whitefish
500	Northern pike	590	Burbot
530	Dolly Varden	610	Arctic grayling
541	Rainbow trout	640	Longnose sucker
550	Lake trout	660	Threespine stickleback
582	Humpback whitefish	661	Ninespine stickleback

JUVENILE ANADROMOUS CODES

410	Chinook 0+	430	Cohn 0+
411	Chinook 1+	431	Coho 1+
412	Chinook juvenile	432	Coho 2+
415	Chinook smolt 0+	433	Coho juvenile
416	Chinook smolt 1+	435	Coho smolt 0+
417	Chinook smolt	436	Coho smolt 1+
		437	Coho smolt 2+
420	Sockeye 0+	438	Coho smolt
421	Sockeye 1+		
422	Sockeye juvenile	440	Pink 0+
425	Sockeye smolt 0+		
426	Sockeye smolt 1+	450	Chum 0+
427	Sockeye Smolt		

ADULT ANADROMOUS CODES

041	Chinook	511	Smelt, Eulachon
042	Sockeye	585	Bering Cisco
043	Coho	600	Pacific lamprey
044	Pink	601	Arctic lamprey
045	Chum		

Figure 3. RJ Data Form Coding, FY-83.

provided. Be sure to record the name of the location exactly the same way each time you return.

RM/TRM

RM = River Mile
TRM = Tributary River Mile

Circle RM or TRM, depending on which is relevant and record the mileage to the nearest tenth of a mile.

GC

GC = Geographic Code

File in: meridian - (i.e.) S or F (Seward/Fairbanks)
township - (i.e.) 32N
range - (i.e.) 01E
section - (i.e.) 04
grid - (i.e.) BAB

Date: Gear Set
Gear Pulled

82 / 06 / 01
year month day

Note - the computer requires you to enter a 2-digit number for the year, month, and day as shown above.

Collectors Initials

The first letter of each samplers first and last name is sufficient.

Remarks

Use this space for line item comments. If more then one line is needed to complete the remark, precede it with a sub-heading indicating which piece of

gear and/or location the remark pertains to.

(i.e.) 5/3-2 Observed a school of 20 sockeye 0+ swimming in the shallows near this trap. Approximate lengths 20 mm.

Comments — The blank space at the bottom of each sampling form is intended for whole page comments.

(i.e.) Sport fishermen questioned at this location indicated that during the current period of low water, rainbow trout catches have diminished.

SUSITNA HYDRO STANDARD GEAR CATCH DATA RJ 82-01

Designed for recording fishing times and catch by species for 15 minnow traps, 1 fish trap, and 3 trotlines.

The PSN space on this form is designed to accommodate a 3 digit location code. The first digit will indicate a hydraulic zone or sub-sampling area within a sampling location. Initially zones were determined based on the following criteria:

ZONE CODES	HYDRAULIC DESCRIPTION
1	Free flowing reach of tributary, slough, or side channel, not influenced by back water or eddies.

Notes: this code will not be used at mainstem sites.

2 At tributary and slough mouths this code will represent backwater areas created by the mainstem. In mainstem sites, this zone will represent slack water areas with no appreciable velocity.

Notes: if a mainstem, tributary, or slough site does not have any slack water zone, then this code will not be used.

3 Represents the zone where the tributary or slough mouth water mixes with the mainstem. At mainstem sites it will represent areas with a significant surface current.

To insure proper coding, a description of each zone should be provided in the field notes along with the zone code number that was assigned. A notation in the remarks column concerning the zone number on the data form (I.E. upper/slough - with current) should also be provided for proper cross checking of code numbers. Currently the zone codes and their corresponding hydraulic description are being revised. A listing of the new zone codes will be included in the updated version of this text. The last 2-digits in the PSN space represent the gear number (i.e. 01-99). Each piece of gear will reflect a replicate of each hydraulic zone but in all cases will be recorded individually.

Time set, time pulled, and total time will be recorded in hours and minutes, and recorded as military time (0000 to 2400 hours).

With regards to the data codes needed to complete the reminder of this form, refer to the Su Hydro Data Code sheet and note the following additions:

Bait Code - since bacon was established as a standard bait, it now has its own code no. - (5).

Species Code - Note that the code changes from last year on slimy sculpin (162), longnose suckers (640), and Bering cisco (585).

The code list for juvenile anadromous fishes has been expanded to differentiate juveniles from smolts. Henceforth the age classes of all juvenile salmon and smolts will be determined after the field season utilizing the computer. Consequently, field personnel will only have to assign a juvenile or smolt code to each juvenile anadromous species that is captured.

(i.e.) All juvenile chinook are assigned the code (412) and all chinook smolts should be coded as (417).

SUSITNA HYDRO BIOLOGICAL DATA RJ 82-02

Species Codes - refer to the Su Hydro Data Code sheet

Length - measure all lengths to the nearest millimeters. Record fork lengths or total lengths for the species being sampled as prescribed in the 1981 procedures manual.

Sex - male or female, check one if the data is available.

Age - recorded in the office.

Scale Card No. - use pre-numbered cards (0001 - 9999). These cards are designed primarily to reference scales and otoliths for aging, however they can also be dropped in specimen bottles and used to identify preserved specimens.

Gear Code - See Su Hydro Data Code Sheet

PSN - 3 digit location code, refer to earlier discussion.

Mesh Size - stretched mesh measurement, recorded to the nearest hundredth of an inch.

Tag Number - refer to the Su Hydro Data Code Sheet. Always record the full 6-digit code and be sure not to leave out any of the zeroes. Floy tags have 00 or 01 prefix and dangler tags are indicated by 0d prefix followed by a 4-digit code.

Fate Code - see Su Hydro Data Code sheet.

SUSITNA HYDRO TAG DEPLOYMENT DATA RJ 82-03

Tag Number
Gear Code
Date — same procedure as indicated previously
Species Code
Length

Sampling Location - reference all sampling sites to known geographic locations (i.e.) tributary mouths, sloughs, bridges, towns, fish distribution locations, etc.

(i.e.) Selected Fish Habitat - 0.5 miles below the Parks Highway bridge.

Mainstem or Tributary - check one. Columns added to aid data processors in determining whether the river mile recorded refers to a mainstem or tributary site.

River Mile - same as procedure discussed previously.

SUSITNA HYDRO TAG RECAPTURE DATA RJ 82-04

Tag Number - Note that this form allows for the recovery of tags with a 7-digit code. This is to allow for

the recovery of 150 7-digit tags used in impoundment last season. For all 6-digit tags recovered, record the number to the right of the existing zero in the second column and leave the first column blank.

Recapture Code - refer to Su Hydro Code sheet

All other items on this form discussed previously

SUSITNA HYDRO OPPORTUNISTIC GEAR CATCH DATA RJ 82-05

Designed for use with gear that for one reason or another can not be utilized on a regular basis. Set and drift gill nets, beach seines, hook and line, and electrofishing gear are considered to be opportunistic gear. When the field biologist believes such gear deployment is required, a minimum of two different conditions should be sampled during each sampling period. The different conditions being sampled and the rationale for why such sampling is being performed are to be recorded in the field notebook. Also record this information in the remarks column on the date forms.

An alternate version of Form RJ 82-05 with no net lengths or mesh sizes listed for gill nets is available upon request.

Conductivity - record hydrolab reading in umhos/cm

Volts
Amps — record settings on shocker

Hook Type - inhouse evaluation of the effectiveness of different hook types

(i.e.) Mepps spinner, No. 2
Royal Coachman, dry fly

SUSITNA HYDRO PROPOSED IMPOUNDMENT HOOK & LINE CATCH DATA RJ 82-06

This form will be utilized to record hook and line catch data from the proposed impoundment area above Devil Canyon.

Reach - two letter location code which designate the following three types of habitat locations based on their physical characteristics:

Code	Description
M	The confluence habitat encompasses that area of the Susitna River below the mouth of the tributary which is influenced by the tributary stream flow, the mixing area, and that area of the tributary which is influenced by the rise/fall of the Susitna River.
P	The pool habitat is comprised of the large pools within the tributaries between the mouth and the proposed impoundment elevation where the bulk of the resident fish have been observed to reside.
R	The riffle habitat will include those stretches of each tributary located between the major pool areas in the reach between the mouth of the tributary and the impoundment elevation. These areas are comprised of smaller pools, rock eddies, riffles, and whitewater.

The second letter of the location code will be composed of lower case letters from a to z. Sampling locations at or near the confluence will all be designated by the letter - a (i.e. Ma, Pa, Ra). Sampling locations above these sites will be assigned letters in sequence thereafter. (i.e. Pb, Rb, Pc, Rc...).

TRM - tributary river mile in tenths of miles.

Total Time - hours and hundreths of hours, rounded off to the nearest quarter hour.

Catch - Species - catches are record by species. Species codes are listed on the Su Hydro Code sheet.

SUSITNA HYDRO PROPOSED IMPOUNDMENT OTHER GEAR CATCH DATA RJ 82-07

This form is designated for use at sampling locations in the mainstem Susitna River, tributary mouths, and lakes in the proposed impoundment area above Devil Canyon.

Species Code
PSN
Net Length
Mesh Size
Hook Size — same procedure as indicated previously
Bait Type
Time (Set, Pulled, and Total)
Catch - Species Code

SUSITNA HYDRO DOWNSTREAM MIGRANT TRAP BIOLOGICAL DATA RJ 82-09

Species Code
Length — same procedure as indicated previously
Age

Scale Slide No. - scale are mounted on glass microscope slides for aging and these slides are numbered from 0001 to 9999.

Fate Code - discussed previously, see Su Hydro Code sheet.

SUSITNA HYDRO DOWNSTREAM MIGRANT TRAP CATCH DATA RJ 02-08

Time - Set
Check
Total
Daily Total
military time
hours, expressed to the nearest tenth of an hour

Trap Depth - feet, expressed to the nearest tenth of a foot

Velocity - feet per second, expressed to the nearest tenth of a foot

Catch - Species Code - same procedure as indicated previously

Remarks - this space will include two addition pieces of data. The distance the trap was set from shore will be recorded to the nearest foot and the total number of fish that were found as mortalities in the live box will also be recorded.

SUSITNA HYDRO AQUATIC HABITAT FIELD DATA AH-82-01

Water Quality Data:

Miltary Time
Temp. - Air
- Water
degrees Centigrade expressed to the nearest tenth of a degree

pH - expressed to the nearest tenth

Dissolved Oxygen - expressed to the nearest tenth

Spec. Cond. - Meter - conductivity meter reading, expressed to the nearest tenth
- Adj - adjusted reading based on correction factor calulated for each meter

Rel. Velocity - feet per second, expressed to the nearest tenth

Turbidity

Hydrolab No. - record meter number

Barometric Pressure

Staff Gage Measurements:

Staff gages will be numbered with a four part, seven place alph-numeric code (see example below).

EXAMPLE: Mainstem gage at River mile 101.2, second gage from shore, set number one

1	0	1	2	M	1	B
Rivermile			Placement Code		Set #	Gage

River Mile (first four places of code) - to be determined to the nearest tenth mile from the blueline aerial photo maps.

Placement Code (PC) (fifth place) - indicates whether a gage is placed in a slough (S), at the head of a slough (H), in a tributary (T), in the mainstem (M), or at an R&M cross-section (X).

SET (sixth place) - a single digit which identifies a group of staff gages within a site which were set to measure the full range of stage flucautions at a given point.

GAGE (seventh place) - a letter identifying a gage within a set. Letters will be assigned alphabetically, beginning with the gage nearest shore.

Gage measurements will be recorded in feet to the nearest hundredth of a

foot

Substrate Date:

General substrate data will be collected for each hydraulic zone that is sampled at a fish distribution or selected fish habitat location.

Gear Code - leave this space blank

PSN - this space will be utilized to specify the hydraulic zone code which is being sampled

Emb - determine embeddedness of the substrate by inspection. If the embeddedness is sufficient to hinder fish activity (i.e. spawning, rearing) enter a (Y), if not enter a (N) in this space.

Dominant - enter the dominant substrate found in that hydraulic zone. Substrate codes are listed on the form as follows:

Substrate Codes:	Substrate Description	
SI	silt	very fine
SA	sand	fines
GR	gravel	1/4" - 3"
RU	rubble	3" - 5"
CO	cobble	5" - 10"
BO	boulder	greater than 10"

Notes - describe breakdown of substrate types if necessary. Also note cover characteristics.

AQUATIC HABITAT AND INSTREAM FLOW STUDIES FY 83 DATA FORM INSTRUCTIONS

Planimetric Map Form (AH-82-03)

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 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. Date: Enter date that measurements are taken.

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 5).

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 transects
Location of sampling gear
Compass orientation

Discharge Form (AH-82-04)

1-10 Refer to 1-10 of instructions for AH-82-03.

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

12. Distance From Head Pin: The horizontal measurement from the head pin 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 (2.5) feet and .2 and .8 for depth greater than three (2.5) feet.

17. Revolutions: Record 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: Record in seconds as timed by 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.

Stage Data Field Form (AH-82-05)

1. File No.: Indicate file number.

2. Page: To ensure that the stage data forms are in order according to date fill in the boxes at the top right corner of the form. These boxes are to indicate the page number in the set and the total number of pages of data in the set in order to facilitate data compilation.

3. Gage No.: Read all the gages within the site and record the appropriate gage number for each gage reading. Multiple readings increase the precision of the stage data. Gage numbers are located on the attached float, on the back of the gage and in many cases on an attached tag.

4. Date: Enter two numbers each to indicate year, month and day for every recorded staff gage reading.

5. Time: Enter military time (24 hour clock).

6. Gage Reading: Record the stage by entering the gage reading to the nearest 0.01 foot. "DRY" or "SUBM" will be recorded when a gage is dewatered or submerged, respectively.

7. Total Depth: Record total depth when the staff gage reading is used in conjunction with a known cross section to be used in determining wetted perimeter or if the staff gage is suspected of being silted in. Total depth is determined by holding a staff gage on the substrate next to the gage being read and reading the water surface on the gage being held.

8. Initials: Enter the first, middle and last initial of the person recording the staff gage reading. If problems with the gage reading do arise many times the person responsible for the reading help in solving the problem.

9. Notes & Comments: Use this space for brief notes about an individual reading (e.g. rising stage, descending stage, choppy water, etc.)

10. Additional Notes & Comments: Record additional information pertinent to the site in general or the individual gage reading, (e.g. poor gage placement, head of slough is breached, straightened bent gage before reading, etc...). Be sure to include the line number.

General Habitat Data Form (AH-82-07)

1-10. Refer to 1-10 of instructions for AH-82-03 (number 4 and 7 are not on this form).

11. Date: Enter date measurements are taken.

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

13. GPSN: enter gear placement site number (described in 1981 procedures manual).

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

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 (NTU): Indicate with a check ( ) on left side of blank that a turbidity sample was taken; enter turbidity value after analysis.

18. Specific Conductance-Meter: enter the value for spec. cond. as displayed on the meter.

19. Specific Conductance-Adjusted: Upon return from the field enter the adjusted value obtained from the calibration curve.

20. Ice thickness: measure the distance form the bottom of the ice to the top.

21. Water Depth: enter the distance from the surface of the water to the substrate. (Notes will be made in the "note" section of the

form if slush ice is present or if the water surface and ice surface differ by more than 0.5 foot).

22. Mean Velocity: Enter the mean velocity measured at 0.6 depth under the 0.6 or mean column. If 0.2 and 0.8 depth is used enter the 0.2 reading above the slash and 0.8 reading below the slash in the 0.2/0.8 column. Enter the mean velocity (calculated by averaging the 0.2 and 0.8 measurement) in the 0.6 or mean column.

23. Substrate: Estimate the three major substrate types within the sampling site and enter their respective percentages.

24. Meter Number (Hydrolab): Enter the serial number of the Hydrolab used.

25. Meter Number (Flow): Enter the type and serial number of the flow meter used.

26. Discharge: Record total discharge if measured.

27. Comments, related data, notes: Enter any comments pertinent to the data collected (i.e. deviation from techniques, other information available, adverse conditions, etc.).

Aquatic Habitat Data Eletroshocking Form (AH-82-ES-01)

1. File Number: Record appropriate file number.

2. Page: Indicate the page number and total number of pages.

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

4. Date: Enter date in digit format in the order: year, month, day.

5. Time: Enter military time.

6. Sample # (in header): Enter the assigned sample number determined by RJ, AH or AA crew member.

7. Location: Enter descriptive location name.

8. RM: Enter river mile of the site or tributary mouth obtained from R&M blue line maps.

9. Tributary River Mile: Enter the river mile of the tributary sampled if applicable.

10. Geographical Code: Enter the 12 digit code identifying the sample location.

11. Sample # (in column): Enter number to identify specific data collection location within the site.

12. Depth: Record total depth corresponding to sample #.

13. Velocity: Record the mean velocity measured at 0.6 of total depth under the X/0.6 column. If 0.2 and 0.8 depths are used

enter the velocities under the appropriate columns and the mean velocity under X/0.6. Record velocity to nearest tenth.

14. Substrate: Record substrate type dominant at the site.

15. Embeddedness: Record embeddedness.

16. Air Temperature: Enter air temperature in °C to nearest tenth.

17. Intragravel Temperature: Enter intergravel temperature °C to the nearest tenth.

18. Surface Water Temperature: Enter surface water temperature °C to the nearest tenth.

19. pH: Enter pH to the nearest tenth.

20. Dissolved Oxygen: Enter dissolved oxygen in mg/l to nearest tenth.

21. Specific Conductance: Enter specific conductance in umhos/cm to the nearest tenth.

22. Comments: Enter any comments in this section.

Aquatic Habitat Data Electrofish Winter Form (AH-ES-WINTER)

1. File Number: Record appropriate file number.

2. Page: Indicate the page number and total number of pages.

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

4. Date: Enter date in digit format in the order: year, month, day.

5. Time: Enter military time.

6. Location: Enter descriptive location name.

7. Description: describe the hydraulic characteristics of the area being shocked (i.e., pool, riffle, confluence).

8. RM: Enter river mile of the site or tributary mouth obtained from R&M blue line maps.

9. Tributary River Mile: Enter the river mile of the tributary sampled if applicable.

10. Geographical Code: Enter the 12 digit code identifying the sample location.

11. Sample #: Enter number to identify specific data collection location within the site.

12. Depth: Record total depth corresponding to sample #.

13. Ice thickness: Enter thickness of ice.

14. Velocity: Enter the mean velocity measured at 0.6 under the X/0.6 column. If 0.2 and 0.8 depths are used enter the

velocities under the appropriate columns and the mean velocity under X/0.6. Record velocity to nearest tenth.

15. Sample #: Enter number to identify specific data collection location within the site.

16. Air Temperature: Enter air temperature in °C to nearest tenth.

17. Surface Water Temperature: Enter surface water temperature °C to the nearest tenth.

18. Dissolved Oxygen: Enter dissolved oxygen in mg/l to nearest tenth.

19. Specific Conductance: Enter specific conductance in umhos/cm to the nearest tenth.

20. pH: Enter pH to the nearest tenth.

21. Substrate: Record substrate type dominant in the site using codes explained in the RJ data from section of this addendum.

22. Comments: Enter any comments in this section.

23. Hydrolab #: Enter serial number of meter used.

24. Marsh-McBirney: Enter serial number of meter used.

Salmon Spawning Habitat Utilization (AH-82-FHU-1)

1. File Number: Enter appropriate file number.

2. Crew: Enter names or initials of persons taking and recording data.

3. Location: Slough number or tributary name.

4. G.C.: Geographical code is expressed by

_ / _ _ _ / _ _ _ / _ _ / _ _ _ / _

meridian township section range grid number of sample sites in grid

5. Gage No.: Seven digit number of the staff gage within the sample area used to record change in the water level.

6. Height start: Record gage height in hundredths of a foot when sampling began.

7. Height end: Record gage height in hundredths of a foot when sampling ended.

8. Page: Indicate the page number and total number of pages.

9. Date: Enter date of recording. To be done in order of: year, month, day with two digits each (_ _ / _ _ / _ _).

10. Time: In military time record beginning and ending time of sampling.

11. Meter type & No.: Type of velocity meter used i.e. Price AA, Marsh McBirney, Pygmy. No. is the serial number of that meter.

12. Digisense No.: Serial number of meter used for intragravel temp.

13. Trans: Record transect number that represents the area in which data was obtained.

14. Depth: Record depth of water in feet at sample site (redd).

15. Rev.: Record number of revolutions of Price AA or Pygmy meter that were used to obtain velocity reading.

16. Sec: Record number of seconds it took to obtain revolutions for velocity readings.

17. Velocity:

    0.2 : 3 digit number velocity reading from rating curve taken at 0.2 foot from the water surface.

    0.8 : 3 digit number velocity reading from rating curve taken at 0.8 foot from the water surface.

    Readings at 0.2 & 0.8 foot are taken only when water depth is 2.5 feet or more.

    0.6/mean: velocity reading taken at 0.6 foot from the water surface or the mean of the 0.2 & 0.8 foot readings.

18. Substr: Use 2 letter codes to indicate the 2 most predominate substrate types present with the most predominate type listed first refer to AH-82-01 for substrate codes.

19. Intragr. Temp: Record in degrees centigrade the intragravel water temperature taken 6" below the substrate surface.

20. Water Temp: Record in degrees centigrade the water temperature.

21. Species Code: Denote which salmon species that the data applies to. Code is at bottom of form.

22. Redd No.: Denote 3 digit number of the redd present (if present) within the area where data is obtained. First digit indicate salmon species (C-chum, P-pink, S-sockeye, S-coho, K-chinook). The last two digits refer to field assigned number (between 1-9).

23. Check for Comments: Record any specific comments here or at bottom of page under NOTES & COMMENTS, be sure to include line number if applies to only one measurement.

24. Air Temp: Record air temperature in degrees centigrade.

25. Daily Redd Summary:

    Measured: List number of redds measured of each salmon species.

    Counted: List number of total redds counted of each salmon species.

26. Notes & Comments: The blank space at the bottom of each form is intended for whole page comments.

Water Quality (AH-82-FHU-2)

1. File Number: Enter appropriate file number.

2. Crew: Enter name(s) or initial(s) of person taking and recording data.

3. Location: Slough number or tributary name.

4. Meter No.: Hydrolab serial number.

5. Page: Indicate the page number and total number of pages.

6. R.M. River mile: Enter the river mile of the site or tributary mouth obtained from R&M blue line maps.

7. G.C.: Geographical code is expressed by

_	/ _ _ _	/ _ _ _	/ _ _	/ _ _ _	/ _
meridian	township	section	range	grid	number of sample sites in grid

8. Date: Enter date of recording. To be done in order of: year, month, day with two digits each (_ _ / _ _ / _ _).

9. Time: In military time when data is obtained.

10. Site: 2 digit number of letter to denote which site within a location that data is obtained.

11. Air Temp: Record air temperature in degrees centigrade.

12. Water Temp: Record in degrees centigrade the water temperature.

13. D.O.: Record dissolved oxygen in mg/l.

14. % Sat: Determined from D.O. concentration, water temperature, and site elevation or barometric pressure using an oxygen saturation nomograph (Wetzel 1975).

15. pH: Record pH.

16. Conductivity

    Meter: Record conductivity in umhos/cm as read from the meter.

    Adjusted: Adjust meter reading according to correction factor from most recent calibration chart.

17. Turbidity: Check ( ) column if sample was taken. Reading: enter the value when sample is analyzed.

18. __ if Comments: Check if comments & record comment at bottom of page under notes & comments.

19. Notes & Comments: Intended for whole page comments as well as comments to the above __'s.

20. Barometric Pressure: Barometric pressure at time of sampling or Elevation: Elevation of sampling location. Both blanks need not be filled out, however Barometric Pressure is preferred.

Available Habitat (Discharge) (AH-82-FHU-3)

1. File Number: Enter appropriate file number.

2. Crew: Enter names or initials of person taking and recording data.

3. Location: Slough number or tributary name.

4. G.C.: Geographical code is expressed by

_ / _ _ _ / _ _ _ / _ _ / _ _ _ / _

meridian township section range gird number of sample sites in grid

5. Gage No.: Seven digit number of the staff gage within the sample area used to record change in the water level.

6. Height start: Record gage height in hundredths of a foot when sampling began.

7. Height end: Record gage height in hundredths of a foot when sampling ended.

8. Page: Indicate the page number and total number of pages.

9. Date: Enter date or recording. To be done in order of: year, month, day with two digits each (_ _ / _ _ / _ _).

10. Time: In military time record beginning and ending time of sampling.

11. Length Represented: Record percent of transect length represented upstream (US) and downstream (DS) of transect; or if transect is the first or last in a set of transects, record the number of

feet represented from the open end and a U or D to denote upstream or downstream. Total = total number of feet represented by transect.

12. Distance: Record distance in feet along a transect at which measurements are taken. Distances are usually 2 foot intervals or multiples thereof, on even numbers.

13. Angle Coeff.: The angle at which the flow of water crossed the transect. If the flow is perpendicular to the transect the coefficient is 1.00. If the flow is parallel the coefficient is 0.00. All other angles are read from a chart prepared by USGS.

14. Depth: Depth in feet taken at the recorded distance.

15. Width: Width of cell represented by the cell number listed before the distance recordings.

16. Rev.: Record number of revolutions of Price AA or Pygmy meter that were used to obtain velocity reading.

17. Sec: Record number of seconds it took to obtain revolutions for velocity readings.

18. Velocity:

    0.2 : 3 digit number velocity reading from rating curve taken at 0.2 foot from the water surface.

    0.8 : 3 digit number velocity reading from rating curve taken at 0.8 foot from the water surface.

Readings at 0.2 & 0.8 foot are taken only when water depth is 2.5 feet or more.

0.6/mean: velocity reading taken at 0.6 foot from the water surface or the mean of the 0.2 & 0.8 foot readings.

19. Flow: Computed by multiplying the angle coefficient by the depth, by the width, by the mean velocity.

20. Substr: Use 2 letter codes to indicate the 2 most predominate substrate types present with the most predominate type listed first refer to AH-82-01 for substrate codes.

21. Check for Comments: Record any specific comments here or check ( ) if at bottom of page under NOTES & COMMENTS.

22. Total flow: Sum total of all flows in flow column. If two pages are used record total of both pages.

23. Meter type & No.: Record type of velocity meter used, and serial number.

24. Notes & Comments: Intended for whole page comments as well as comments pertaining to checks (s) within the form.

Intragravel/Surface Water Measurements (AH-83-FHU-4)

Explanation of Form:

1. File No.: Enter file number.

2. Personnel: Enter names or initials of person taking and recording data.

3. Location: Slough # or tributary name (This study is being done primarily in the sloughs at this time. It may be expanded to include tributaries in the future. If there is more than one sampling site in a slough/tributary, it will be indicated in the site column).

4. Date: Year-month-day.

5. Time: 24 hour (military) time.

6. R.M.: River mile.

7. T.R.M.: Tributary river mile (use only for sampling in a tributary, leave blank if sampling was done in a slough).

8. G.C.: Geographic Code - 12 digit code.

9. Barometric Pressure: In inches of mercury.

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

Items in box labeled for AH use only, pertain to the whole page. They do not need to be computerized.

11. D.O. Calibration: Fill in as you calibrate the meter in the field.

12. Measurement method/meter number: For each measurement (conductivity, pH, dissolved oxygen, temperature) note meter number or wet chemistry, whichever method is used.

13. Site: A...Z for each slough, only one space is needed. There will probably not be more than one or two sites per slough.

14. Standpipe #: Standpipes are to be numbered L (left bank), R (right bank) or M (mid stream) followed by a number (1...n) starting with the pipe furthest downstream and working upstream at each site enter 0 before the first 9 digits (ie., 01, 02 etc).

Water Quality measurements (pH, water temperature, dissolved oxygen, % oxygen saturation, and conductivity) are repeated for the intragravel and surface measurements. The water depth for each is standardized and need not be recorded.

15 & 25 pH: To be measured with DigiSense portable field pH meter or Hach wet chemistry.

16 & 22 Water Temperature: °C to the nearest tenth of a degree, to be measured with Y.S.I. 57 D.O./Temp meter or Y.S.I. 33 S.C.T. meter.

17 & 23 Dissolved Oxygen (mg/l): To be measured with the Y.S.I 57 D.O./Temp meter or the modified Hach wet chemistry method.

18 & 24 % Oxygen Saturation: Upon return to the office, percent oxygen saturation is determined from a nomograph, based on measured water temperature (°C), dissolved oxygen (mg/l) and barometric pressure (inches of mercury).

19 & 25 Conductivity (umhos/cm) Field: Conductivity measured in the field with the Y.S.I. 33 S.C.T. meter. Conductivities are reported in micromhos/cm.

20 & 26 Conductivity (umhos/cm) adjusted: The standard reporting format for conductivity measurements is umhos/cm (micro umhos per centimeter) at 25°C. If the conductivity meter isn't automatically temperature compensated, such as with the Y.S.I. 33 S-C-T or the Beckman model RC-16C, the meter reading must be corrected to 25°C using the following formula.

When the sample conductivity is measured, conductivity at 25°C is

$$K = \frac{(Km)\ (C)}{1 + 0.0191\ (T-25)}$$

Where: K = conductivity (umhos/cm)

Km = measured conductivity in umhos/cm at tC

Note: If the conductivity reading is not in umhos/cm, multiply the numerator by 1,000,000.

C = cell constant, cm^{-1} (YSI 33 S-C-T meter = 5.00, Beckman RC-16C = 0.1)
(If the cell constant for a specific meter isn't stated in the instruction manual for that meter, it must be calculated as described in Standard Methods).

T = Temperature of measurement (°C)

Note: Terri Cassady, Y.S.I. Scientific Division Sales states that the YSI 33.S.CT meter internally compensates for the cell constant during conductivity measurements. When correcting for temperature, use 1 as the cell constant not 5. This is not stated in the manual.

27. Notes and Comments: Record any information that will aid in interpretation of data. Be sure to indicate line number if specific to a particular line.

Water Quality Field Form (AH-83-IFE-01)

1. File No.: Indicates file location.

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

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

4. Date: Enter two numbers each to indicate year, month and day for every recorded staff gage reading.

5. Location: Enter the study site location (i.e. Slough 8A).

6. Site: Enter the location of the sampling (i.e. Slough 8A discharge transect mouth, head, etc.).

7. Time: Enter military time (24 hour clock).

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

9. Gage No.: Record the established identification number for the gage.

10. Gage Height: Record the gage reading to the nearest 0.01 foot, "Dry" or "Subm" will be recorded when a gage is dewatered or submerged, respectively.

11. Meter Type: Record the type of meter used to obtain the water quality information.

12. No: Record the meter serial number used to obtain the water quality information.

13. River Mile: Enter the appropriate river mile for the study location as determined for the most downstream point of the study location.

14. Tributary River Mile (T.R.M.): Enter the number of miles from the tributary mouth to the sampling location.

15. Distance: Record the distance from the head pin to indicate the location of the measurement. Circle LB if the left bank head pin was used or RB if the right bank head pin is used as the zero point on the transit.

16. Sample Depth: Enter the depth of water the probe was inserted when obtaining the data.

17. Mercury Thermometer: Record both the water and air temperature utilizing a calibrated mecury thermometer.

18. Hydrolab: Record water temperature, pH, D.O., and specific conductance (meter) under the appropriate column from the meter read out. If the hydrolab meter serial number begins with 08, the specific conductance value obtain from the meter readout must be adjusted by the conductivity correction program and the adjusted value inserted in the "adjusted" column.

19. Line Comments: Enter comments pertaining to values recorded in the same line.

20. Whole Page Comments: Enter general comments that may help in interpreting the data.

Discharge Data Summary - Office Form (AH-82-IFE-02)

1. File No.: Indicates file location.

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

3. Location: Enter the study site location (i.e. Slough 8A).

4. Sampling Site: Enter the location of the sample site (i.e. Slough 8A discharge site, mouth, head, etc.).

5. R.M.: Enter river mile for the study location as determined for the most downstream point of the study location.

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

7. Tributary River Mile (T.R.M.): Enter the distance from the tributary mouth to the sampling location.

8. Date: Enter the date as year, month and day (i.e. 821201)

9. Gage No.: Record the established identification number of the gage at site of data collection.

10. Gage Height: Enter the gage height (to the nearest one-hundredth of a foot), observed at the beginning and end of sampling.

11. Discharge: Enter the measured total discharge.

12. Meter Type: Enter the type of meter used to obtain the measurements (i.e. Price AA, Pygmy).

13. Comments: Enter the comments pertaining to the specific line.

14. Additional Comments: Enter general comments or comments pertaining to a specific line. Enter the line number also.

Staff Gage Elevation Summary - Office Form (AH-83-IFE-03)

1. File No.: Indicates file location.

2. Location: Enter the study site location (i.e. Slough 8A).

3. Sampling Site: Enter the location of the sample site (i.e. Slough 8A discharge site, mouth, head, etc.).

4. R.M.: Enter river mile for the study location as determined for the most downstream portion of the study location.

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

6. Tributary River Mile (T.R.M.): Enter the distance from the tributary mouth to the sampling location.

7. Date: Enter the date as year, month and day (i.e. 821201)

8. Gage No.: Record the established identification number of the gage at site of data collection.

9. True Elevation: Enter the true elevation of the top of the gage as determined from a project datum.

10. Compass Heading from TBM: Enter the true north compass heading as determined from the temporary benchmark (TBM) established for the gage site.

11. Distance from TBM: Enter the measured distance from the temporary bench mark (TBM).

12. T.B.M. I.D.: Enter the established name identifying the TBM used for determining the true elevation of the gage.

13. Comments: Enter comments and line number relevant to describing any circumstances affecting the gage elevation, TBM location, etc.

FY 83 ADDENDUM TO APPENDIX V - ELECTROSHOCKING INSTRUCTIONS[1]

A 20 ft. by 4½ flat bottom aluminum river boat powered by a 75 hp outboard jet and 15 hp outboard prop kicker will be modified for electrofishing operations on the lower river. The power source for the electrofishing apparatus (and possible supplemental lighting equipment for night shocking) will be a four cycle, 3.5 kilowatt, 120/240 volt, 60 HZ A.C. Homlite Voltamatic genator. Voltage and amperage regulation from the power source to the water will be through a Coffelt Variable Voltage Pulsator model VVP-15 and two Coffelt models VVP-3E. Both models are designed to supply A.C., D.C., or pulse output voltages. The output voltages from the VVP-15 can be varied continuously from 0 to 600 volts for all outputs (A.C., D.C., or pulse output voltages. The output voltages from the VVP-15 can be varied continuously from 0 to 600 volts for all outputs (A.C., D.C., Pulsed D.C. and 0 referenced A.C. Pulsed), for the VVP-3E the output voltages can be varied from 0 to 300 volts for all outputs (A.C., D.C. and Pulsed D.C., and Pulsed A.C.). The VVP-15 incorporates a 20 to 80 percent adjustable DC pulse width. For further specifications, refer to the Appendix V. The proper current type, voltage, amperage and electrod arrangement for efficient capture of fish will vary for different species of fish and according to water quality parameters such as water temperature, conductivity, depth and turbidity.

Electric current will be applied to the water through either single and dual anode system, with the cathode comprising the boat surface in contact with the water. When a single anode is used, a single dip netting pole will be used both as the anode and as a dip net. The single anode design will be utilized when probing in deep pools and confinged areas and in searching for specific species. Under situations when a dual anode system will be tuilized, each anode will be suspended into the water using a standard electrofishing boom design. A standard dip net will be used to capture stunned fish.

[1]Addendum to FY 82 Appendix V

Due to the high voltages and potential hazards associated with electrofishing, several safety features will be designed into each electrofishing boat. Each boat will be fitted with 36-40" high non-conductive coated railing enclosing a non-skid platform. Electrical units will be placed in covered boxes designed to prevent water from entering the unit and thereby preventing shour-curcuting. In addition, a safety circuit incorporating foot fedals and fall off switches will be included in the circuitry. All individuals working on the electrofish boat will wear hip boots, life preserver and rubber gloves and be trained in C.P.R. and basis first aid techniques.

Operational Procedures

1. The power source for electrofishing will be supplied by a 3.5 kilowatt Homelite Voltmatic generator. The four-cycle engine uses regular unmixed gasoline. The crank case reservoir oil (30 wt. automotive) must be checked daily and should be changed after the initial 10 hour break-in period and every 25 hours thereafter.

2. For optimum electrofising success, a Coffelt electroshocker (model VVP-15) will be used to regulate the output amperage, voltage, frequency and current type. A basic knowledge of electrical terms and uses as they relate to electrofishing will result in better understanding of the effects that occur with adjustment of the power output. The basic unit of electric charge is the coulomb and the rate at which this charge moves through a circuit is the amperage. The volt or potential difference generates the energy (joules) needed to move an electric charge through the circuit. The amount of voltage required to move X amount of current through a circuit will vary with water temperature, water conductivity, and the circuit resistance. The current types available as output are alternating current (A.C.), direct current (D.C.) and pulsed A.C. and D.C. The literature suggests that pulsed D.C. has the best effective capture range with the least amount of physiological

harm to the fish. Fish that enter a D.C. field exhibit forced swimming towards the anode electrode.

3) A 20 foot riverboat with a 90 hp outboard will be used to electrofish. A non-conductive safety railing will be attached to the bow of the boat. Two electrode systems will be available and selection will be predicated by the type of habitat being studied.

A. Mobile electrode system (MES) - The MES utilizes the boat as a cathode and a dipnet as the anode. This electrode system will be used in shallow water or in areas of restricted maneuverability. The disadvantage of the MES is the relatively small area effectively shocked.

B. The stationary electrode system (SES) - The SES will have two retractable booms which will allow the anode to be extended 10 feet in front of the bow. The boat itself or braided steel wire trailing from the stern will be the cathode. The SES should be used in deeper waters and areas of unrestricted maneuverability. The advantage will be an increase in area that is effectively shocked.

Safety Precautions

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

1. A minimum of two persons is required to safely and efficiently conduct electrofishing, provided the control box can be easily monitored by the boat operator. For two 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. One 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. The metal railing should be 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 to be worn as an added safety measure.

6. All personnel will wear life jackets or other adequate floatation devices.

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 member of the crew should have completed a recognized first aid course.

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 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.

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. Quick action will increase the chance of resuscitation. Do not endanger yourself attempting to rescue someone with the power on.

If the victim is not breathing, begin artificial resuscitation at once. Mouth-to-mouth 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 resuscitation 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 resuscitation.

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 resuscitator - 15 compressions, two breaths or two resuscitators - one breath every fifth compression.

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 ON BOARD THE SHOCKING BOAT AT ALL TIMES!!!!!