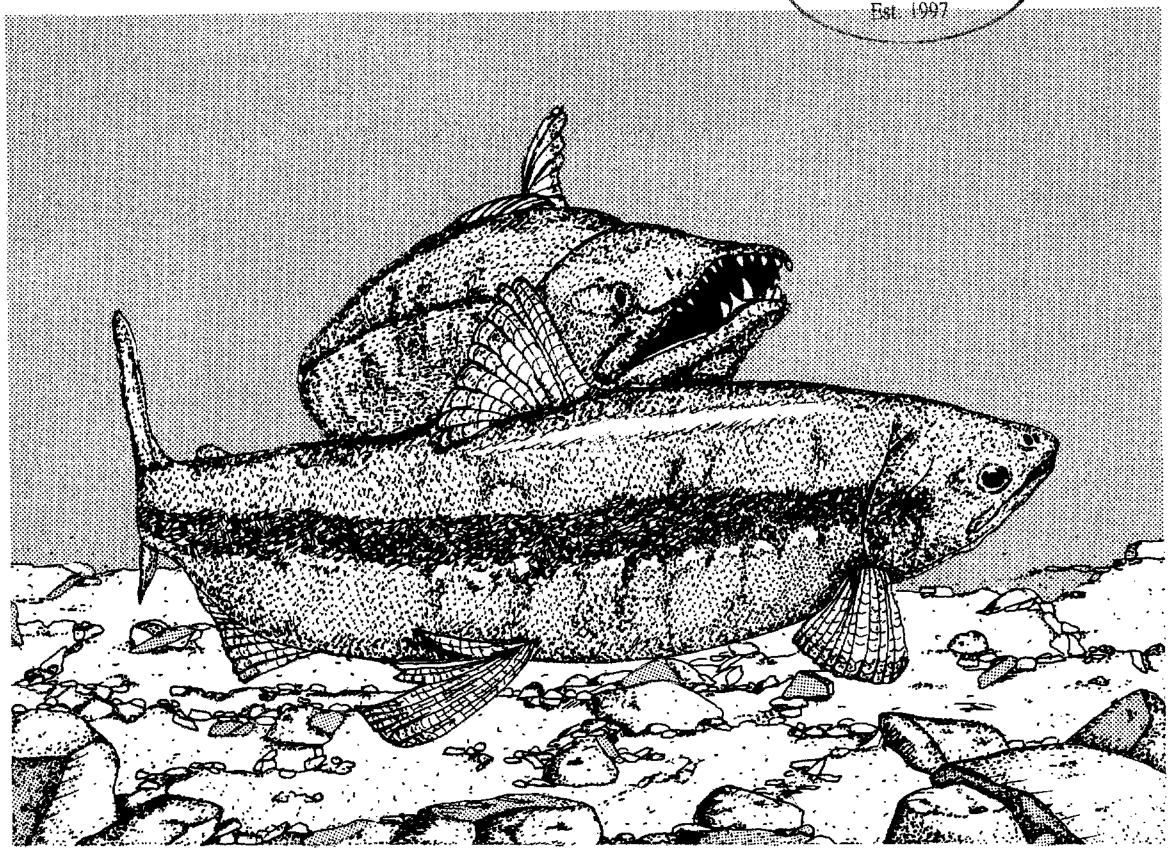

ALASKA
DEPARTMENT OF FISH AND GAME

SUSITNA HYDRO AQUATIC STUDIES
PHASE II BASIC DATA REPORT

Volume 3. Resident and Juvenile Anadromous Fish Studies on the Susitna River Below Devil Canyon, 1982

-by-

ALASKA DEPARTMENT OF FISH AND GAME
Susitna Hydro Aquatic Studies
2207 Spenard Road
Anchorage, Alaska 99503
1983

PREFACE

This report is part of a five volume presentation of the fisheries, aquatic habitat, and instream flow data collected by the Alaska Department of Fish and Game (ADF&G) Susitna Hydroelectric (Su Hydro) Feasibility Aquatic Studies Program during the 1981-82 (October-May) ice-covered and 1982 open water (May-October) seasons. It is one of a series of reports prepared for the Alaska Power Authority (APA) and its principal contractor, Acres American (Acres) by the ADF&G and other contractors to evaluate the feasibility of the proposed Susitna Hydroelectric Project. This report is intended for data transmittal to other Susitna Hydroelectric Feasibility Study participants. A preliminary draft was circulated for review in February.

The topics discussed in Volumes Two through Five are illustrated in Figure A. Volume One presents a synopsis of the information contained in the other four volumes. Volume Two also includes a comparison of 1981 and 1982 adult anadromous fisheries data.

An ADF&G data analysis report will include an analysis of the pre-project fishery and habitat relationships derived from this and related reports prepared by other study participants. A review draft will be circulated to study participants on May 1, 1983. The final report will be submitted to the APA on June 30, 1983 for formal distribution to study participants, state and federal agencies, and the public. Also scheduled for completion on June 30, 1983 is the first draft of the ADF&G 1982-83 ice-covered season basic data report. It will include a presentation of 1982-83 incubation and other fishery and habitat data.

These and other ADF&G reports (1974, 1976, 1977, 1978, 1979, 1981a, b, c, d, e, f, 1982) and information reported by others will be summarized and analyzed by the Arctic Environmental Information and Data Center (AEIDC) to evaluate post-project conditions. Woodward

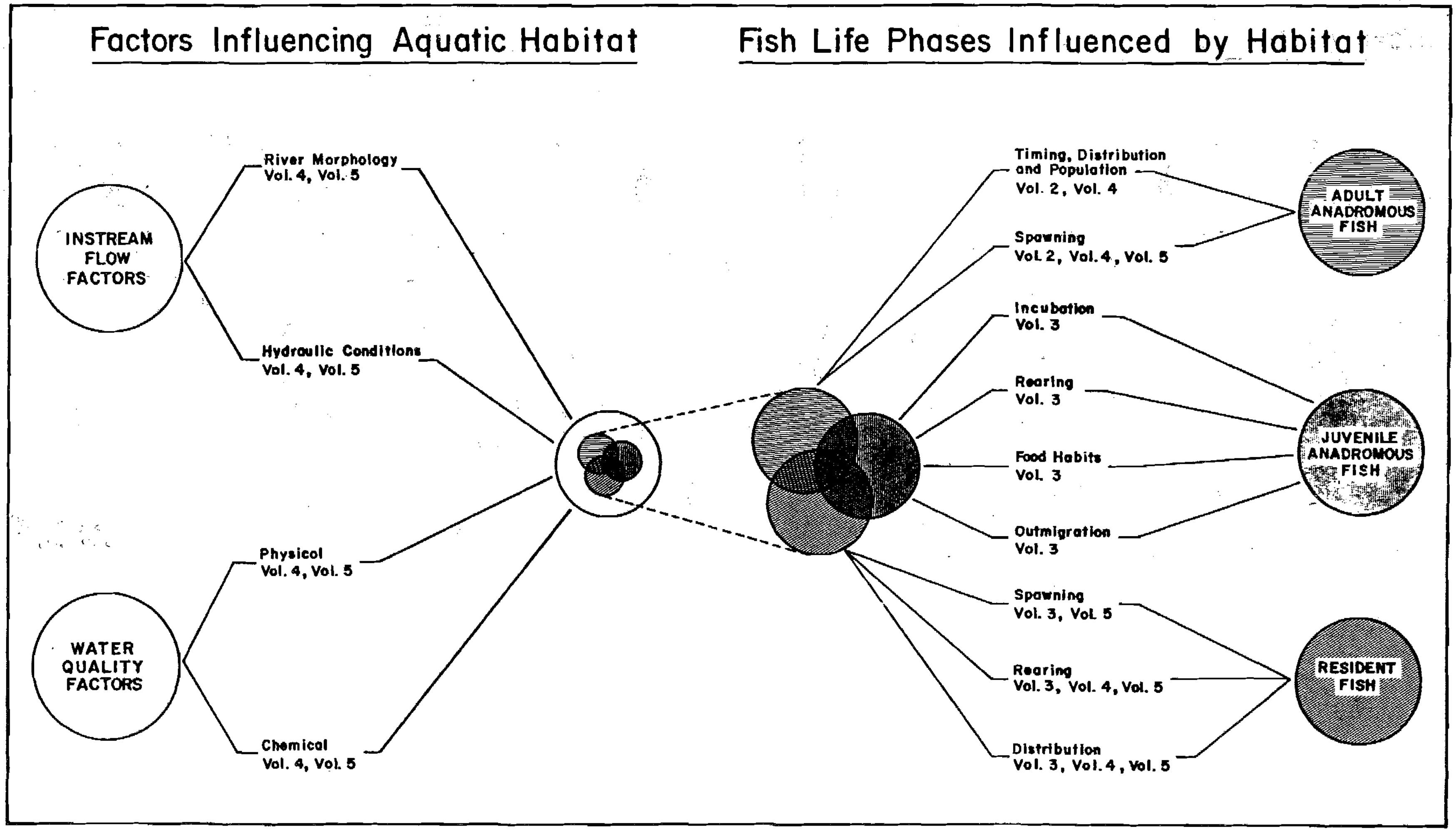

Figure A. Program elements presented in Volumes Two through Five.

Clyde Consultants will, in turn, use this information to support their preparation of the Federal Energy Regulatory Commission License Application for Acres.

The five year (Acres 1980) ADF&G Su Hydro Aquatic Studies program was initiated in November, 1980. It is subdivided into three study sections: Adult Anadromous Fish Studies (AA), Resident and Juvenile Anadromous Fish Studies (RJ), and Aquatic Habitat and Instream Flow Studies (AH).

Specific objectives of the three sections are:

1. AA - determine the seasonal distribution and relative abundance of adult anadromous fish populations produced within the study area (Figure B);

2. RJ - determine the seasonal distribution and relative abundance of selected resident and juvenile anadromous fish populations within the study area; and

3. AH - characterize the seasonal habitat requirements of selected anadromous and resident fish species within the study area and the relationship between the availability of these habitat conditions and the mainstem discharge of the Susitna River.

The 1982 ADF&G portion (Figures C and D) of the overall feasibility project study area (Figure B) was limited to the mainstem Susitna River and the mouths of major tributaries. Portions of tributaries which will be inundated by the proposed impoundments were also evaluated. Descriptions of study sites are presented in each of these volumes including the ADF&G reports (ADF&G 1981a, b, c, d, e, f).

The Susitna River is approximately 275 miles long from its sources in the Alaska Mountain Range to its point of discharge into Cook Inlet. Its drainage encompasses an area of 19,400 square miles. The mainstem

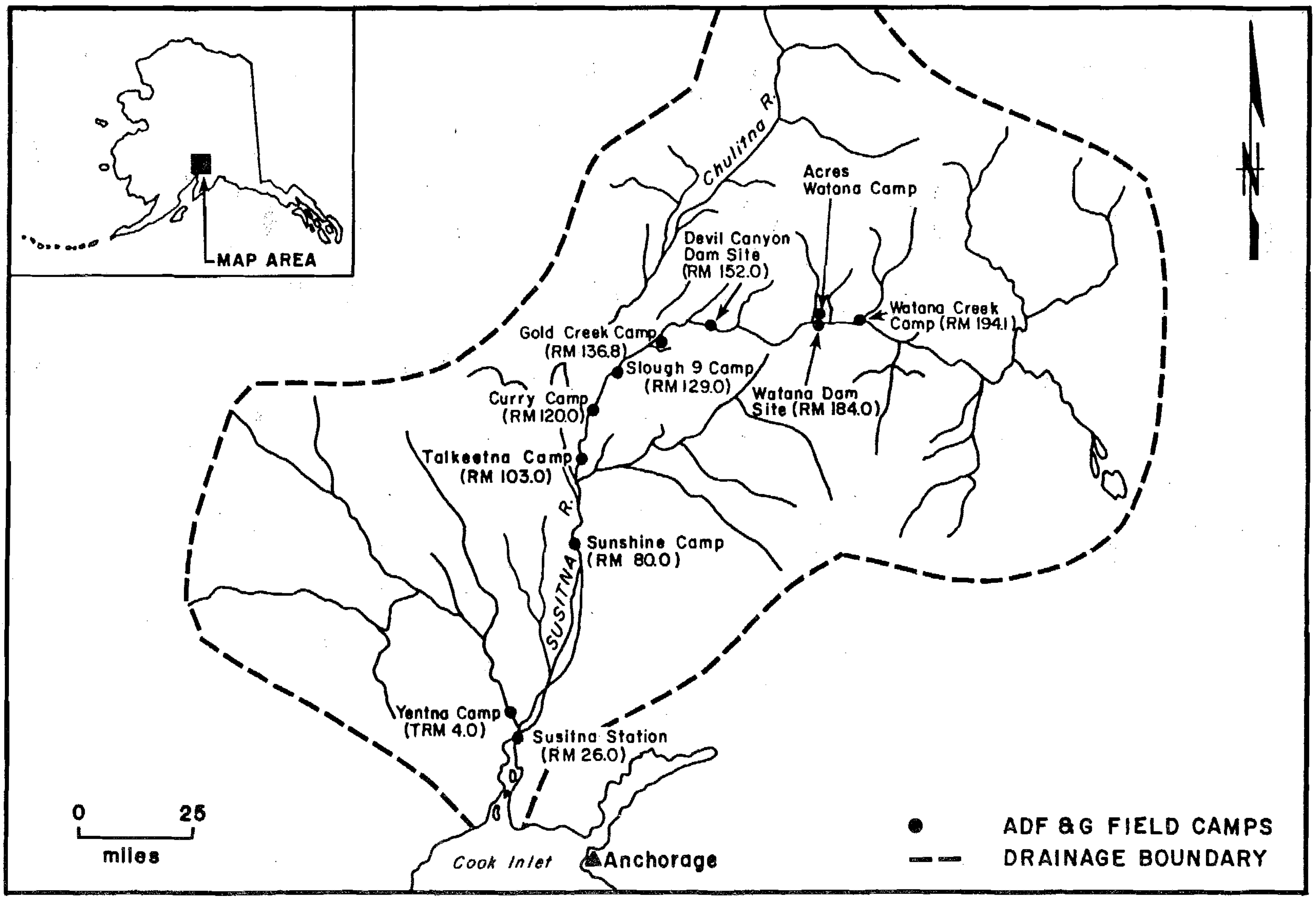

Figure B. Susitna River drainage basin.

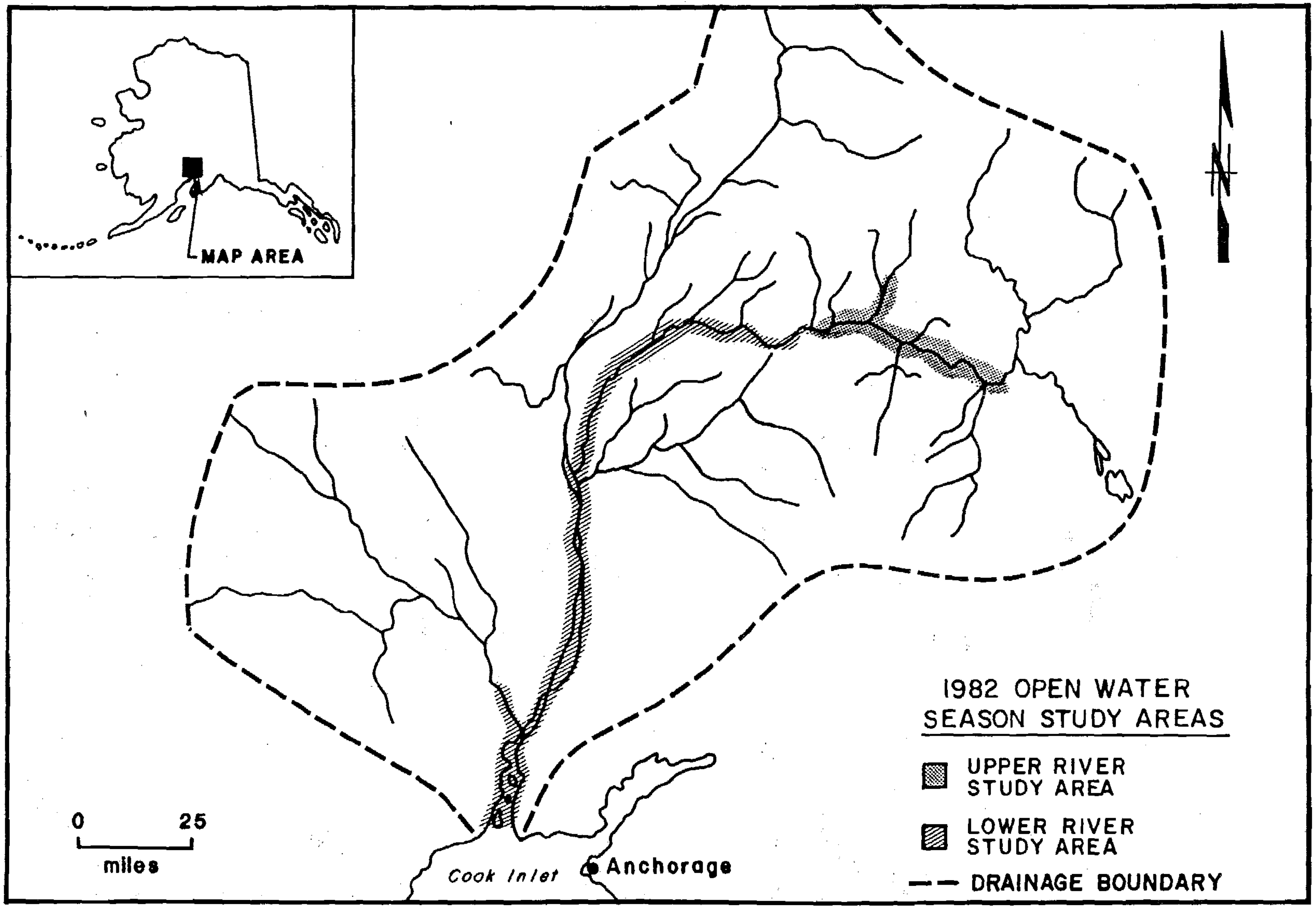

Figure C. 1982 ADF&G open water season (May through October) study area.

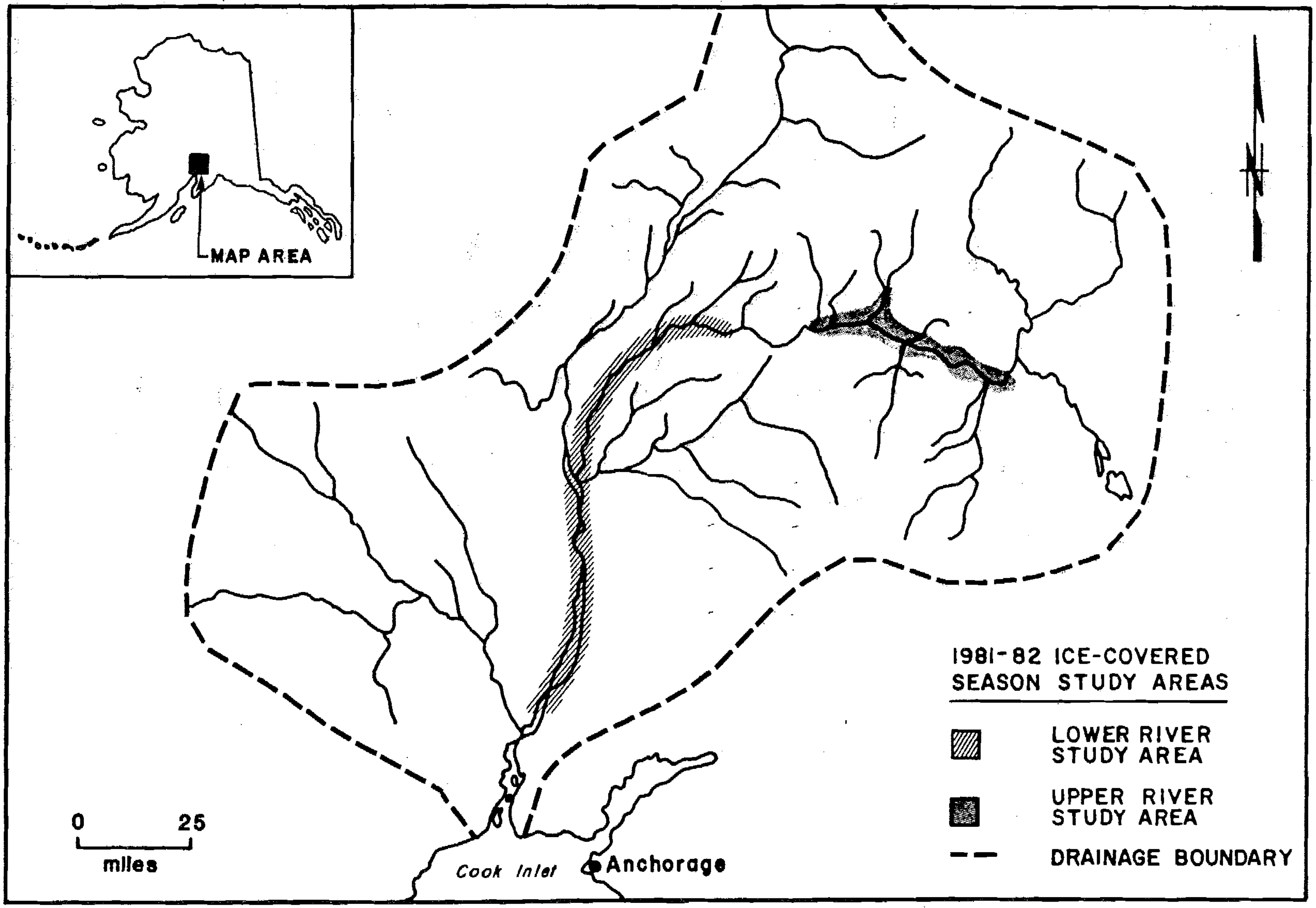

Figure D. 1981-82 ADF&G ice-covered season (October through May) study area.

and major tributaries of the Susitna River, including the Chulitna, Talkeetna and Yentna rivers, originate in glaciers and carry a heavy load of glacial flour during the ice-free months (approximately May through October). There are many smaller tributaries which are perennially clear.

Questions concerning these reports should be directed to:

Thomas W. Trent
Aquatic Studies Coordinator
Alaska Department of Fish & Game
Su Hydro Aquatic Studies Program
2207 Spenard Road
Anchorage, Alaska 99503
Telephone (907) 274-7583

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1. OBJECTIVES

1.1 Distribution and Abundance Studies

The development of hydroelectric power has frequently been associated with downstream changes on the aquatic environment. These changes include effects on the amount of water available for fish, (the "instream flow" available), changes in water quality, and corresponding changes to all components of the aquatic communities.

The resident and juvenile anadromous species have been studied during the 1981 and 1982 field season with two major goals to be accomplished:

1. Provide an inventory of the baseline resources that may be affected by the development of the Susitna hydroelectric project.

2. Determine which factors are limiting their freshwater survival and production, with emphasis on those factors which may be influenced by the development of the hydroelectric projects.

This report provides baseline data on the distribution and relative abundance of the resident and juvenile anadromous species, primarily directed at meeting the first goal. This data base was also collected using study designs that would further address the second goal. Further data from this study are presented in the habitat report (Vol. 4) as it contributes to our understanding of the response of the fish populations to the variable habitat conditions that exist in the Susitna River.

To accomplish these goals, some intermediate objectives of these studies were established. These include the following:

A. Determine the geographical and seasonal distribution and relative abundance of all resident and juvenile anadromous species.

B. Examine a wide array of habitat conditions to document the presence or absence of species in areas not previously surveyed.

C. Collect baseline information on resident species such as age distribution, length distribution, growth, sex ratio, migration and movement, spawning, and rearing.

D. Collect baseline information for juvenile anadromous species on age distribution, length distribution, growth, rearing areas, and outmigration.

The studies were confined primarily to the reach of the Susitna River above the Chulitna confluence, where the major effects of the project are anticipated. Representative sites in the reach of river below the confluence were also studied.

1.2 Emergence and Outmigration Studies

Development of hydroelectric power has been associated with changes in the downstream aquatic environment, often creating deleterious effects on downstream fisheries. In order to predict adverse or beneficial effects of the changes that are associated with the development of large scale hydroelectric power on the Susitna River, an inventory of the resources below the project and development of an understanding of the critical portions of the life cycle of the fish is necessary. One important factor is the rate of development of the embryos and subsequent emergence and outmigration. It is known from other systems that this portion of the life cycle is critical to the well being of the populations and small changes in timing or in other associated environmental parameters may cause major changes in the survival of these species.

To evaluate the potential impacts associated with the Susitna hydroelectric project and to allow the development of mitigation strategies, certain types of information are required. The following goals of the emergence and outmigration studies of the resident and juvenile anadromous program should meet this information requirement.

1. Develop an understanding of the emergence and outmigration of juvenile salmon and selected resident species in the Susitna River reaches which may be affected by the development of hydroelectric power.

2. Determine which physiochemical factors of the Susitna River are critical determinants of the timing of emergence and outmigration in the various habitat types and how alteration of these factors might affect survival of the species being evaluated.

This report provides baseline data on the temporal movement of outmigrating species and preliminary information on emergence rates. Baseline condition of the species collected, including size, age, and other important factors are reported. Specific objectives addressed in this baseline data report are as follow:

A. Determine the timing of downstream migration of juvenile salmon from the reach of the Susitna River above the Chulitna confluence.

B. Provide basic biological data including species, age class, and length to determine the relative condition and stage of development of the species collected.

C. Provide preliminary baseline data for determining the rates of embryonic development and emergence times of the early life stages of Susitna River salmon.

D. Provide baseline data for determining how development of incubation rates, emergence times and outmigration timing correlate with natural changes in environmental conditions measured.

E. Provide descriptions of the variability of the biological development and outmigration behavior among the different species and within a given species.

These data, and their subsequent analysis in the Fish and Habitat Relationships report, will provide the basis for meeting the major goals of the emergence and outmigration studies.

1.3 Food Habits of Juvenile Salmon

A major factor influencing the distribution and abundance of rearing juvenile salmon is the food base supporting these fish. Historically, hydroelectric projects are accompanied by changes in discharge, water temperature and water quality of a river system. These changes often affect the system's benthic invertebrate community (Ward and Stanford, 1979). In the Susitna River, primary questions regarding the juvenile salmonid populations are: (1) are existing populations of juvenile salmon limited by the availability of rearing areas? and, (2) does the naturally occurring variability of environmental parameters and benthic invertebrate communities suggest that dam-induced changes in these parameters will affect the juvenile salmonid populations in the system? The goals of the food habits study are to enlarge our understanding of the rearing properties of the system, and to determine which aspects may be highly sensitive to change.

This preliminary investigation of the salmonid population's relationship to their food base has two major objectives. The first is to describe the food habits of the juvenile salmon present at each site. The second objective is to qualitatively describe invertebrate communities at different habitat sites, and to make comparisons between those communities. From this it is hoped that environmental variability between sites can be related to observed differences in invertebrate community structure. Corollary to this, because of the large differences in water quality, morphology, and hydraulic properties present at the habitats sampled, the biological information obtained will provide insights into whether changes in hydraulic parameters can be expected to provide a large change in the composition of the invertebrate communities.

The mid-summer (July 1, 1982) starting date for this investigation limited the scope of the study. Rearing of sockeye salmon and of certain age classes of chinook salmon could not be effectively studied because the majority of them had outmigrated by the time sampling began. Similarly, the limited freshwater rearing of chum salmon could not be effectively studied. Investigation of these age classes and species will begin during the spring of 1983.

2. METHODS

2.1 Distribution and Abundance Studies

2.1.1 Boat Electrofishing

A boat-mounted electrofishing unit was used to sample resident fish populations in the Susitna River between Cook Inlet and Devil Canyon from ice-out to freeze-up, 1982 (Plate 3-2-1). Two additional electrofishing boats assisted in the sampling of resident fish populations during mainstem salmon spawning surveys conducted in August and September.

A wide variety of sites were sampled by electrofishing crews during 1982. These included tributary, slough, side channel, and mainstem sites on the Susitna River between RM 7.2 and RM 150.1 (Figure 3-2-1). Seventeen Designated Fish Habitat (DFH) sites were sampled twice monthly with boat-mounted electrofishing gear during the ice free months (Appendix Table 3-A-1). During periods of low mainstem flows, however, many of the DFH sites were inaccessible by boat and therefore could not be sampled. Normally only backwater areas or mixing areas were sampled at these sites.

In addition to the DFH sites, a large number of Selected Fish Habitat (SFH) sites in the mainstem, at sloughs, and at mouths of tributaries were also sampled with boat electrofishing gear (Appendix Table 3-A-2). Some of these SFH sites were sampled monthly in order to document

Plate 3-2-1. Electrofishing with a boat mounted electroshocking unit at Mainstem Susitna-gravel bar opposite Montana Creek (RM 78.0).

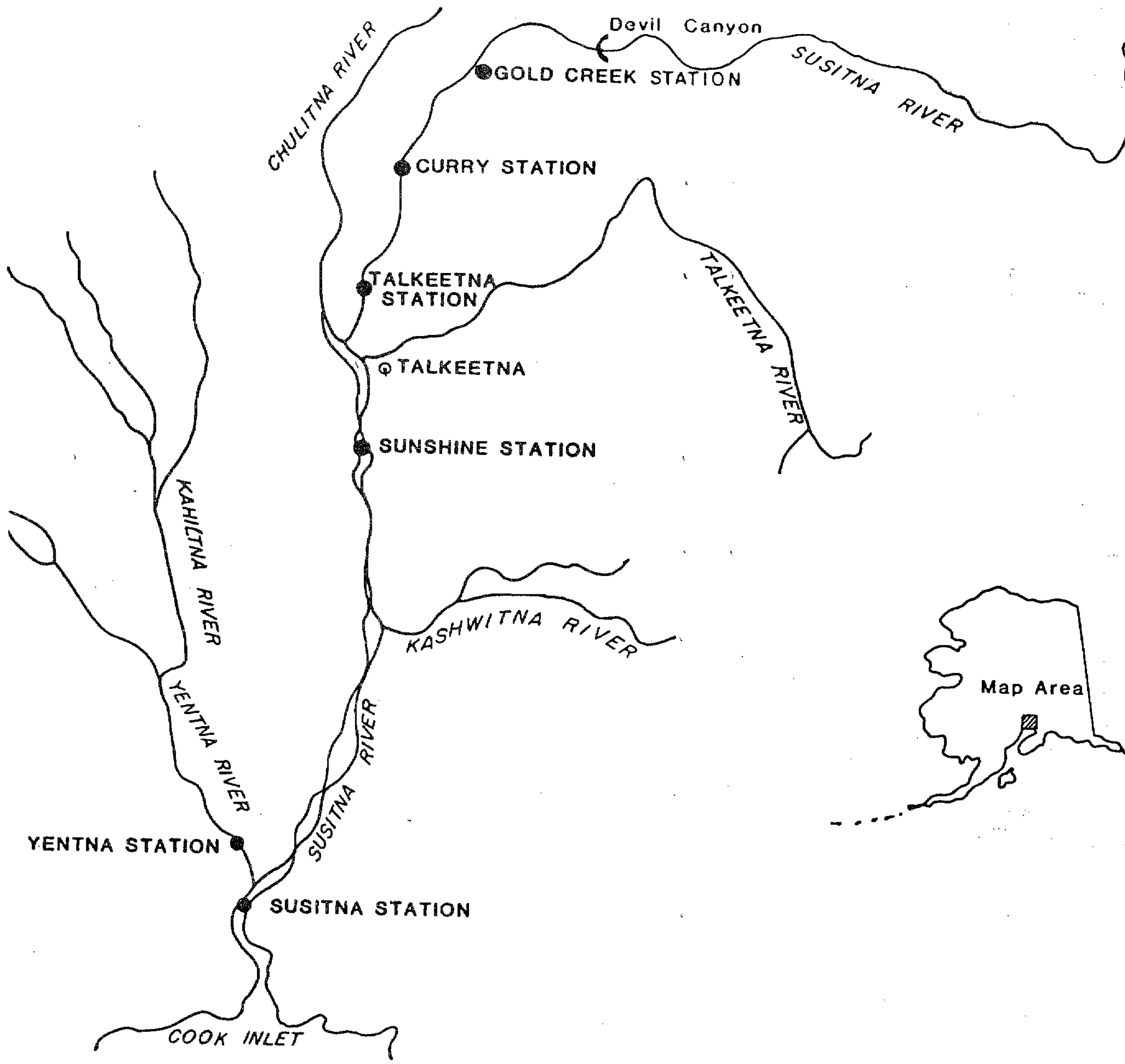


Figure 3-2-1. Map of the Susitna River between Cook Inlet and Devil Canyon showing major tributaries and field stations, 1982.

seasonal changes in fish populations. However, most of the SFH sites were sampled only once or possibly several times at random intervals during the course of the season.

The length of time spent electrofishing a site ranged from one minute to 75 minutes. The area of sites electrofished also varied tremendously; some sites were fished for a distance of 20 yards while at other sites, drifts ranged in length up to several miles. A site often encompassed a variety of fish habitats with varying substrates, water velocities, turbidities and depths.

These procedures were used to cover the broad range of habitat conditions that exist in this system. Data collected at each site included time fished, distance fished, and catch information. Biological data were collected on all resident fish captured and adult resident fish were tagged as specified in the procedures manual (ADF&G, 1982). Recaptures were also recorded. Initially, burbot (Lota lota L.) were tagged with disc dangler tags and all other resident species were tagged with Floy anchor tags. After observing tag retention on several burbot that were Floy anchor tagged during the 1981 field season and recaptured in May 1982, a decision was made to also tag burbot with Floy anchor tags.

Scales were taken from captured resident fish (humpback and round whitefish, rainbow trout, Arctic grayling, and longnose sucker) during field sampling for age-length analysis according to methods and sampling schedules outlined in the procedures manual (ADF&G, 1982). In addition, scales were taken from juvenile anadromous species. Otoliths were taken from burbot and Dolly Varden mortalities for aging.

At all sites where adult resident fish spawning was documented, habitat measurements of water chemistry, water velocity, and substrate composition were taken as specified in the procedures manual (ADF&G, 1982). A map of the spawning site was also drawn. A representative sample of water temperature and conductivity was also collected from a number of other sites where electrofishing was conducted but no spawning activity was found.

2.1.2 Radio Telemetry

Radio telemetry equipment used in this study was developed by Smith Root Corporation in Vancouver, Washington. Equipment consisted of a low frequency (40 MHz) radio tracking receiver (Model RF-40), a loop antenna (Model LA-40) and ten transmitters (Model P40-500L 3V). This equipment was also used in the study of adult anadromous species (ADFG, 1981a).

The transmitters used were cigar shaped, encapsulated in plastic, and had an external 17.0 centimeter (cm) antenna. The transmitters measured 5.3 cm in length and were 1.6 cm in diameter; each tag weighed approximately 13.0 grams (gm) dry (approximately 2.6 gm in water). The power source for the transmitter was a lithium, three volt battery which provide a life expectancy of approximately 150 days. Different frequencies, between 40.740 and 40.770 MHz, or pulse rates or both were used to differentiate between the ten radio tags. The radio tags were measured to the nearest millimeter (mm) (fork length for rainbow trout and total length for burbot). Scales were taken from the rainbow trout for aging purposes, however, they were regenerative and unreadable. Burbot were tagged with disc dangler tags and rainbow trout were tagged with Floy anchor tags.

A transmitter was then surgically implanted in the coelom using a procedure similar to that described by Ziebell (1973) (Plate 3-2-2). A three to five cm incision was made approximately one cm to the left and parallel to the mid-line of the ventral surface, cutting posteriorly beginning slightly behind the pectoral fins. The radio tag was then inserted with the antenna to the posterior of the fish. Each incision was closed with seven or eight individual silk sutures.

Each fish was then placed into a live box and held upright until it regained equilibrium from the effects of the anesthesia. The fish were held overnight for observation. The sutures were then checked and the implanted transmitter's signal was tested. Each fish was then released in the vicinity of its capture area.

The ten fish were radio tracked by boat, aircraft or snowmobile until April 6, 1982 when only one of the radio tagged fish was located. The batteries from the other nine radio tags implanted in rainbow trout and burbot were assumed to have expired. Aerial tracking proved to be the most efficient method for locating the fish in comparison to the other methods described. Radio tracking by boat was last attempted on October 30 due to the presence of slush ice in the Susitna River.

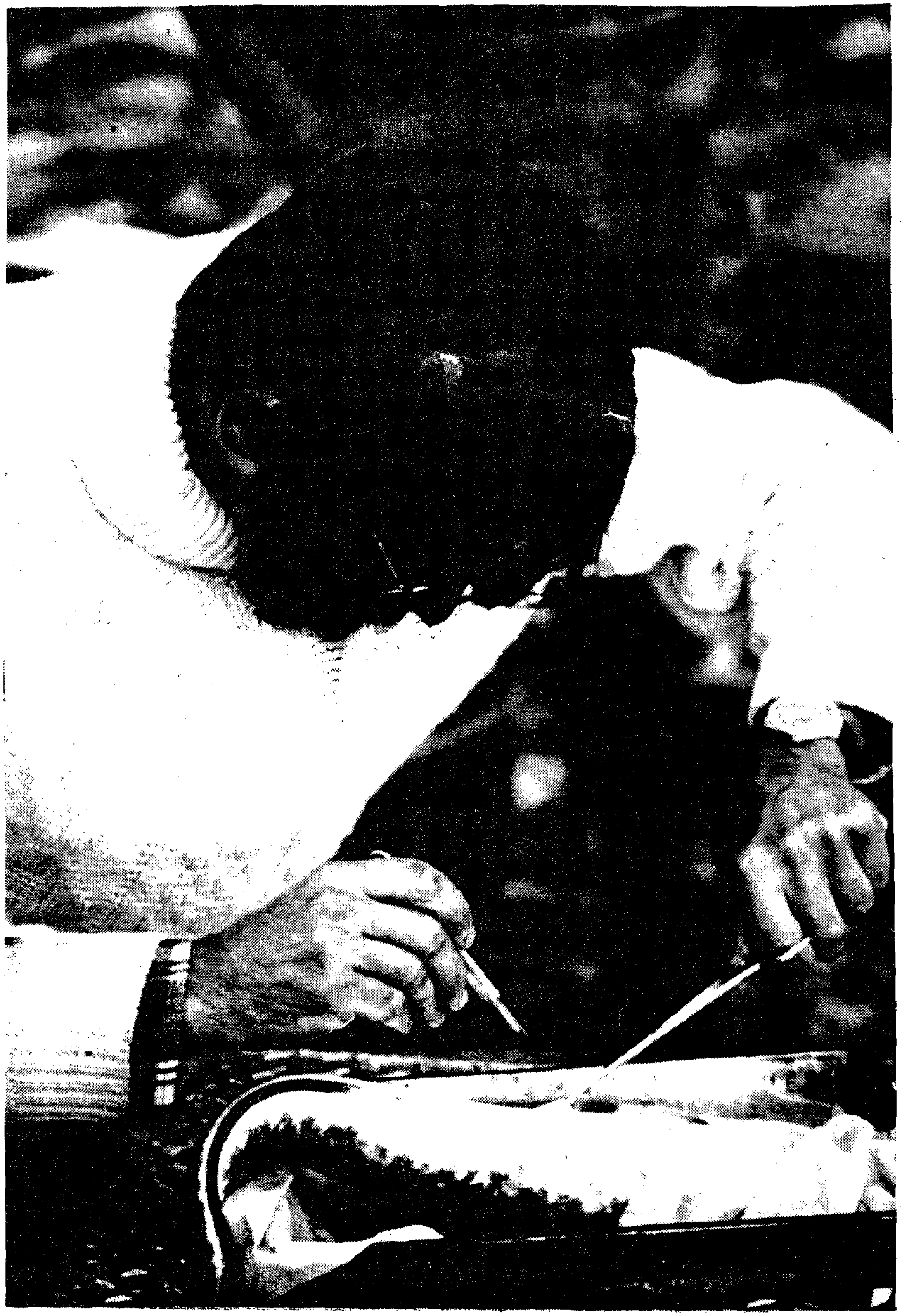


Plate 3-2-2. Surgical implantation of a radio transmitter into a burbot at Mainstem Susitna (RM 84.1).

immersed in water for 48 hours and then tested for signal strength and frequency before they were implanted in fish.

Rainbow trout (Salmo gairdneri Richardson) and burbot were selected as the target resident species for the 1981-1982 radio telemetry studies in the lower river. Based on personal communications with Carl Burger (USFWS), a minimum length was determined for each species to be radio tagged. Three hundred and fifty mm was selected as the minimum fork length for rainbow trout and 550 mm the minimum total length for burbot. It was felt that fish smaller than these minimum sizes would not be able to tolerate the implanted radio tags.

Five burbot and five rainbow trout captured in the Susitna River between RM 76.3 and RM 84.1 from October 3rd to October 15, 1981 were used for telemetry studies (Appendix Table 3-A-3). The rainbow trout and two of the burbot were captured by electrofishing. These fish were held overnight in live boxes for observation, prior to being radio tagged. The following day, each fish was observed to make sure it had fully recovered from being electroshocked and was suitable for radio tagging. The other three burbot were captured on trotlines. The condition of trotline caught fish was assessed as they were captured and those that were healthy and vigorous were selected to be radio tagged that same day. No injured or lethargic fish were radio tagged.

Each fish determined to be suitable for radio tag implantation was placed in a holding box and anesthetized with MS-222 (tricaine methanesulfonate). After the fish were anesthetized, their lengths were

Aerial tracking procedures utilized were identical to methods used and described by Adult Anadromous Investigations (ADF&G, 1981a). Aerial flights were conducted between October 14, 1981 and April 6, 1982. The time period between tracking flights ranged between six and 24 days but was generally done at approximately two week intervals.

Radio tracking flights during October to January 6 were conducted only along the mainstem Susitna River from the mouth of the Deshka River (RM 40.6) to the mouth of the Talkeetna River (RM 97.0). Due to an increase in the number of radio tagged fish that were not located on the December 28 and January 6 flights, the search was expanded on the subsequent flight on January 14th, by beginning at the mouth of the Susitna River (RM 0.0) and radio tracking along the mainstem Susitna River to Talkeetna (RM 97.0).

Subsequent flights after January 6 also included periodically searching five major tributaries of the Susitna River, [Montana Creek (RM 77.0), Kashwitna River (RM 61.0), Deshka River (RM 40.6), Yentna River (RM 28.5), and Alexander River (RM 10.1)], upstream as far as ten miles from their mouths.

Recapture of five of the radio tagged fish was attempted in February and March to recover the soon to be expired radio tags. The fish were first located by aerial tracking. Biologists then traveled to these sites on snowmobiles and set gillnets and trotlines in the vicinity of the radio tagged fish.

Other purposes for conducting the surveys were: to find the maximum range of the radio tags on ground during the winter (observe the effects of ice on the transmitter's signal); to find if the areas where the radio tagged fish were located were areas where large concentrations of resident fish gathered during the winter; to examine the radio tagged fish to observe effects resulting from the surgery to internally implant the radio tags; to examine the habitat where the radio tagged fish were located; and to determine if the radio tagged fish were still alive.

2.1.3 Designated Fish Habitat Studies

The study of resident and juvenile anadromous species at specific habitat sites, begun in June 1982, reflects a change in emphasis from the 1981 resident and juvenile anadromous program. The studies changed from the collection of broad-based distribution and biological data of resident and juvenile anadromous fishes to providing a more detailed study of the aquatic environmental factors affecting their distribution and relative abundance. The sampling design was based upon the hypothesis that the distribution of resident and juvenile anadromous fishes is related to the influence of the mainstem stage on the aquatic environments associated with sloughs and tributaries. The methods used for the 1981-1982 winter sampling were the same as those of the 1980-1981 winter season (ADF&G 1982).

2.1.3.1 Sampling sites and reaches

The specific habitat studies investigated the tributary mouths, sloughs, and limited mainstem sites that were influenced by changes in mainstem Susitna River discharge. These sampling locations were selected based on data collected during 1981 studies which indicated that these sites contained significant resident and juvenile anadromous fish populations or important habitat.

Seventeen Designated Fish Habitat (DFH) sites, ranging from Goose Creek (RM 73.1) to Portage Creek (RM 148.8), were chosen for the study (Figure 3-2-2 and Table 3-2-1). A general description of each site including an aerial photograph is included in Appendix F of Vol. 4. These sites were sampled from June through September (Appendix Table 3-A-1). Two sampling trips, approximately 8 to 9 days in duration, were made each month. Additionally, two DFH sites (Portage Creek mouth and Slough 20) were sampled in early October. Increasing slush ice prevented access to the other sites. The only catch was two burbot caught on a trotline at Portage Creek. This sampling period is not discussed further.

The section of the river sampled was divided into two reaches. The upper reach ranged from the Chulitna River confluence (RM 98.4) to Portage Creek (RM 148.8). The lower reach ranged from Goose Creek (RM 73.1) to the Chulitna River confluence and included the discharge of two major tributaries, the Chulitna River and Talkeetna River.

Additionally, five Selected Fish Habitat (SFH) sites on the Susitna River [Gash Creek and Side Channel (RM 111.5), Mainstem Susitna - Curry

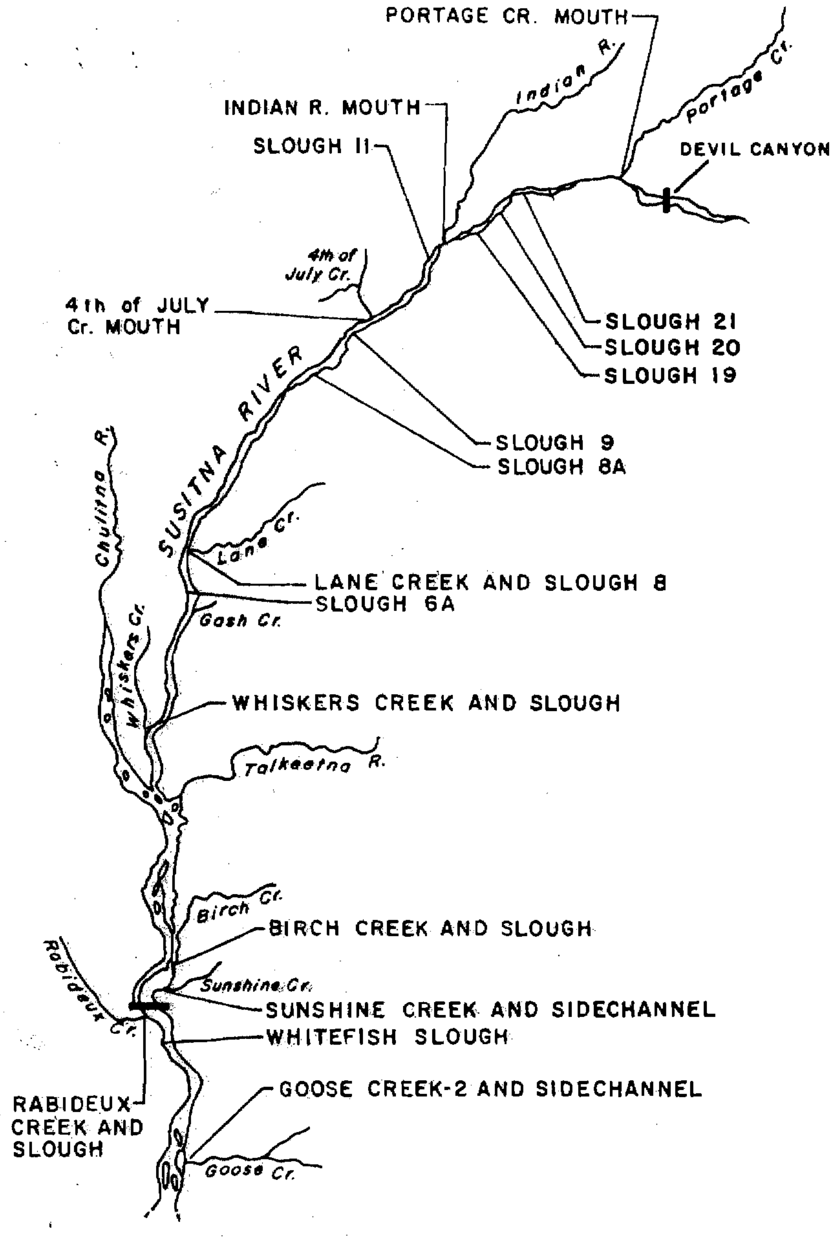


Figure 3-2-2. Map of Designated Fish Habitat (DFH) sites sampled on the Susitna River, June through September, 1982.

Table 3-2-1. Designated Fish Habitat (DFH) sites sampled on the Susitna River, June through October, 1982.

Site	Geographic Code	River Mile
Goose Creek to Chulitna Reach		
Goose Creek 2 and Side Channel	S 23N 04W 30 BBC	73.1
Whitefish Slough	S 23N 05W 01 BBC	78.7
Rabideux Creek and Slough	S 24N 05W 16 AAC	83.1
Sunshine Creek and Side Channel	S 24N 05W 14 AAB	85.7
Birch Creek and Slough	S 25N 05W 25 DCC	88.4
Chulitna to Portage Creek Reach		
Whiskers Creek and Slough	S 26N 05W 03 ADB	101.2
Slough 6A	S 28N 05W 13 CAC	112.3
Lane Creek and Slough 8	S 28N 05W 12 ADD	113.6
Slough 8A	S 30N 03W 16 BCD	125.3
Slough 9	S 30N 03W 16 BDC	129.2
4th of July Creek, Mouth	S 30N 03W 03 DAC	131.1
Slough 11	S 31N 02W 19 DDD	135.3
Indian River, Mouth	S 31N 02W 09 CDA	138.6
Slough 19	S 31N 02W 10 DBB	140.0
Slough 20	S 31N 02W 11 BBC	140.1
Slough 21	S 31N 02W 02 AAA	142.0
Portage Creek, Mouth	S 32N 01W 25 CAC	148.8

(RM 120.7), Slough 10 (RM 133.8), Slough 16 (RM 137.7) and Slough 22 (RM 144.3)] were sampled, but on an irregular basis (Appendix Table 3-A-2).

Also, three SFH sites on upper Indian River were sampled once a month with fry traps from June through September and three SFH sites in upper Portage Creek were sampled once in June and once in July (Appendix Report 3-D-1).

2.1.3.2 Hydraulic Zones

In order to further evaluate the relative biological importance of the DFH sites during the open water season, each site was subdivided into zones based on the hydraulic conditions present and on the water source. The zones were then sampled independently so that statistical comparisons of fish distribution and abundance could be made among zones in order to determine the relative importance of each zone to each species. Changes in the spatial distribution and the surface area of hydraulic zones over time were correlated with corresponding changes in the discharge of the mainstem Susitna, tributary or ground water input. The methods, results, and discussion of this aspect of the study are presented in Volume 4, Part I. Nine sampling zones were defined (Table 3-2-2). The number of hydraulic zones varied at each site depending on the mainstem stage levels, as well as on tributary and slough flows. The distribution of zones at a hypothetical site at three different levels of mainstem discharge is shown in Figure 3-2-3. A further discussion of the hydraulic zone concept is contained in Vol. 4, Part II, Section 2.2. Various habitat parameters were measured in each zone

Table 3-2-2. Description of habitat zones sampled at Designated Fish Habitat Sites on the Susitna River, June through September, 1982.

ZONE CODE	DESCRIPTION
1	Areas with a tributary or groundwater water source, which are not influenced by mainstem stage, and which usually have significant[a] surface water velocity.
2	Areas with a tributary or groundwater water source, which have no appreciable[a] surface water velocity as a result of a hydraulic barrier created at the mouth of a tributary or slough by mainstem stage.
3	Areas of significant surface water velocities, primarily influenced by mainstem, where tributary or slough water mixes with the mainstem water.
4	Areas of significant surface water velocities, which are located in a slough or side channel above a tributary confluence (or in a slough or side channel where no tributary is present), when the slough head is open.
5	Areas of significant water surface velocities, which are located in slough or side channel below a tributary confluence, when the slough head is open.
6	Backwater areas with no appreciable surface water velocities resulting from a hydraulic barrier created by mainstem stage, which occur in a slough or side channel above a tributary confluence (or in a slough or side channel where no tributary is present), when the head of the slough is open.
7	Backwater areas with no appreciable surface water velocities resulting from a hydraulic barrier created by mainstem stage, which occur in a slough or side channel below a tributary confluence, when the head of the slough is open.
8	Backwater areas consisting of mainstem eddies.
9	A pool with no appreciable surface water surface velocities, which is created by a geomorphological feature of a free-flowing zone or from a hydraulic barrier created by a tributary; not created as a result of mainstem stage.

[a] "Significant" and "appreciable" surface water velocities mean a velocity of at least 0.5 ft/sec. However, there are site-specific exceptions to this, based on local morphology.

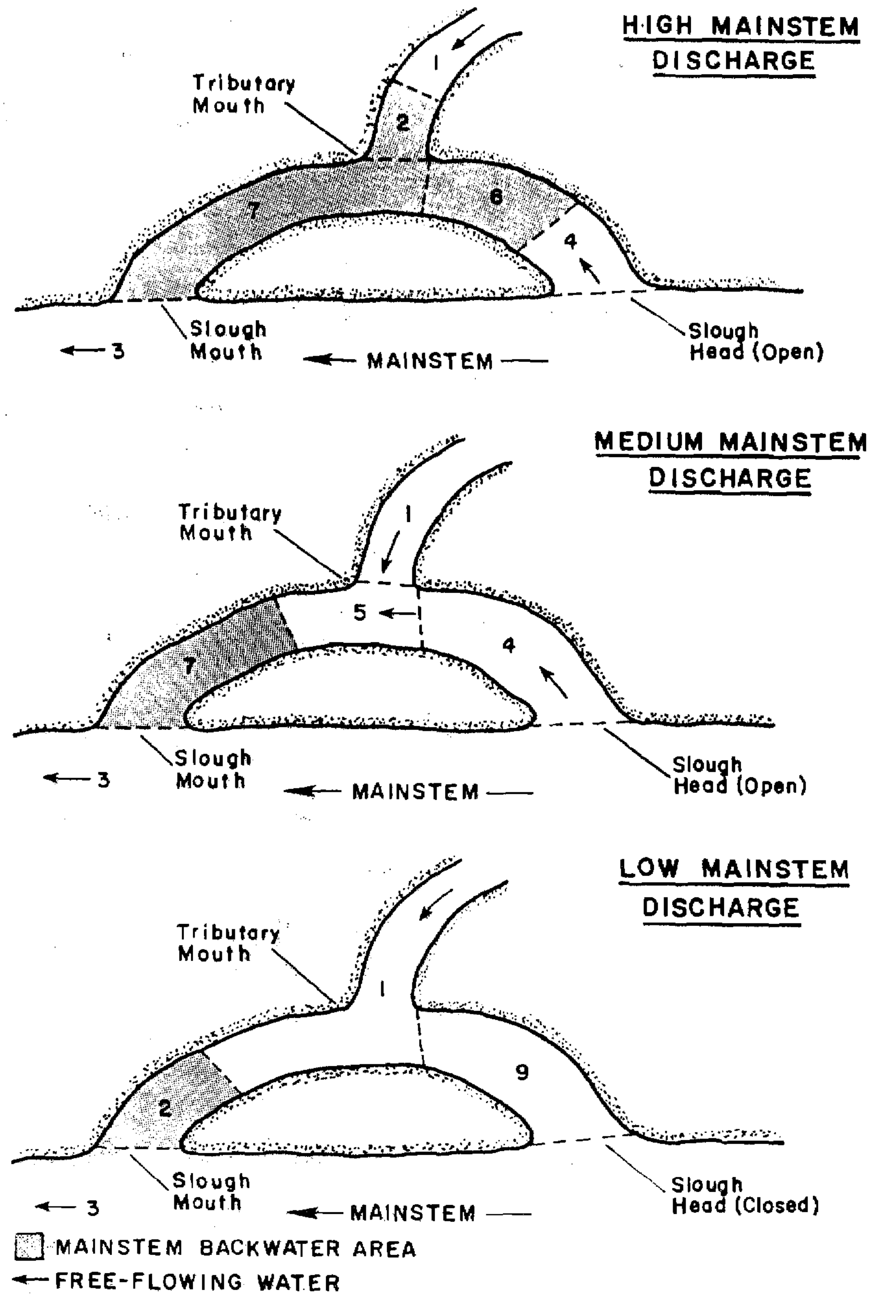


Figure 3-2-3. Hypothetical slough with associated tributary showing hydraulic zones present at three mainstem discharges.

in order to relate fish distribution to habitat variables. The methods, results, and discussion of this phase of the study are presented in Volume 4, Part II.

2.1.3.3 Biological Sampling

Biological sampling at the 17 DFH sites was conducted in two, three, or four of the hydraulic zones present at each site, depending upon conditions. Fisheries sampling gear was classified standard or opportunistic gear. Standard gear consisted of minnow traps, each baited with a tablespoon of salmon roe, and trot lines consisting of six #4 hooks baited with salmon roe, fish flesh and bacon. Generally, five to ten minnow traps were set in each hydraulic zone sampled for a period of three to four hours. (Results of a 24 hour experiment to determine an adequate length of time to fish minnow traps are contained in Appendix Report 3-E-1). Also, one trot line was set for 24 hours in each zone sampled with minnow traps.

Opportunistic gear consisted of beach seines, backpack electrofishing units, dip nets, hoop nets, fish traps, variable mesh gill nets and hook and line and was used to sample the same zones as standard gear whenever conditions permitted their use. Beach seines and electrofishing gear were the most frequently utilized opportunistic gear (Plate 3-2-3 and 3-2-4). Information collected by opportunistic gear was less reproducible than that collected by standard gear, but was useful in observing the relative distribution of fish species not collected by minnow traps or trot lines. Opportunistic gear was essential for collecting chum and

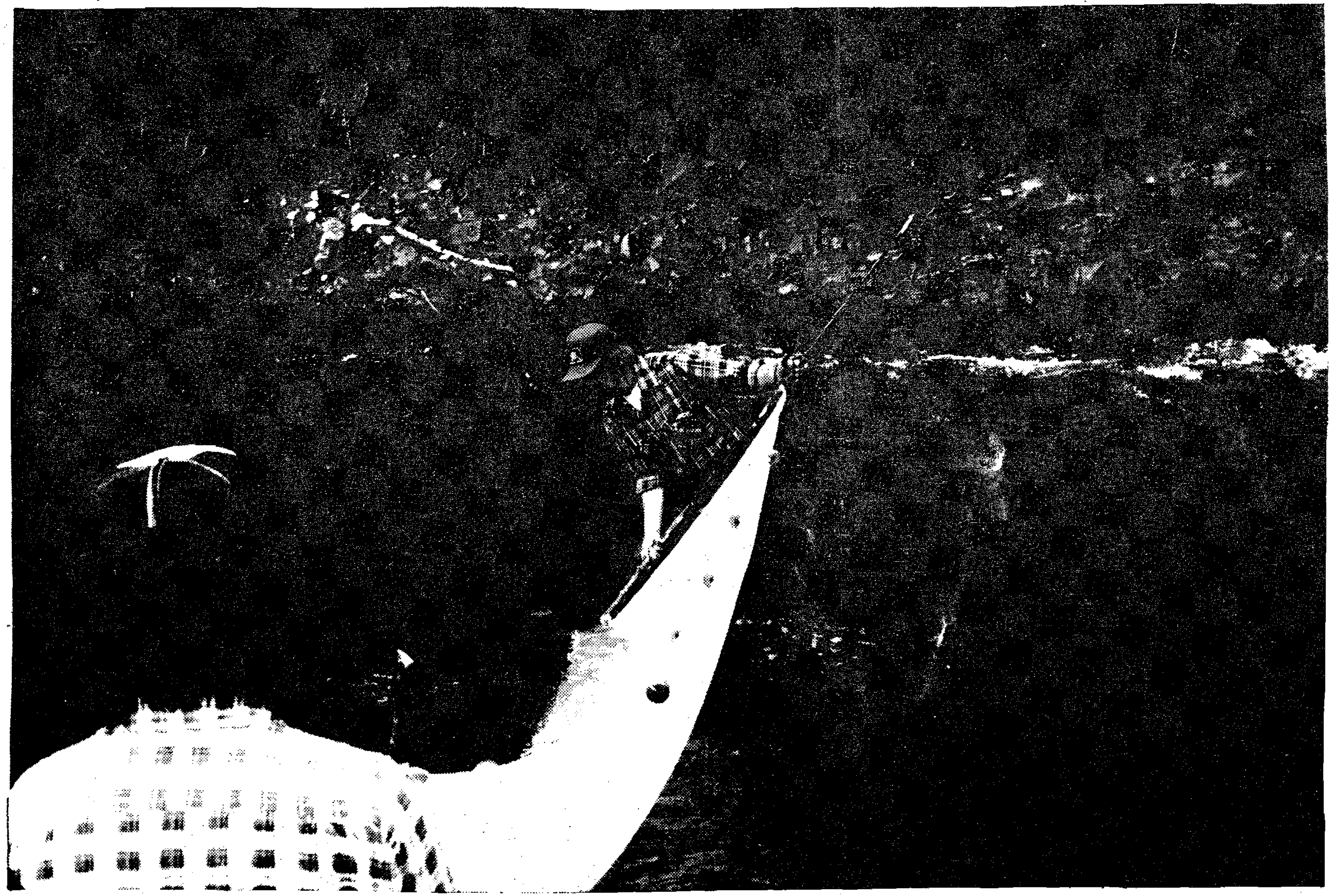


Plate 3-2-3. Beach seining along a gravel bar at Indian River - Helicopter Site 1 (TRM 2.7).

Plate 3-2-4. Electrofishing with a backpack electroshocker at Slough 8 (RM 113.6).

sockeye salmon fry and juvenile grayling, round whitefish and rainbow trout. Techniques used to deploy biological sampling gear and methods of data collection can be found in the Procedures Manual (ADF&G, 1982d).

Fish that were collected were anesthetized with Tricaine Methanesulfonate (MS-222) when necessary to minimize physiological stress due to handling while collecting length and scales. All specimens were identified to species. Burbot and cottids were measured for total length in millimeters (mm); all other resident species were measured for fork length. A subsample of juvenile salmon, taken in accordance with the Procedures Manual, were measured to total length. Adult and juvenile resident specimens greater than 200 mm in fork length were tagged with a Floy tag below the dorsal fin (Plate 3-2-5). Otoliths were taken from burbot mortalities for age analysis. Resident species mortalities were necropsied to determine sex and relative sexual maturity (Plate 3-2-6).

Occasional juvenile anadromous and juvenile resident fish of questionable identity were preserved in 10% formalin for later laboratory identification. Certain large juvenile chinook and coho salmon were preserved for later scale analysis to help determine the length at which age classes were separated. Age classes for juvenile salmon were determined from scale analysis and from length frequency of the pooled fish from the fish distrubition study and from the downstream migrant trap.

In addition, each biologist recorded field observations concerning the predominant hydraulic and habitat conditions and major biological

Plate 3-2-5, Tagging burbot with Floy anchor tags at Whitefish Slough (RM 78.7).

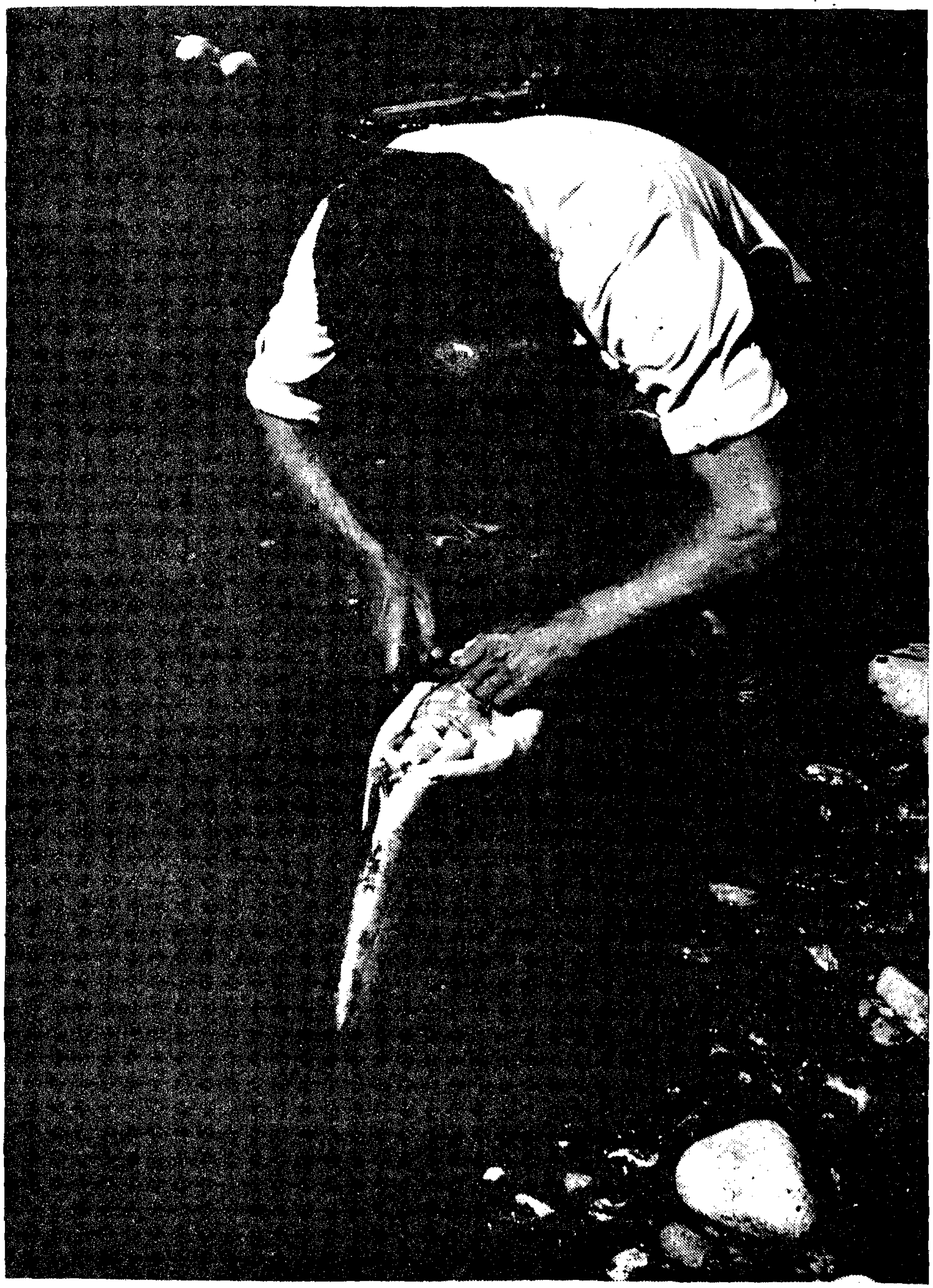


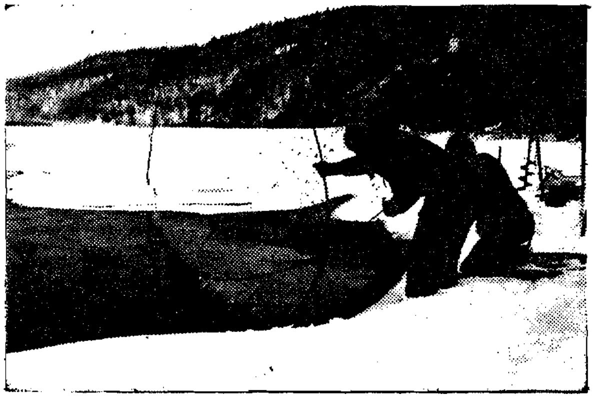
Plate 3-2-6. Necropsying a burbot to determine its sex and relative maturity at Portage Creek mouth (RM 148.8).

findings encountered at each sampling site. The entire study site was mapped on aerial photographs and staff gage readings from each zone were recorded (see Vol. 4, Part I, Methods). Ground photographs were taken of each zone boundary each sampling trip.

Other data was obtained at DFH sites by the boat electrofishing study, which also sampled these sites twice monthly. Most of that effort occurred in the mixing zone or in the mainstem backwater zone. Additionally, data collected on juvenile anadromous species composition, length, and age were correlated with the data from the downstream migrant trap (located at RM 103.0) to assist in determining timing of fish movements.

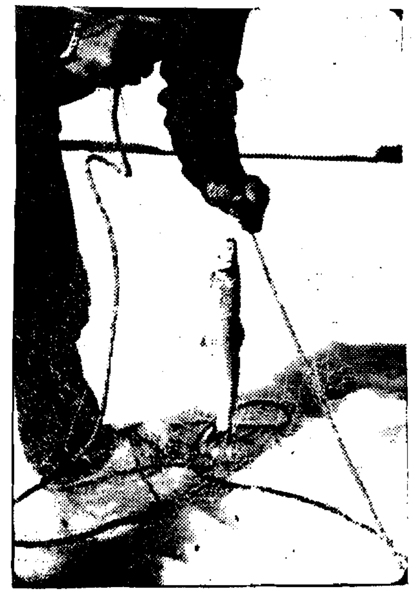
2.1.3.4 Winter Season Methods

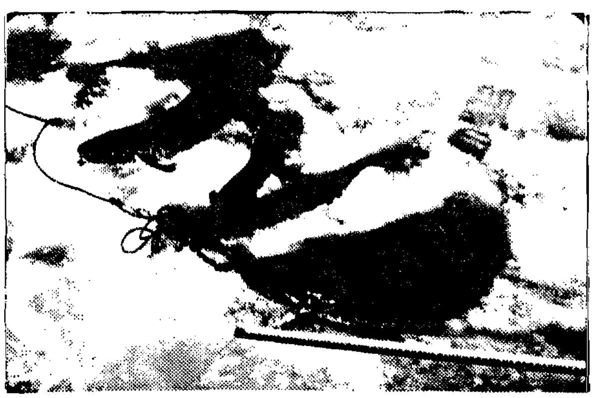
Thirty two sites, including 15 of 17 DFH sites, were sampled during February, March, and April, 1982 (Appendix Tables 3-A-4 and 3-A-5). The sites ranged from Mid Kroto Slough (RM 36.3) to Portage Creek (RM 148.8). The winter program was not designed to differentiate hydraulic zones within a habitat location. Deployment of winter sampling gear was limited to areas at each site that could be sampled under existing ice conditions. Minnow traps, trotlines, and variable mesh gillnets were deployed at each habitat location in areas of open water or through access holes made through the ice with gas powered augers (Plate 3-2-7). Access to sampling sites was accomplished by snow machines and helicopters.



Setting a variable mesh gill net in an open lead.

Checking an under-ice gill net in the mainstem Susitna River.





Burbot caught on a trotline.

Plate 3-2-7. Winter sampling techniques.

2.1.4 Other Methods

Crews operating fishwheels at the Yentna, Sunshine, Talkeetna, and Curry stations for the purpose of capturing adult anadromous fish also collected data on adult resident fish catches of the fishwheels. They recorded daily catches and also tagged and measured adult residents captured when time allowed from their primary duties. An table of fishwheel effort by bimonthly sampling period for each location is given in Appendix Table 3-A-6.

Additionally, hook and line, trotlines, and hoop nets were used at a few selected sites in an attempt to obtain burbot and rainbow trout for radio tagging. Catch and biological data were recorded during these incidental efforts. All adult residents in good condition were tagged.

2.2 Emergence and Outmigration Studies

Minnow traps, beach seines, and backpack electrofishing units were utilized as collection techniques during the 1981-82 resident and juvenile anadromous studies program. These techniques did not adequately assess the times of emergence and outmigration of juvenile anadromous fishes of the Susitna River. Additional techniques were developed during 1982 to provide a more detailed study of emergence and the downstream movements of juveniles of selected species and the factors affecting their distribution.

Surveys of selected spawning areas were conducted monthly during March, April, and May of 1982 to collect baseline data on the timing of emergence of juvenile salmon. Utilizing snow machines and helicopters to gain access to the study areas, eggs and alevins were collected by dip nets and spade shovels.

A downstream migrant trap employing an inclined plane was developed to capture outmigrating resident and juvenile anadromous fishes in the Susitna River. The trap was constructed during the spring of 1982 and was operated from June 18 through October 12, except for short periods of down time caused by manpower limitations, excessive debris loads, or the need to conduct trap modifications or repairs. The trap was deployed above the confluence of the Chulitna River to limit the collection of fish to only upper Susitna River stocks. These stocks of fish would most likely be affected by changes in the river conditions resulting from the proposed hydroelectric development. A site at the Talkeetna base camp (RM 103.0) was selected for trap operation because of its single channel morphology, optimum depth and velocity, and its close proximity to logistical support (Figure 3-2-4).

The downstream migrant trap consisted of two polyethylene plastic modular pontoons serving as flotation for a welded steel lattice frame in which was mounted the inclined plane and livebox (Plate 3-2-8). The steel infrastructure was covered by a two-feet wide plywood deck surrounding a five by ten feet center opening for suspension of the inclined plane and livebox. A three-feet high safety railing was attached to the rear of the trap. The entire trap structure measured 10 feet by 17 feet.

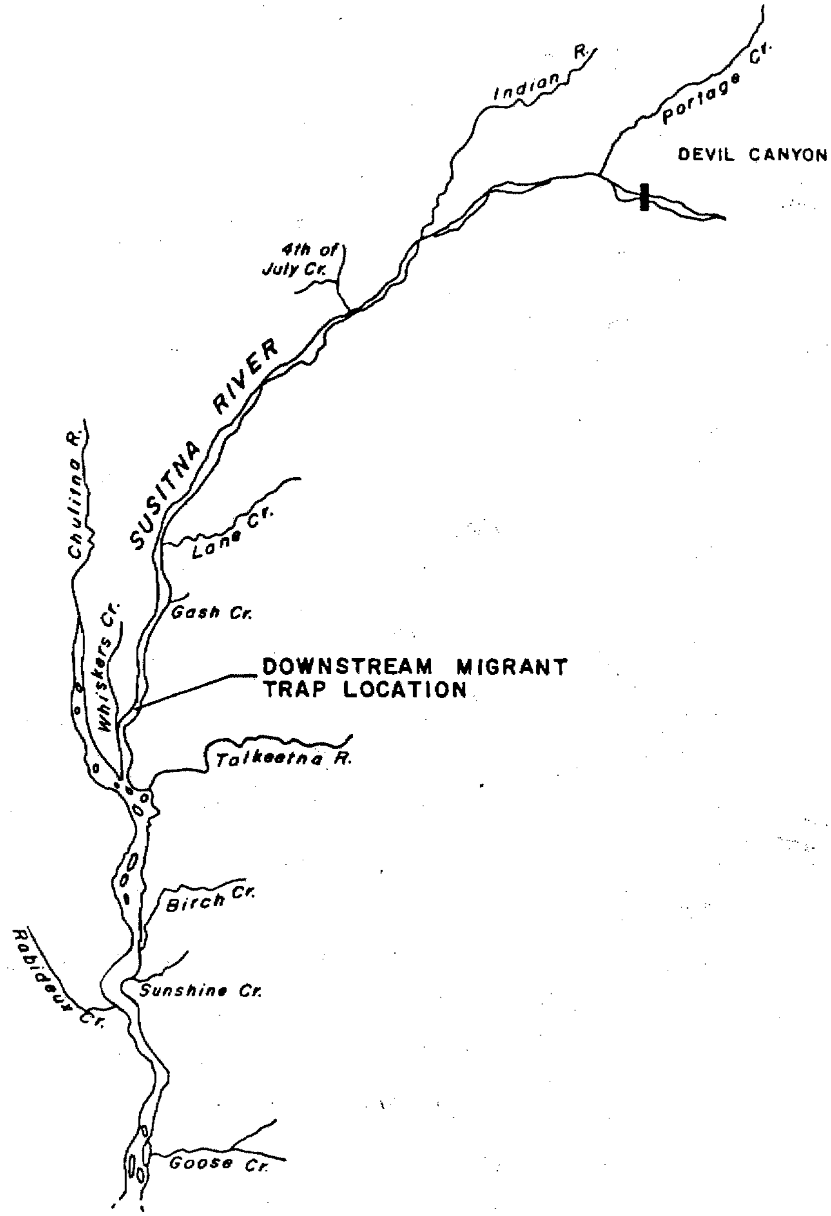


Figure 3-2-4. Map showing the location of the site on the Susitna River where the downstream migrant trap was operated, June 18 to October 12, 1982.

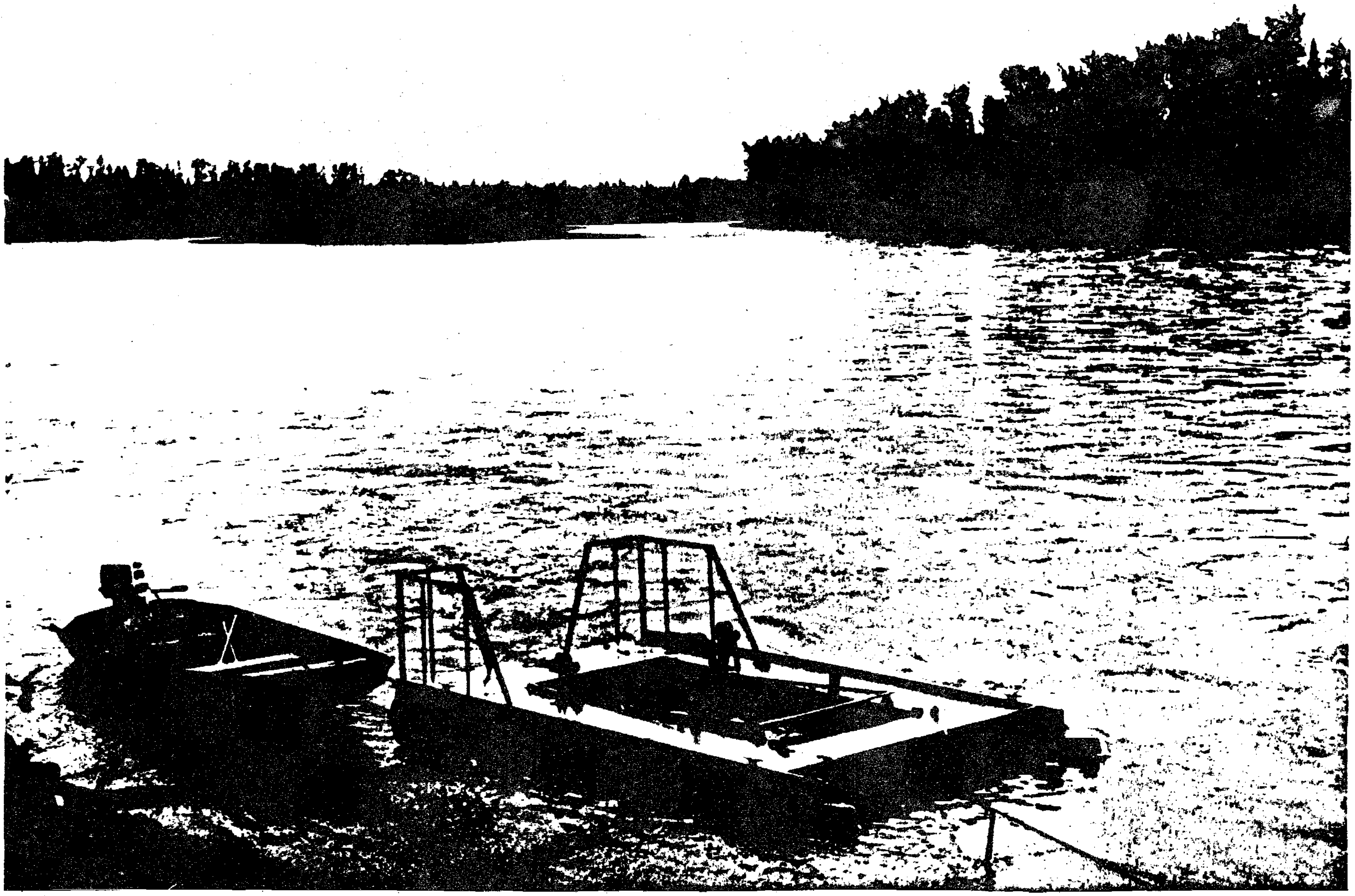


Plate 3-2-8. Downstream migrant trap fishing at its mainstem Susitna River location at River mile 103.0, 1982.

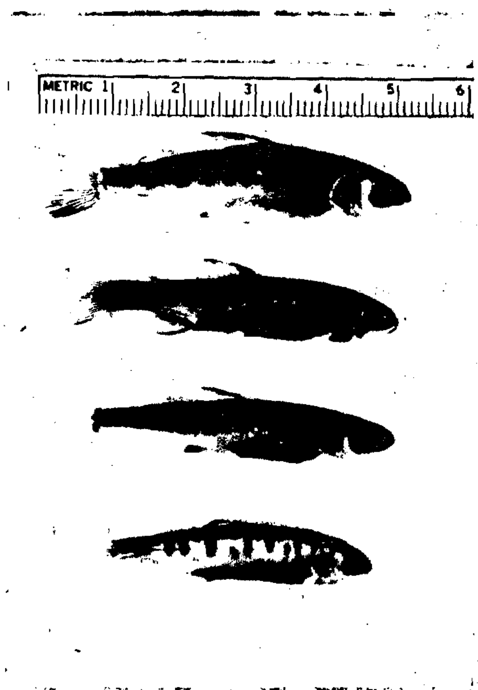
The inclined plane was eight feet long with an entrance opening measuring 4.5 feet square and was covered by one-quarter inch galvanized hardware cloth on the sides and bottom. Hand crank winches were used to adjust the fishing depth and to raise the inclined plane for cleaning. The livebox was covered by one-eighth inch hardware cloth on the sides and bottom and was removable from the trap structure to accommodate cleaning and retrieval of captured fish. A more detailed description of trap design and construction, techniques utilized to determine optimum trap placement, and vertical and horizontal fish distribution and diurnal movements are provided in Appendix Report 3-F-1.

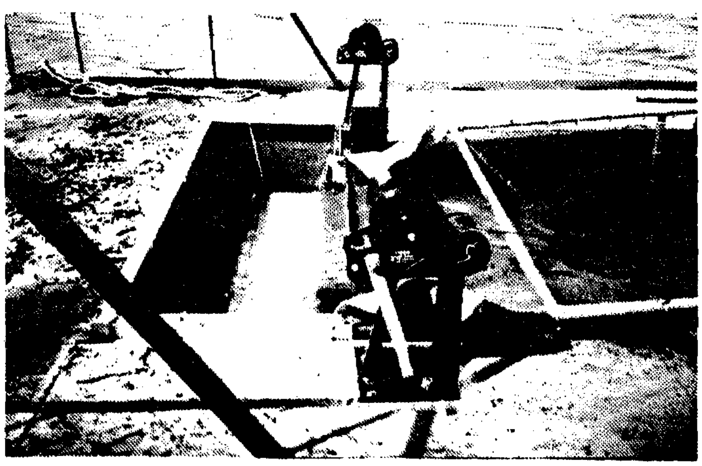
The stationary inclined plane trap requires a river velocity of at least 1.0 feet per second for successful operation. The mesh of the inclined plane allows the major portion of the sampled water column to pass through the screen while retaining the fish and the remaining water which pass over a baffle and into the livebox (Plate 3-2-9). The trap was secured via a cable and rope attached to large trees upstream of the trap and was held out from the bank by a boom log attached to the trap and shore. Distance from shore was adjustable by movement of the shore end of the boom log.

Captured fish were anesthetized using Tricane methane-sulfonate (MS-222). Species, total length, and fate were recorded for each fish. All fish were retained until anesthetic recovery was complete and then released downstream of the trap to prevent recapture.

Winching up the inclined plane of the downstream migrant trap to clean the screen surfaces.

Sample of the downstream migrant trap catch of Age o+ salmon: Chinook, Coho, Chum, and Sockeye salmon.





Winch assembly, baffle, and livebox on the downstream migrant trap.

Plate 3-2-9. Downstream migrant trap operation and sample catch, 1982.

Trap check intervals were determined by catch rates and debris levels. Periods of high catch rates or high debris loads required a shortened check interval to reduce mortalities associated with livebox turbulence and to maintain optimum trap fishing conditions.

Turbidity readings were recorded daily beginning August 14 using an HF Instruments turbidometer. Staff gauge readings were recorded daily and water temperatures were obtained from a Ryan thermograph located at the Talkeetna camp.

The date fished, effort, catch by species, trap depth, distance from shore, and live box mortalities were recorded daily. Species, age, total length in millimeters (mm), and fate were also recorded. Scales were collected from a subsample of the captured fish for comparison to length frequency distribution to determine age class composition by species.

Additional data on juvenile anadromous and resident fishes was collected by Designated Fish Habitat site surveys and mobile boat-mounted electrofishing units. Refer to report sections 2.1.1 and 2.1.3 for a description of the methods used in these mobile gear surveys.

2.3 Food Habits of Juvenile Salmon

2.3.1 Field sampling

Field investigations for the Food Habits Study were conducted at five slough and two clear water tributaries of the Susitna River (Table

3-2-3). This was a pilot study begun in early August when funds became available. All sites were between RM 125.3 and RM 142.0. These sites were selected because they were considered to be representative of the major habitat types, and because they were expected to have sizeable populations of juvenile salmon. Detailed descriptions of these sloughs and tributaries are presented in Appendix 4-F of Volume 4.

Collections were made every other week in August and September. Juvenile salmon were collected by electroshocking, minnow trap, and seines. Seining for juveniles was not very successful and was used only during the August sampling trips. The use of minnow traps in sloughs was discontinued in September because electroshocking was found to be a more productive and efficient collecting method in all sloughs sampled. Minnow traps, however, were the most successful method in Fourth of July Creek, and were also effective in Indian River. Traps were used during both August and September at both tributary sites.

The minnow traps used had a mesh size of 6.4 mm (1/4 inch), and were baited with salmon eggs held in a perforated plastic bottle. They were usually placed near beaver dams, brush piles, cut banks, and large rocks which provide cover for juveniles (Plate 3-2-10). These traps were fished for three to six hours, usually from mid-morning to early afternoon. Electroshocking was done with backpack electroshockers in areas similar to where the minnow traps were set. Both Coffelt and Smith-Root shocker models were used. Electroshocking was ineffective at Fourth of July Creek due to low conductivity.

Table 3-2-3. Six DFH sites on the Susitna River and the dates on which they were sampled by the Food Habits Investigations Group, August to September, 1982.

DFH Sites	River Mile	Miles Sampled	Sampling Dates	
Slough 8A	125.3	Mouth to 0.5 Upstream	8/6,25	9/7,22
Slough 9	129.2	Mouth to 0.5 Upstream		9/7
4th July Creek	131.1	Mouth to 0.25 Upstream	8/5,28	9/8,22
Slough 11	135.3	Mouth to 0.5 Upstream	8/3,24	9/5,20
Indian River	138.6	Mouth to 0.3 Upstream	8/8,29	9/9,23
Slough 20	140.1	Entire 0.5	8/4,26	9/6,21
Slough 21	142.0	Origin to 0.6 Downstream	8/7,27	9/8,21

Plate 3-2-10. Minnow trap set in a typical juvenile salmon rearing habitat at Slough 21 (RM 142.5).

Fish collected were immediately preserved in 70% ethanol. Observation of the first several fish captured indicated that they did not regurgitate their stomach contents when preserved by this method. The body wall of large specimens (greater than 80mm) was opened to insure rapid preservation of the stomach contents. The goal was to collect 15 individuals of each species of juvenile salmon present at each site. Generally it was not possible to collect this many of each species in the time alloted for sampling each site. If more than 15 individuals of any species were collected they were released.

Invertebrate samples were collected by using a kick screen and a set drift net. The kick screen consisted of a 63 x 83 cm sheet of "noseeum" netting, with approximately 500 mu mesh (Plate 3-2-11). This screen was stretched between two dowels, and was held by hand in the stream. The substrate was disturbed in an approximately two meter square area immediately upstream of the net, and the dislodged invertebrates were carried by the current downstream into the net. In areas with little or no current, the screen was pushed through the sampling area. Kick screen collections of invertebrates were carried out near areas where fish had been found at each site. Usually, two collections were made at each site on each sampling date.

The drift net used for collecting invertebrates had a 30 x 50 cm opening, and was 99.1 cm long with a Wisconsin type plankton bucket attached to the downstream end. The netting was 500 mu nylon mesh. The net was placed at the base of a riffle downstream of an area which would not be disturbed by our other sampling activities and was held in place

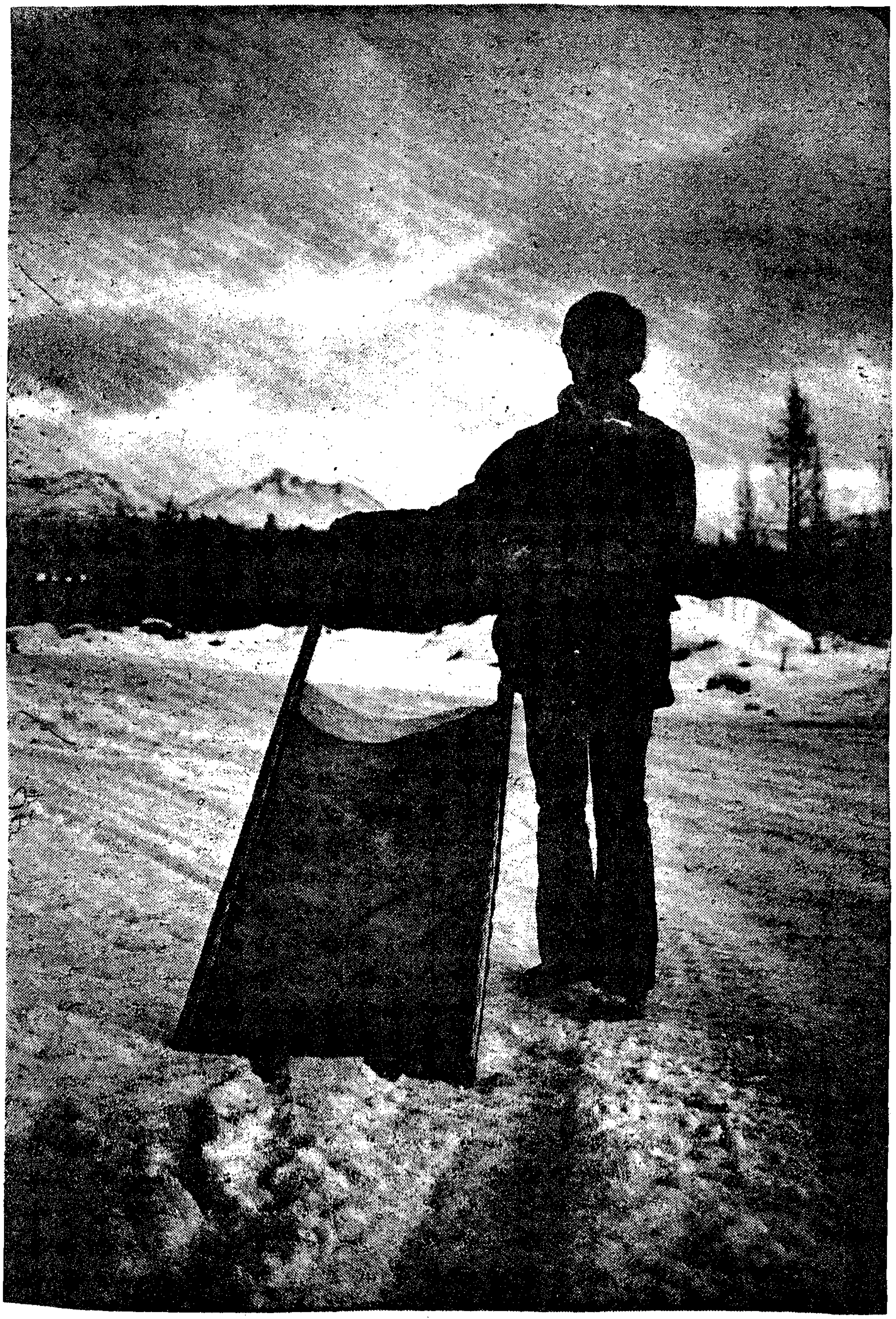


Plate 3-2-11. Kick screen used for sampling invertebrates.

by two steel stakes (Plate 3-2-12). Care was taken that the net was set in water shallow enough to allow at least eight cm of its opening to be above the water surface. The net was left in place for a minimum of three hours. Invertebrate samples were preserved in 70% ethanol and taken to the lab in Anchorage for sorting and identification.

2.3.2 Laboratory Methods

Fish stomachs were removed by making one cut just posterior to the esophagus, and one just anterior to the pyloric cecae. The contents were removed, and examined under a dissection microscope. Only those invertebrates which had both a head and part of their body were counted. Enumeration was done in this way to prevent any numerical bias being given to those invertebrates which could be recognized by the head alone. However, chironomid larvae were counted even if only their head remained because they are soft-bodied, and all but their head capsule is rapidly digested. It was felt that the chironomid larvae count would not be representative of the number of chironomid larvae consumed unless the count was done in this manner.

Invertebrate kick screen and drift samples were sorted under a dissection microscope (Plate 3-2-13). Aquatic invertebrates from both the stomach contents and invertebrate samples were identified to order or family. Terrestrial invertebrates which have no aquatic life stage were identified to order. Major keys used for identification were: Borrer and Delong (1971), Merrit and Cummins (1978), and Pennak (1978). At the

Plate 3-2-12. Invertebrate sampling with a stream drift net at Slough 21 (RM 142.5).

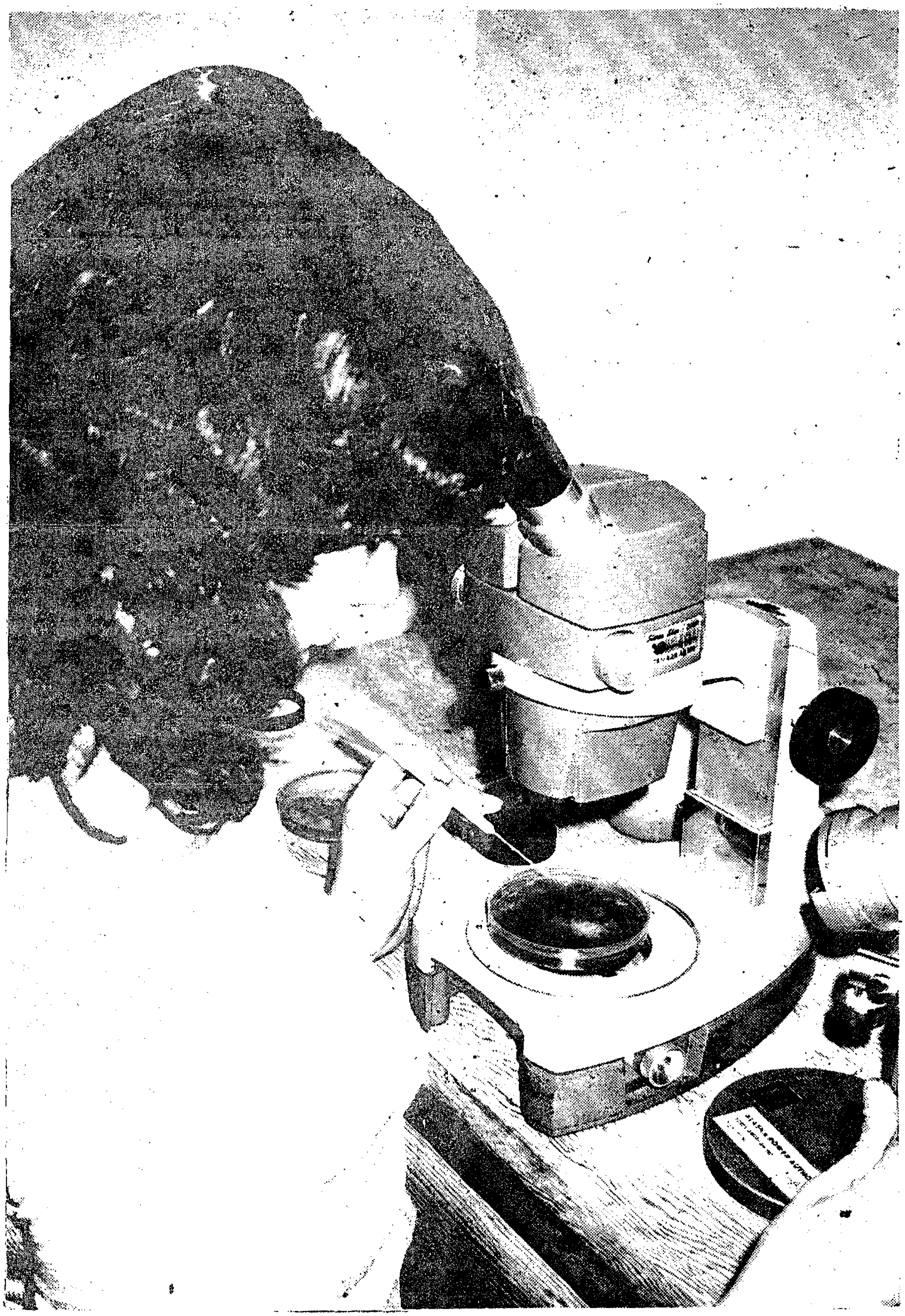


Plate 3-2-13. Sorting field samples of invertebrates in the lab with the aid of a dissecting scope.

time this report was written, manpower limitations did not allow the examination of all collections made during the 1982 season. Kick screen samples from our early August and late September samples will be examined as time permits.

2.3.3 Analytical Methods

Abundance of each prey type in the environment was compared to its abundance in the stomachs using Strauss's linear electivity index (Strauss 1979). The linear index is simply the difference between two proportions (r_i-p_i) where r_i is the percent of prey type i in the stomachs, and p_i is the percent of that prey type in the environment. The linear index ranges from -1.0 to +1.0. Positive values indicate that the proportion of the prey type in the stomach is higher than in the environment (positive selection). Negative values indicate that the prey is either inaccessible or is avoided by the fish (negative selection). Values near zero indicate random selection of prey from the environment. Confidence limits for the linear index were calculated using the formula given by Strauss (Strauss 1979).

Rough comparisons of invertebrate populations between sites were also made. Invertebrate samples were not quantitative so direct comparisons of numbers at each site could not be made. Analysis was done instead by comparing the proportion of the total sample made up by each invertebrate type at each site using chi-square analysis (Fleiss 1981). Contributions of prey types to the diet of each of the salmon species were also compared using chi-square analysis.

3. RESULTS

3.1 Distribution and Abundance Studies

3.1.1 Resident Fish Species

Eleven species of resident fish were captured during 1982 field studies conducted below Devil Canyon (RM 150.2). Individuals of all these species were also captured during 1981 ADF&G Studies (ADF&G 1981c). The Bering Cisco (Coregonus laurettae Bean) was categorized as a resident fish in ADF&G (1981c) but now is discussed with the adult anadromous species in Volume 2.

One northern pike (Esox lucius L.) was captured in the Yentna River (RM 27.5, TRM 6.0) in a fishwheel on August 19, 1982. In 1981, one adult northern pike was also captured near the Yentna River confluence (ADF&G 1981c). Apparently the fish are expanding their range or simply wandering downriver from several lakes in the Yentna River drainage where they were illegally transplanted during the 1950's.

The results of 1982 field studies are detailed for the other resident species in the following sections. Habitat relationships of these species are discussed in Volume 4, Part II. Age, length, and sex data for all resident species are contained in Appendix Report 3-G-1.

3.1.1.1 Rainbow Trout

Distribution and Relative Abundance

Eight rainbow trout (Salmo gairdneri Richardson) were captured during the ice-covered season from February through April (Appendix Table 3-A-7). Four of these fish were captured in the mainstem below the Chulitna River confluence, while the other four were captured at the Deshka River (RM 40.6, TRM 3.5), Goose Creek 1 (RM 72.0), Slough 10 (RM 133.8) and Slough 22 (RM 144.3).

Another 307 rainbow trout were captured between May and October (Table 3-3-1). At the DFH sites, a total of 207 rainbow trout were captured at 16 of the 17 sites (Appendix Tables 3-A-8 and 3-A-9). The 4th of July Creek DFH site had the largest number of rainbow trout sampled with 43 captured. Other DFH sites at which more than 20 rainbow trout were captured included Whiskers Creek and Slough, Slough 8A, and Indian River. Whitefish Slough was the only DFH site at which no rainbow trout were caught. Other DFH sites at which only one or two rainbow trout were captured included Rabideux Creek and Slough, Slough 19, Slough 21, and Portage Creek.

Rainbow trout were also captured at SFH tributary and mainstem sites both above and below the Chulitna River confluence (Appendix Tables 3-A-10 and 3-A-11). Tributary sites below the confluence at which rainbow trout were captured included the mouths of Little Willow Creek (RM 50.5) and the Talkeetna River (RM 97.0). Above the Chulitna River

Table 3-3-1 Rainbow trout catch on the Susitna River between Cook Inlet and Devil Canyon by study site type, May to October, 1982.

Study Site Type	MAY 16-31	JUNE 1-15	JUNE 16-30	JULY 1-15	JULY 16-31	AUG 1-15	AUG 16-31	SEPT 1-15	SEPT 16-30	OCT 1-15	TOTAL
DFH Sites	15	26	44	16	4	8	10	27	53	4	207
SFH Sites	2	13	14	2	2	2	3	13	3	1	55
Downstream migrant trap	-	-	1	0	3	1	0	1	0	0	6
Fishwheel sites	-	5	10	4	0	2	2	13	3	-	39
TOTAL	17	44	69	22	9	13	15	54	59	5	307

- no sample

confluence, rainbow trout were captured at five tributary sites and five slough sites. Six rainbow trout were captured in the mainstem by the downstream migrant trap and 39 by fishwheels (Table 3-3-1). Thirty-seven of the rainbow trout captured in fishwheels were captured at the Sunshine (RM 79.0) and Curry (120.0) stations (Appendix Table 3-A-12).

Movement and Migration

Radiotelemetry was used to study winter movements of adult rainbow trout. The five rainbow trout that were radio tagged were captured, tagged and released between October 5 and 15, 1981. Four of the rainbow trout were captured at RM 76.3, the other rainbow trout at RM 84.1. The five fish tagged ranged from 350 mm to 455 mm in fork length. The fish were then radio tracked until April 6, primarily with fixed wing aircraft.

During the earliest aerial tracking flight on October 15, all five rainbow trout were located. Two of the rainbows showed no movement, one moved upstream 0.5 miles, and one moved downstream 5.6 miles from where it was tagged and released (Figure 3-3-1). One rainbow was still in the live box and was released later that day.

One radio tagged rainbow was not located on subsequent flights after January 6. Rainbow trout 750-1 was last located during December 28 on the Susitna River at RM 62.5. The fish at this time was in the same vicinity as rainbow trout 750-2.

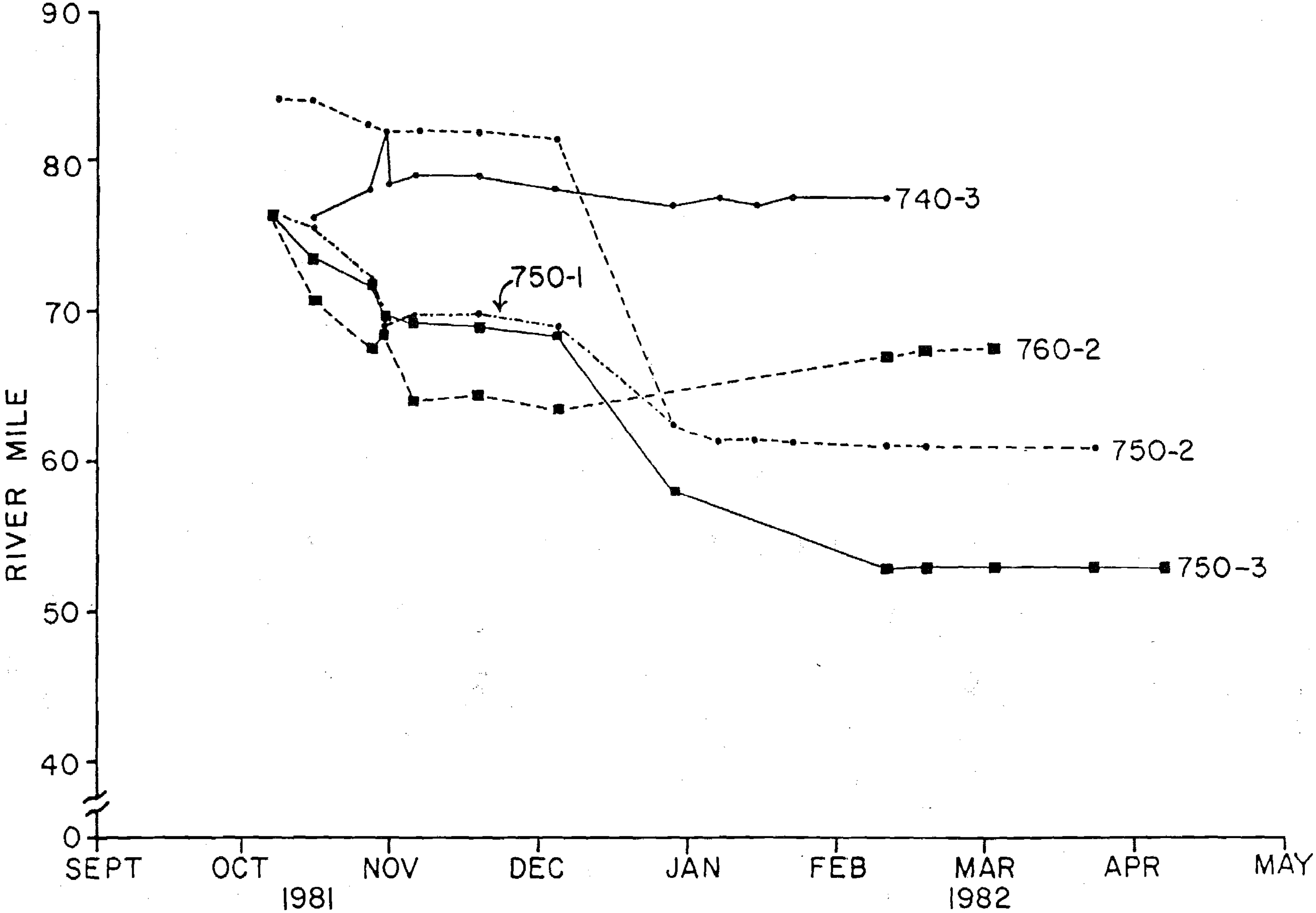


Figure 3-3-1. Movement of five radio tagged rainbow trout in the Susitna River, October 1981 to April 1982.

Four of the rainbow trout were located on an aerial tracking flight during February 10. Two of the rainbow trout, 750-3 and 760-2 were located in the east channel of the Susitna between the mouth of Little Willow Creek (RM 50.5) and the mouth of Goose Creek (RM 72.0). Rainbow trout 750-2 was located in a side channel of the Susitna River at RM 61.0.

Three of the four rainbow trout were located on subsequent flights after February 10 but none moved over 0.5 miles after this date. The maximum movement by any of the five rainbow trout was recorded for rainbow trout 750-3; it moved 23.3 miles downstream in a maximum of 126 days. Three of the radio tagged rainbow trout moved upstream between October and April. The farthest upstream movement was evidenced by rainbow trout 740-3 which moved 4.0 miles in a maximum of six days.

Recapture of three of the radio tagged rainbow trout was attempted in February and March as the radio tags approached their battery expiration dates. However, none of the radio tagged rainbow trout were recaptured during these trips.

Ice augering in the vicinity of rainbow trout 750-3 during mid-February at RM 53.0 indicated that this fish was dead. There was no water in the immediate vicinity of the maximum signal strength of the radio tag. Three adult nontagged resident fish, however, were captured by trotlines set nearby. One Arctic grayling, one rainbow trout and one burbot were captured using 8.0 units of trotline effort.

One rainbow trout (tag number 750-2) was located in a side channel of the Susitna River opposite the mouth of Kashwitna River (RM 61.0) during February. The fish would move approximately 300 feet after ice augering in the suspected vicinity of the fish. During the March recapture attempt, no movement was detected. One untagged rainbow adult was captured in the vicinity of rainbow trout 750-2 using 3.0 units of gillnet effort and 4.3 units of trotline effort.

During March, rainbow trout 760-2 was in the east channel of the Susitna River at RM 67.5. Ice augering in the vicinity of this radio tagged fish did not indicate if the fish was alive or dead; no movement was detected. Two untagged rainbow trout were captured in the vicinity in 17.3 gear units of trotline effort.

Rainbow trout 740-3 was captured on May 27, 1982 by a sports fisherman at the mouth of Montana Creek (RM 77.0). He reported that the fish was healthy and vigorous, and that the incision had healed. There was no connective tissue formed on the surface area of the radio tag as a result of the fish rejecting the tag. Connective tissue has been reported to encase surgically implanted radio tags during other radio telemetry studies (Carl Burger, USFWS, pers. Comm.).

Movements of adult rainbow trout were also studied with a tag and recapture program. During 1982, 195 rainbow trout were tagged and a total of 32 recoveries of 29 different rainbow trout were made (Appendix Table 3-A-13). Twelve of the recoveries made were fish tagged in 1981 and the overall recovery rate of fish tagged in 1981 was 5.3 percent (11 of 206, one fish was recaptured twice). The recovery rate of rainbow trout tagged in 1982 was 9.2 percent (18 of 195).

Apparent movements of tagged rainbows were limited. Only three of the 11 rainbow trout tagged in 1981 and recovered in 1982 were captured more than five miles from their tagging location. Similarly, less than 20 percent (3 fish) of the 18 rainbows tagged and recovered in 1982 moved more than five miles. Twenty-one of the 32 recoveries made in 1982 showed movements of one mile or less. The maximum movement was made by a rainbow trout tagged at Birch Creek and Slough on May 25, 1982 and then recovered on June 2, 1982 by an angler at Fish Creek, a tributary of the Talkeetna River 17.3 river miles upstream.

Spawning

No rainbow trout were observed spawning during the 1982 field season in the mainstem Susitna River. Three male rainbow trout captured in late May at Whiskers Creek and Slough, however, discharged milt when their abdomens were palpated. The fork length of these fish ranged from 280-385 mm. Age-length frequency data indicate that the 280 mm fish was four or five years old, while the 385 mm male was six years old (Appendix Report 3-G-1). One other ripe male was captured at Indian River on June 28th.

3.1.1.2 Arctic Grayling

Distribution and Relative Abundance

Winter sampling efforts from February through April, 1982 resulted in the capture of two Arctic grayling (*Thymallus arcticus* Pallas). One adult was captured in late February at a mainstem site (RM 53.5) by trotline and one juvenile was minnow trapped in April at Cache Creek.

A total of 1,023 juvenile (fork length under 200 mm) and adult Arctic grayling were captured during 1982 summer field operations on the Susitna River downstream of Devil Canyon (Table 3-3-2). Over 80 percent (821 fish), of the Arctic grayling captured in summer were captured by boat electrofishing at DFH and SFH sites.

Five hundred and twenty-two (51.0%) of the Arctic grayling captured during the summer were caught at DFH sites (Table 3-3-2). Most of these fish were captured by electrofishing, and beach seining; other sampling methods (trotlines, gillnets, dipnet, and angling) captured only 38 of the 522 (Appendix Tables 3-A-14 and 3-A-15). The highest catch of Arctic grayling at DFH sites was recorded at Lane Creek and Slough 8 where 117 fish were captured. Other DFH sites where relatively large catches were made included Whiskers Creek and Slough, Fourth of July Creek, Indian River, Slough 20, and Portage Creek. Sunshine Creek and Side channel was the only DFH site where no Arctic grayling were caught.

Arctic grayling were also captured at ten other tributaries and sloughs above the Chulitna River confluence and at six other tributaries and

Table 3-3-2 Arctic grayling catch on the Susitna River between Cook Inlet and Devil Canyon by study site type, May to October, 1982.

Study Site Type	MAY 16-31	JUNE 1-15	JUNE 16-30	JULY 1-15	JULY 16-31	AUG 1-15	AUG 16-31	SEPT 1-15	SEPT 16-30	OCT 1-15	TOTAL
DFH Sites	12	27	126	35	47	63	50	86	70	6	522
SFH Sites	5	55	128	8	26	38	51	78	22	-	411
Downstream migrant trap	-	-	1	8	1	4	0	0	1	0	15
Fishwheel sites	-	16	6	2	2	2	0	13	34	-	75
TOTAL	17	98	261	53	76	107	101	177	127	6	1023

- no sample

sloughs below the confluence (Appendix Tables 3-A-16 and 3-A-17). A total of 193 Arctic grayling were captured at these SFH tributary or slough sites; electrofishing also captured 216 Arctic grayling at SFH mainstem sites between Cook Inlet and Devil Canyon. The highest catch of Arctic grayling at SFH sites was recorded at Jack Long Creek (RM 144.5) where 58 Arctic grayling were caught. Other SFH sites where relatively large catches were made in 1982 included Skull Creek (RM 124.7), Slough 15 (RM 137.2), and a mainstem site at RM 150.1. The farthest downstream site where Arctic grayling were caught was RM 31.1, and RM 150.1 was the farthest upstream site for the reach of river below Devil Canyon.

In addition to the Arctic grayling captured by mobile gear at DFH and SFH sites, fish were captured by fishwheels and a downstream migrant trap. Seventy-five adult fish were captured by fishwheels (Appendix Table 3-A-18). Fifty of these fish were captured at Sunshine (RM 79.0), ten were caught at Talkeetna (RM 103.0) and 15 at Curry (RM 120.0). The downstream migrant trap at RM 103.0 captured 14 juveniles (fork length under 200 mm) and one adult Arctic grayling during 1982. The maximum seasonal catch at the trap was recorded during early July when eight Arctic grayling were captured.

The maximum seasonal catch of Arctic grayling by all methods was recorded in late June when 261 fish were captured. Relatively high catches were also recorded in September.

Four hundred and eighty-three (47.2%) of the 1,023 Arctic grayling captured downstream of Devil Canyon were juveniles. Three hundred and twenty-seven (67.7%) of these juveniles were captured upstream of the Chulitna River confluence. Boat electrofishing captured the highest number, 347 (71.8%), of juveniles in comparison to other sampling methods.

In the reach of river below Devil Canyon juvenile Arctic grayling were caught at sites ranging from RM 35.0 to RM 150.1. Seasonally, high catches of juveniles were also recorded during June and September.

Movement and Migration

Seven hundred and forty-eight Arctic grayling were Floy anchor tagged in the Susitna River below Devil Canyon between 1980 and 1982 (447 in 1982) during a tag and recapture program. Forty eight Arctic grayling have been recaptured with 45 (94%) of those occurring during 1982 (ADF&G 1981; Appendix Table 3-A-19). Of the 45 fish recaptured in 1982, ten were recoveries of fish tagged in 1981. The recovery rate for Arctic grayling tagged in 1981 was 3.3 percent (10 of 301) while 7.8 percent (35 of 447) of the fish tagged in 1982 were recaptured.

The Arctic grayling recaptured in 1982 were at large from two days to over a year. The maximum upstream movement was 13.3 miles and the maximum downstream movement was 10.0 miles. No movement was recorded for 30 (66.7%) of the 45 recaptured fish. The maximum movement recorded for any recaptured Arctic grayling in the Susitna River below Devil Canyon was in 1981, it moved 32.5 miles (ADF&G 1981c).

Spawning

No Arctic grayling spawning was observed during the 1982 field season in the mainstem Susitna River between Cook Inlet and Devil Canyon. One female, 362 mm in fork length and six years old, captured in the mainstem Susitna River at RM 60.5 during late May, discharged eggs when its abdomen was palpated (Appendix Table 3-A-20). One ripe male was also captured during late May in the mainstem Susitna River (RM 77.5) Spent Arctic grayling were captured at the mouth of the Talkeetna River (RM 97.5) on June 5, Lane Creek on June 6 and Indian River on June 28.

The fork lengths of the two ripe and three spent Arctic grayling ranged from 352 mm to 400 mm. Analysis of scales from Arctic grayling indicate that they were predominately six and seven year old fish (Appendix Report 3-G-1).

3.1.1.3 Burbot

Distribution and Relative Abundance

During 1982 field studies, a total of 452 adult burbot (*Lota lota* L.) were captured in the Susitna River downstream of Devil Canyon. Winter sampling during February through April captured 32 burbot with the remaining 420 fish taken during May through October (Appendix Table 3-A-21, Table 3-3-3). Trotlines and electrofishing were the most effective means of catching burbot.

Table 3-3-3 Burbot catch on the Susitna River between Cook Inlet and Devil Canyon by study site type, May to October, 1982.

Study Site Type	MAY 16-31	JUNE 1-15	JUNE 16-30	JULY 1-15	JULY 16-31	AUG 1-15	AUG 16-31	SEPT 1-15	SEPT 16-30	OCT 1-15	TOTAL
DFH Sites	0	14	30	13	22	18	19	33	19	3	171
SFH Sites	2	5	14	24	23	8	26	29	26	11	168
Downstream migrant trap	-	-	18	3	21	5	2	9	12	0	70
Fishwheel sites	-	0	0	0	2	1	2	3	3	-	11
TOTAL	2	19	62	40	68	32	49	74	60	14	420

- no sample

Burbot were caught at all 17 DFH sites during 1982 (Appendix Tables 3-A-22 and 3-A-23). The most productive of the DFH sites for adults were Goose Creek 2 and Side Channel, Rabideux Creek and Slough, Sunshine Creek and Side Channel, Birch Creek and Slough, Slough 6A, and Slough 21. Less than five burbot were captured at the mouth of 4th of July Creek, Slough 11, Indian River and Slough 20.

Burbot were also captured at a number of SFH sites both above and below the Chulitna River confluence (Appendix Tables 3-A-24 and 3-A-25). Most of the SFH sites where burbot were captured were in the mainstem. Fishwheel catches of burbot were limited but at least one burbot was caught at all of the fishwheel stations except Talkeetna (RM 103.0) (Appendix Table 3-A-26).

In addition to the adult catch, a total of 106 burbot juveniles (total length under 200 mm) were captured downstream of Devil Canyon during 1982 sampling. Seventy of these juveniles were caught in the downstream migrant trap (RM 103.0) with the remainder taken by minnow traps, beach seine, or electrofishing.

Movement and Migration

Little data on summer movements of burbot have been collected from a tagging program because tag recoveries have been low. During 1982 sampling, 265 burbot were tagged and three tag recoveries were made (Appendix Table 3-A-27). Movements represented by the tag recoveries of burbot tagged in 1982 were 0-1.6 miles upstream over a 5-69 day period.

One burbot was also recaptured in 1982 out of 240 tagged during 1981. This burbot was tagged September 12, 1981 and recovered 68.9 miles upstream one year later on September 14, 1982.

In addition, five burbot were captured, radio tagged and released between October 3 and October 6, 1981 in an attempt to study winter movements. Two of the burbot were captured at RM 76.3 and three at RM 84.1 The five fish tagged ranged from 575 mm to 835 mm in total length. The fish were radio tracked until April 6 primarily with fixed wing aircraft. During the earliest aerial tracking flight on October 15, all five burbot were located. Three of the burbot had not moved from the site of their capture while the other two moved downstream 0.6 and 1.3 miles respectively (Figure 3-3-2). Burbot 760-3 was not located after December 4. The other four burbot were located until March 22. Only burbot 770-2 was located during the last monitoring flight on April 6.

The maximum movement and rate of movement was recorded for the burbot 760-1. This burbot was released at RM 76.3 on October 5 and located at RM 16.0 on February 18. It moved 57.2 miles downstream between December 4 and January 15 at a minimum rate of 1.5 miles per day. This fish moved upstream three miles on the subsequent trip. Three of the other four radio tagged burbot also made upstream movements between October and April. The maximum upstream movement was made by burbot 770-2 which moved 5.5 miles in a maximum of 48 days.

Recapture of two radio tagged burbot was attempted twice in March as the radio tags approached their known battery life. Initially aerial

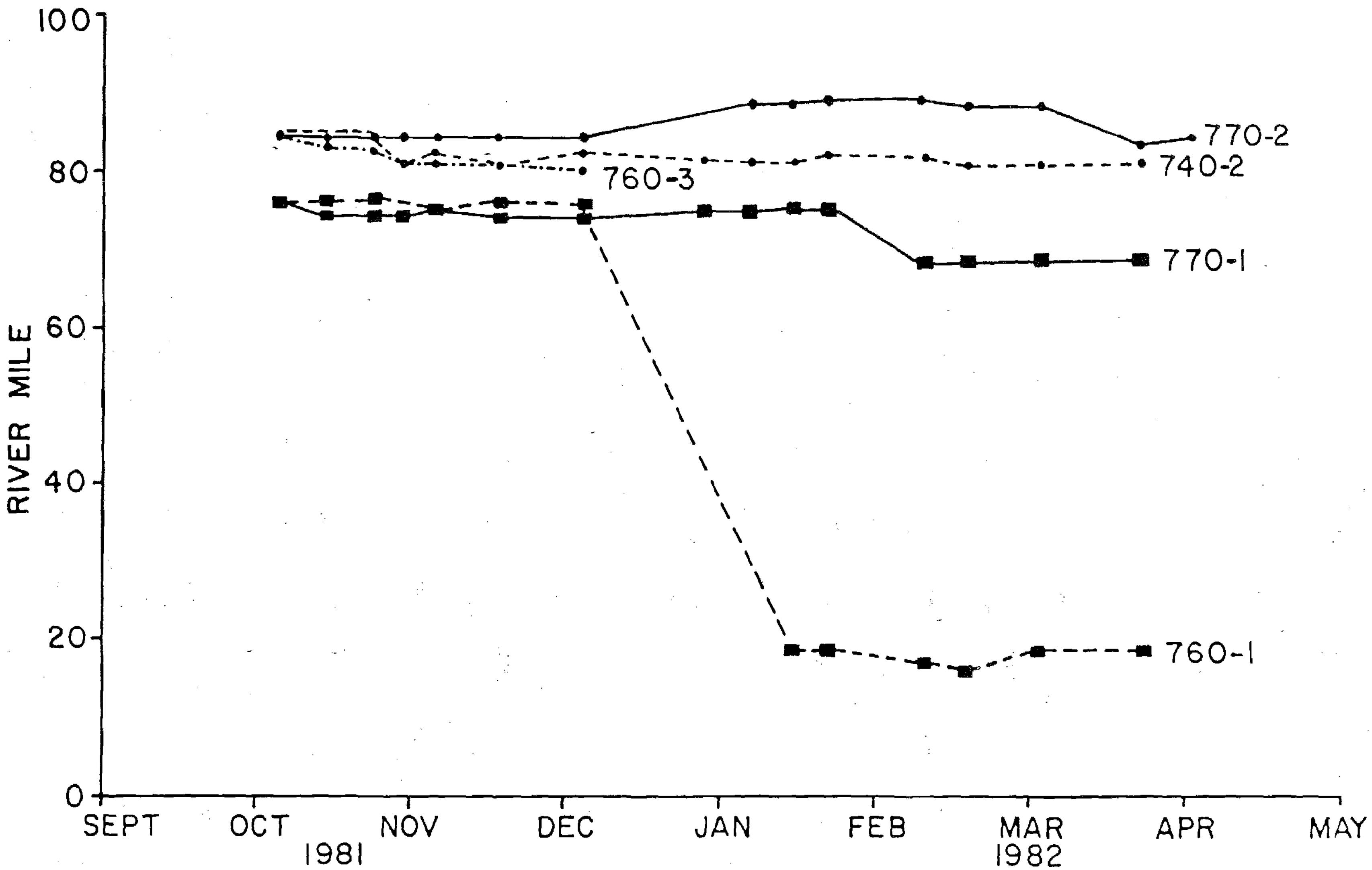


Figure 3-3-2. Movement of five radio tagged burbot in the Susitna River, October 1981 to April 1982.

tracking was used to locate the fish, and then trotlines and burbot lines were set in the vicinities of the radio tagged fish via snowmobiles. Neither of the radio tagged fish were recaptured during these trips. Ice augering in the vicinity of burbot 770-1 in the mainstem Susitna River at RM 68.5 did not show if the fish was alive or dead, as no movement was detected. Two other nontagged burbot, however, were captured utilizing 11.5 gear units of trotline and burbot set effort. Burbot 740-2 was in the mainstem at RM 82.0 and was apparently alive during the two recapture attempts made in March. Telemetry gear detected the fish reacting to the ice auger when drilling in the vicinity. Movement ranged from 500 to 1,000 feet during three days of an early March sampling trip. This fish was not recaptured; however, eight other non-tagged burbot were captured in the vicinity in 16.3 gear units of trotline and burbot set effort.

Spawning

Although no burbot were observed spawning in the Susitna River between Cook Inlet and Devil Canyon during 1981 and 1982, burbot sampling mortalities were examined for sexual development monthly to document timing of spawning.

During September and October of 1981, 31 burbot mortalities with a total length ranging from 105 mm to 900 mm were necropsied. Twenty-two of these fish had larger gonads than burbot examined in June, 1981 (Appendix Table 3-A-28). Adult burbot mortalities examined during the 1982 field season also indicated enlarging of gonads monthly. Individual eggs were evident in eggs sacs of mature female burbot necropsied in September and Oc‧ober. The minimum length of mature female burbot sampled during September and October, 1981 was 330 mm while mature males were at least 310 mm in length. Age - length analysis indicates both of these fish were III or IV year olds (ADF&G 1981c).

Fourteen burbot sampling mortalities were examined for sexual development during February and March, 1982. All of the 11 female burbot necropsied had spawned. Residual eggs were found in the eggs sacs of each of these female burbot. The minimum length of the females sampled was 425 mm and the minimum age was IV (Appendix Table 3-A-28). Two of the three males captured had also spawned.

3.1.1.4 Round Whitefish

Distribution and Relative Abundance

A total of 2,141 juvenile and adult round whitefish (*Prosopium cylindraceum* Pallas) were captured during 1982 summer field operations on the Susitna River downstream of Devil Canyon (Table 3-3-4). Winter sampling from February through April failed to capture any round whitefish. Most of the round whitefish caught during the summer were captured by boat electrofishing (51.8%) or by a downstream migrant trap (19.3%).

Nine hundred and twenty-two (43.1%) of the round whitefish captured during the summer were caught at DFH sites (Table 3-3-4, Appendix Tables 3-A-29 and 3-A-30). Most of these fish were captured by electrofishing,

Table 3-3-4 Round whitefish catch on the Susitna River between Cook Inlet and Devil Canyon by study site type, May to October, 1982.

Study Site Type	MAY 16-31	JUNE 1-15	JUNE 16-30	JULY 1-15	JULY 16-31	AUG 1-15	AUG 16-31	SEPT 1-15	SEPT 16-30	OCT 1-15	TOTAL
DFH Sites	19	43	261	163	111	55	79	78	113	-	922
SFH Sites	13	67	166	11	55	52	84	115	22	-	585
Downstream migrant trap	-	-	22	227	61	55	12	9	14	13	413
Fishwheel sites	1	15	15	17	10	7	14	111	32	-	221
TOTAL	32	125	464	418	237	169	189	313	181	13	2141

- no sample

either boat-mounted or backpack, and beach seining; only one fish was captured by minnow trapping. The highest catch of round whitefish at DFH sites was recorded at Portage Creek where 201 fish were caught. Other DFH sites where relatively large catches were made in 1982 were Slough 6A, Slough 9, 4th of July Creek, and Indian River.

Round whitefish were also captured at 14 other tributaries and sloughs above the Chulitna River confluence and at 12 other tributaries and sloughs below the confluence (Appendix Tables 3-A-31 and 3-A-32). A total of 239 round whitefish were captured at these SFH sites. Electrofishing and beach seining also captured 327 and 19 round whitefish, respectively, at mainstem sites between Cook Inlet and Devil Canyon. The highest catch of round whitefish at SFH sites was recorded at Jack Long Creek (RM 144.5) where 60 fish were caught. Other SFH sites where relatively large catches were made in 1982 were the mouths of the Talkeetna River (RM 97.0) and Skull Creek (RM 124.7), and a mainstem site at RM 150.1. The farthest downstream site where adult round whitefish were caught was RM 19.0, and RM 150.1 was the farthest upstream site for the reach of river below Devil Canyon.

In addition to the round whitefish captured by mobile gear at DFH and SFH sites, fish were captured by fishwheels and a downstream migrant trap (Table 3-3-4). Two hundred and twenty-one adult fish were captured by fishwheels. One hundred and fifty-two of these were captured at Sunshine (RM 79.0), while 25 were recorded at Talkeetna (RM 103.0), 38 at Curry (RM 120.0), and six at the Yentna River (RM 27.5, TRM 6.0) station (Appendix Table 3-A-33). The downstream migrant trap captured

410 juvenile (fork length under 200 mm) and three adult round whitefish during 1982. The maximum seasonal catch at the trap was recorded during early July when 227 round whitefish were captured.

The maximum catch of round whitefish by all methods was recorded in late June when 464 fish were captured, 81 percent of these fish were captured by electrofishing. Large catches of round whitefish were also made in early July and early September.

Nine hundred and ninety-nine (46.7%) of the 2,141 round whitefish captured downstream of Devil Canyon were juveniles. Eight hundred and forty-three of these juveniles were captured upstream of the Chulitna River. The downstream migrant trap captured the highest percentage (41.0%) of juveniles in comparison to other sampling methods. The farthest downstream site where juvenile round whitefish were caught was RM 14.8 while RM 150.1 was the farthest upstream site in the reach of river below Devil Canyon.

Movement and Migration

Eleven hundred and forty-five round whitefish were Floy anchor tagged between 1980 and 1982, (1,008 in 1982) during a tag and recapture program. Thirty-six round whitefish have been recaptured with 35 (97%) of those occurring during 1982 (ADF&G 1981; Appendix Table 3-A-34). Two of the 35 fish recaptured in 1982 were tagged in 1981. The recovery rate of fish tagged in 1981 was 1.5 percent (2 of 137) while 3.3 percent (33 of 1,008) of the fish tagged in 1982 have been recovered.

The round whitefish recaptured in 1982 ranged from four hours to 355 days between time of tagging and recapture. The maximum upstream movement was 36.6 miles while the maximum downstream movement was 32.6 miles. No movement was recorded for 17 (48.6%) of the 35 recaptured fish. The maximum movement recorded for 1981 or 1982 recaptured fish was the fish tagged and recovered in 1982 which moved 36.6 miles.

Spawning

Sexually mature round whitefish were captured at two locations in the mainstem Susitna River between Cook Inlet and Devil Canyon during the 1981 and 1982 field seasons. Sexually ripe round whitefish were captured by electrofishing during early October, 1982 in the mainstem Susitna River at RM 102.6 and on October 2, 1981 at RM 100.8. At both sites, milt and eggs were discharged by palpating several captured fish.

All adult whitefish captured in 1982 over 200 mm fork length evidenced spawning coloration (bronze on back and sides) in late May. All of the 24 adult female round whitefish necropsied between Cook Inlet and Talkeetna from June to September, 1982 contained eggs. One round whitefish captured at the mouth of Portage Creek on September 21, had nuptial tubercles on its lateral scales.

3.1.1.5 Humpback Whitefish

Gill raker counts were taken on 26 humpback whitefish mortalities to determine which species of the humpback whitefish complex (Coregonus clupeaformis, C. nelsoni, and/or C. pidschian) inhabits the Susitna River. The modal gill raker count is the best method used to differentiate between species. Morrow (1980) reported that in Alaska the modal gill raker count for C. clupeaformis is 26 or more, C. nelsoni is usually 25 and C. pidschian is 22 or 23. Counts from Susitna River humpback whitefish ranged from 19 to 26, with a mode of 22 (Appendix Table 3-A-35). On this basis, the humpback whitefish present in the Susitna River has been determined to be C. pidschian.

Distribution and Relative Abundance

A total of 553 humpback whitefish were captured downstream of Devil Canyon during 1982 (Table 3-3-5). No catches of humpback whitefish were made during the winter field season. Most humpback whitefish were captured by fishwheels.

Humpback whitefish were captured at 13 (76%) of the 17 DFH sites although they were caught infrequently (Appendix Tables 3-A-36 and 3-A-37). The greatest catches of humpback whitefish were recorded at the Portage Creek and Sunshine Creek and Side Channel DFH sites. A total of 23 humpback whitefish were captured at these sites while 54 were captured at all DFH sites combined.

Humpback whitefish were also captured at SFH sites (Appendix Tables 3-A-38 and 3-A-39). Boat electrofishing gear was used to capture humpback whitefish at eight SFH tributary or slough sites above the Chulitna River confluence and at eight tributaries below the confluence.

Table 3-3-5 Humpback whitefish catch on the Susitna River between Cook Inlet and Devil Canyon by study site type, May to October, 1982.

Study Site Type	MAY 16-31	JUNE 1-15	JUNE 16-30	JULY 1-15	JULY 16-31	AUG 1-15	AUG 16-31	SEPT 1-15	SEPT 16-30	OCT 1-15	TOTAL
DFH Sites	9	3	12	8	5	5	4	5	3	-	54
SFH Sites	-	7	11	3	11	11	22	11	1	-	77
Downstream migrant trap	-	-	0	1	2	15	26	1	4	0	49
Fishwheel sites	-	5	9	49	25	81	148	67	8	-	392
TOTAL	9	15	32	61	43	112	200	84	16	-	572

- no sample

Thirty-five humpback whitefish were also captured at mainstem SFH sites between Cook Inlet and Devil Canyon by boat electrofishing.

In addition, humpback whitefish were captured by fishwheels and by a downstream migrant trap (Table 3-3-5). A total of 163 adult humpback whitefish were captured in the mainstem Susitna River with fishwheels, while another 211 were captured at the Yentna River (RM 28.5, TRM 6.0) station (Appendix Table 3-A-40). The downstream migrant trap at RM 103.0 also captured 48 juvenile humpback whitefish. Most of the mainstem catch was made in August.

Movement and Migration

Adult humpback whitefish were again tagged in 1982 in an attempt to delineate seasonal movements in the Susitna River system. Over the course of the summer field season, 268 humpback whitefish were tagged. A total of eight recaptures of humpback whitefish were made (Appendix Table 3-A-41). Four of these recaptured fish were initially tagged in 1981 out of a total of 189 tagged that year. The calculated recovery rate of fish tagged in 1981 was 2.1 percent while the recovery rate of fish tagged in 1982 was 1.5 percent.

Spawning

Thirty-five humpback whitefish sampling mortalities were necropsied during June to September, 1982. Eggs were present in all necropsied adult females that were captured between Cook Inlet and Devil Canyon.

Nuptial tubercles were evident on the lateral scales of all adult humpback whitefish captured on the Susitna River during September.

3.1.1.6. Longnose Suckers

Distribution and Relative Abundance

One longnose sucker (*Catostomus catostomus* Forster) was captured during the ice-covered months. This individual was caught in a minnow trap in February in a mainstem side channel at RM 121.6.

During the ice-free months of May through October, 1,130 longnose suckers were captured (Table 3-3-6). Sixty-one percent of the catch was at the downstream migrant trap, fishwheels, or SFH sites. Boat electrofishing gear was used to capture 324 (73%) of the 441 longnose suckers found at DFH sites. Longnose suckers were captured at all the DFH sites, but catches between sites varied tremendously (Appendix Tables 3-A-42 and 3-A-43). The DFH site at which the most longnose suckers were caught was Rabideux Creek and Slough where 68 were captured. Other sites at which more than 30 longnose suckers were captured included Goose Creek 2, and Side Channel, Sunshine Creek and Side Channel, Whiskers Creek and Slough, and Slough 8A. Only one longnose sucker was captured at both Slough 11 and Slough 19. The catch was divided fairly evenly among sampling periods over the course of the open water season.

Longnose suckers were captured at 29 SFH tributary or slough sites with electrofishing gear (Appendix Tables 3-A-44 and 3-A-45). Fifteen of

Table 3-3-6 Longnose sucker catch on the Susitna River between Cook Inlet and Devil Canyon by study site type, May to October, 1982.

Study Site Type	MAY 16-31	JUNE 1-15	JUNE 16-30	JULY 1-15	JULY 16-31	AUG 1-15	AUG 16-31	SEPT 1-15	SEPT 16-30	OCT 1-15	TOTAL
DFH Sites	27	25	58	81	15	40	66	76	53	-	441
SFH Sites	7	80	50	75	86	25	112	125	10	-	570
Downstream migrant trap	-	-	14	6	5	0	1	2	0	0	28
Fishwheel sites	-	11	20	21	7	16	12	4	0	-	91
TOTAL	34	116	142	183	113	81	191	207	63	0	1130

- no sample

these sites were below the Chulitna River confluence and the other sites were above the confluence. The mouth of Trapper Creek (RM 91.5) recorded the highest catch (62) of longnose suckers at the SFH sites. The mouth of the Deshka River (RM 40.6) and a beaver pond (RM 86.3) were also found to harbor large numbers of longnose suckers. Boat electrofishing gear was also used to capture 324 longnose suckers at a number of SFH mainstem sites both above and below the Chulitna River confluence. Mainstem catches decreased after June and then gradually increased in August and September. Most of the longnose suckers captured with boat electrofishing gear had fork lengths greater than 200 mm. Ninety-one longnose suckers were also captured in the mainstem in fishwheels and the catch was evenly divided among the sites (Appendix Table 3-A-46).

Movement and Migration

Eight hundred and eighty-nine longnose suckers were tagged with Floy anchor tags during 1982. Eighteen tag recoveries were made, three of the recoveries were fish tagged in 1981 (Appendix Table 3-A-47). The recovery rate of tags deployed in 1981 was 0.8 percent (3 of 350) while the 1982 recovery rate was 1.7 percent. All three of the longnose suckers tagged in 1981 were recaptured at a location less than one mile from where they were tagged while 11 of the 15 longnose suckers tagged and recovered in 1982 moved one mile or less. The other four longnose suckers recovered all moved downstream and movements ranged from 1.2 to 7.5 miles.

Spawning

Sexually ripe and spent longnose suckers were captured during late May and early June, 1982 at the mouth of Trapper Creek (RM 91.5) and below the mouth of Sunshine Creek.

Electrofishing gear was used to capture 28 longnose suckers ranging from 155-380 mm fork length, at the mouth of Trapper Creek on June 5 at the interface of the mainstem and the tributary. At this time, four sexually mature and two spent longnose suckers were captured (Appendix Table 3-A-48). On June 10, only 13 longnose suckers were captured by electrofishing this site.

The mouth of Sunshine Creek was the other location where evidence of longnose sucker spawning was observed. Peak spawning also occurred before June 10 at this location; 20 longnose suckers were captured on May 25 while only two were captured on June 10. One ripe male and one spent female were captured on May 25.

Sexually mature males captured during May and June in the Susitna River ranged from 293 mm to 370 mm while mature females ranged from 296 mm to 370 mm. Scale and age-length analysis of these fish indicated they were Age V to VII (Appendix Report 3-G-1).

Ten sexually mature males were also captured by electrofishing in the mainstem between RM 35.4 and RM 138.6 during September. All discharged milt when palpated. In addition, five necropsied female longnose suckers captured during September had very well developed eggs. Concentrations of longnose suckers were observed during September in the mainstem between RM 35.4 and RM 47.1 in habitat similar to that found during spring spawning.

Nuptial tubercles were evident on the anal fin of all sexually mature males captured during May, June and September.

Young of the year longnose suckers, mean fork length of 15 mm, were first captured during early August, 1982 at Slough 8A. Young of the year longnose suckers were also captured at Goose Creek 2 and Side Channel, Whitefish Slough, and Whiskers Creek and Slough.

3.1.1.7 Dolly Varden

Distribution and Relative Abundance

One Dolly Varden (*Salvelinus malma* Walbaum) was captured during winter sampling efforts. This juvenile was captured in a minnow trap in March at the mouth of Montana Creek (RM 77.0). The majority of the 116 Dolly Varden sampled during the ice-free months of 1982 were captured in June and July (Table 3-3-7). During the summer field season, the majority of Dolly Varden were captured by boat electrofishing, fishwheels, and minnow traps.

Dolly Varden were captured at only nine (53%) of the 17 DFH sites (Appendix Tables 3-A-49 and 3-A-50). The catch of Dolly Varden at Lane

Table 3-3-7 Dolly Varden catch on the Susitna River between Cook Inlet and Devil Canyon by study site type, May to October, 1982.

Study Site Type	MAY 16-31	JUNE 1-15	JUNE 16-30	JULY 1-15	JULY 16-31	AUG 1-15	AUG 16-31	SEPT 1-15	SEPT 16-30	OCT 1-15	TOTAL
DFH Sites	-	7	2	3	1	7	1	3	2	-	26
SFH Sites	3	22	7	12	4	4	1	3	-	-	56
Downstream migrant trap	-	-	0	0	7	0	0	0	0	0	7
Fishwheel sites	-	2	7	3	1	0	3	10	1	-	27
TOTAL	3	31	16	18	13	11	5	16	3	-	116

- no sample

Creek and Slough 8 was higher than at any other DFH site with a total of eight captured. Total catch of Dolly Varden at all the DFH sites was only 28.

Boat electrofishing gear was used capture Dolly Varden at the mouths of six tributary SFH sites (Appendix Tables 3-A-51 and 3-A-52). Dolly Varden were found below the Chulitna River confluence at Kashwitna River (RM 61.0), Gray's Creek (RM 59.5), Talkeetna River (RM 97.0) and Goose Creek (RM 72.0). Above the Chulitna River confluence, the mouths of Skull Creek (RM 124.7) and Sherman Creek (RM 130.8) produced Dolly Varden. Twelve Dolly Varden were also captured by boat electrofishing in the mainstem below the Chulitna River confluence and three in the mainstem above the confluence. Fishwheels captured 27 other adult Dolly Varden in the mainstem of which 13 were captured above the confluence (Appendix Table 3-A-53).

Seven juvenile (fork length under 200 mm) Dolly Varden were captured in late July by the downstream migrant trap located at Talkeetna camp (RM 103.0). Five of these fish were captured on July 26 and all were approximately 30-35 mm in length. Juvenile Dolly Varden were also captured at the mouths of Sunshine Creek and Side Channel, Gash Creek (RM 111.5), Slough 6A, Lane Creek and Slough 8, 4th of July Creek, and Portage Creek. Minnow trapping in upper Portage Creek and Indian River has also shown the presence of a number of juvenile or stunted adult Dolly Varden from 2.7 to 15.5 miles above the mouths of these streams (Appendix Report 3-D-1).

Movement and Migration

Forty-six Dolly Varden were tagged in 1982 in an effort to delineate seasonal movements. Seven of the tags deployed in 1981 and 1982 were recovered (Appendix Table 3-A-54). Only one of the 59 Dolly Varden tagged in 1981 was recovered in 1982; the recovery rate of tagged 1981 fish was 1.7 percent. The recovery rate of Dolly Varden tagged in 1982 was 13.0 percent. One of the Dolly Varden tagged in 1982 moved 25 miles upstream between the time of tagging and subsequent recovery, the other recaptured fish moved much smaller distances.

Spawning

No Dolly Varden were observed spawning, and no sexually mature adults were captured during the 1982 field season in the mainstem Susitna River.

3.1.1.8 Threespine Stickleback

Distribution and Relative Abundance

Only one threespine stickleback (*Gasterosteus aculeatus* L.) was captured during the 1981-1982 winter field season. This individual was captured at Whiskers Creek and Slough in a minnow trap in April.

An additional 267 threespine stickleback were captured during the ice-free field season (Table 3-3-8). Minnow traps, beach seines, dip nets, and electroshockers were used to capture the fish at DFH and SFH

Table 3-3-8 Threespine stickleback catch on the Susitna River between Cook Inlet and Devil Canyon by study site type, May to October, 1982.

Study Site Type	MAY 16-31	JUNE 1-15	JUNE 16-30	JULY 1-15	JULY 16-31	AUG 1-15	AUG 16-31	SEPT 1-15	SEPT 16-30	OCT 1-15	TOTAL
DFH Sites	-	11	24	18	5	72	47	25	17	-	219
SFH Sites	0	1	0	0	14	1	0	0	0	0	16
Downstream migrant trap	-	-	0	0	1	0	4	17	9	1	32
Fishwheel sites	-	0	0	0	0	0	0	0	0	-	0
TOTAL	-	12	24	18	20	73	51	42	26	1	267

- no sample

sites. Most of the threespine stickleback were captured below the confluence of the Chulitna River; only 50 (18.7%) fish were captured above the confluence. The farthest upstream location at which threespine stickleback were captured was at the Talkeetna station (RM 103.0) where they were captured by the downstream migrant trap.

Threespine stickleback were captured at six of the 17 DFH sites (Appendix Tables 3-A-55 and 3-A-56). All of the five DFH sites below the confluence were found to have threespine stickleback present. The site at Whiskers Creek and Slough was the only DFH site above the confluence at which threespine stickleback were captured. Catches at DFH sites peaked in August as the juveniles reached a size where they were catchable.

Boat electrofishing gear captured 16 threespine stickleback at two mainstem sites and five tributary sites below RM 80.0 (Appendix Tables 3-A-57 and 3-A-58).

Juvenile stickleback were observed at five SFH sites below the Chulitna River confluence. Schools of juvenile stickleback were observed in late July and early August at Lower Fish Creek (RM 7.6), Anderson Creek (RM 23.8), Kroto Slough (RM 38.3), Rolly Creek (RM 39.0), and an unnamed slough on the west bank (RM 57.4). At Whitefish Slough, juvenile threespine stickleback were captured during early August. These juveniles were 15 mm to 25 mm in length. By early September, the juveniles had moved out of Whitefish Slough as it was nearly dewatered. At the downstream migrant trap at Talkeetna Station (RM 103.0), 31 juvenile threespine sticklebacks were captured. Most of the juvenile catch, composed of 23-35mm fish, was made from August 25 through September 26.

Movement and Migration

Since no threespine stickleback have been marked, no information is available on threespine stickleback movement.

Spawning

Threespine stickleback ranging in length from 50mm to 100mm were observed in spawning colors during early June to late July, 1982 at DFH sites below the Chulitna River confluence. However, no adult threespine stickleback were actually observed spawning. Young of the year threespine stickleback with total lengths between 15mm and 20mm were first observed during late July and early August. Since threespine stickleback are only about 4.5mm in length upon hatching (Morrow 1980), these fish were at least several weeks old at the time they were observed.

3.1.1.9 Slimy Sculpin

Distribution and Relative Abundance

All cottids that were examined in 1982 proved to be slimy sculpins (*Cottus cognatus* Richardson). It is possible that several other species of sculpin may be present in the lower Susitna River (ADF&G 1981c), but it appears that the great majority of individuals at the sites sampled in 1982 were slimy sculpins. For purposes of further discussion, all cottids captured have been assumed to be slimy sculpins.

Slimy sculpins were captured in minnow traps at 11 sites during the ice covered months (Appendix Table 3-A-59). A total of 43 individuals were captured, and 13 of these were captured at Slough 22. All the slimy sculpin were captured at slough or tributary sites. None were captured at mainstem sites; however, minnow trapping efforts in the mainstem were limited (Appendix Table 3-A-5). Slimy sculpins were captured both above and below the Chulitna River confluence.

During the ice free months of May through October, 659 slimy sculpins were captured (Table 3-3-9). Most (82%) were captured at DFH sites and the remainder were captured at the downstream migrant trap or SFH sites. Minnow traps, beach seines, electrofishing units, and dip nets were used to capture slimy sculpin.

Slimy sculpins were captured at all 17 DFH sites (Appendix Tables 3-A-60 and 3-A-61). Sampling efforts at Whiskers Creek and Slough produced the highest number of slimy sculpin with 101 captured. More than 50 slimy sculpin were also captured at Sunshine Creek and Side Channel, Birch Creek and Slough, and Lane Creek and Slough 8. Only two slimy sculpin were captured at Slough 11 and less than 10 fish were captured at Whitefish Slough, Slough 19, and Portage Creek. In general, fewer slimy sculpin were captured at DFH sites above the confluence. The seasonal catch at DFH sites peaked in September.

Table 3-3-9 Slimy sculpin catch on the Susitna River between Cook Inlet and Devil Canyon by study site type, May to October, 1982.

Study Site Type	MAY 16-31	JUNE 1-15	JUNE 16-30	JULY 1-15	JULY 16-31	AUG 1-15	AUG 16-31	SEPT 1-15	SEPT 16-30	OCT 1-15	TOTAL
DFH Sites	2	12	50	63	46	84	46	123	116	-	542
SFH Sites	4	3	34	12	9	0	9	3	1	0	75
Downstream migrant trap	-	-	15	3	14	2	3	2	2	1	42
Fishwheel sites	-	0	0	0	0	0	0	0	0	-	0
TOTAL	6	15	99	78	69	86	58	128	119	1	659

- no sample

SFH tributary or slough sites at which slimy sculpin were captured included four sites below the Chulitna River confluence and eleven above (Appendix Tables 3-A-62 and 3-A-63). Twelve slimy sculpin were captured at mainstem SFH sites below the confluence and 26 were captured at mainstem SFH sites above the confluence. Slimy sculpins were often observed at most sites electrofished by boat but few were captured due to a selection for other resident or juvenile anadromous species and time constraints. Slimy sculpin were observed at nearly every tributary and slough site sampled and they were also present at a large number of mainstem sites.

Movement and Migration

The highest catches of adult slimy sculpin at the downstream migrant trap (RM 103.0) were in late June and late July, although adults were captured whenever the trap was in operation. Adult catches were fairly constant during the ice free months at DFH and SFH sites. Winter catches of slimy sculpin were similar to summer catches, suggesting slimy sculpins are resident year round in specific areas.

Spawning

No data concerning slimy sculpin spawning were gathered in 1982. The first captures of young of the year slimy sculpin was made during late July. At this time the young were 10-15 mm in length.

3.1.1.10 Arctic Lamprey

Distribution and Relative Abundance

No Arctic lamprey (*Lampetra japonica* Martens) were captured during the winter field season. A total of 62 Arctic lamprey were captured in the downstream migrant trap and at DFH and SFH sites during the open water field season (Table 3-3-10). Arctic lamprey were captured at only three DFH sites; the upstream most site being Whiskers Creek and Slough (Appendix Tables 3-A-64 and 3-A-65). The most productive DFH site was Birch Creek and Slough where 31 Arctic lamprey were caught. Seven Arctic lamprey were captured at SFH sites downstream of RM 58.0 (Appendix Tables 3-A-66 and 3-A-67). The downstream migrant trap (RM 103.0) captured 18 Arctic lamprey during summer operations (Table 3-3-10). Catch per hour at the downstream migrant trap was consistently low, ranging from 0.03-0.18 Arctic lamprey/hour.

In addition, two Arctic lamprey were captured while parasitizing other fish. One was attached to a 81mm chinook salmon smolt captured in the mainstem at RM 31.8. The other was attached to a longnose sucker captured at Sunshine Creek and Side Channel.

Movement and Migration

The catches of Arctic lamprey in 1982 were too low to document any movement patterns. Populations of Arctic lamprey can be anadromous or resident (Morrow 1980).

Table 3-3-10 Arctic lamprey catch on the Susitna River between Cook Inlet and Devil Canyon by study site type, May to October, 1982.

Study Site Type	MAY 16-31	JUNE 1-15	JUNE 16-30	JULY 1-15	JULY 16-31	AUG 1-15	AUG 16-31	SEPT 1-15	SEPT 16-30	OCT 1-15	TOTAL
DFH Sites	-	7	7	-	-	-	1	21	-	-	36
SFH Sites	0	0	0	0	6	2	0	0	0	0	8
Downstream migrant trap	-	-	2	5	3	3	0	1	3	1	18
Fishwheel sites	-	0	0	0	0	0	0	0	0	0	0
TOTAL	-	7	9	5	9	5	1	23	3	1	62

- no sample

Spawning

Arctic lamprey were observed spawning in Birch Creek Slough near the mouth of Birch Creek during late June and early July. During this time, two pairs of Arctic lampreys were observed constructing nests and spawning as described by Morrow (1980). Although Arctic lamprey were observed spawning only at Birch Creek Slough, ammocoetes of Arctic lamprey were captured between RM 39.0 and RM 111.5.

3.1.2 Juvenile Anadromous Fish Species

Juvenile salmon catch data in this section are presented as sampling site totals. For a separation by habitat zone at each sampling site, refer to Volume 4, Appendix 4-G.

3.1.2.1 Chinook Salmon

A total of 963 juvenile chinook salmon (*Oncorhynchus tshawytscha* Walbaum) were captured by all gear types at Designated Fish Habitat (DFH) sites from Goose Creek 2 upstream to Slough 21 during sampling conducted from June through September, 1982 (Appendix Table 3-A-68).

The seasonal variation in distribution and relative abundance of juvenile chinook salmon at DFH sites on the Susitna River is summarized in Figure 3-3-3. Lower reach sampling sites between Goose Creek and the Chulitna River show higher relative abundance during June and July. The upper reach, between Chulitna River and Portage Creek, had the highest

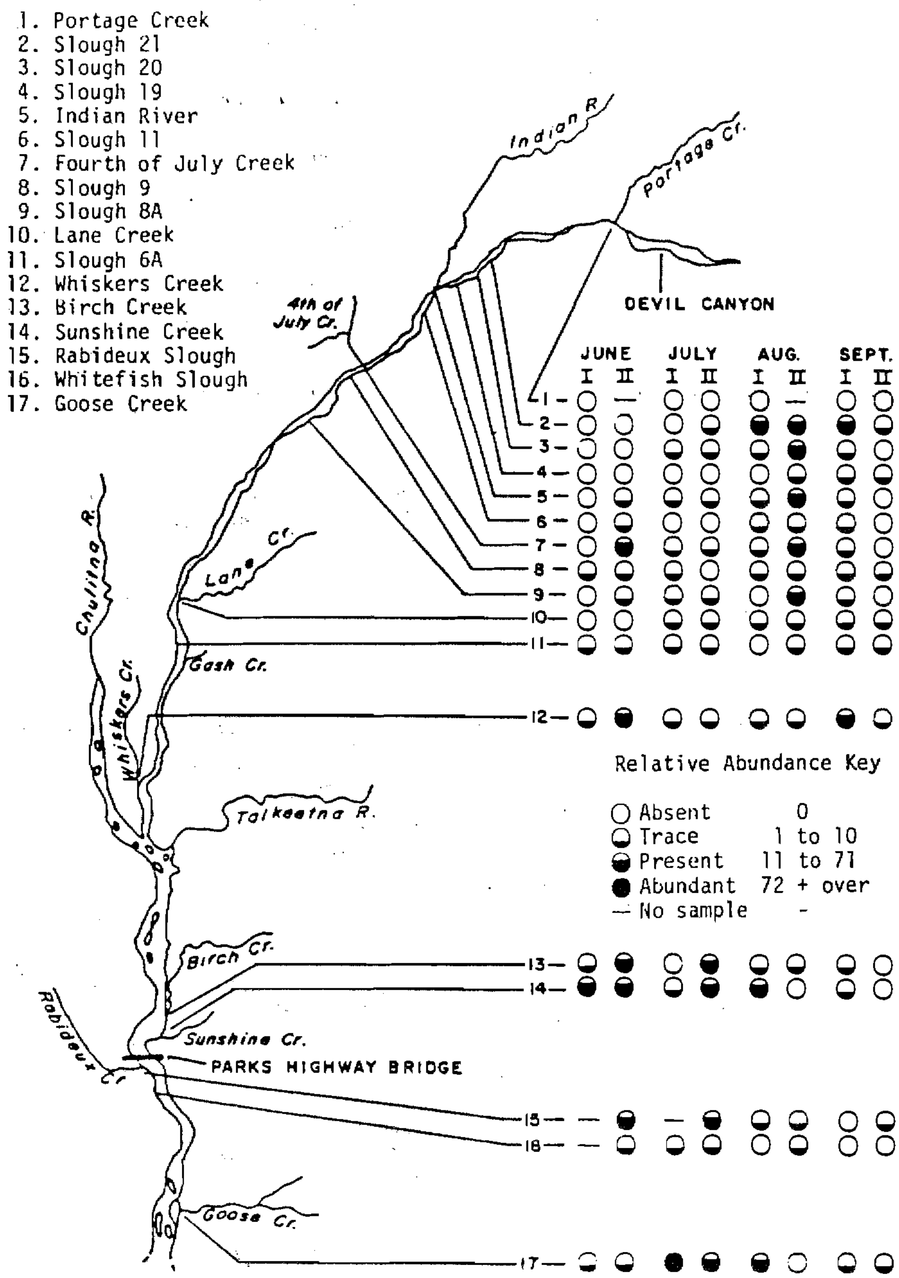


Figure 3-3-3. The seasonal variation in distribution and relative abundance of chinook salmon juveniles at DFH sites on the Susitna River, June through September, 1982.

relative abundance during August and September. Age 1+ chinook salmon juveniles appear to be outmigrating in the lower reach during June and July while Age 0+ fish were observed more frequently at upper reach locations in August and September.

A total of 515 (53.4%) of the juvenile chinooks salmon were captured in the lower reach between Goose Creek 2 and the Chulitna River confluence by all methods including boat electrofishing (Table 3-3-11). At the upper reach sites between Chulitna River and Portage Creek, a total of 448 (46.6%) juvenile chinook salmon were captured (Table 3-3-12). The total catch of juvenile chinook salmon captured by all gear types at DFH sites by two week intervals is summarized in Figure 3-3-4. Most juvenile chinook salmon (159) in the lower reach were captured during early July, while in the upper reach, most chinook salmon juveniles (122) were captured during late August.

Juvenile chinook salmon were collected at 16 (94.1%) of 17 DFH sites. Portage Creek was the only sampling location where juvenile chinooks were not captured. Goose Creek had the highest percentage (20.6%) of the total catch by all gear types for the lower reach (Table 3-3-11). Whiskers Creek and Slough had the highest percent (11.8%) of the total catch for the upper reach (Table 3-3-12).

The range of catch per unit effort for minnow traps varied from a trace (0.1) at Slough 20 and Slough 11 throughout the season to a high catch rate of 6.2 fish per trap recorded at Goose Creek 2 and Side Channel in early July (Appendix Table 3-A-69). The highest mean catch per minnow

Table 3-3-11. Total catch of chinook salmon juveniles by all gear types at DFH sites on the Susitna River between Goose Creek and Chulitna River, June through September, 1982.

Site	River Mile	June 1-15	June 16-30	July 1-15	July 16-31	Aug. 1-15	Aug. 16-31	Sept. 1-15	Sept. 16-30	Site Total	Percent of Total Catch: Goose Ck. to Chulitna	Percent of Total Catch: Goose Ck. to Portage Ck.
Goose Creek 2	73.1	1	9	140	26	16	0	6	1	199	38.6	20.6
Whitefish Slough	78.7	-	10	3	1	0	2	0	0	16	3.1	1.7
Rabideux Slough	83.1	-	50	-	57	3	1	0	1	116	22.5	12.0
Sunshine Creek	85.7	11	51	4	40	11	0	3	0	120	23.3	12.4
Birch Creek	88.4	3	22	0	35	1	1	2	0	64	12.4	6.6
TOTALS		15	142	147	159	31	4	11	2	515	100.0	53.3

- Not sampled

Table 3-3-12. Total catch of chinook salmon juveniles by all gear types at DFH sites on the Susitna River between Chulitna River and Portage Creek, June through September, 1982.

Site	River Mile	June 1-15	June 16-30	July 1-15	July 16-31	Aug. 1-15	Aug. 16-31	Sept. 1-15	Sept. 16-30	Site Total	Percent of Total Catch: Chulitna to Portage Ck.	Percent of Total Catch: Goose Ck. to Portage Ck.
Whiskers Creek	101.2	6	44	7	4	6	9	35	3	112	25.0	11.8
Slough 6A	112.3	1	9	5	8	0	1	8	3	35	7.8	3.6
Lane Creek/Sl. 8	113.6	0	0	2	3	8	9	9	9	40	8.9	4.1
Slough 8A	125.3	0	4	1	6	0	11	8	0	30	6.7	3.1
Slough 9	129.2	4	4	1	0	2	7	2	6	26	5.8	2.7
Fourth of July Mouth	131.1	0	11	5	10	7	14	8	0	55	12.3	5.7
Slough 11	135.3	0	1	0	0	3	8	2	0	14	3.1	1.5
Indian River-Mouth	138.6	0	1	1	1	5	18	1	0	27	6.0	2.8
Slough 19	140.0	0	0	0	0	0	2	3	6	11	2.4	1.1
Slough 20	140.1	0	0	5	4	2	14	3	0	28	6.2	2.9
Slough 21	142.0	0	0	0	1	12	29	22	6	70	15.6	7.3
Portage Creek-Mouth	148.8	0	0	0	0	0	0	0	0	0	0	0
TOTALS		11	74	27	37	45	122	101	33	448	100.0	46.6

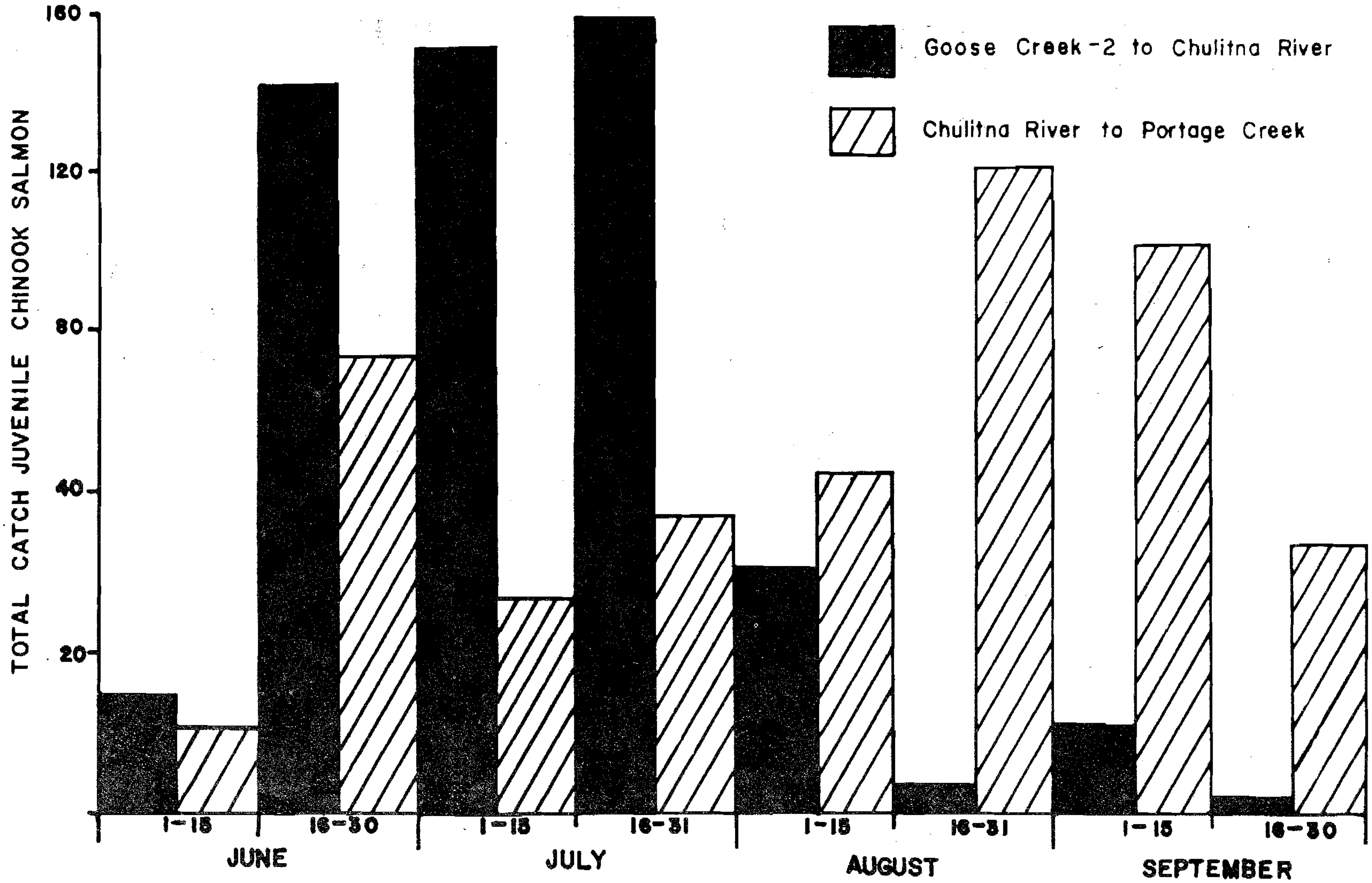


Figure 3-3-4. The total catch of chinook salmon juveniles by two week periods for two reaches on the Susitna River, June through September, 1982.

trap for all DFH sites from Goose Creek 2 to the Chulitna River confluence occurred in early July at Goose Creek 2 and Side Channel (Table 3-3-13), while the highest mean catch per minnow trap for all DFH sites from the Chulitna River to Portage Creek occurred in late June at Whiskers Creek and Slough (Table 3-3-14). The high catch per unit effort levels recorded during late June in the upper reach, early July in the lower reach, and the high mean catch per hour levels of the downstream migrant trap during these periods indicate an outmigration of Age 1+ chinook salmon juveniles. The mean catch per minnow trap by reach is presented in Table 3-3-15 and plotted in Figure 3-3-5.

No Age 2+ chinook salmon were captured (Appendix Table 3-H-1). All Age 1+ fish had outmigrated from the study reach (Goose Creek to Portage Creek) by the end of July. At most sampling sites, the abundance of Age 1+ fish peaked prior to the peak abundance of Age 0+ fish.

A total of 151 juvenile chinook salmon were captured, primarily incidental captures during boat electrofishing, at SFH sites surveyed from mainstem Susitna (RM 17.7) upstream to the Mainstem E. Bank (RM 145.0) during sampling conducted from late May through September. A total of 74 fish (49%) were captured at SFH locations between Cook Inlet and the Chulitna River confluence. Upper river SFH locations between the Chulitna River and Susitna River mile 145.0 had a total catch of 77 fish (51%) (Appendix Table 3-A-70). The small numbers captured are a result of the inefficiency of the gear and do not reflect any patterns. The catch per unit effort data are presented in Appendix Table 3-A-71.

Table 3-3-13. Chinook salmon juveniles, mean catch per minnow trap at DFH sites on the Susitna River between Goose Creek and Chulitna River, June through September, 1982.

Reach	River Mile	June 1-15	June 16-30	July 1-15	July 16-31	Aug 1-15	Aug 16-31	Sept 1-15	Sept 16-30
Goose Creek 2 and Side Channel	73.1	0.0	0.4	6.2	1.6	0.8	0.0	0.1	0.0
Whitefish Slough	78.7	-	2.0	0.0	0.0	0.0	0.0	0.0	0.0
Rabideux Creek and Slough	83.1	-	1.9	-	2.7	0.1	0.0	0.0	0.1
Sunshine Creek and Side Channel	85.7	0.6	2.2	0.4	4.0	1.0	0.0	0.1	0.0
Birch Creek and Slough	88.4	0.1	0.9	0.0	1.7	0.0	0.0	0.0	0.0

- not sampled

Table 3-3-14. Chinook salmon juvenile, mean catch per minnow trap at DFH sites on the Susitna River between Chulitna River and Portage Creek, June through September, 1982.

Site	River Mile	June 1-15	June 16-30	July 1-15	July 16-31	Aug. 1-15	Aug. 16-31	Sept. 1-15	Sept. 16-30
Whiskers Creek (and Slough)	101.2	0.0	1.5	0.2	0.2	0.3	0.2	1.3	0.1
Slough 6A	112.3	0.1	0.6	0.3	0.1	0.0	0.0	0.1	0.0
Lane Creek and Slough 8	113.6	0.0	0.0	0.1	0.1	0.1	0.3	0.0	0.3
Slough 8A	125.3	0.0	0.0	0.0	0.1	0.0	0.3	0.0	0.0
Slough 9	129.2	0.3	0.1	0.0	0.0	0.0	0.2	0.0	0.3
Fourth of July Creek - Mouth	131.1	0.0	0.1	0.2	0.3	0.1	0.0	0.0	0.0
Slough 11	135.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Indian River - Mouth	138.6	0.0	0.0	0.0	0.1	0.3	0.3	0.1	0.0
Slough 19	140.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3
Slough 20	140.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Slough 21	142.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
Portage Creek - Mouth	148.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 3-3-15. Chinook salmon juveniles, mean catch per minnow trap by reach on the Susitna River, between Goose Creek 2 and Portage Creek, June through September, 1982.

Reach	River Mile	June 1-15	June 16-30	July 1-15	July 16-31	Aug 1-15	Aug 16-31	Sept 1-15	Sept 16-30
Goose Creek 2 to Chulitna River	73.1--98.5	0.3	1.4	4.3	2.3	0.5	0.1	0.1	0.1
Chulitna River to Portage Creek	98.5-148.8	0.1	0.7	0.2	0.1	0.2	0.2	0.4	0.2
Goose Creek 2 to Portage Creek	73.1-148.8	0.2	1.1	1.1	0.9	0.3	0.3	0.3	0.1

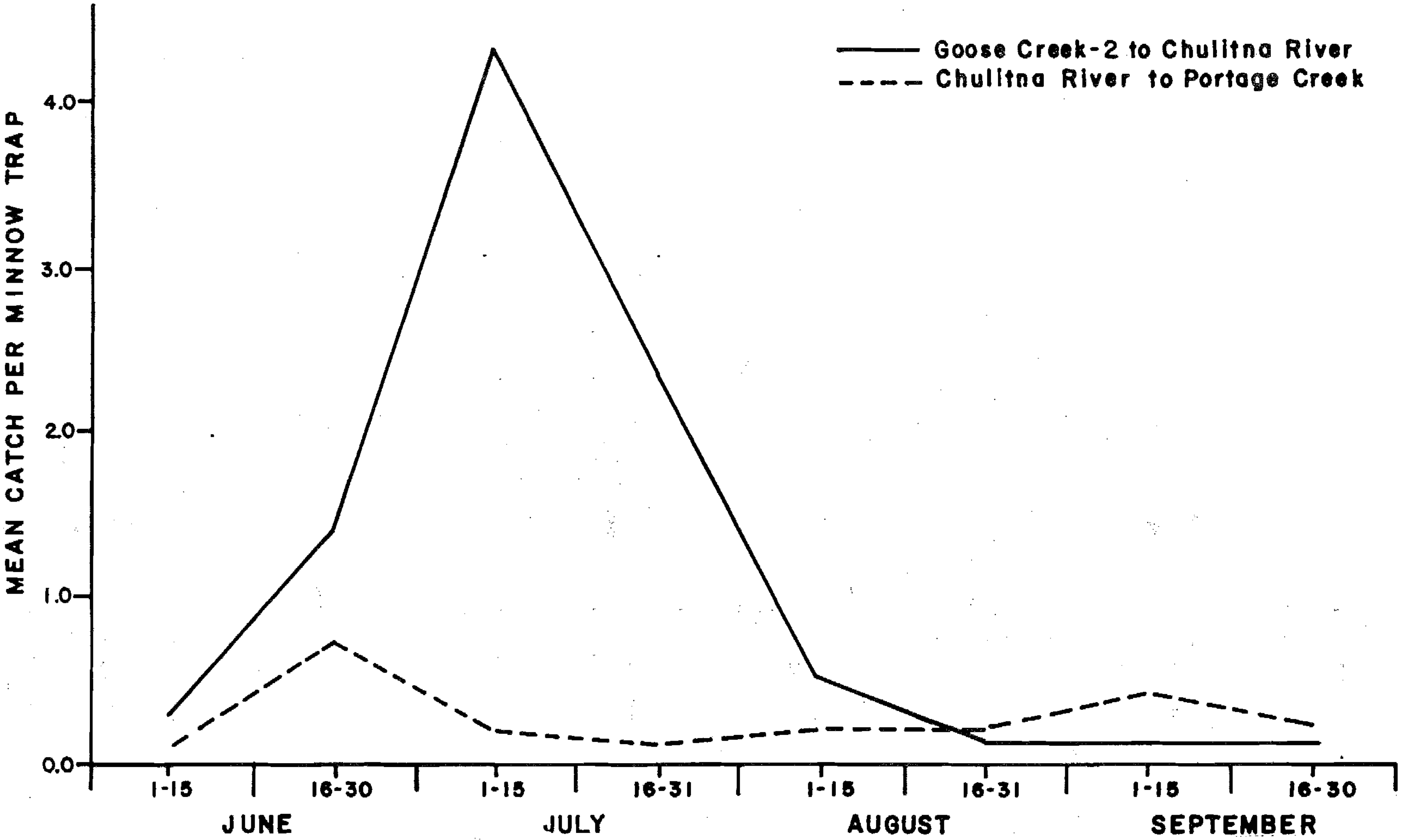


Figure 3-3-5. Chinook salmon juvenile, mean catch per minnow trap at DFH sites by reach on the Susitna River between Goose Creek 2 and Portage Creek, June through September, 1982.

A total of 227 chinook salmon juveniles were captured during winter sampling from February through April, 1982 at the nine of twelve DFH sites sampled above the Chulitna River confluence (see Appendix Table 3-A-72). There was no chinook salmon juvenile catch at DFH sites below the Chulitna River during winter sampling. Another 82 fish were captured at SFH sites between Mid Kroto Slough (RM 31.3) and Portage Creek (RM 148.8) (Appendix Table 3-A-73). It is difficult to note any trends with this small number of fish collected. Either the sampling methods are not efficient through the ice or in open leads at that time of year or the fish are not present in any great numbers at these sites. Most chinook salmon juveniles were collected at Whiskers Creek (37), Slough 10 (39), and Slough 20 (158). Chinook salmon juveniles were present during all three months at Fourth of July Creek, Slough 10, Slough 11, and Slough 20.

3.1.2.2 Coho Salmon

Sampling efforts conducted at DFH sites in the Susitna River, both above and below the Chulitna River confluence, resulted in collection of juvenile coho salmon, *Oncorhynchus kisutch* (Walbaum), of three different brood years (Ages 0+, 1+, and 2+). Approximately 90 percent of the 17 DFH sites sampled had coho salmon present for at least one of the eight sampling periods. Catch data are presented in Appendix Table 3-A-74 and catch per unit effort data are contained in Appendix Table 3-A-75.

Small numbers of juvenile coho salmon were also collected by the use of electrofishing boats. The downstream migrant trap, located 4.5 miles upstream from the Chulitna confluence, reported catches of coho salmon juveniles throughout the open water season.

The seasonal variation in distribution and relative abundance of coho salmon juveniles at DFH sites is summarized in Figure 3-3-6. Catch rates were highest in July.

The total juvenile coho salmon catch for all gear types including boat electrofishing are tabulated in Table 3-3-16 for the sampling sites located below the Chulitna River confluence. The percentage contribution of each site to the total catch by all gear types in this reach is presented in this table. Eighty percent of the coho salmon juveniles captured were collected from the sampling sites located below the Chulitna River confluence. Rabideux Creek and Slough, Sunshine Creek and Side Channel, and Birch Creek and Slough were the most productive sites in this reach.

Total juvenile coho salmon catch data for all gear types including boat electrofishing are presented for the reach of river above the Chulitna River confluence in Table 3-3-17. Catches in this reach were lower than in the reach below the Chulitna River confluence and most juvenile coho salmon were collected in June and September. Tributary mouths and their associated slough habitat contributed to the majority of juveniles collected (i.e. Whiskers Creek and Slough, Lane Creek and Slough 8, and Fourth of July Creek). Slough 6A (an upland slough) was the most productive juvenile coho salmon site in this reach. Coho juveniles were collected at Slough 6A during all sampling periods. Total catches of

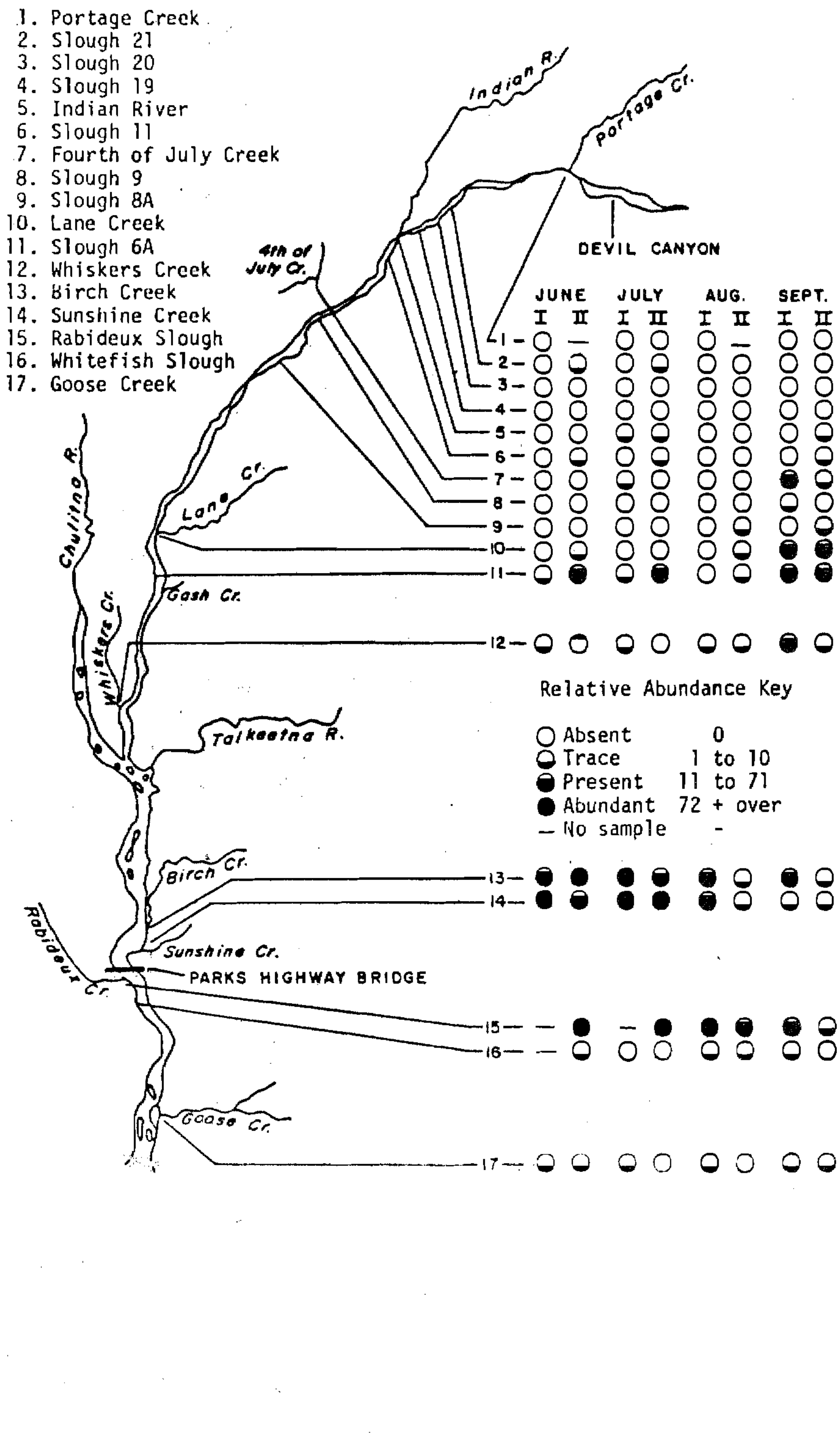


Figure 3-3-6. The seasonal variation in distribution and relative abundance of coho salmon juveniles at DFH sites on the Susitna River, June through September, 1982.

Table 3-3-16. Total catch coho salmon juveniles, by all gear types at DFH sites on the Susitna River between Goose Creek 2 and Chulitna River, June through September, 1982.

Site	River Mile	June 1-15	June 16-30	July 1-15	July 16-31	August 1-15	August 16-31	September 1-15	September 16-30	Site Totals	Percent of Total Catch: Goose Creek 2 to Chulitna River	Percent of Total Catch: Goose Creek 2 to Portage Creek
Goose Creek 2 and Sidechannel	73.1	2	9	1	0	1	0	2	2	17	1.2	0.9
Whitefish Slough	78.7	-	1	0	0	8	7	2	0	18	1.2	1.0
Rabideux Creek and Slough	83.1	-	121	-	255	75	31	31	3	516	34.9	27.8
Sunshine Creek and Sidechannel	85.7	89	46	183	164	58	2	5	3	550	37.2	29.7
Birch Creek and Slough	88.7	42	84	113	63	35	7	32	2	378	25.5	20.3
Totals		133	261	297	482	177	47	72	10	1479	100	79.7

- Site not sampled.

Table 3-3-17. Total catch of coho salmon juveniles by all gear types at DFH sites on the Susitna River between Chulitna River and Portage Creek, June through September, 1982.

Site	River Mile	June 1-15	June 16-30	July 1-15	July 16-31	August 1-15	August 16-31	September 1-15	September 16-30	Site Totals	Percent of Total Catch: Chulitna River to Portage Creek	Percent of Total Catch: Goose Creek to Portage Creek
Whiskers Creek Slough	101.2	2	28	9	0	1	7	37	1	85	22.5	4.6
Slough 6A	112.3	2	23	9	17	0	1	35	44	131	34.7	7.0
Lane Creek and Slough 8	113.6	0	2	0	0	0	3	40	42	87	23.0	3.1
Slough 8A	125.3	0	0	0	0	0	7	0	10	17	4.5	0.9
Slough 9	129.2	0	0	0	0	0	0	1	0	1	0.3	0.0
4th of July Creek-Mouth	131.1	0	0	1	0	0	0	24	5	30	8.0	1.6
Slough 11	135.3	0	5	0	1	0	0	0	4	10	2.7	0.5
Indian River-Mouth	138.6	0	0	1	1	0	0	0	6	8	2.1	0.4
Slough 19	140.0	0	0	0	0	0	0	0	0	0	0.0	0.0
Slough 20	140.1	0	0	0	8	0	0	0	0	8	2.1	0.0
Slough 21	142.0	0	1	0	0	0	0	0	0	1	0.3	0.0
Portage Creek-Mouth	148.8	0	0	0	0	0	0	0	0	0	0.0	0.0
Totals		4	59	20	27	1	18	137	112	378	100.0	19.7

juvenile coho salmon by reach are presented in Figure 3-3-7 for each of the sampling periods.

The minnow trap data is presented as catch per unit effort values in Tables 3-3-18 and 3-3-19 for DFH sites located in both the upper and lower reaches of the Susitna River. As minnow trap data dominated the collection efforts for coho salmon, these trends are similar to those indicated for total catch with all gear types. The catch per unit effort for all sampling sites in each of the reaches sampled is portrayed on Table 3-3-20. These values are plotted on Figure 3-3-8.

Coho salmon juveniles of age class other than Age 0+ were present in the two reachs for the entire open water season (Appendix Table 3-H-2). The peak abundance of age classes greater than Age 0+ occurred prior to the peak abundance of Age 0+ fish.

The juvenile coho catch and CPUE data collected at SFH sites is presented in Appendix Table 3-A-76 and 3-A-77. These small numbers collected reflect the ineffectiveness of the boat-mounted electrofishing gear for the collection of juveniles, rather than any pattern or trend in distribution.

Winter sampling for juvenile salmon was conducted at 32 sites from Mid-Kroto Slough (RM 36.3) to Portage Creek (RM 148.8) from February through April, 1982. Juvenile coho salmon catches were low at all sites. A total of 92 coho salmon juveniles were captured (Appendix

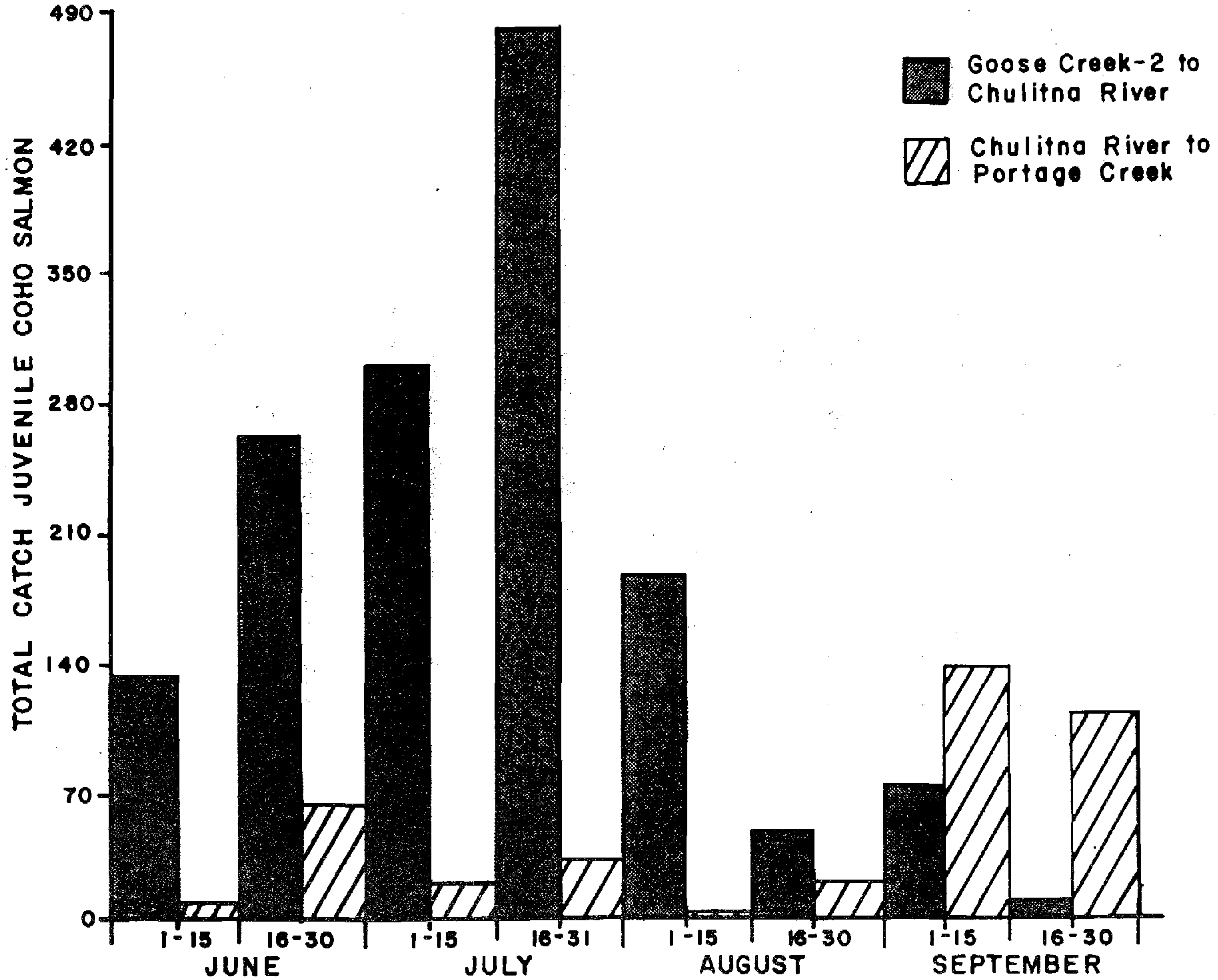


Figure 3-3-7. The total catch of coho salmon juveniles by two week periods for two reaches on the Susitna River, June through September, 1982.

Table 3-3-18. Coho salmon juveniles, mean catch per minnow trap at DFH sites on the Susitna River between Goose Creek 2 and Chulitna River, June through September, 1982.

Site	River Mile	June 1-15	June 16-30	July 1-15	July 16-31	August 1-15	August 16-31	Sept 1-15	Sept 16-30
Goose Creek 2 and Side Channel	73.1	0.1	0.4	0.0	0.0	0.0	0.0	0.1	0.1
Whitefish Slough	78.7	-	0.2	0.0	0.0	0.7	0.7	0.1	0.0
Rabideux Creek and Slough	83.1	-	4.0	-	12.1	3.4	0.4	1.0	0.2
Sunshine Creek and Side Channel	85.7	5.5	2.2	18.1	16.4	5.8	0.0	0.2	0.2
Birch Creek and Slough	88.4	1.1	3.1	4.5	3.0	2.1	0.2	0.8	0.0

- Site not sampled.

Table 3-3-19. Coho salmon juveniles, mean catch per minnow trap at DFH sites on the Susitna River between the Chulitna River and Portage Creek, June through September, 1982.

Site	River Mile	June 1-15	June 16-30	July 1-15	July 16-31	August 1-15	August 16-31	Sept 1-15	Sept 16-30
Whiskers Creek and Slough	101.2	0.1	0.9	0.4	0.0	0.0	0.2	1.2	0.0
Slough 6A	112.3	0.1	1.5	0.3	0.8	0.0	0.1	1.2	4.3
Lane Creek and Slough 8	113.6	0.0	0.1	0.0	0.0	0.0	0.0	1.2	2.3
Slough 8A	125.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Slough 9	129.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4th of July Creek Mouth	131.1	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0
Slough 11	135.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Indian River - Mouth	138.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Slough 19	140.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Slough 20	140.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Slough 21	142.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Portage Creek Mouth	148.8	0.0	-	0.0	0.0	0.0	-	0.0	0.0

- Site not sampled.

Table 3-3-20. Coho salmon juveniles, mean catch per minnow trap at DFH sites by reach on the Susitna River, between Goose Creek 2 and Portage Creek, June through September, 1982.

Reach	River Mile	June 1-15	June 16-30	July 1-15	July 16-31	August 1-15	August 16-31	Sept 1-15	Sept 16-30
Goose Creek 2 to Chulitna River	73.1-98.5	2.0	2.3	4.8	6.2	2.2	0.2	0.5	0.1
Chulitna River to Portage Creek	98.5-148.8	0.0	0.2	0.1	0.0	0.0	0.0	0.5	0.4
Goose Creek 2 to Portage Creek	73.1-148.8	0.5	0.8	1.0	1.6	0.6	0.1	0.5	0.3

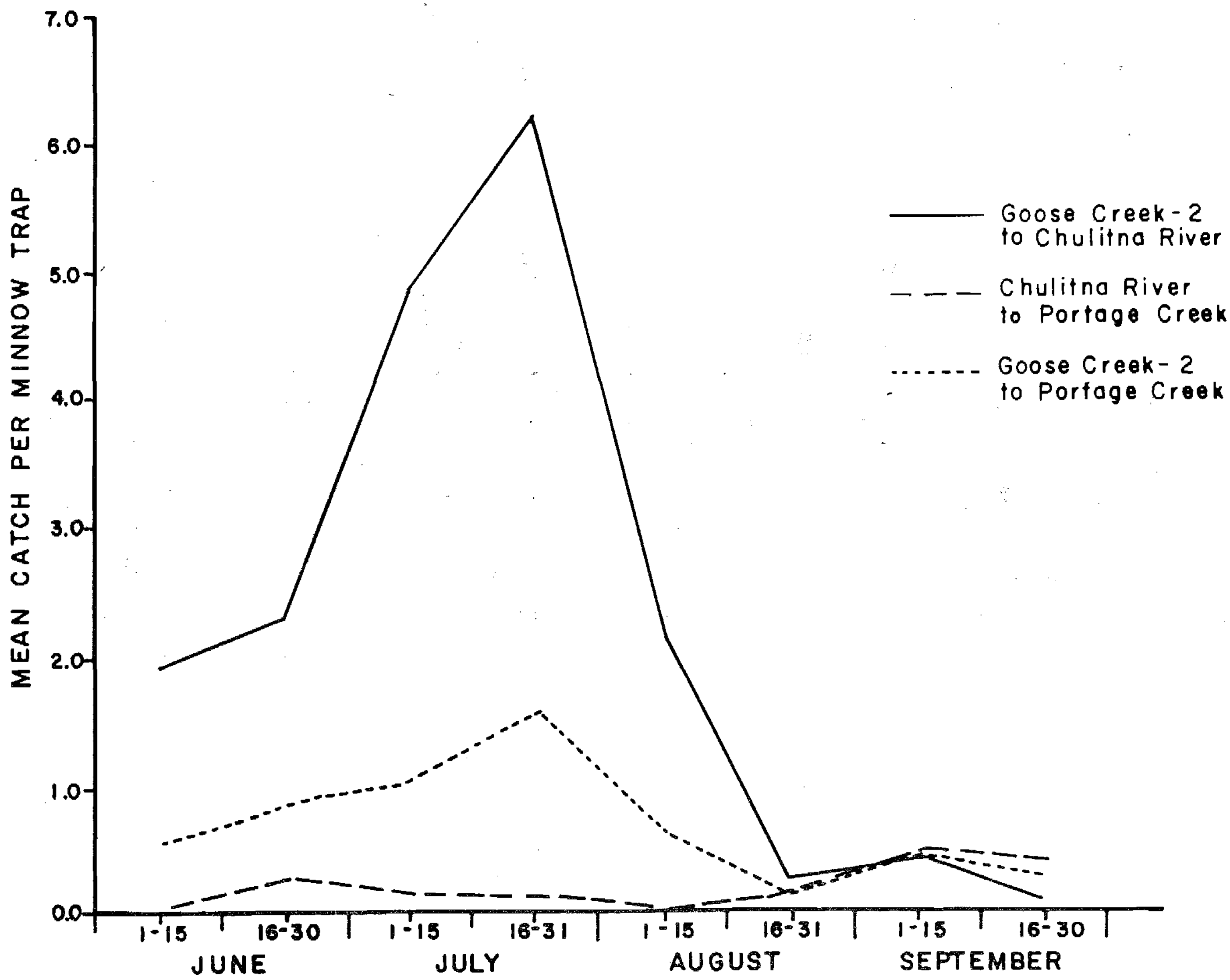


Figure 3-3-8. Coho salmon juvenile, mean catch per minnow trap at DFH sites by reach on the Susitna River between Goose Creek 2 and Portage Creek, June through September, 1982.

Tables 3-A-78 and 3-A-79). The most productive sites for juvenile coho salmon were Rustic Wilderness (21 fish), Whiskers Creek and Slough (16 fish), Slough 6A (19 fish) and Slough 9 (13 fish).

3.1.2.3 Chum Salmon

A total of 1,231 juvenile chum salmon (Oncorhynchus keta Walbaum) were taken by all gear types, primarily by beach seining and backpack electrofishing, from June through September at the 17 DFH sites (Appendix Table 3-A-80). The seasonal variation in distribution and relative abundance of juvenile chum salmon is summarized in Figure 3-3-9. The early summer outmigration of juvenile chum salmon from the system is clearly shown. The peak juvenile catch at the downstream migrant trap occurred in late June. No chum salmon juveniles were captured at DFH sites in the upper reach after early July. The last chum salmon juvenile captured at DFH sites in the lower reach was captured at Birch Creek and Slough in early August. However, the downstream migrant trap located 4.5 miles above the Chulitna River confluence, continued to catch juvenile chum salmon until mid-August.

A total of 126 chum salmon juveniles were captured in the Goose Creek to Chulitna River reach (Table 3-3-21). Eighty-two chum salmon fry were captured at Birch Creek and Slough, accounting for 64.3% of the total catch for sites in this reach. Goose Creek 2 and Side Channel accounted for the majority (22.2%) of the remaining chum salmon fry caught in this reach. Rabideux Creek and Slough was the only site in this reach where chum salmon fry were not captured.

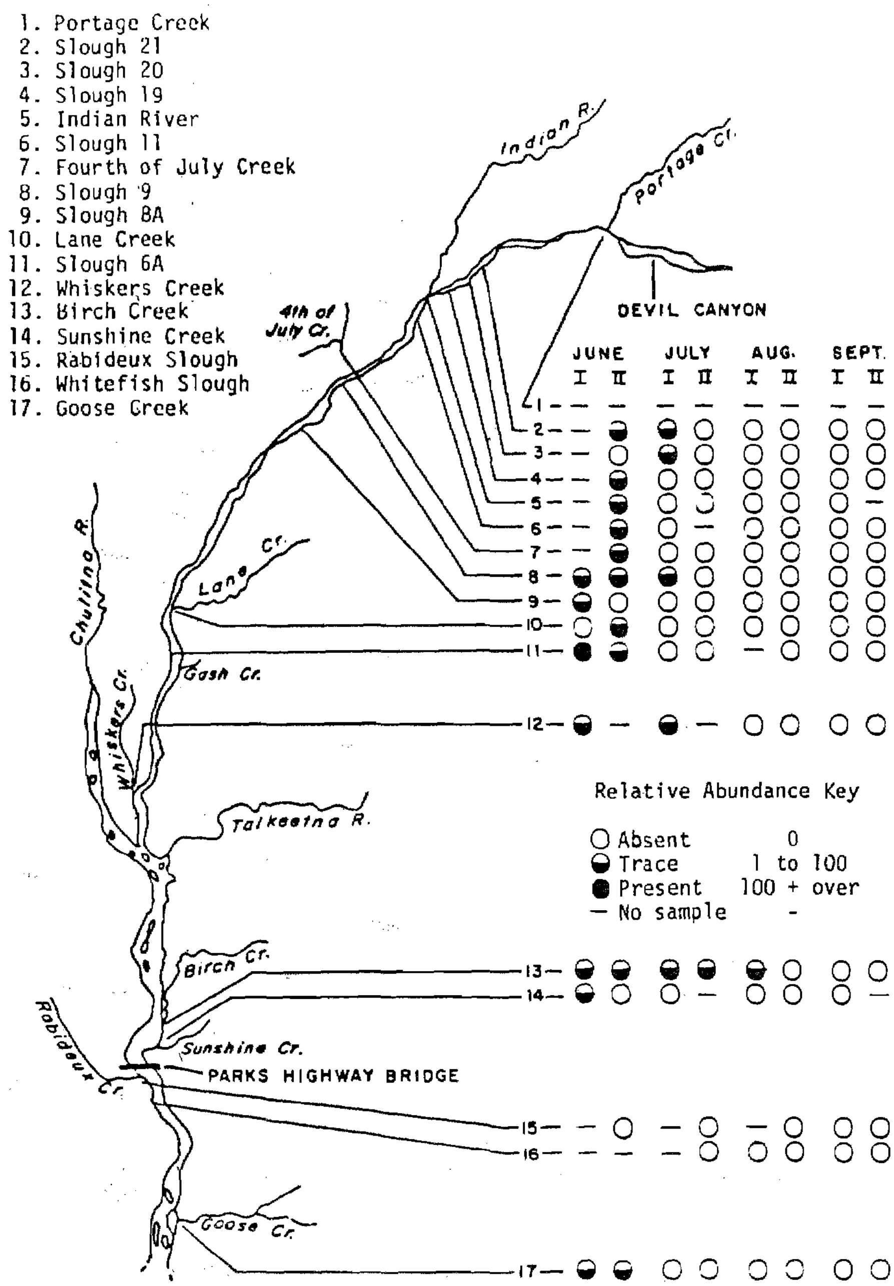


Figure 3-3-9. Seasonal variation in distribution and relative abundance of chum salmon juveniles at DFH sites on the Susitna River, June through September, 1982.

Table 3-3-21. Total catch of chum salmon juveniles by all gear types at DFH sites on the Susitna River between Goose Creek 2 and Chulitna River, June through September 1982.

Site	River Mile	June 1-15	June 16-30	July 1-15	July 16-31	August 1-15	August 16-31	September 1-15	September 16-30	Site Totals	Percent of Total Catch: Goose Creek 2 to Chulitna River	Percent of Total Catch: Goose Creek 2 to Portage Creek
Goose Creek 2 and Side Channel	73.1	3	25	0	0	0	0	0	0	28	22.2	2.3
Whitefish Slough	78.7	3	0	0	0	0	0	0	0	3	2.4	0.2
Rabideux Creek and Slough	83.1	-	0	-	0	0	0	0	0	0	0.0	0.0
Sunshine Creek and Side Channel	85.1	14	0	0	0	0	0	0	0	14	11.1	1.1
Birch Creek and Slough	88.4	41	21	16	2	1	0	0	0	81	64.3	6.7
Total		61	46	16	2	1	0	0	0	126	100.0	10.3

- Site not sampled.

The reach from Chulitna River to Portage Creek accounted for 89.4 percent (1104) of the chum salmon juveniles caught by all gear types at DFH sites (Table 3-3-22). Slough 6A produced 895 chum fry, 81.1% of the catch above the Chulitna River and 72.7% of the total season catch for both reaches. Beach seine hauls accounted for 92.7% of the fish. Lane Creek produced 58 fry, 5.3% of the total in the Chulitna River to Portage Creek reach. Forty chum salmon fry were captured at Slough 8A. These three sites, in a 13 mile stretch of river, accounted for 993 fry, representing 80.7% of the total seasonal catch of juvenile chum salmon for all DFH sites. The total catch for each reach is shown in Figure 3-3-10.

The percentages of the total chum salmon juvenile catch by each reach is illustrated in Figure 3-3-11. Because chum salmon were not susceptible to minnow trapping, most of the collection efforts were completed by methods that are difficult to provide comparable quantitative data between sites. Beach seines and electrofishing equipment provided the bulk of the catches. Because of this problem in collection, the numbers and percentages presented for this species often reflect the efficiency of the sampling gear used at a particular site rather than the percentage of fish at each site. Areas of limited conductivity, heavy debris loads, or rough substrate all contribute to decreased gear efficiency. Changes in collection efforts to provide more comparable catch data among sites are planned for the 1983 field season.

Twenty-nine additional chum salmon fry were incidentally collected at five SFH sites from RM 86.3 to RM 133.8 (Appendix Table 3-A-81). The

Table 3-3-22. Total catch of chum salmon juveniles by all gear types at DFH sites on the Susitna River between Chulitna River and Portage Creek, June through September, 1982.

Site	River Mile	June 1-15	June 16-30	July 1-15	July 16-31	August 1-15	August 16-31	September 1-15	September 16-30	Site Totals	Percent of Total Catch: Chulitna River to Portage Creek	Percent of Total Catch: Goose Creek to Portage Creek
Whiskers Creek Slough	101.2	8	0	1	0	0	0	0	0	9	0.8	0.7
Slough 6A	112.3	890	5	0	0	0	0	0	0	895	81.1	72.7
Lane Creek and Slough 8	113.6	0	58	0	0	0	0	0	0	58	5.3	4.7
Slough 8A	125.3	40	0	0	0	0	0	0	0	40	3.5	3.2
Slough 9	129.2	5	13	2	0	0	0	0	0	20	1.8	1.6
4th of July Creek-Mouth	131.1	0	8	0	0	0	0	0	0	8	0.7	0.6
Slough 11	135.3	0	15	0	0	0	0	0	0	15	1.4	1.2
Indian River-Mouth	138.6	0	28	0	0	0	0	0	0	28	2.5	2.3
Slough 19	140.0	0	4	0	0	0	0	0	0	4	0.4	0.3
Slough 20	140.1	0	0	3	0	0	0	0	0	3	0.3	0.2
Slough 21	142.0	0	22	2	0	0	0	0	0	24	2.2	1.9
Portage Creek-Mouth	148.8	0	-	0	0	0	-	0	0	0	0	0
Totals		943	153	8	0	0	0	0	0	1104	100.0	89.4

- Site not sampled.

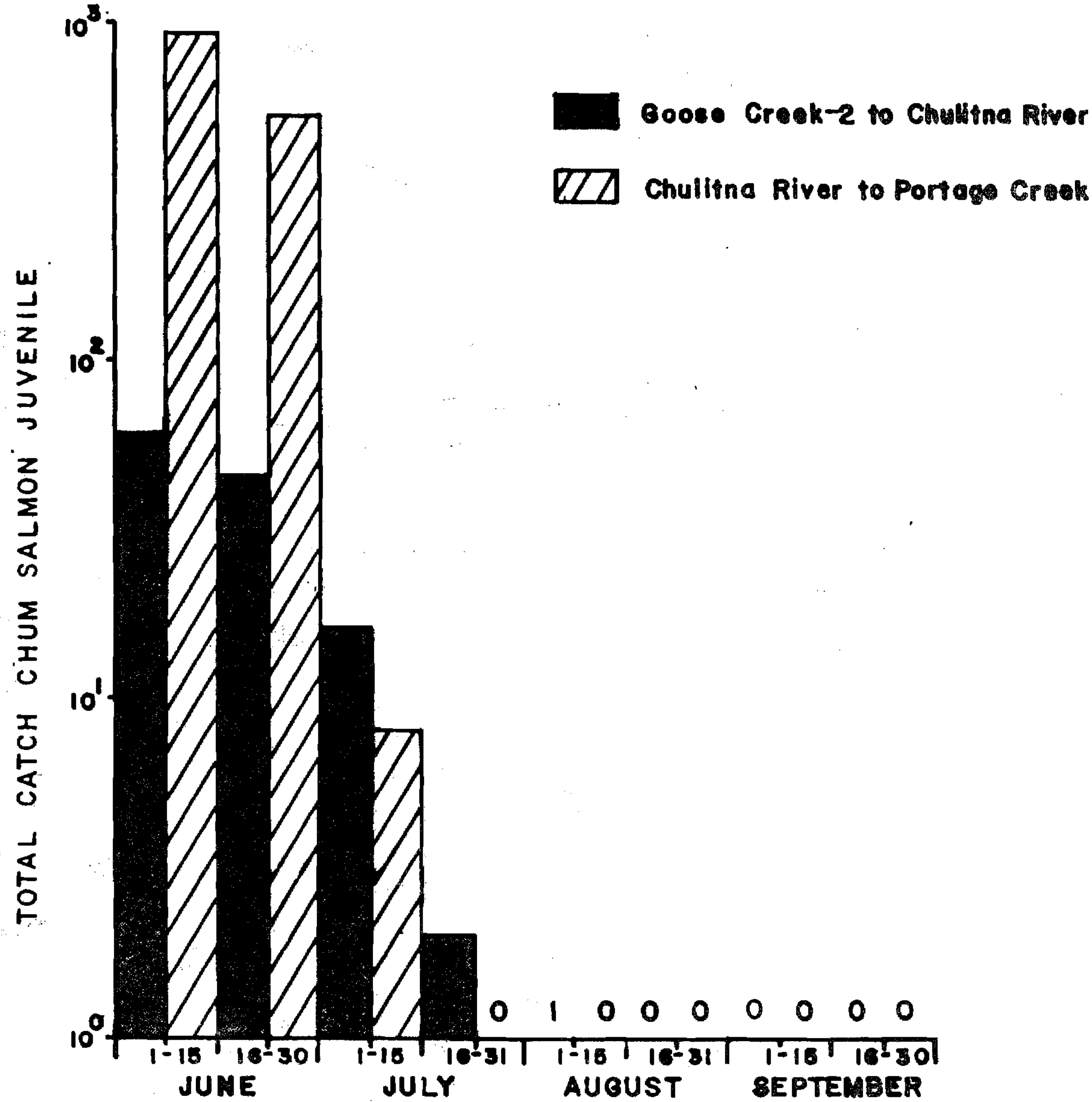


Figure 3-3-10. Total catch of chum salmon juveniles by two week periods for two reaches on the Susitna River, June through September, 1982.

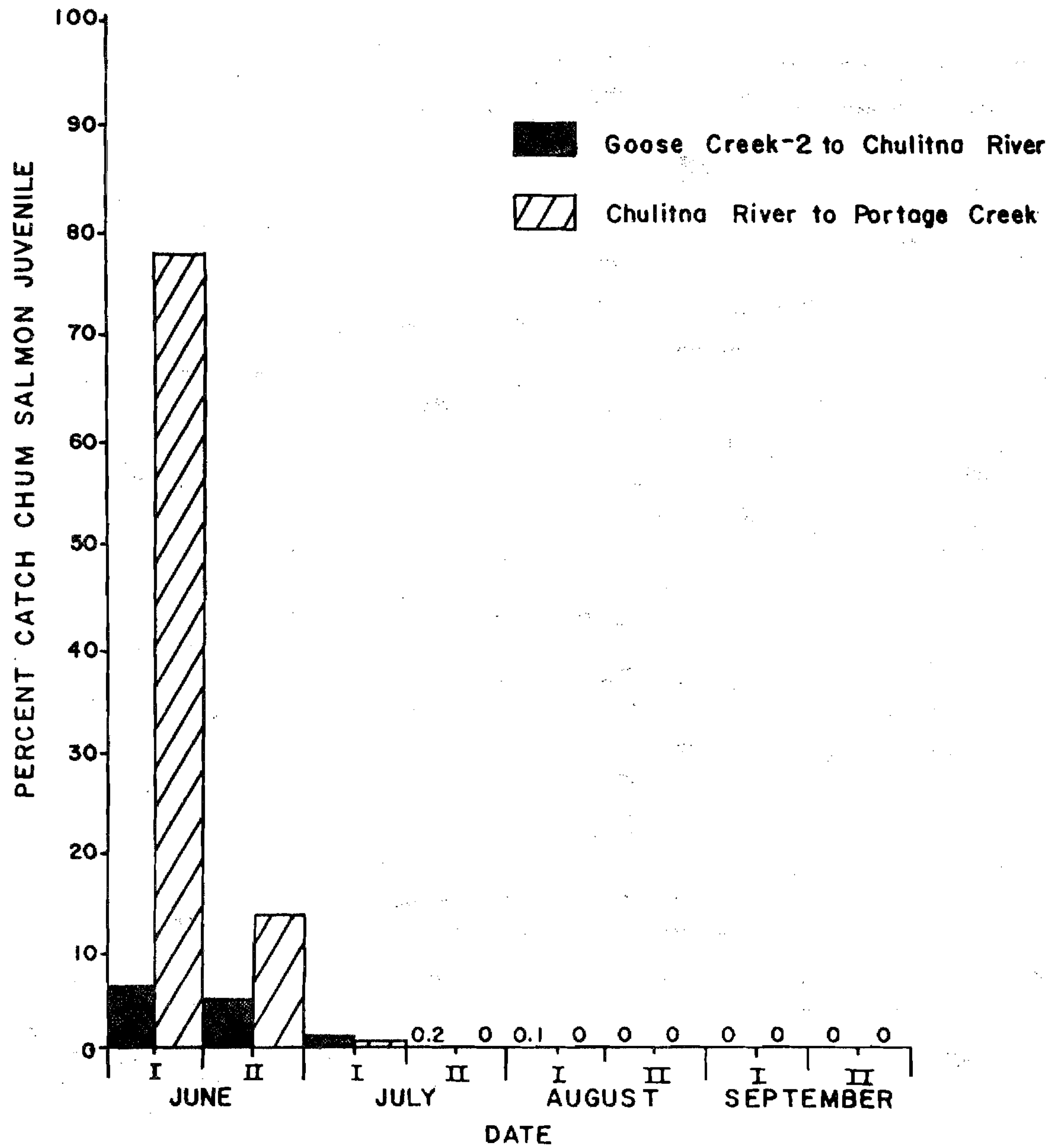


Figure 3-3-11. Percentages of the total chum salmon juvenile catch caught in two reaches of the Susitna River, June through September, 1982.

small numbers collected are a result of the inefficiency of the gear (boat-mounted electrofishing) and do not reflect any patterns.

Winter sampling included 32 sites between the Mid Kroto Slough (RM 36.3) and Portage Creek (RM 148.8) in February, March and April, 1982. Most of the 90 chum salmon juveniles were collected from four sloughs above the Chulitna River confluence. Twenty six chum juveniles were captured at Slough 8A. Twenty-eight chum fry were captured in Slough 11. Twenty-six fry were captured in Slough 21. With the exception of two fish taken at Lane Creek and Slough 8 with a fry trap, all fry were collected with a shovel and a dip net. Only 90 chum juveniles were collected all winter, but thousands more were observed during a sampling trip in late April. An estimated 5,000 juvenile chum salmon were observed in the upper reach of Slough 8A. Several hundred fish were observed in each of three more sloughs (Slough 11, Slough 20, and Slough 21). Smaller numbers of fish were observed in Slough 9. The patchiness of the catch illustrates the difficulties of sampling this species during the winter period. Minnow traps are not effective for this species and it is very difficult to use beach seines or backpack electroshockers through open leads in the ice which are often inaccessible or too small to sample effectively.

3.1.2.4 Sockeye Salmon

A total of 1413 sockeye salmon (*Oncorhynchus nerka* Walbaum) juveniles were captured by all gear types, primarily by beach seining, from June through September, 1982, at the 17 DFH sites (Appendix Table 3-A-82).

The seasonal variation in distribution and relative abundance is summarized in Figure 3-3-12. Sockeye salmon juveniles were present throughout both reaches for the entire open water season. In general, catches were lower in the lower reach of river (below the Chulitna River confluence) than in the upper reach. Birch Creek and Slough, the uppermost site in the reach below the Chulitna River confluence, accounted for over 50% of the juvenile sockeye salmon caught in that reach (Table 3-3-23).

The reach from the Chulitna River confluence to Portage Creek accounted for 93.7% of the juvenile sockeye salmon collected from all DFH sites (Table 3-3-24). A total of 1,144 sockeye fry, 81.0% of the total catch at DFH sites in both reaches for the entire ice-free season, were captured in the lower section (RM 101.2 - RM 125.3) of this reach. Slough 6A and Slough 8A accounted for 1081 fry, 76.5% of the season total for both reaches. Sockeye salmon fry were present at these two sites during each sampling trip. The total catch for each reach is shown in Figure 3-3-13.

The percentages of the total sockeye salmon juvenile catch for each reach is presented in Figure 3-3-14. This figure represents the actual catch, but probably does not accurately reflect the true distribution of sockeye salmon juveniles in the river. The methods used which are effective in capturing sockeye fry (beach seining and electrofishing) do not lend themselves to site to site comparisons.

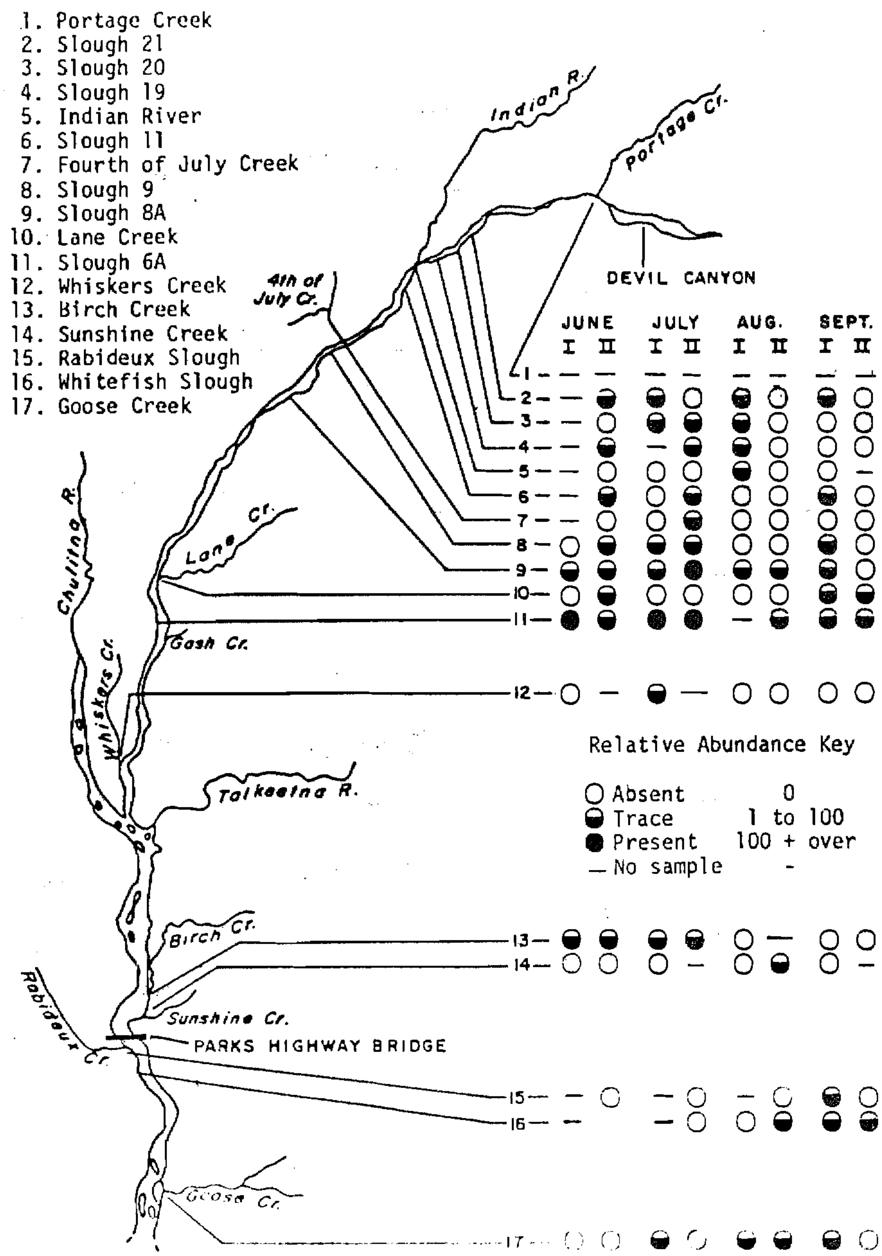


Figure 3-3-12. Seasonal variation in distribution and relative abundance of sockeye salmon juveniles at DFH sites on the Susitna River, June September, 1982.

Table 3-3-23. Total catch of sockeye salmon juveniles by all gear types at DFH sites on the Susitna River between Goose Creek 2 and Chulitna River, June through September, 1982.

Site	River Mile	June 1-15	June 16-30	July 1-15	July 16-31	August 1-15	August 16-31	September 1-15	September 16-30	Site Totals	Percent of Total Catch: Goose Creek 2 to Chulitna River	Percent of Total Catch: Goose Creek 2 to Portage Creek
Goose Creek 2 and Sidechannel	73.1	0	0	3	0	3	6	4	0	16	18.2	1.1
Whitefish Slough	78.7	-	0	0	0	0	1	1	3	5	5.7	0.4
Rabideux Creek and Slough	83.1	-	0	1	0	0	0	13	0	14	15.9	1.0
Sunshine Creek and Sidechannel	85.1	0	0	0	0	0	3	0	0	3	3.4	0.2
Birch Creek and Slough	88.4	2	2	35	9	0	0	2	0	50	56.8	3.5
Total		2	2	39	9	3	10	20	3	88	100.0	6.2

- Site not sampled.

Table 3-3-24. Total catch of sockeye salmon juveniles by all gear types at DFH sites on the Susitna River between Chulitna River and Portage Creek, June through September, 1982.

											Percent of Total Catch	
Habitat Location	River Mile	June 1-15	June 16-30	July 1-15	July 16-31	August 1-15	August 16-31	September 1-15	September 16-30	Site Totals	Chulitna River to Portage Creek	Goose Creek to Portage Creek
Whiskers Creek and Slough	101.2	0	0	11	0	0	1	0	0	12	0.9	0.8
Slough 6A	112.3	223	16	173	375	2	1	23	6	819	61.8	58.0
Lane Creek and Slough 8	113.6	0	2	0	0	0	16	13	20	51	3.6	3.6
Slough 8A	125.3	1	2	19	207	4	13	9	7	262	19.8	18.5
Slough 9	129.2	0	7	6	2	0	0	4	0	19	1.4	1.3
4th of July Creek-Mouth	131.1	0	0	0	1	0	0	0	0	1	0.1	0.1
Slough 11	135.3	0	8	0	9	0	0	10	7	34	2.6	2.4
Indian River-Mouth	138.6	0	0	0	1	2	0	0	0	3	0.2	0.2
Slough 19	140.0	0	40	0	8	23	2	10	10	93	7.0	6.6
Slough 20	140.1	0	0	3	2	1	0	0	0	6	0.5	0.4
Slough 21	142.0	0	2	1	0	20	0	2	0	25	1.9	1.8
Portage Creek-Mouth	148.8	0	-	0	0	0	-	0	0	0	0.0	0.0
Totals		224	77	213	605	52	33	71	50	1325	100.0	93.7

- Site not sampled.

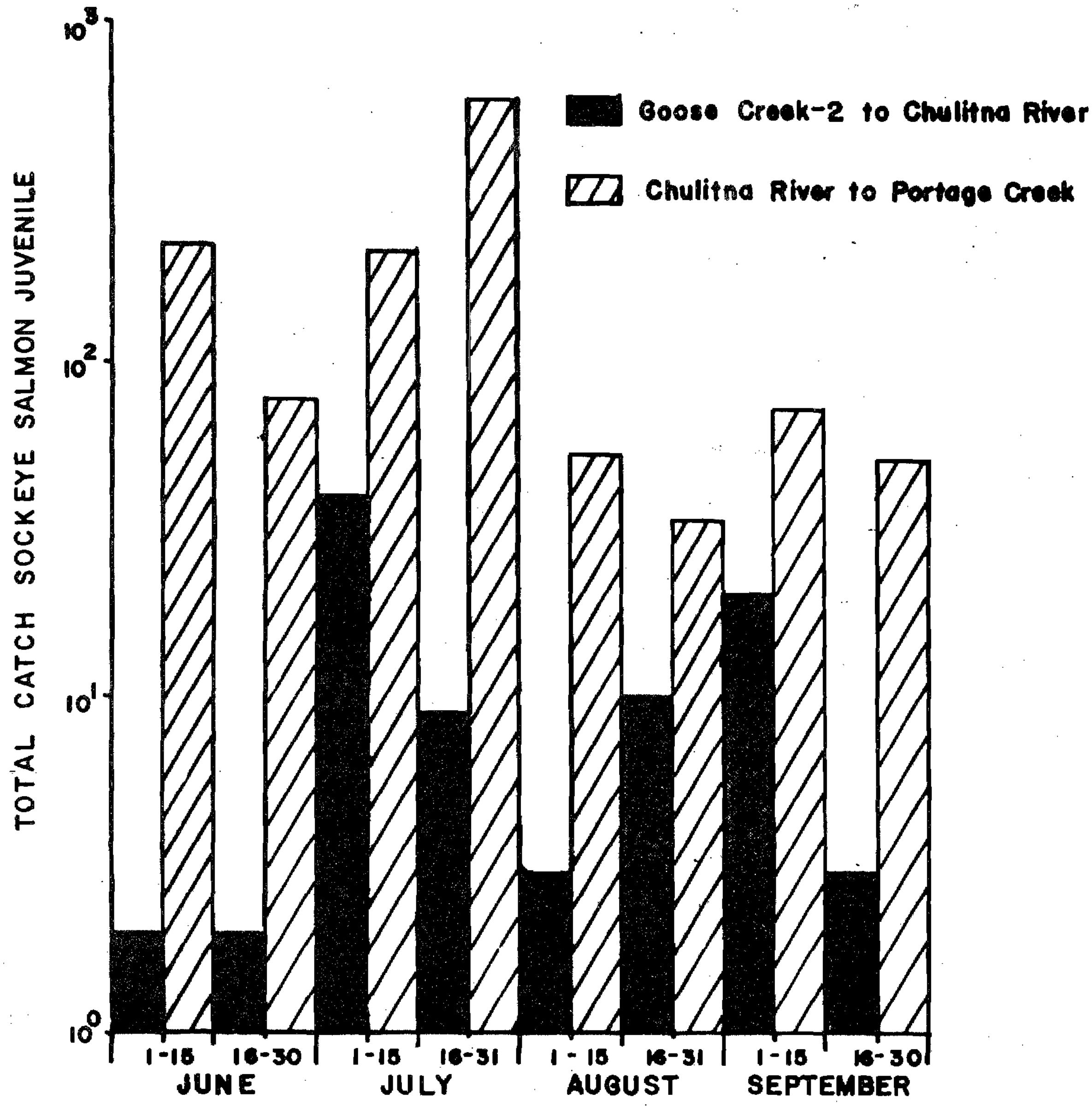


Figure 3-3-13. Total catch of sockeye salmon juveniles by two week periods for two reaches of the Susitna River, June through September, 1982.

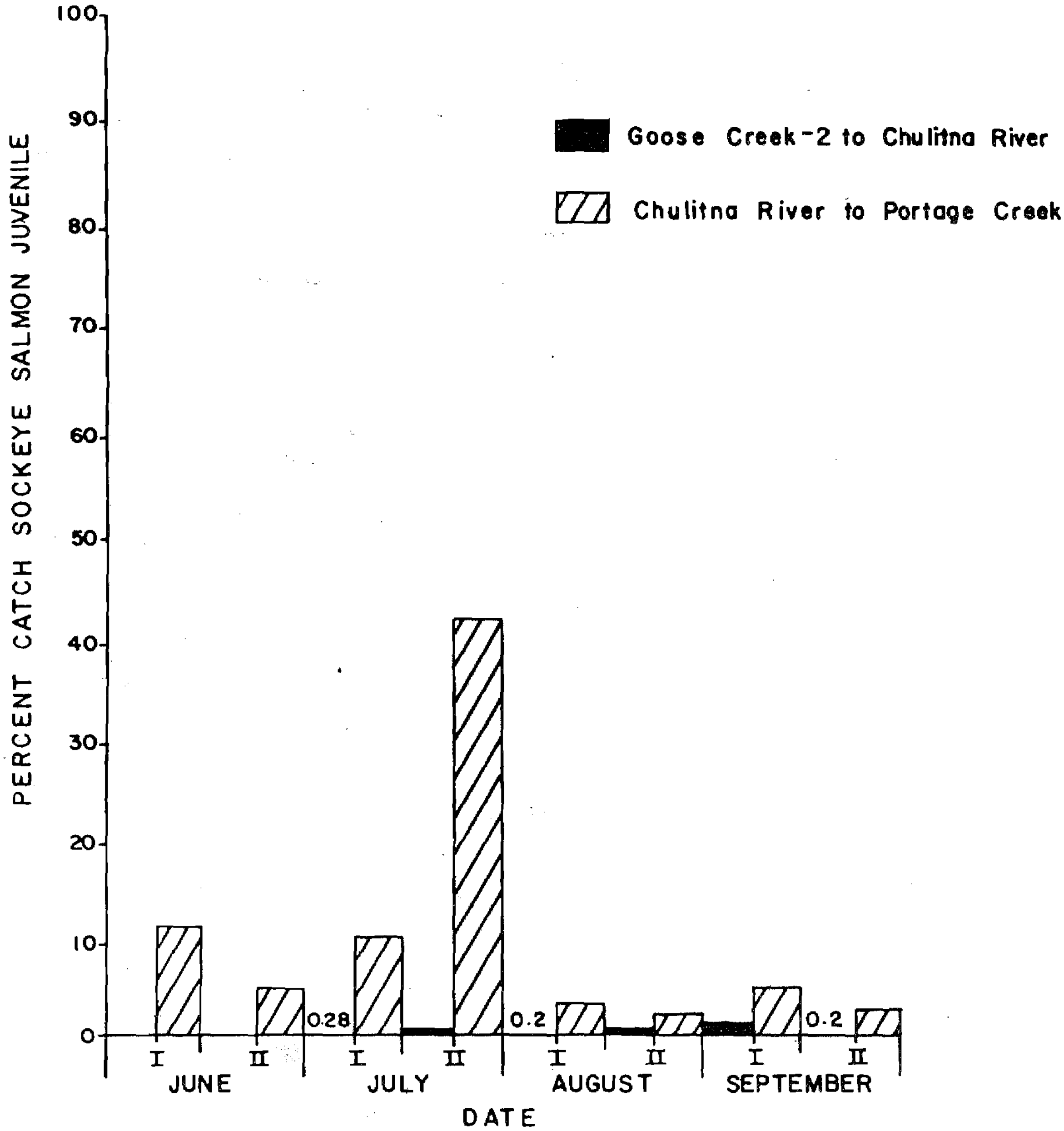


Figure 3-3-14. Percentages of the total sockeye salmon juvenile catch caught in two reaches of the Susitna River, June through September, 1982.

The majority of the Age 1+ sockeye salmon captured were taken at Slough 6A in early June (Appendix Table 3-H-3). No Age 1+ sockeye salmon were captured in the reach sampled (Goose Creek to Portage Creek) after the end of July.

Eighty sockeye salmon juveniles were captured at eight SFH sites between Kroto Slough and to Slough 22 (Appendix Table 3-A-83). The small numbers collected are a result of the inefficiency of the gear (primarily boat electrofishing) and do not reflect any patterns.

A total of 17 sockeye salmon juveniles were caught at the 32 winter sampling sites between RM 125.3 and 142.0. Eleven fry were captured at Slough 11, six at Slough 21, two at Slough 8A, and one at Slough 9. The sockeye juvenile captured at Slough 9 was the only Age 1+ fish collected during the winter survey; it was 51 mm long. The remaining fry were all Age 0+ (from the 1981 brood year). The low numbers captured reflect the ineffectiveness of the primary sampling gear used (minnow traps) in capturing this species.

3.1.2.5 Pink Salmon

Only one juvenile pink salmon (*Oncorhynchus gorbuscha* Walbaum) was captured by the mobile juvenile anadromous fish studies crew. All pink salmon data are presented in the emergence and outmigration section (Section 3.2.5).

3.2 Emergence and Outmigration Studies

The following results for the timing of emergence and outmigration and for the determination of the relative condition and stage of development by species for juvenile salmon are presented by reach of river above and below the Chulitna River confluence. Data collected at the downstream migrant trap and during surveys conducted at Designated Fish Habitat (DFH) sites and Selected Fish Habitat (SFH) sites have been combined. The surveys were separated by month during the spring studies conducted from February through May, and were organized as two periods per month for the summer surveys conducted from June through early October.

Daily catch per hour for the five species of juvenile salmon collected in the downstream migrant trap was adjusted for the periods not sampled by computing the mean of the catch rates recorded for the day preceding and the day following each unsampled period. The cumulative catch totals for each species were expanded to 24 hour periods, and these were adjusted for the periods not sampled by tabulating the mean of the catch totals recorded for the three days preceding and the three days following each unsampled period.

Resident fish species collected in the downstream migrant trap are presented in Appendix Table 3-B-1 and the results are included in the section on relative abundance and distribution of resident fishes (Section 3.1.1).

The scale analysis data provided for chinook, coho, and sockeye salmon represent the range of lengths only of fish for which scales were collected and are not intended to represent the limits of the ranges of total length for the fish present during the surveys.

3.2.1 Chinook Salmon

Juvenile chinook salmon (*Oncorhynchus tshawytscha* Walbaum) were observed from the mouth of the Susitna River upstream to RM 145.0 during 1982. Three hundred, nine fish were collected at DFH and SFH sites from February through April (Appendix Tables 3-A-72 and 3-A-73). The downstream migrant trap captured 309 juvenile chinook salmon during its operation from June 18 to October 12 (Appendix Table 3-B-2). Surveys of DFH sites recorded timing data from 364 chinook salmon juveniles collected from late May through October at slough, side channel, and tributary mouth habitats in the reach of river between the Chulitna River confluence and Devil Canyon (Appendix Table 3-A-68). Sampling conducted in the same reach using boat-mounted electrofishing gear over a broader range of habitats resulted in the collection of 78 juvenile chinook salmon (Appendix Table 3-A-70). Below the confluence of the Chulitna River, surveys of DFH sites collected 508 fish and boat electrofishing gear collected 102 chinook salmon juveniles.

Overwintering chinook salmon from the 1980 brood year were observed at numerous sites surveyed during February through April (Appendix Tables 3-A-72 and 3-A-73). They also were collected by the combined mobile sampling techniques during late May and early June (Appendix Table 3-A-68 and 3-A-70).

The catch rate for juvenile chinook salmon in the downstream migrant trap averaged 0.55 fish per hour during the first sampling period in late June with a peak catch rate of 1.24 fish per hour occurring on June 28 (Figure 3-3-15). Juvenile chinook salmon catch rates in the trap averaged 0.48 fish per hour during early July and 0.27 fish per hour during late July. The peak catch rate for July was 1.15 fish per hour recorded on July 18.

August catch rates for juvenile chinook salmon in the downstream migrant trap decreased below 0.10 fish per hour with a high catch rate for the period of 0.21 fish per hour occurring August 1. By September, the average catch rate in the trap for this species was 0.01 fish per hour with a peak catch rate of 0.56 fish per hour observed on September 20. The last capture of juvenile chinook salmon during 1982 was recorded October 3 (Figure 3-3-16).

In order to provide an indication of condition and age of downstream migrants, length measurements and age determinations were collected for a representative subsample of fish. During surveys conducted from February through April, 310 juvenile chinook salmon were measured. A total of 302 chinook salmon juveniles captured in the downstream migrant trap were measured for total length, and over 1,150 fish were measured from mobile survey collection efforts conducted both above and below the Chulitna River confluence.

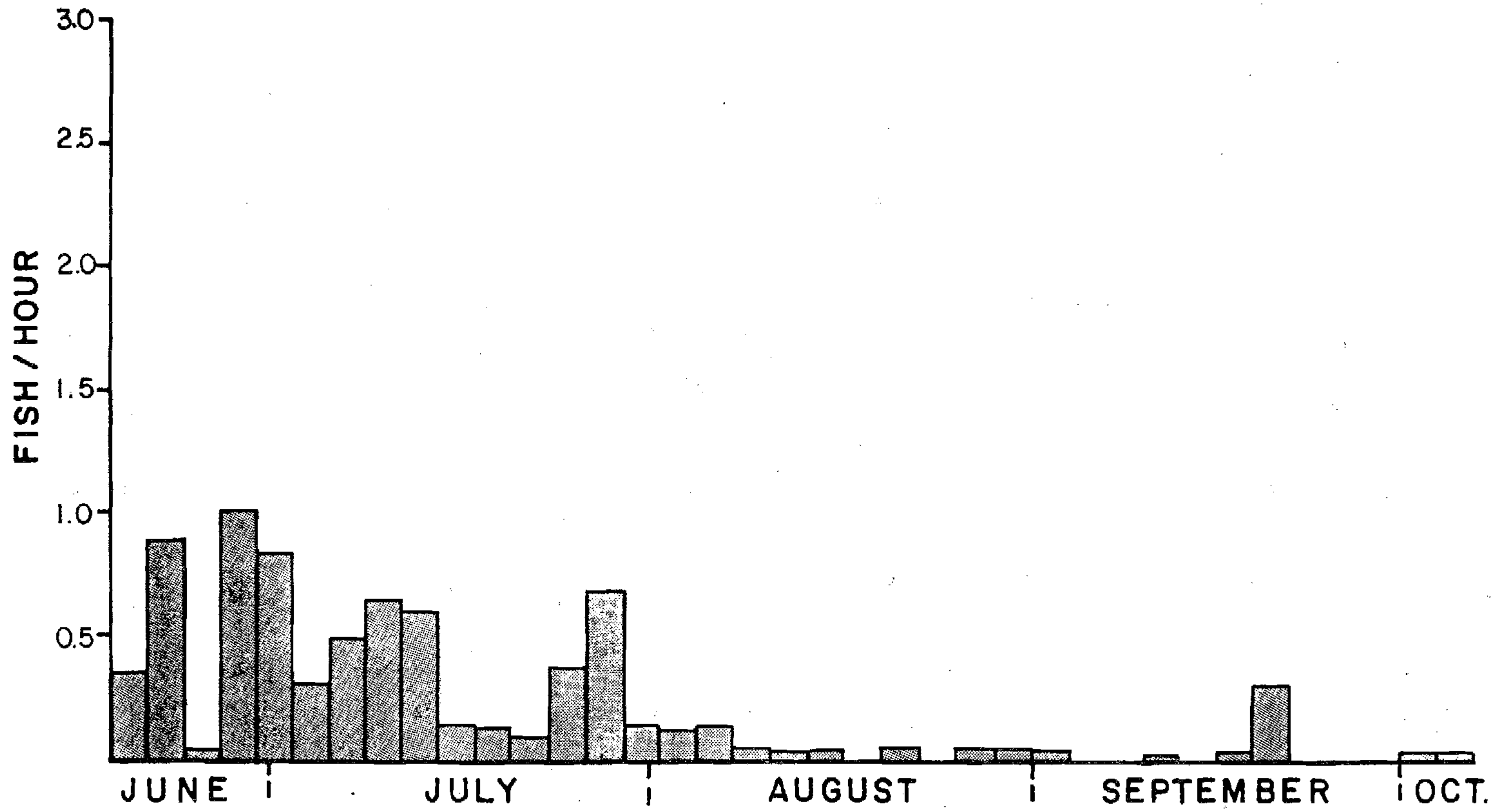


Figure 3-3-15. Chinook salmon juveniles, downstream migrant trap catch rates averaged by three day periods, June through October, 1982.

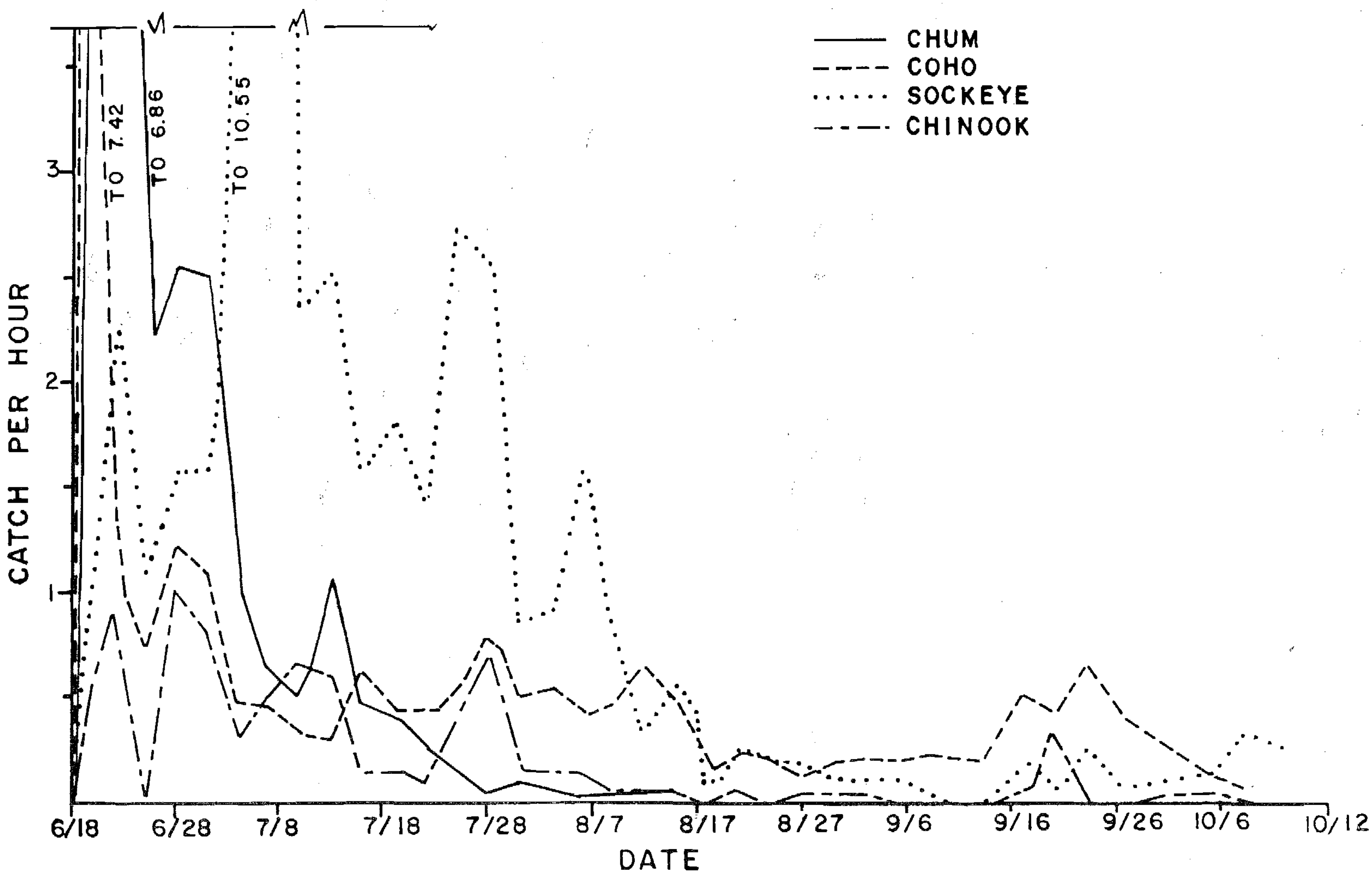


Figure 3-3-16. Downstream migrant trap catch rates by three day periods for juvenile chinook, coho, chum, and sockeye salmon, June 18 through October 12, 1982.

All fish collected during the spring surveys were from the 1980 brood year and were undergoing their first winter in fresh water. Beginning in May with the first captures of juvenile chinook salmon from the 1981 brood year, two age classes, Age 0+ and Age 1+, were present. Correlations of complimentary size frequency distribution and scale analysis data were used to determine the age class composition of the fish measured (Table 3-3-25). A length of 66 mm was determined to represent the minimum length of chinook salmon Age 1+ collected between the Chulitna River confluence and Devil Canyon for the first two weeks of June. Attributing an increase in total length of five millimeters for each successive two-week survey period (based on 1981 studies, ADF&G 1981b), the minimum lengths for Age 1+ chinook salmon for late June, early July, and late July were set at 71 mm, 76 mm, and 81 mm, respectively. Scale sample analysis showed that only one Age 1+ fish was collected during early August and that no Age 1+ chinook salmon were collected above the Chulitna River confluence after early August.

Fish collected during February had a mean length of 70 mm with a range of 53 mm to 90 mm (Table 3-3-26). March surveys captured chinook salmon juveniles ranging from 51 mm to 98 mm with a mean length of 80 mm, and a mean length of 77 mm was determined for fish collected during April with a range from 61 mm to 97 mm.

The mean length and range of lengths for Age 0+ and Age 1+ chinook salmon captured by two-week period between the Chulitna River confluence and Devil Canyon from May to October is presented in Table 3-3-27. Age 1+ fish collected during late May and early June had a mean length of 84

Table 3-3-25 Chinook salmon juveniles, scale analysis of age class composition for collected fish by survey period between Cook Inlet and Devil Canyon, 1982.

Survey Period	Age 0+ 1981 Brood Year		Age 1+ 1982 Brood Year	
	Number of Fish	Range of Lengths (mm)	Number of Fish	Range of Lengths (mm)
February to May	0	-	10	87-100
June 1-15	0	-	6	78-98
June 16-30	8	55-69	59	75-112
July 1-15	0	-	14	86-106
July 16-31	11	57-86	5	85-95
August 1-15	13	63-80	1	117
August 16-31	7	77-94	0	-
September 1-15	10	74-86	0	-
September 16-31	6	77-92	0	-
October 1-12	0	-	0	-

Table 3-3-26 Chinook Salmon juveniles, mean length and range of lengths between Cook Inlet and the Chulitna River confluence, and between the Chulitna River confluence and Devil Canyon, February to April, 1982.

	Cook Inlet to Chulitna			Chulitna to Devil Canyon		
Survey Period	Number of Fish	Mean Length (mm)	Range of Lengths (mm)	Number of Fish	Mean Length (mm)	Range of Lengths (mm)
February	0	-	-	130	70	53-90
March	14	78	57-90	77	80	51-98
April	2	77	69-85	87	77	61-97

Table 3-3-27 Chinook salmon juveniles, mean length and range of lengths by age class between the Chulitna River confluence and Devil Canyon, May to October, 1982.

	Age 0+			Age 1+		
Date	Number of Fish	Mean Length (mm)	Range of Lengths (mm)	Number of Fish	Mean Length (mm)	Range of Lengths (mm)
May 16-31	0	-	-	2	90	85-95
June 1-15	1	40	40	38	84	68-100
June 16-30	19	49	34-70	142	89	71-125
July 1-15	67	55	36-74	63	92	76-115
July 16-31	139	54	36-77	17	90	83-108
August 1-15	84	61	39-88	1	117	117
Aug. 16-31	65	64	42-94	0	-	-
Sept. 1-15	100	69	41-95	0	-	-
Sept. 16-30	41	69	47-100	0	-	-
Oct. 1-12	1	80	80	0	-	-

mm with a range from 68 mm to 100 mm. By late June, the mean length had increased to 89 mm with a range from 71 mm to 125 mm. Age 1+ chinook salmon collected during July ranged in length from 76 mm to 115 mm and had a mean length of 90 mm. The last Age 1+ chinook salmon collected above the Chulitna River confluence was captured during early August and measured 117 mm.

Age 0+ chinook salmon captured above the confluence of the Chulitna River in early June had a mean length of 49 mm with a range from 34 mm to 70 mm (Appendix Figure 3-B-1). By early September, the mean length for Age 0+ fish in this reach was 69 mm with a range from 41 mm to 95 mm.

Appendix Figure 3-B-2 provides the percent length frequency distribution by two-week period for juvenile chinook salmon collected below the Chulitna River confluence. Utilizing the same length separation between Age 0+ and 1+ fish which was determined for the reach above the confluence of the Chulitna River, Age 1+ chinook salmon mean lengths in the lower reach ranged from 80 mm in late May to 89 mm in late July (Table 3-3-28). Only two Age 1+ fish were measured during August and the last capture of Age 1+ chinook salmon in this reach was recorded during early September when a 130 mm fish was collected in a small backwater slough at RM 17.7.

Age 0+ chinook salmon collected below the Chulitna River confluence had a mean length of 61 mm with a range from 51 mm to 70 mm in early June

Table 3-3-28 Chinook salmon juveniles, mean length and range of lengths by age class between the Chulitna River confluence and Devil Canyon, May to October, 1982.

	Age 0+			Age 1+		
Date	Number of Fish	Mean Length (mm)	Range of Lengths (mm)	Number of Fish	Mean Length (mm)	Range of Lengths (mm)
May 16-31	0	-	-	9	80	68-87
June 1-15	7	61	51-70	21	84	72-118
June 16-30	63	64	51-75	80	84	75-115
July 1-15	65	69	54-80	15	86	81-91
July 16-31	176	74	42-85	7	89	86-95
Aug. 1-15	38	74	38-89	2	92	92
Aug. 16-31	11	74	55-92	0	-	-
Sept. 1-15	14	75	56-101	1	130	130
Sept. 16-30	3	74	56-84	0	-	-
Oct. 1-12	0	-	-	0	-	-

and had reached a mean length of 75 mm by early September with a range from 56 mm to 101 mm.

3.2.2 Coho Salmon

Juvenile coho salmon (Oncorhynchus kisutch Walbaum) were collected during the 1982 studies from Fish Creek (RM 31.2) upstream to Jack Long Creek (RM 144.5). Surveys conducted from February through April captured 105 fish (Appendix Table 3-A-79). Nine hundred thirty-nine juvenile coho salmon were collected in the downstream migrant trap during its operation from June 18 to October 12 in the Susitna River (RM 103.0) above the confluence of the Chulitna River (Appendix Table 3-B-3). Surveys of DFH sites between the Chulitna River confluence and Devil Canyon from late May to early October collected 350 coho salmon juveniles (Appendix Table 3-A-74). Sampling conducted in this same reach utilizing boat-mounted electrofishing gear resulted in the collection of 12 fish (Appendix Table 3-A-76). Below the confluence of the Chulitna River, DFH site surveys collected 1,463 fish and mobile electrofishing gear captured 54 juvenile coho salmon.

Overwintering coho salmon juveniles from the 1979 and 1980 brood years were collected at numerous SFH sites during February through April. Fish were consistently recorded at Rustic Wilderness, Whiskers Creek and Slough, Slough 6A, Slough 9, and Slough 22 during this period.

At least one coho salmon juvenile was collected in the downstream migrant trap during each of the 104 days of trap operation (Figure 3-3-17). The peak catch of juvenile cohos occurred during the first three days of operation. The high catch rate of the season was 19.5 fish per hour, recorded on June 18. Catch rates remained high during the first five days of trap operation with an average of 2.5 fish per hour, while the entire late June period trap catches averaged 1.4 fish per hour. Small peaks in catch rate were observed for juvenile coho salmon in the downstream migrant trap during late July, early August and late September but average rates for each survey period following late June remained below 1.0 fish per hour (Figure 3-3-16).

Boat-mounted electrofishing gear and DFH site surveys conducted above the confluence of the Chulitna River collected coho salmon juveniles from late May through September. Major sites of collection in this reach included Whiskers Creek and Slough, Slough 6A, and Lane Creek. Peak catch rates for these mobile surveys occurred in late June and September.

During the course of 1982 studies, the following samples of juvenile coho salmon were measured for total length. One hundred five juvenile coho salmon were measured from February through April at SFH sites. A total of 931 coho salmon juveniles were measured from fish collected in the downstream migrant trap. Electrofishing and DFH site surveys between the Chulitna River confluence and Devil Canyon measured 366 fish and these surveys conducted below the Chulitna River confluence measured 911 juvenile coho salmon.

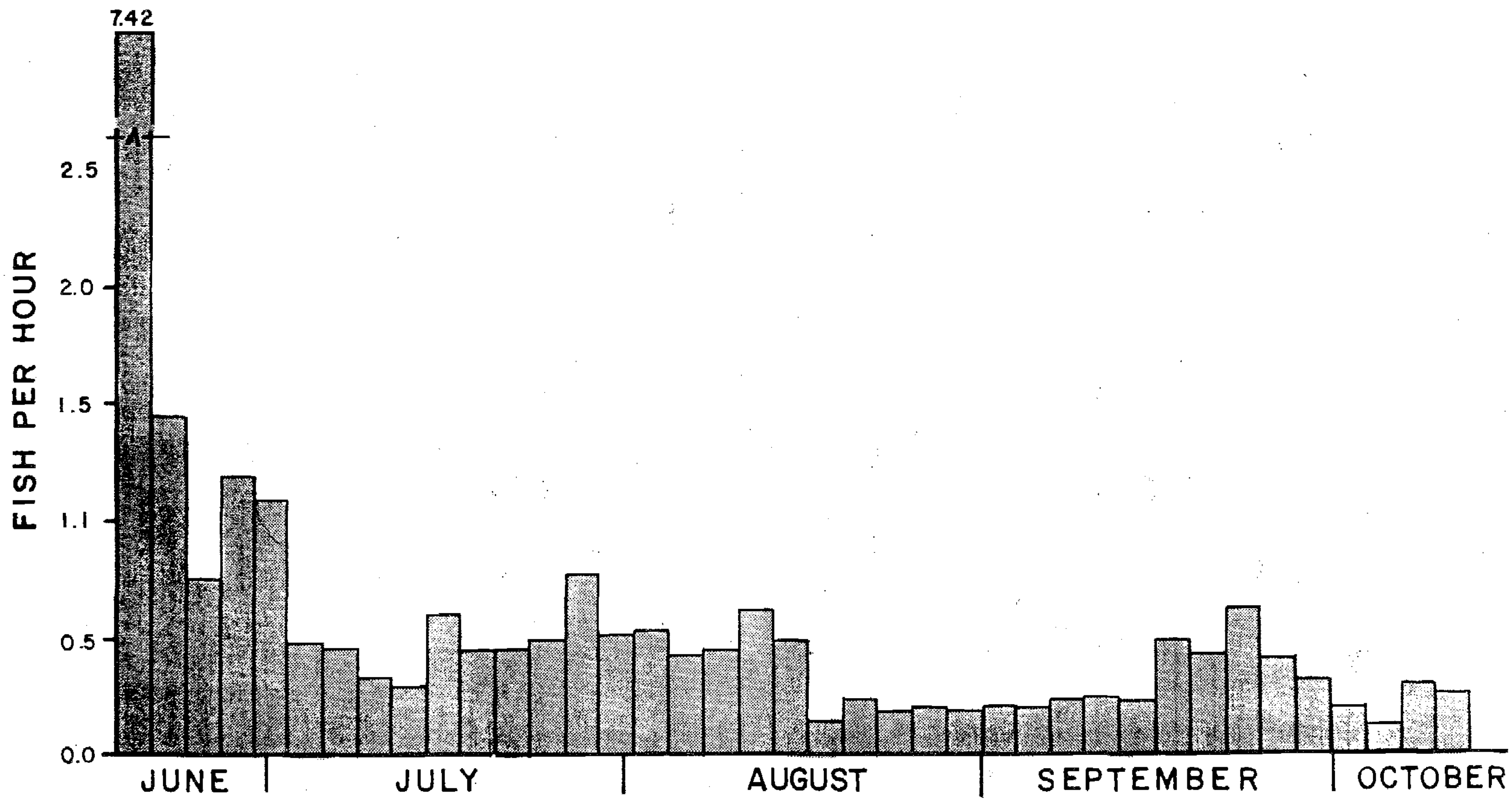


Figure 3-3-17. Coho salmon juveniles, downstream migrant trap catch rates averaged by three day periods, June through October, 1982.

Scale samples from 56 (53%) of the juvenile coho salmon collected during February through April showed that 1980 brood year fish ranged in length from 58 mm to 116 mm during this period. Fish from the 1979 brood year ranged in length from 89 mm to 166 mm. One hundred, ten millimeters was used as the minimum total length for 1979 brood year fish collected during the spring surveys. Fish with a length less than 110 mm were assigned to the 1980 brood year. Utilizing this inflection point, the mean length for 1980 brood year coho salmon was calculated to be 83 mm with a range in lengths from 58 mm to 107 mm. The 1979 brood year fish had a mean length of 122 mm and a range from 110 mm to 162 mm (Table 3-3-29).

Beginning with the first captures of 1981 brood year fish in June, three age classes of coho salmon juveniles (Age 0+, Age 1+ and Age 2+) were present. Length frequency distribution and scale analysis were used to determine the separation by age class for the reach of river above the Chulitna River confluence. Below this reach, a larger overlap in the range of lengths between age classes was apparent. Insufficient numbers of scale samples were collected in the lower reach to provide an accurate inflection point between age classes. However, length frequency distribution indicated a similar separation to that observed for the reach above the Chulitna River confluence. Table 3-3-30 presents the results of scale analysis on the subsample of coho salmon juveniles collected for the entire river during the 1982 surveys.

Utilizing this data, a minimum length of 61 mm was established to represent the smallest size of Age 1+ fish during early June. A five

Table 3-3-29. Coho salmon juveniles, mean length and range of lengths by age class between Cook Inlet and Devil Canyon, February to April, 1982.

Survey Period	Age I+			Age II+		
	Number of Fish	Mean Length (mm)	Range of Lengths (mm)	Number of Fish	Mean Length (mm)	Range of Lengths (mm)
February	7	78	68-93	1	119	119
March	21	79	58-100	21	122	110-148
April	35	86	58-107	20	123	111-162
Combined	63	83	58-107	42	122	110-162

Table 3-3-30. Coho salmon, scale analysis of age class composition for juvenile fish by survey period collected between Cook Inlet and Devil Canyon, 1982.

Survey Period	Age 0+ 1981 Brood Year		Age I+ 1980 Brood Year		Age II+ 1979 Brood Year	
	Number of Fish	Range of Lengths (mm)	Number of Fish	Range of Lengths (mm)	Number of Fish	Range of Lengths (mm)
February to May	0	-	28	63-116	28	89-158
June 1-15	0	-	21	85-129	15	117-202
June 16-30	3	57-59	30	71-138	3	99-118
July 1-15	0	-	7	79-116	0	-
July 16-31	4	62-71	19	72-120	0	-
Aug. 1-15	7	59-81	15	71-129	0	-
Aug. 16-31	8	58-94	15	96-137	0	-
Sept. 1-15	2	87-89	18	92-149	0	-
Sept. 16-30	21	68-95	29	102-163	1	192
Oct. 1-12	7	79-105	11	100-152	0	-

millimeter increase in length was attributed for each successive two-week period. By the end of September, the minimum length for Age 1+ coho salmon was set at 96 mm. Length frequency and scale analysis could not accurately provide a separation by size for Age 1+ and Age 2+ coho salmon due to the extreme overlap of ranges. Consequently, these two age classes were combined as Age 1+ for most length frequency calculations.

Appendix Figure 3-B-3 presents the length frequency distribution for juvenile coho salmon by two-week period for fish collected above the confluence of the Chulitna River. Mean lengths and range of lengths by two-week period for Age 0+ and 1+ coho salmon collected in this same reach from June to October are presented in Table 3-3-31. During a period of peak catches recorded at both the downstream migrant trap and at DFH sites in late June, Age 0+ coho salmon had a mean length of 41 mm with a range from 29 mm to 65 mm. The mean length had increased to 61 mm with a range from 42 mm to 95 mm during the second peak in catches observed during September. In early October, Age 0+ coho salmon ranged from 51 mm to 100 mm with a mean length of 72 mm.

Age 1+ and older coho salmon had a mean length during June of 103 mm with a range from 67 mm to 202 mm. A mean length of 92 mm was observed during July with a range from 71 mm to 150 mm. This 11 mm decrease in mean length in July was a result of the influence of outmigrating larger Age 2+ fish during June. The major outmigration of Age 2+ coho salmon had occurred by early July as indicated by an increase in mean length following this period. Analysis of scale samples collected during early

Table 3-3-31. Coho salmon age 0+ and age 1+ mean length and range of lengths by survey period between the Chulitna River confluence and Devil Canyon, June to October, 1982.

	Age 0+			Age I+		
Date	Number of Fish	Mean Length (mm)	Range of Lengths (mm)	Number of Fish	Mean Length (mm)	Range of Lengths (mm)
June 1-15	0	-	-	10	113	67-202
June 16-30	184	41	29-65	52	101	70-138
July 1-15	58	50	32-69	39	88	71-132
July 16-31	187	48	32-75	53	94	77-150
Aug. 1-15	161	49	34-78	11	97	81-129
Aug. 16-31	66	55	37-85	9	105	94-134
Sept. 1-15	176	57	42-90	22	121	92-149
Sept. 16-30	180	65	44-95	35	128	102-192
Oct. 1-12	46	72	51-100	11	118	105-152

June showed that 15 of 36 (41.7%) coho salmon in the subsample were Age 2+ fish. In late June there were only three Age 2+ fish out of 35 fish sampled. No Age 2+ coho salmon were measured during July and August although one Age 2+ fish (192 mm in total length) was collected in the downstream migrant trap during late September. By this time, Age 1+ coho salmon had a mean length of 126 mm with a range from 102 mm to 165 mm.

Appendix Figure 3-B-4 provides the percent length frequency composition by two-week period for juvenile coho salmon collected below the confluence of the Chulitna River. The mean length and range of lengths for Age 0+ and Age 1+ coho salmon from May to September in this same reach of river is presented in Table 3-3-32. The mean length for Age 0+ fish collected in this reach during June was 49 mm with a range from 38 mm to 65 mm. A continued increase in mean length was observed for Age 0+ fish in this reach and by late September, the mean length had reached 72 mm with a range from 56 mm to 85 mm.

Age 1+ coho salmon collected below the confluence of the Chulitna River averaged 100.9 mm during early June with a range from 61 mm to 195 mm. Following the outmigration of larger Age 2+ fish, the mean length in early July was 83 mm with a range from 71 mm to 102 mm. By September Age 1+ coho salmon in this reach averaged 103 mm with a range from 92 mm to 122 mm.

Table 3-3-32. Coho salmon age 0+ and age 1+, mean length and range of lengths by survey period between Cook Inlet and the Chulitna River confluence, May to September, 1982.

Date	Age 0+ Number of Fish	Age 0+ Mean Length (mm)	Age 0+ Range of Lengths (mm)	Age I+ Number of Fish	Age I+ Mean Length (mm)	Age I+ Range of Lengths (mm)
May 16-31	0	-	-	2	125	119-130
June 1-15	13	49	38-59	130	101	61-195
June 16-30	59	49	35-65	78	91	67-130
July 1-15	72	54	40-70	41	83	71-102
July 16-31	126	64	47-75	82	92	76-128
Aug. 1-15	125	65	47-80	40	98	82-123
Aug. 16-31	45	67	32-85	8	113	91-137
Sept. 1-15	58	70	50-90	15	103	92-122
Sept. 16-30	16	72	56-85	2	106	101-110

3.2.3 Chum Salmon

Surveys conducted during 1982 collected juvenile chum salmon (Oncorhynchus keta Walbaum) from Goose Creek (RM 73.1) upstream to Slough 21 (RM 142.0). Surveys conducted from March through early May collected 90 juvenile chum salmon above the Chulitna River confluence (Appendix Table 3-A-81). Operating in this same reach, the downstream migrant trap captured a total of 754 chum salmon fry from June 18 to August 15 (Appendix Table 3-B-4). Surveys conducted between the Chulitna River confluence and Devil Canyon collected 1,041 chum salmon juveniles during June and July at DFH sites (Appendix Table 3-A-80). Boat electrofishing gear in this same reach collected 61 chum salmon fry (Appendix Table 3-A-81). Mobile sampling surveys conducted below the confluence of the Chulitna River captured 133 juvenile chum salmon from June to early September (Appendix Table 3-A-81).

The percent of total chum salmon fry captured by all collection techniques by two-week period and by reach of river between Cook Inlet and Devil Canyon is presented in Figure 3-3-18. Over 85 percent of the total captures of juvenile chum salmon during 1982 were recorded during June.

Sixty-seven percent (505 fish) of the total captures of chum salmon fry in the downstream migrant trap occurred during late June (Figure 3-3-19). The average catch rate for this period was 3.7 fish per hour. The peak catch rate of 10.0 fish per hour was recorded on June 21, three days after initial trap deployment. A decrease in catch rate was

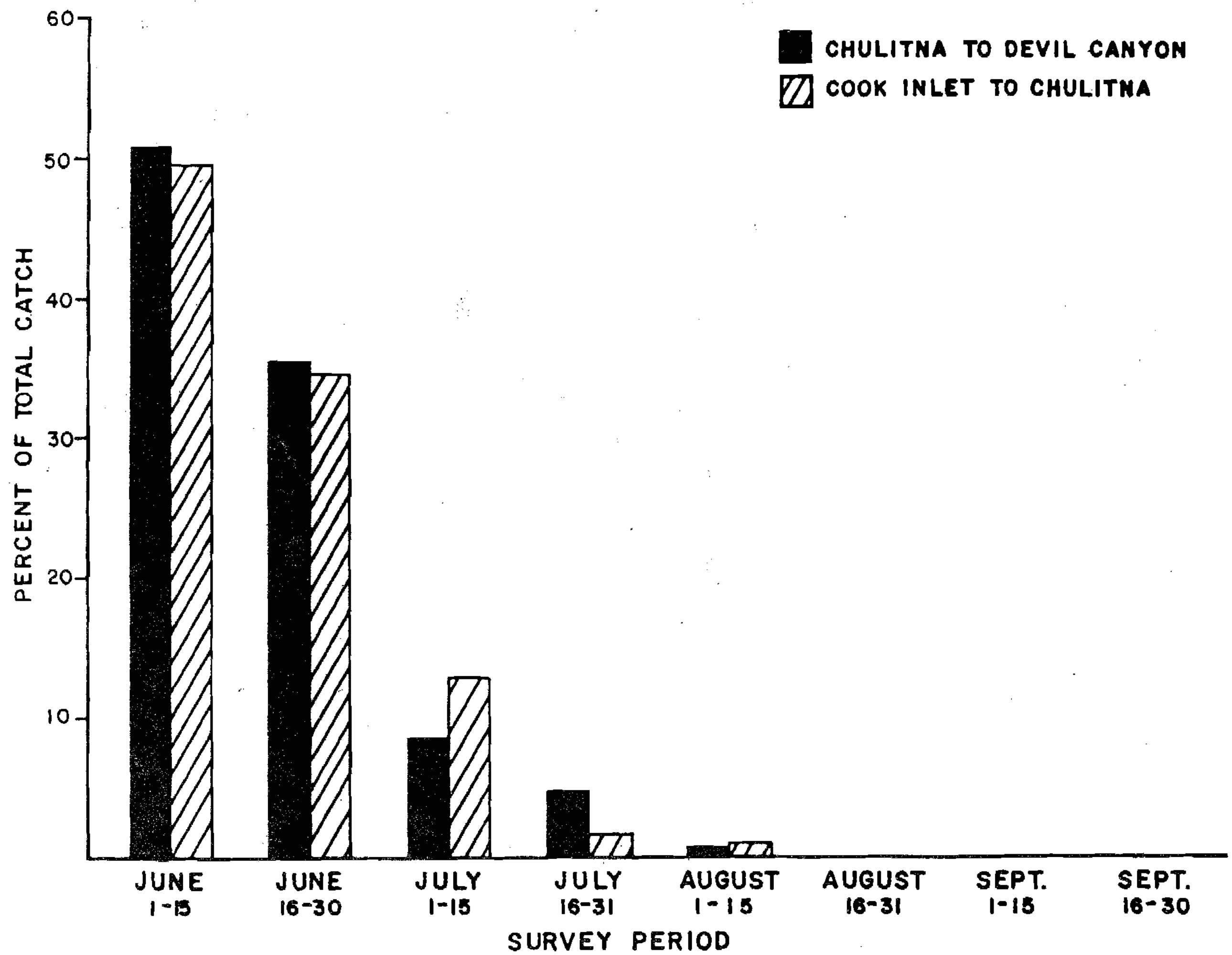


Figure 3-3-18. Chum salmon juveniles, percent of total catch by all gear types including smolt trap by reach of river averaged by two week period on the Susitna River between Cook Inlet and Devil Canyon, 1982.

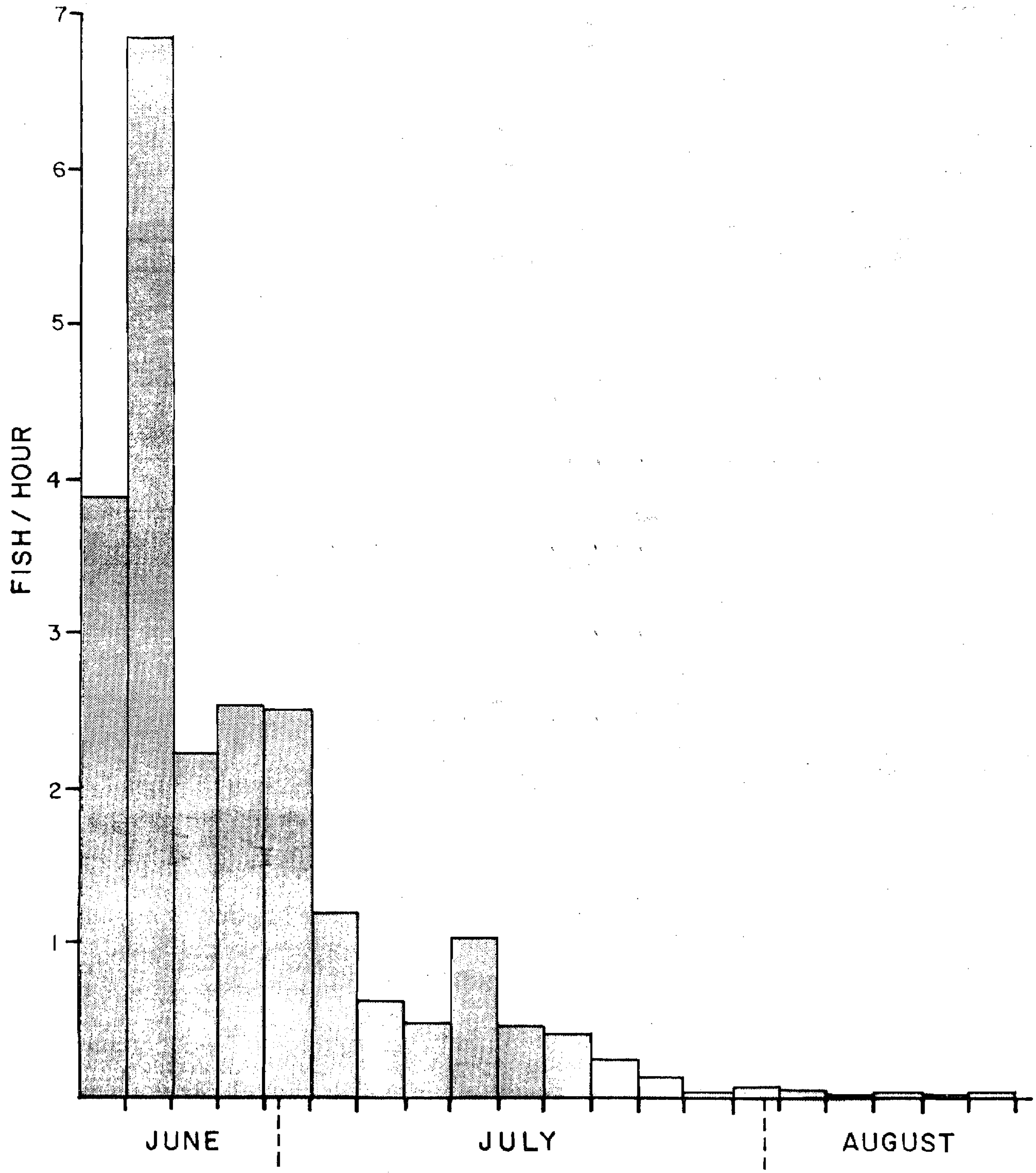


Figure 3-3-19. Chum salmon juveniles, downstream migrant trap catch rates averaged by three day periods, June through August, 1982.

observed during early July and 87 percent of the total chum salmon fry collected in the trap were recorded by July 15. This is the latest period during which chum salmon fry were collected at DFH sites above the Chulitna River confluence.

The downstream migrant trap catch rate for chum salmon fry dropped below 0.1 fish per hour by the end of July, and only ten fish were collected during early August. The last capture of chum salmon fry above the Chulitna River confluence was recorded August 15 (Figure 3-3-16).

Boat electrofishing gear and surveys of DFH sites below the confluence of the Chulitna River during 1982 collected chum salmon fry from June through early August. About 50 percent of the total captures of chum salmon fry in this reach occurred in early June.

Ninety newly emerged chum salmon juveniles collected above the Chulitna River confluence were measured for total length from February through April. A total of 569 chum salmon fry were measured from fish collected in the downstream migrant trap. Two hundred sixteen fish were measured at DFH and SFH sites above the Chulitna River confluence and 113 fish were measured at sites below the Chulitna River confluence. All captured chum salmon fry were from the 1981 brood year and were Age 0+.

Chum salmon fry collected during March still had yolk sacs present, but most fish had reached the buttoned-up stage by April. The mean length of chum salmon fry following yolk sac absorption was approximately 35 mm during March and April, with a range from 29 mm to 41 mm.

The percent length frequency composition by two-week period for chum salmon fry collected above the Chulitna River confluence is presented in Appendix Figure 3-B-5. Mean total length and range of lengths by survey period for chum salmon fry captured by the combined sampling efforts for the reaches of river above and below the Chulitna River confluence are presented in Table 3-3-33.

Calculated mean lengths for chum salmon fry collected above the Chulitna River confluence ranged from 34 mm in March to 42 mm in early July, an increase of 9 mm during the survey period. No appreciable change in mean length was observed following the early July survey but a seven millimeter increase in the upper limit of the range was observed by late July. Insufficient numbers of fry were collected during early August to provide a representative mean length for this period.

Appendix Figure 3-B-6 provides the percent length frequency composition by two-week period for chum salmon fry collected below the Chulitna River confluence. Chum salmon fry collected in this reach had a mean total length of 43 mm in early June with a range from 29 mm to 51 mm. By the end of June they had reached a mean length of 45 mm with a range from 34 mm to 54 mm. The nine fish measured in this reach after late June had a mean length of 43 mm and a range from 30 mm to 50 mm.

A mean length of 40 mm with a range from 30 mm to 52 mm was recorded for chum salmon fry during the peak catches above the Chulitna River confluence during June. The peak catches in the lower reach during this same

Table 3-3-33. Chum salmon fry, mean length and range of lengths by survey period and by reach of river, March to September, 1982.

Survey Period	Cook Inlet to Chulitna Number of Fish	Cook Inlet to Chulitna Mean Length (mm)	Cook Inlet to Chulitna Range of Lengths (mm)	Chulitna to Devil Canyon Number of Fish	Chulitna to Devil Canyon Mean Length (mm)	Chulitna to Devil Canyon Range of Lengths (mm)
March	0	-	-	6	34	30-36
April	0	-	-	37	38	35-42
May	0	-	-	45	40	37-43
June 1-15	60	43	29-51	97	40	30-52
June 16-30	44	45	33-54	423	36	28-52
July 1-15	3	43	36-49	161	42	29-55
July 16-31	2	48	45-50	92	42	30-62
Aug. 1-15	1	39	39	10	41	37-46
Aug. 16-31.	0	-	-	0	-	-
Sept. 1-15	1	30	30	0	-	-

period were comprised of chum salmon fry with a mean length of 43 mm and ranged from 29 mm to 54 mm.

3.2.4 Sockeye Salmon

Sockeye salmon juveniles (*Oncorhynchus nerka* Walbaum) were observed from a small tributary entering Kroto Slough (RM 38.5) to Slough 21 (RM 142.0) during 1982. Surveys conducted from March through early May between the Chulitna River confluence and Devil Canyon resulted in the collection of 19 juvenile sockeye salmon (Appendix Table 3-A-83). The downstream migrant trap captured 2,134 sockeye salmon while in operation above the Chulitna River confluence from June 18 to October 12 (Appendix Table 3-B-5). Designated fish habitat surveys conducted between the Chulitna River confluence and Devil Canyon from June through October collected 1,308 juvenile sockeye salmon (Appendix Table 3-A-82) and 15 fish were collected by boat-mounted electrofishing gear. Mobile sampling techniques collected 130 juvenile sockeye salmon at sites below the confluence of the Chulitna River (Appendix Table 3-A-83).

One 1980 brood year sockeye salmon (Age 1+) was collected at Slough 9 during March. Eggs and alevins from the 1981 brood class were observed at Slough 11 and Slough 21 during the same period. Post-emergent sockeye salmon fry were collected at Sloughs 8A, 11, and 21 during early May.

In early June, surveys of DFH sites above the Chulitna River confluence collected 223 sockeye salmon juveniles at Slough 6A and one fish at

Slough 8A. By late June, sockeye salmon juveniles were observed at numerous sites including Sloughs 6A, 9, 11, and 19.

The downstream migrant trap catch data averaged by three-day periods is presented in Figure 3-3-20. The downstream migrant trap collected 190 juvenile sockeye salmon during late June. The average catch rate for this period was 1.4 fish per hour and the highest catch was 3.2 fish per hour recorded on June 21. The highest overall catch rates for juvenile sockeye salmon in the downstream migrant trap occurred during early July when an average catch rate of 4.4 fish per hour was recorded and a peak catch rate of 16.3 fish per hour occurred July 7. By late July, trap catches averaged 1.9 fish per hour with a peak catch rate of 6.1 fish per hour on July 26.

The average catch rate of juvenile sockeye salmon in the trap dropped below one fish per hour during early August and averaged less than 0.1 fish per hour after late August. The last captures of juvenile sockeye salmon were recorded October 11 (Figure 3-3-16).

Mobile electrofishing gear and DFH site surveys collected sockeye salmon juveniles from early June through late September at sites located below the confluence of the Chulitna River (Appendix Tables 3-A-82 and 3-A-83). Peak catches for this species in the lower reach were recorded during July.

Nineteen juvenile sockeye salmon captured between the Chulitna River confluence and Devil Canyon were measured for total length from March

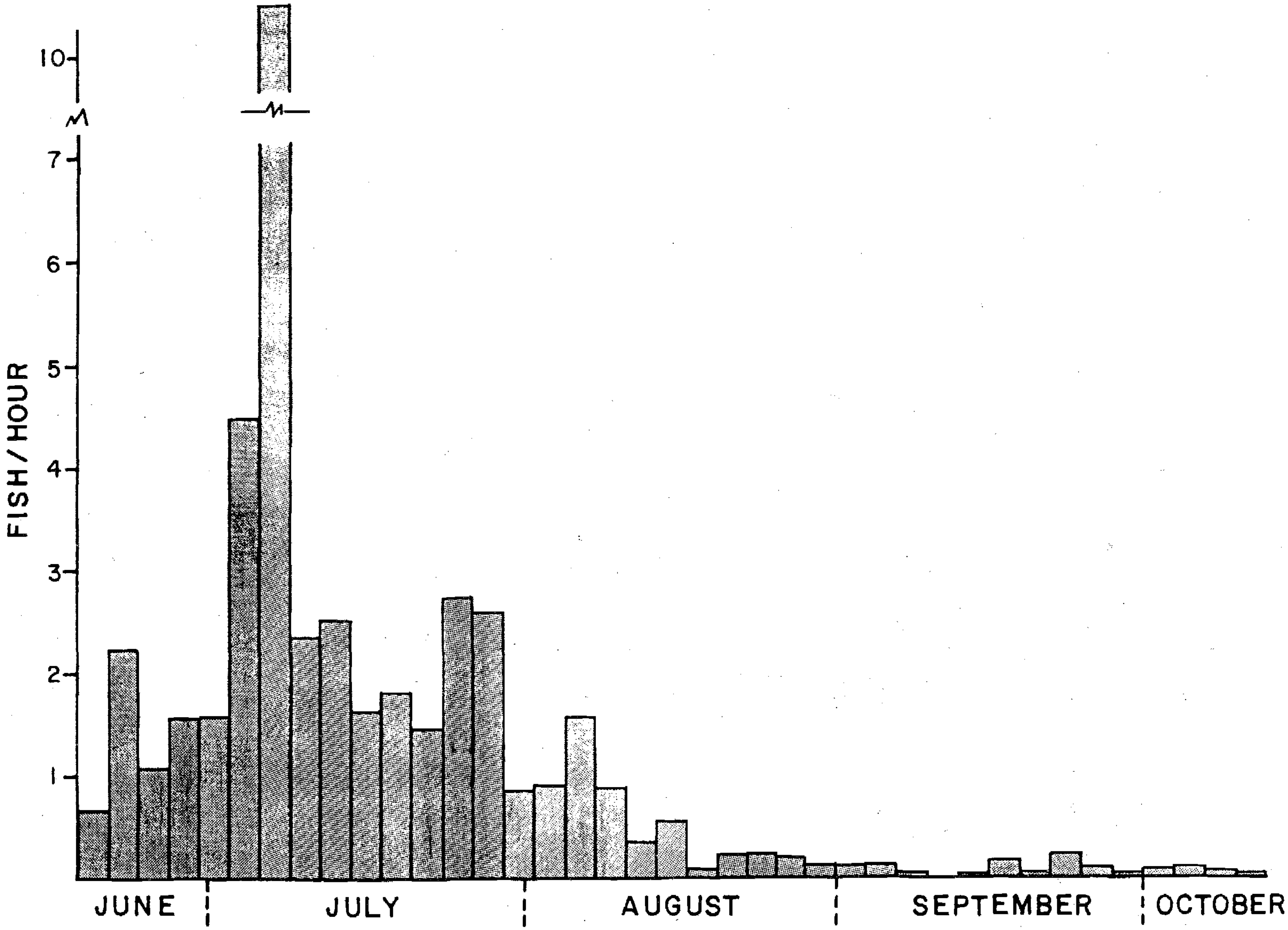


Figure 3-3-20. Sockeye salmon juveniles, downstream migrant trap catch rates averaged by three day periods, June through October, 1982.

through early May. A total of 2,122 sockeye salmon collected in the downstream migrant trap were measured, and 697 fish captured by mobile sampling techniques in this same reach of river from June through October were measured. One hundred four juvenile sockeye salmon collected at sites located below the Chulitna River confluence were measured.

Scale analysis and comparisons of the length frequency distribution showed the presence of both Age 0+ and Age 1+ (brood years 1981 and 1980, respectively) sockeye salmon in the Susitna River (Table 3-3-34). A separation by age classes showed that a total of 2,910 (98.9%) Age 0+ and 32 (1.1%) Age 1+ sockeye salmon juveniles were measured for total length.

Mean total length and range of lengths by survey period for Age 0+ and Age 1+ sockeye salmon captured by the combined studies above the Chulitna River confluence are presented in Table 3-3-35. The percent length frequency for juvenile sockeye salmon collected between the Chulitna River confluence and Devil Canyon by two-week period is presented in Appendix Figure 3-B-7. Surveys conducted from March to early May collected post-emergent Age 0+ sockeye salmon having a mean length of 38 mm with a range from 29 mm to 37 mm. A mean length of 42 mm with a range from 27 mm to 63 mm was observed for Age 0+ fish collected during late June between the Chulitna River confluence and Devil Canyon. During the period of peak catch rates observed in the downstream migrant trap during early July, Age 0+ fish had a mean length of 42 mm with a range from 30 mm to 74 mm. A mean length of 45 mm with a range of 28 mm

Table 3-3-34. Sockeye salmon, scale analysis of age class composition for juvenile fish by survey period collected between Cook Inlet and Devil Canyon, 1982.

	Age 0+ 1981 Brood Year		Age 1+ 1980 Brood Year	
Survey Period	Number of Fish	Range of Lengths (mm)	Number of Fish	Range of Lengths (mm)
Feb.--May	0	-	0	-
June 1-15	0	-	17	57-120
June 16-30	4	51-63	1	72
July 1-15	3	60-74	0	-
July 16-31	20	51-86	0	-
Aug. 1-15	15	68-90	0	-
Aug. 16-31	4	68-84	0	-
Sept. 1-15	0	-	0	-
Sept. 16-30	8	70-82	0	-
Oct. 1-12	9	72-87	0	-

Table 3-3-35. Sockeye salmon age 0+ and age 1+, mean length and range of lengths by survey period between the Chulitna River confluence and Devil Canyon, 1982.

Survey Period	Age 0+ Number of Fish	Age 0+ Mean Length (mm)	Age 0+ Range of Lengths (mm)	Age 1+ Number of Fish	Age 1+ Mean Length (mm)	Age 1+ Range of Lengths (mm)
March-May	18	33	29-37	1	57	57
June 1-15	1	30	30	23	77	62-88
June 16-30	266	42	27-63	1	72	72
July 1-15	998	42	30-74	1	93	93
July 16-31	818	50	24-84	2	87	86-87
Aug. 1-15	348	51	28-90	0	-	-
Aug. 16-31	94	48	29-84	0	-	-
Sept. 1-15	82	51	29-75	0	-	-
Sept. 16-30	72	59	34-82	0	-	-
Oct. 1-12	15	72	48-87	0	-	-

to 79 mm was observed for Age 0+ fish captured by mobile sampling gear during the peak catch rates recorded for these gear types in July. Mean lengths of Age 0+ sockeye salmon collected by all gear types above the Chulitna River confluence increased to 59 mm with a range from 34 mm to 82 mm during late September. The fourteen sockeye salmon juveniles collected during early October ranged in length from 48 mm to 87 mm with a mean length of 71 mm.

The percent length frequency distribution by two-week period for juvenile sockeye salmon collected below the Chulitna River confluence is presented in Appendix Figure 3-B-8. Age 0+ sockeye salmon in this reach had a mean length of 41 mm in early July with a range from 30 mm to 65 mm and had increased to a mean length of 62 mm with a range from 40 mm to 91 mm during September (Table 3-3-36).

Age 1+ sockeye salmon ranged in length from a 57 mm fish captured during March to a fish 120 mm in length collected during the peak migration of Age 1+ fish in June. The mean length for Age 1+ sockeye salmon recorded during this period for the combined sampling reaches was 80 mm with a range of 62 mm to 120 mm. The last recorded capture of Age 1+ sockeye salmon during 1982 was on July 27 in the downstream migrant trap.

3.2.5 Pink Salmon

A total of 28 pink salmon fry (*Oncorhynchus gorbuscha* Walbaum) were collected from May to late July, 1982. Surveys conducted during late May accounted for 71.4 percent of the total captures and 21.4 percent

Table 3-3-36. Sockeye salmon age 0+ and age 1+ mean length and range of lengths by survey period below the Chulitna River confluence, June through September, 1982.

	AGE 0+ 1981 Brood Year			AGE 1+ 1980 Brood Year		
Survey Period	Number of Fish	Mean Length (mm)	Range of Lengths (mm)	Number of Fish	Mean Length (mm)	Range of Lengths (mm)
June 1-15	1	33	33	4	99	81-120
June 16-30	2	45	41-49	0	-	-
July 1-15	36	41	30-65	0	-	-
July 16-31	12	57	40-80	0	-	-
Aug. 1-15	7	52	49-65	0	-	-
Aug. 16-31	11	55	34-78	0	-	-
Sept. 1-15	19	61	40-91	0	-	-
Sept. 16-30	3	67	41-87	0	-	-

were collected in the downstream migrant trap during July (Appendix Table 3-B-6). The last capture of pink salmon fry was recorded July 24 at Slough 11 (RM 135.3).

Table 3-3-37 presents the mean length and range of lengths by site for pink salmon fry collected during the 1982 surveys. Pink salmon fry had a mean length of 36 mm with a range from 29 mm to 43 mm. All pink salmon juveniles captured were from the 1981 brood year.

3.3 Food Habits of Juvenile Salmon

3.3.1 Salmonid Collections

Total numbers of chinook, coho, and sockeye juveniles captured during 1982 sampling were 313, 171, and 116, respectively (Table 3-3-38). Numbers of these juveniles retained for laboratory analysis were 279, 113, and 116 respectively. Large numbers of chinook salmon juveniles salmon juveniles were captured at Slough 21 and Indian River. Substantial numbers of coho salmon juveniles were captured at Fourth of July Creek, Slough 8A, and Indian River. Most sockeye salmon juveniles captured were from Slough 11, though they were also found at Slough 8A.

3.3.2 Important Food Types

All three salmon species collected during this study consumed both terrestrial and aquatic invertebrates (Appendix Tables 3-C-1 to 3-C-3). Midges (Diptera: Chironomidae) were the numerically dominant taxa in

Table 3-3-37. Pink salmon fry collection by site for the combined studies, 1982.

Site Surveyed	River Mile	Date	Number of Fish	Mean Length (mm)	Range (mm)
Mainstem opposite Sunshine Camp	79.0	May 25	3	42	41-42
Rabideux Creek	83.1	May 25	1	43	43
Birch Creek Slough	88.4	May 25	16	35	35
Downstream Migrant Trap	103.0	July 3-17	6	34	29-37
Mainstem at Curry Camp	120.7	July 7	1	36	36
Slough 11	135.3	July 24	1	35	35
TOTAL - ALL SITES		May 25 to July 24	28	36	29-43

Table 3-3- 38. Numbers of juvenile salmon captured and retained from six Designated Fish Habitat sites in the upper reach of the Susitna River in August and September, 1982.

	Chinook		Coho		Sockeye	
Location	Captured	Retained	Captured	Retained	Captured	Retained
Slough 8A	27	17	51	40	24	24
Slough 11	19	19	3	3	87	87
Slough 20	39	39	0	0	0	0
Slough 21	86	86	2	2	3	3
4th July Crk	84	74	68	37	0	0
Indian River	58	44	47	31	0	0

the stomach contents of chinook, coho, and sockeye salmon juveniles and were consumed as larvae, pupae, and adults (Figures 3-3-21 to 3-3-31). Larvae of other dipterans (Simuliidae, Psychodidae, and Tipulidae) were also present in many stomach samples. All three salmon species occasionally consumed mayfly (Ephemeroptera) and stonefly (Plecoptera) nymphs of various families. Sockeyes captured at Slough 11 and Slough 8A in August had large numbers of copepods and cladocerans in their stomachs.

All of the analysis was done in terms of numbers, not volume. Chironomids are dominant numerically, but they are physically small in comparison to mayfly and stonefly nymphs, tipulid larvae (Diptera: Tipulidae), and many other invertebrates found in the system. As a result, chironomids may not be as important in terms of their volumetric contribution.

3.3.3 Comparisons Between Species

Chi-square tests comparing the stomach contents of the salmon species showed that differences between proportions of invertebrate types in coho and sockeye stomachs were usually significant ($p < 0.05$). Refer to Appendix Tables 3-C-4 to 3-C-23 for a listing of proportions used in chi-square test. Invertebrate taxa with less than five individuals found in all salmon species were not included in these analyses. Significant differences were also found among coho, chinook, and sockeye when they occurred together ($p < 0.05$) (Table 3-3-39). In some samples coho and chinook were also shown to have

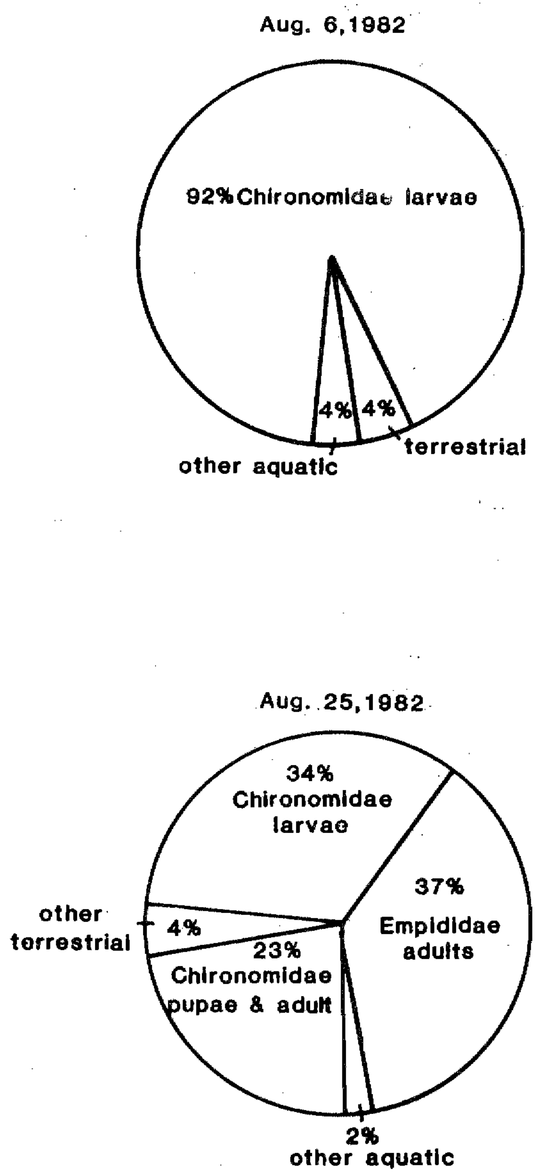


Figure 3-3-21. Stomach contents of chinook salmon juveniles collected in Slough 8A during August, 1982. Percent composition is based on numbers of individuals.

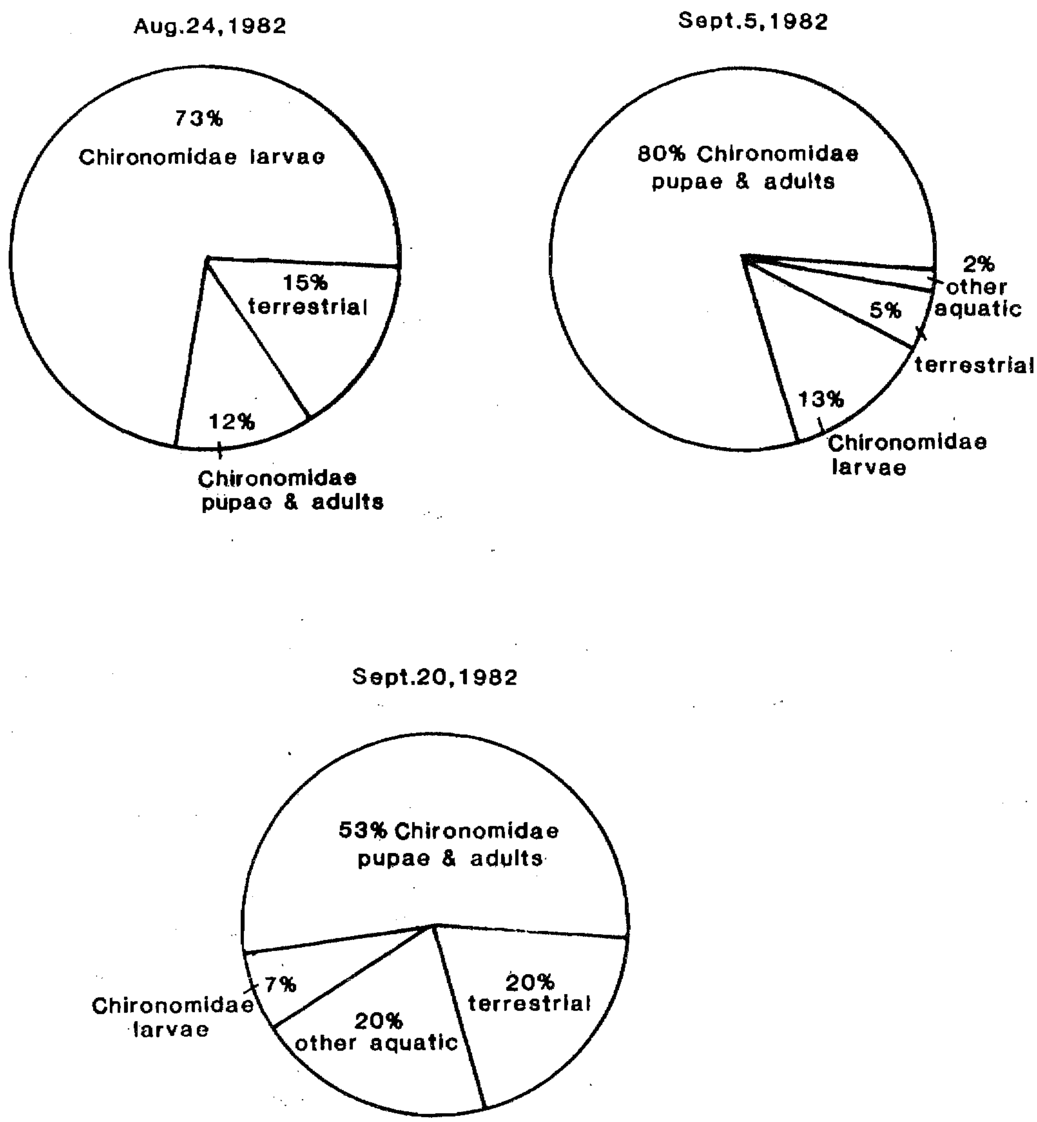


Figure 3-3-22. Stomach contents of chinook salmon juveniles collected in Slough 11 during August and September, 1982. Percent composition is based on numbers of individuals.

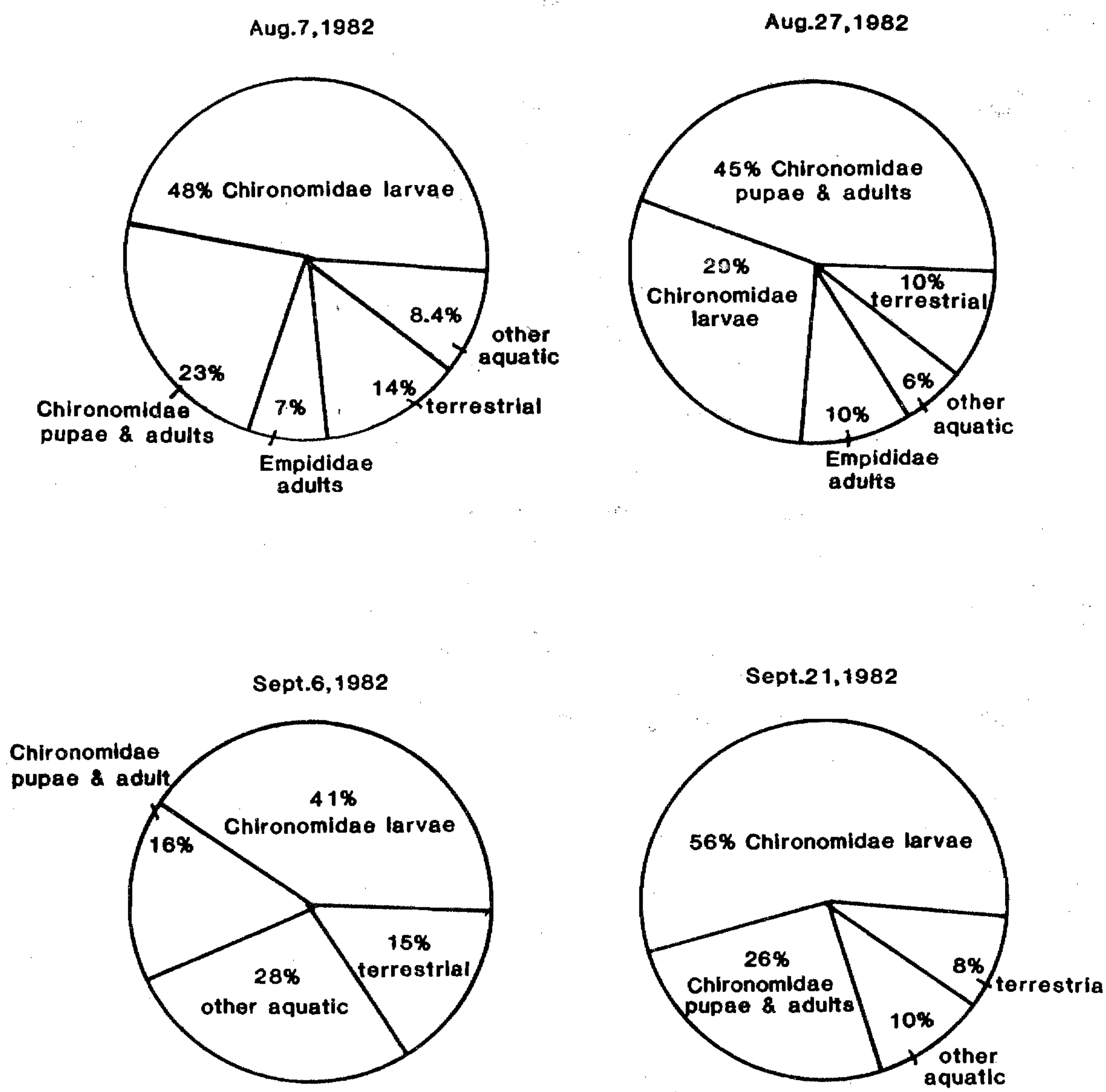


Figure 3-3-23. Stomach contents of chinook salmon juveniles collected in Slough 21 during August and September, 1982. Percent composition is based on numbers of individuals.

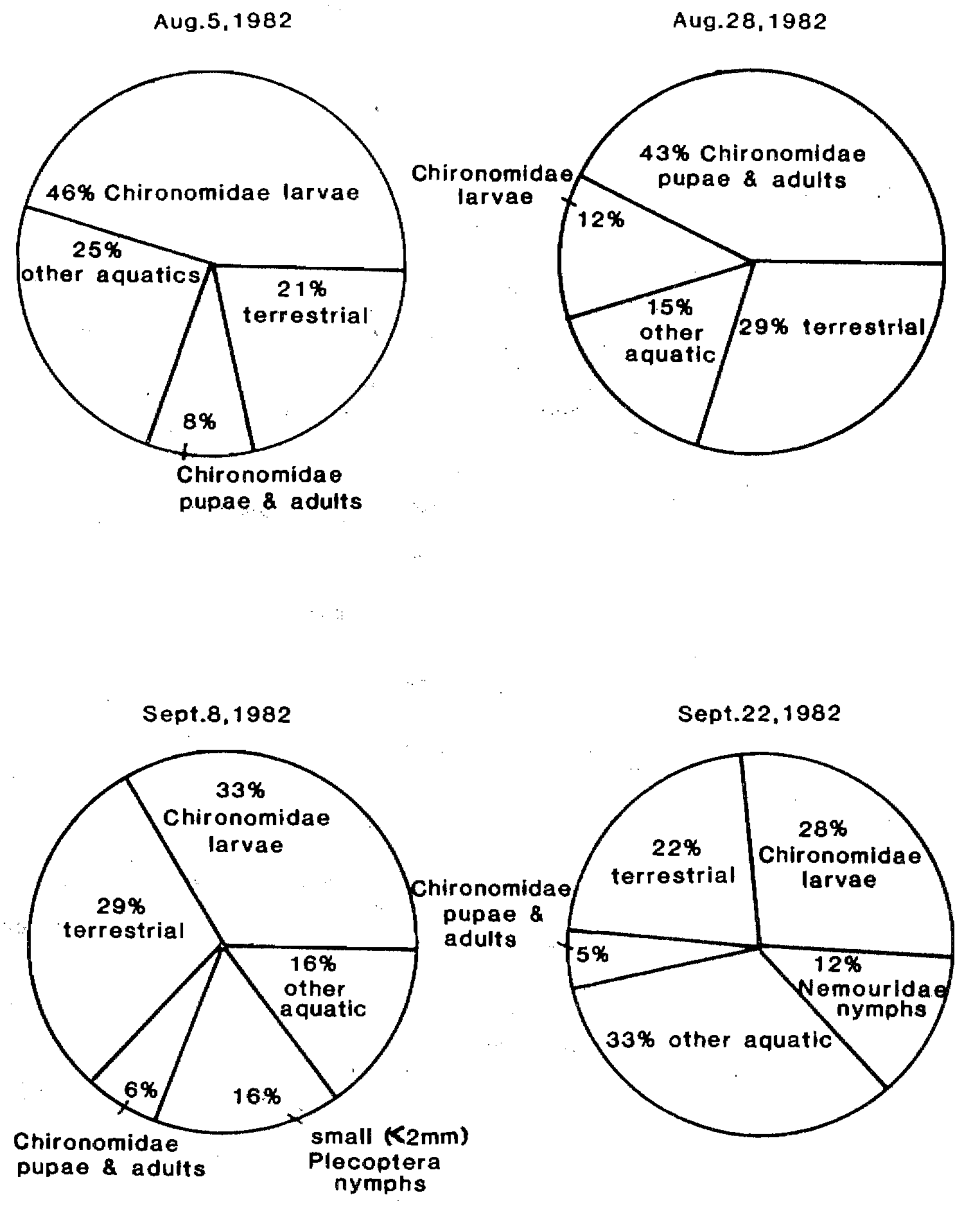


Figure 3-3-24. Stomach contents of chinook salmon juveniles collected in Fourth of July Creek during August and September, 1982. Percent composition is based on numbers of individuals.

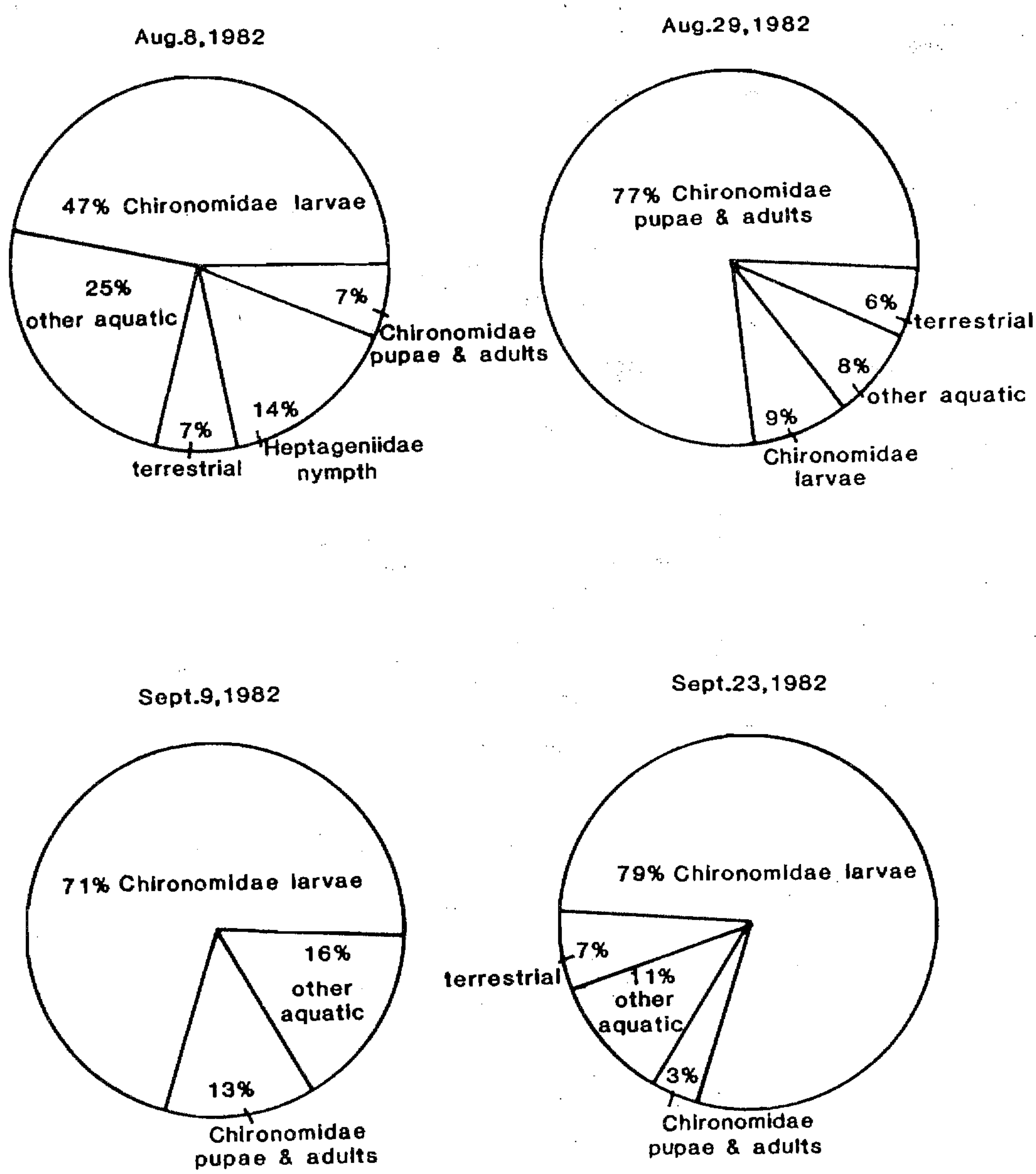


Figure 3-3-25. Stomach contents of chinook salmon juveniles collected in Indian River during August and September, 1982. Percent composition is based on numbers of individuals.

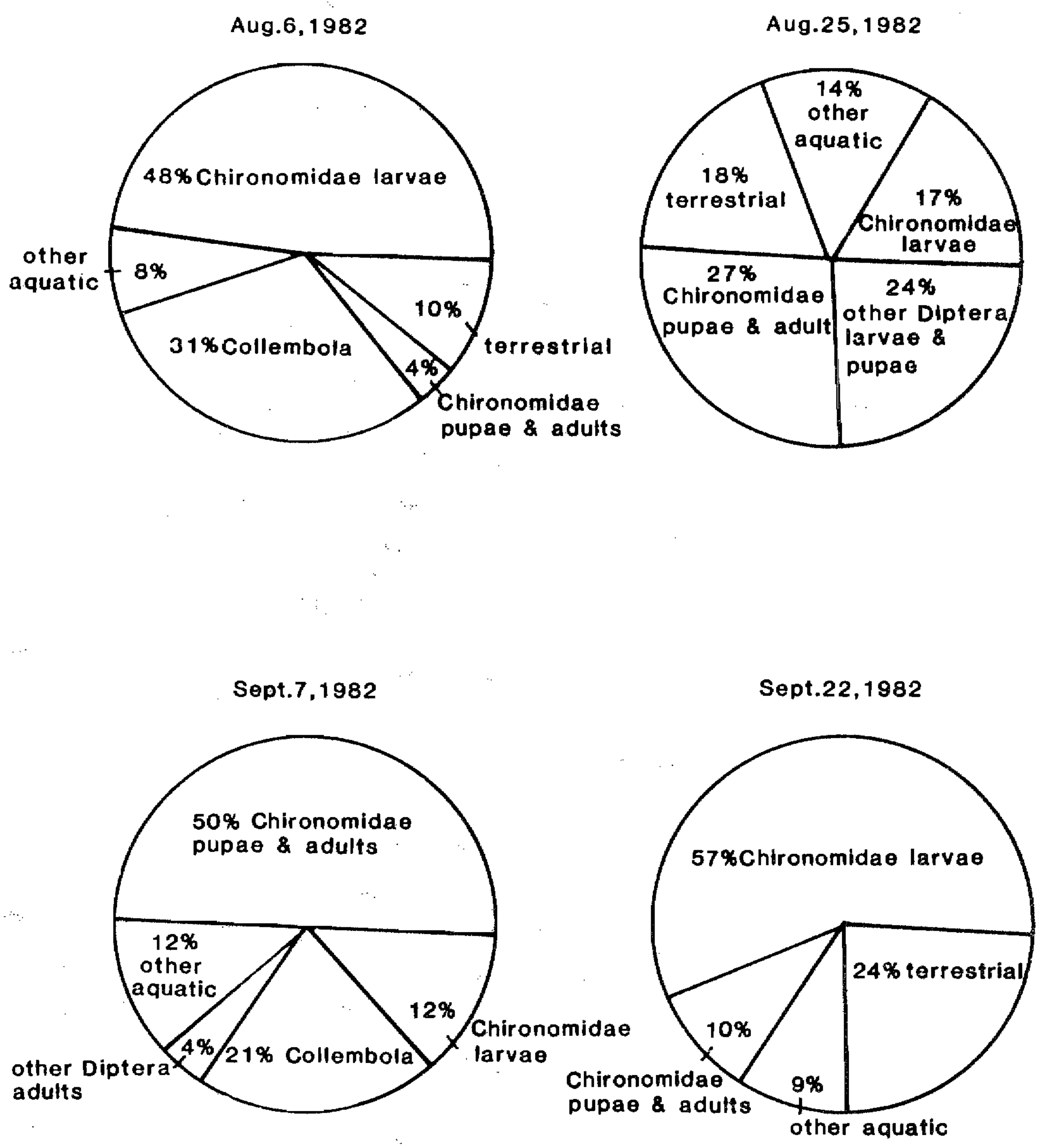


Figure 3-3-26. Stomach contents of coho salmon juveniles collected in Slough 8A during August and September, 1982. Percent composition is based on numbers of individuals.

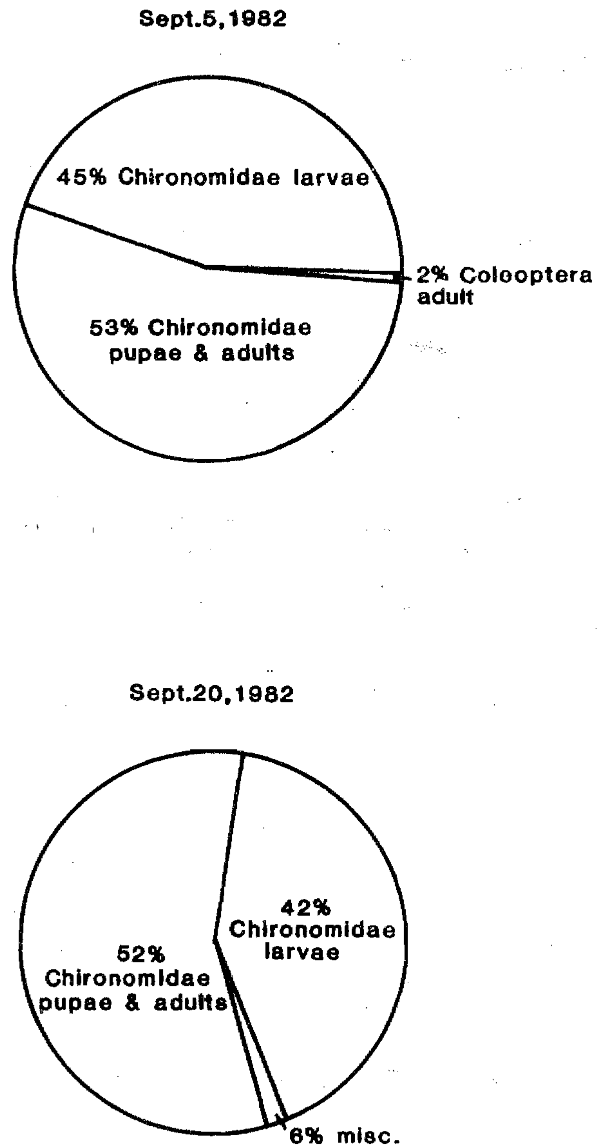


Figure 3-3-27. Stomach contents of coho salmon juveniles collected in Slough 11 during September, 1982. Percent composition is based on numbers of individuals.

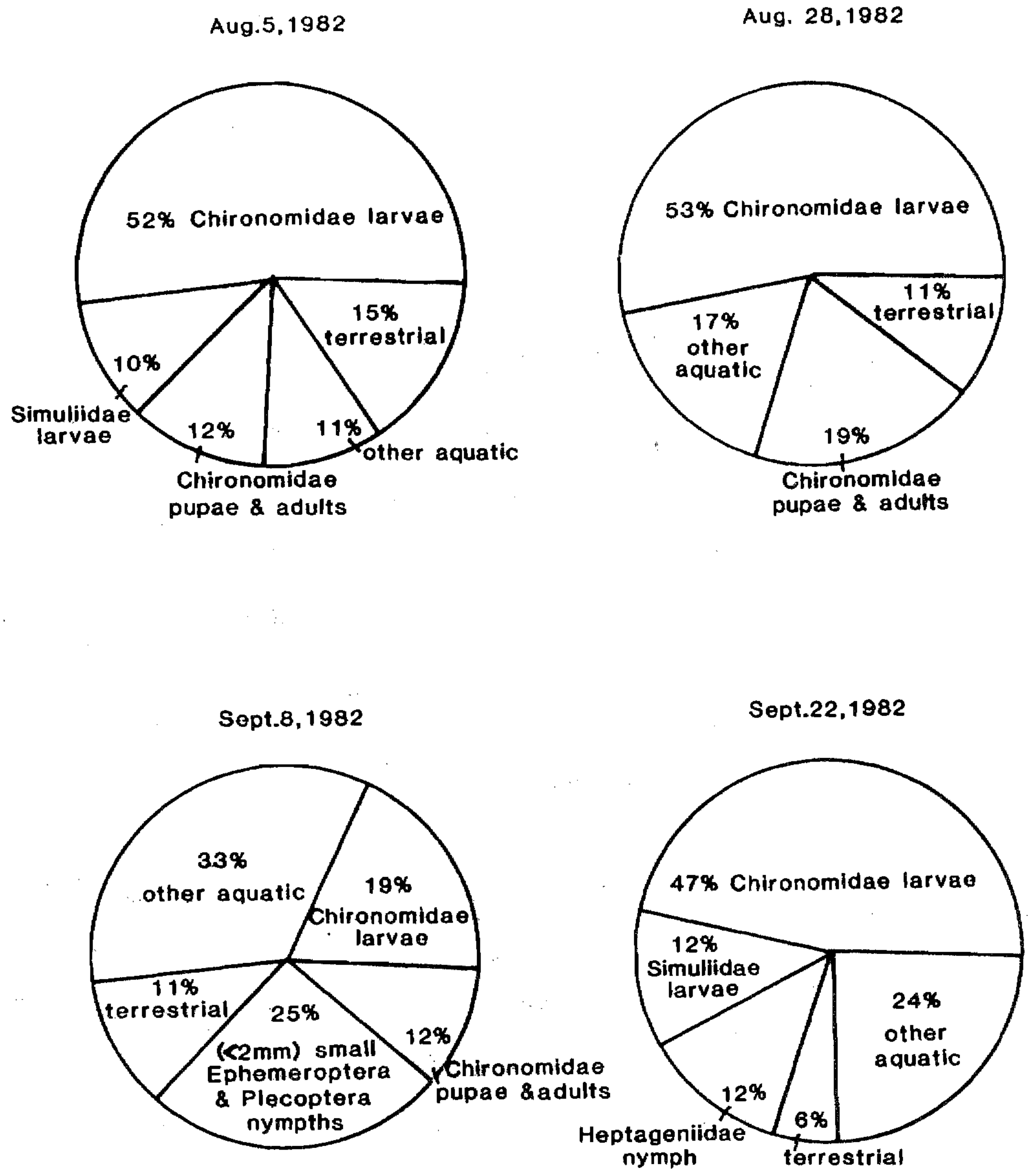


Figure 3-3-28. Stomach contents of coho salmon juveniles collected in Fourth of July Creek during August and September, 1982. Percent composition is based on numbers of individuals.

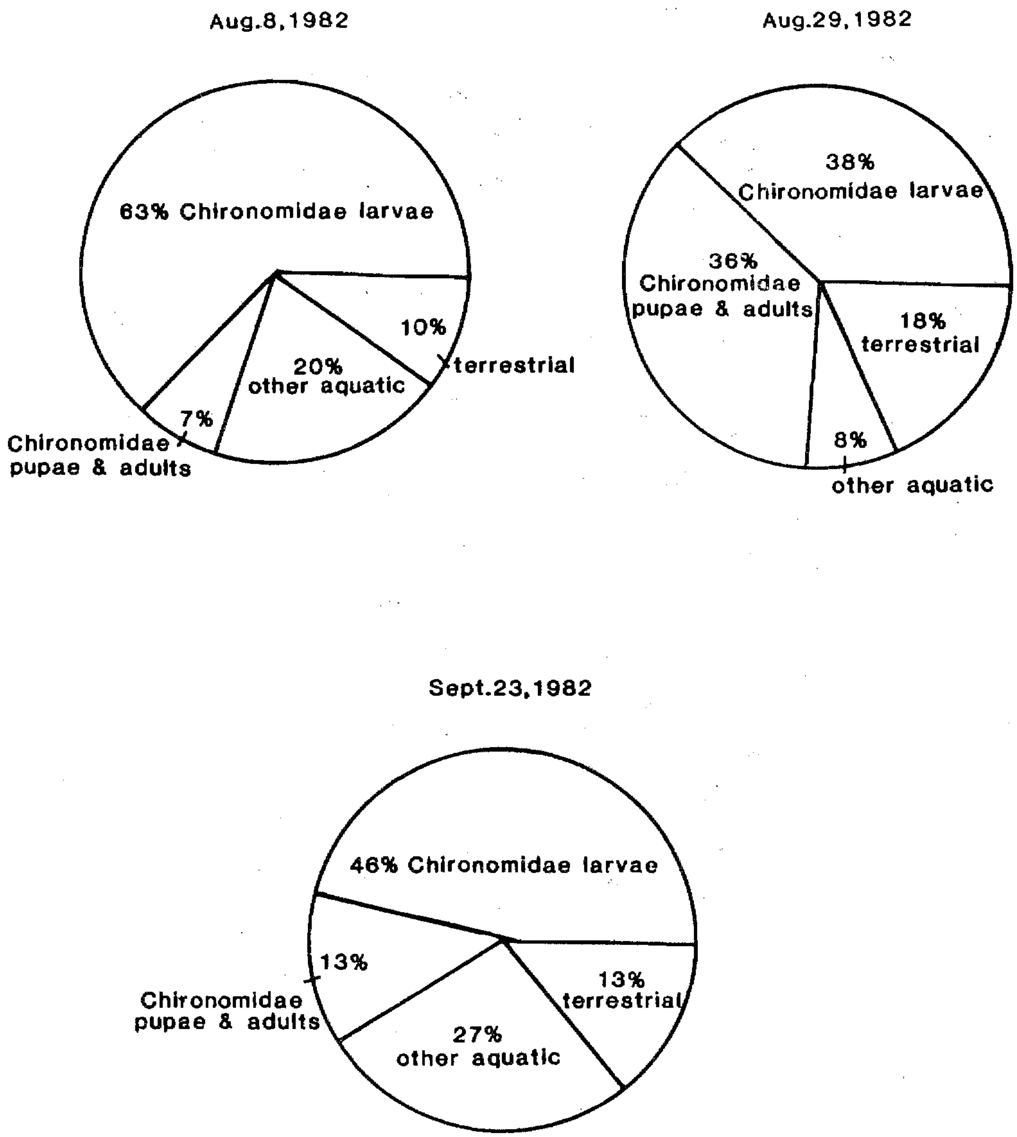


Figure 3-3-29. Stomach contents of coho salmon juveniles collected in Indian River during August and September, 1982. Percent composition is based on numbers of individuals.

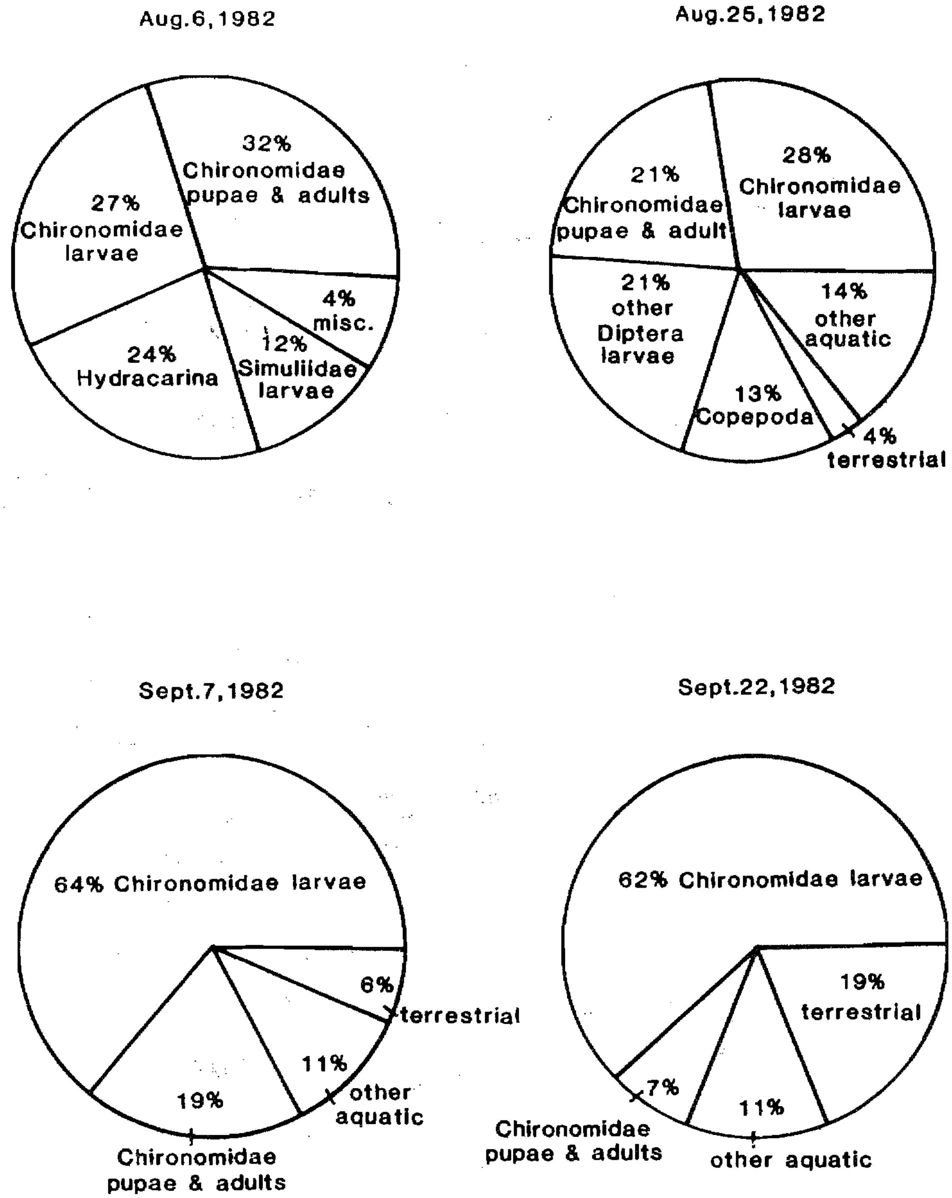


Figure 3-3-30. Stomach contents of sockeye salmon juveniles collected in Slough 8A during August and September, 1982. Percent composition is based on numbers of individuals.

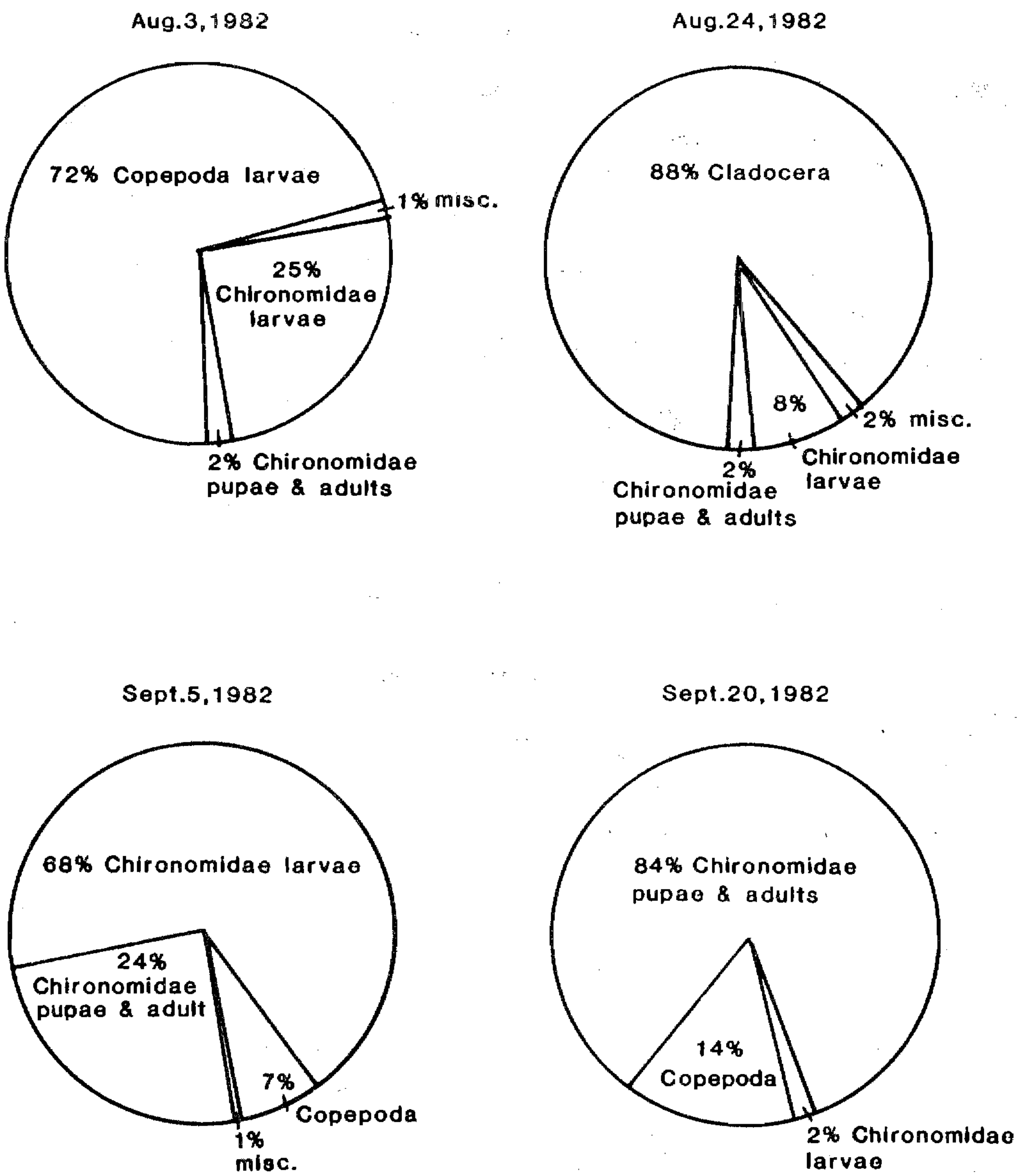


Figure 3-3-31. Stomach contents of sockeye salmon juveniles collected in Slough 11 during August and September, 1982. Percent composition is based on numbers of individuals.

Table 3-3-39. Results of chi-square analyses, comparing percent composition of major invertebrate taxa in stomach contents of co-occuring species of salmonid juveniles. H_o: proportions of invertebrate taxa are the same in all species is tested at the 95% confidence level. Chi-square (X^2) values, and degrees of freedom for testing (DF) are shown. Numbers in parenthesis are samples sizes (total number of invertebrates used for the test in each species). a/

Site	Date	Species compared	X^2	DF	Test Results
Slough 8A	82/08/06	Chinook-Coho (165) (41)	70	2	Reject H_o
Slough 8A	82/08/25	Chinook-Coho (51) (134)	81	5	Reject H_o
Slough 8A	82/08/25	Coho-Sockeye (134) (74)	77	10	Reject H_o
Slough 8A	82/09/07	Coho-Sockeye (150) (19)	30	4	Reject H_o
Slough 8A	82/09/22	Coho-Sockeye (141) (65)	24	8	Accept H_o
Slough 11	82/08/24	Chinook-Sockeye (22) (104)	3	3	Accept H_o
Slough 11	82/09/05	Chinook-Coho-Sockeye (138) (46) (676)	236	6	Reject H_o
Slough 11	82/09/20	Chinook-Coho-Sockeye (9) (95) (98)	64	6	Reject H_o
4th of July Crk	82/08/05	Chinook-Coho (129) (70)	8	6	Accept H_o
4th of July Crk	82/08/28	Chinook-Coho (45) (123)	57	5	Reject H_o
4th of July Crk	82/08/28	Chinook-Coho (359) (151)	34	15	Reject H_o
4th of July Crk	82/09/22	Chinook-Coho (91) (14)	8	8	Accept H_o
Indian River	82/08/08	Chinook-Coho (216) (28)	7	7	Accept H_o
Indian River	82/09/29	Chinook-Coho (22) (725)	222	4	Reject H_o
Indian River	82/09/29	Chinook-Coho (257) (304)	147	8	Reject H_o
Indian River	82/09/23	Chinook-Coho (76) (72)	18	4	Reject H_o

a/ When fish were collected in more than one area at a site, separate comparisons were done for each collection.

similar stomach contents, but more often there were significant differences in inverteb.ate taxa consumed by the two species ($p < 0.05$). These differences, however did not follow any perceivable pattern. No one invertebrate, taxa or group of taxa was consistently used more heavily by either species.

3.3.4 Electivity Indices

Electivity indices, which compare the proportion of each invertebrate type in the drift samples to their proportion in the stomach contents, usually showed positive selection for Chironomidae larvae in all three salmon species (Appendix Tables 3-C-4 to 3-C-23). An exception to the above was for sockeye salmon at Slough 11 in late August. At this time the sockeyes were feeding heavily on copepods and cladocerans, and were not consuming large numbers of chironmid larvae. Since almost no cladocerans or copepods were caught on that date in the drift net, the electivity values for them in those sockeyes examined were significantly positive (Appendix Table 3-C-22).

3.3.5 Drift Samples Compared to Kick Screen Samples

Four families of Ephemeroptera, and five families each of Diptera, Plecoptera, and Trichoptera (caddis flies) were identified in the drift and kick screen samples (Appendix Tables 3-C-24 and 3-C-25).

Since time and budget constraints limited the sorting and identification of invertebrates from kick screen samples, only those from late August and early September were analyzed. Chi-square tests indicated that the proportions of invertebrate taxa collected concurrently by kick screen and drift nets were significantly different ($p < 0.05$) (Table 3-3-40). The drift samples usually contained fewer Chironomidae larvae, and more adult dipterans and other terrestrials than the kick screen samples (Figures 3-3-32 to 3-3-40).

3.3.6 Comparison of Invertebrate Populations at Different Sites

Drift samples from the tributary sites (Fourth of July Creek and Indian River) were compared by chi-square analysis to determine if the proportions of invertebrate types differed between sites. The analysis showed that on all dates these proportions were not the same ($p < 0.05$) (Table 3-3-41).

The same test was conducted comparing drift samples from the sloughs. These chi-square tests indicated that there were significant differences between proportions of invertebrate taxa in the sloughs ($p < 0.05$) (Table 3-3-41). Since few invertebrates were collected in the drift samples at Slough 11 in early September, and at Slough 8A in late September, those samples were not included in the analysis.

A chi-square test was used to determine if the proportion of all individuals occurring in each taxa was the same for both tributaries and sloughs. Samples from all sloughs were combined in one group and

Table 3-3-40. Results of chi-square analyses comparing porportions of invertebrates collected in drift net and kick screen samples, where H_o: proportions of invertebrate taxa collected are the same in both methods, is tested at the 95% confidence level. Degrees of freedom for testing (DF), and the chi-square values (X^2) are also given. a/

Date	Samples Compared	Test Results	DF	X^2
82/08/24 to 82/09/29	drift from sloughs and kick screen from sloughs	Reject H_o	18	1,566
82/08/24 to 82/08/29	drift from tributaries and kick screen from tribs.	Reject H_o	19	1,177
82/09/05 to 82/09/09	drift from sloughs and kick screen from tribs.	Reject H_o	25	1,750
82/09/05 to 82/09/09	drift from sloughs and kick screen from tribs.	Reject H_o	19	2,478

a/ Taxa with less than five individuals found at all sites were not used in anlayses.

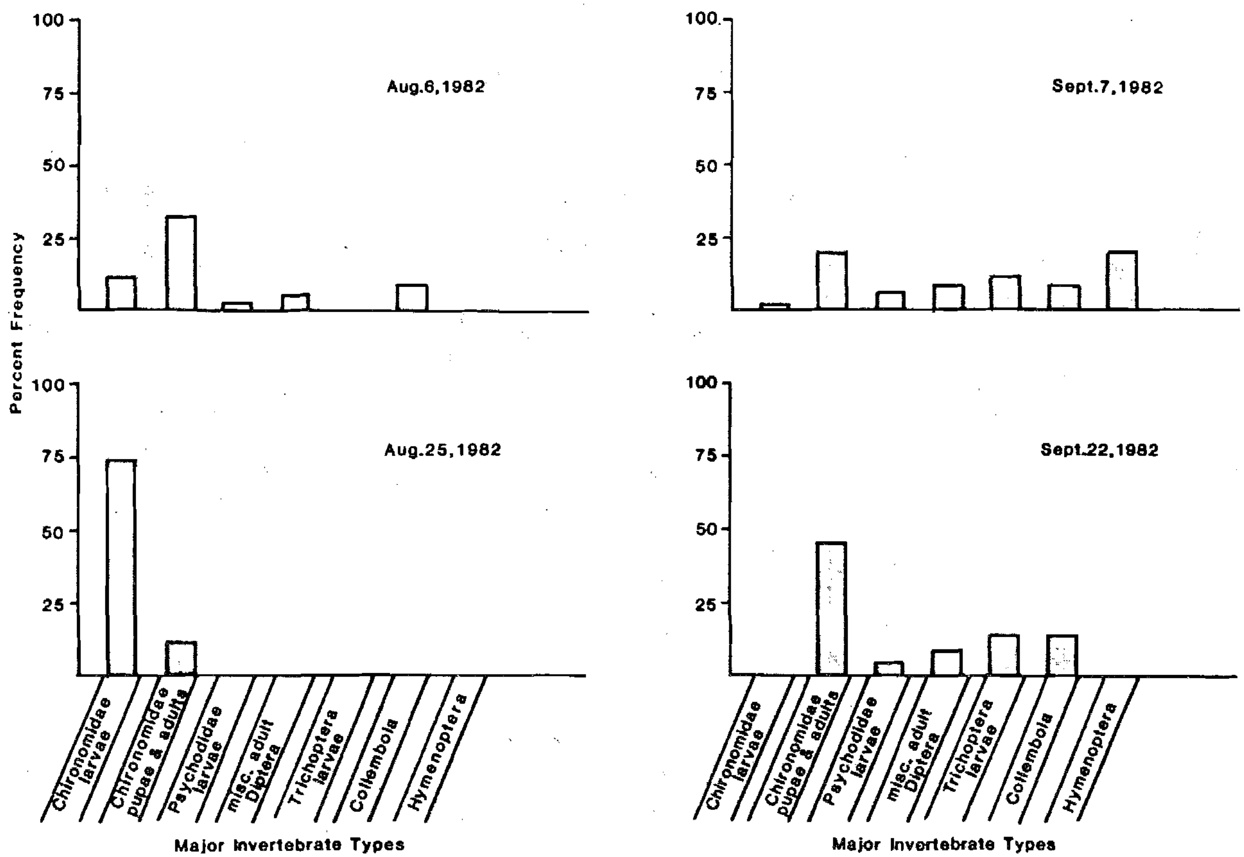


Figure 3-3-32. Percent frequency of major invertebrate types found in drift net samples taken in Slough 8A during August and September, 1982. Percent frequency was calculated using numbers of individuals and is given for those types representing over two percent of the total.

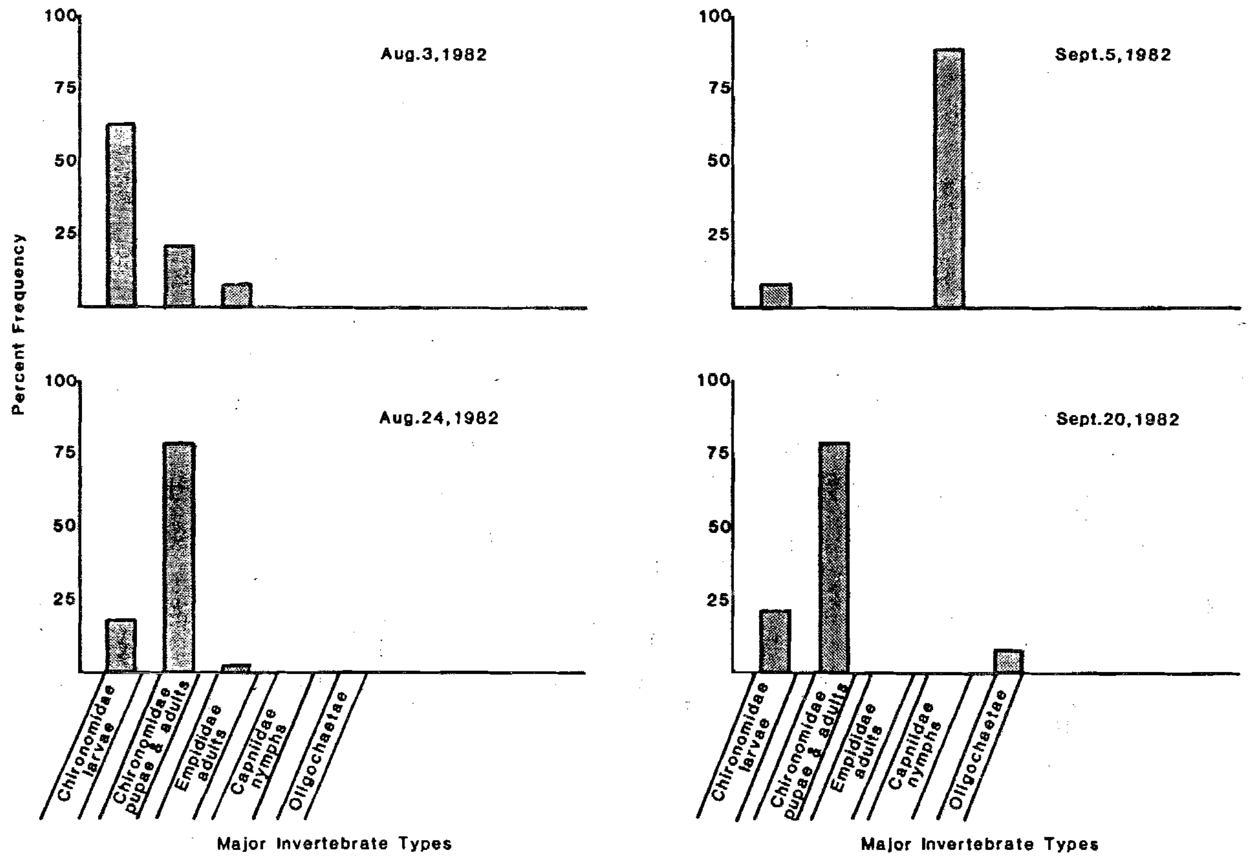


Figure 3-3-33. Percent frequency of major invertebrate types found in drift net samples taken in Slough 11 during August and September, 1982. Percent frequency was calculated using numbers of individuals and is given for those types representing over two percent of the total.

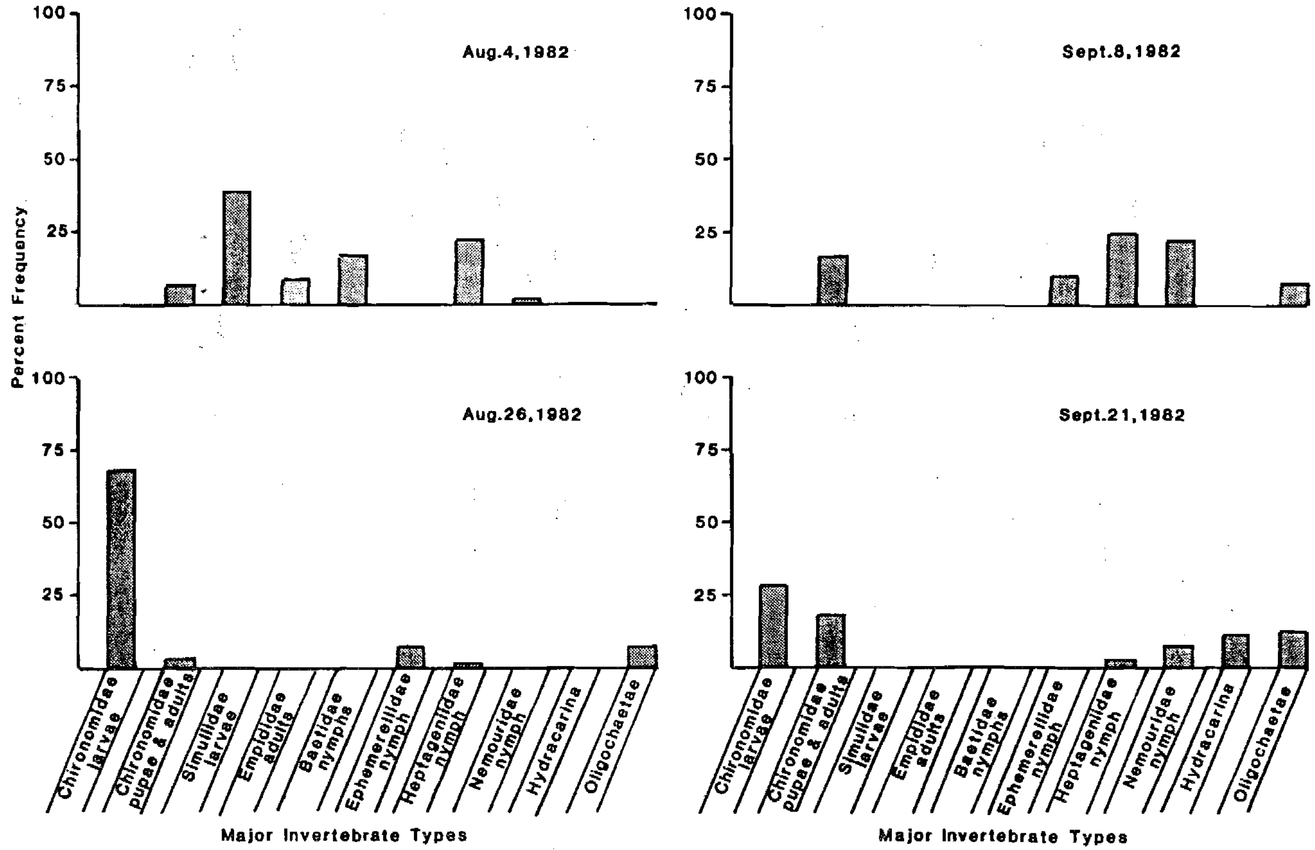


Figure 3-3-34. Percent frequency of major invertebrate types found in drift net samples taken in Slough 20 during August and September, 1982. Percent frequency was calculated using numbers of individuals and is given for those types representing over two percent of the total.

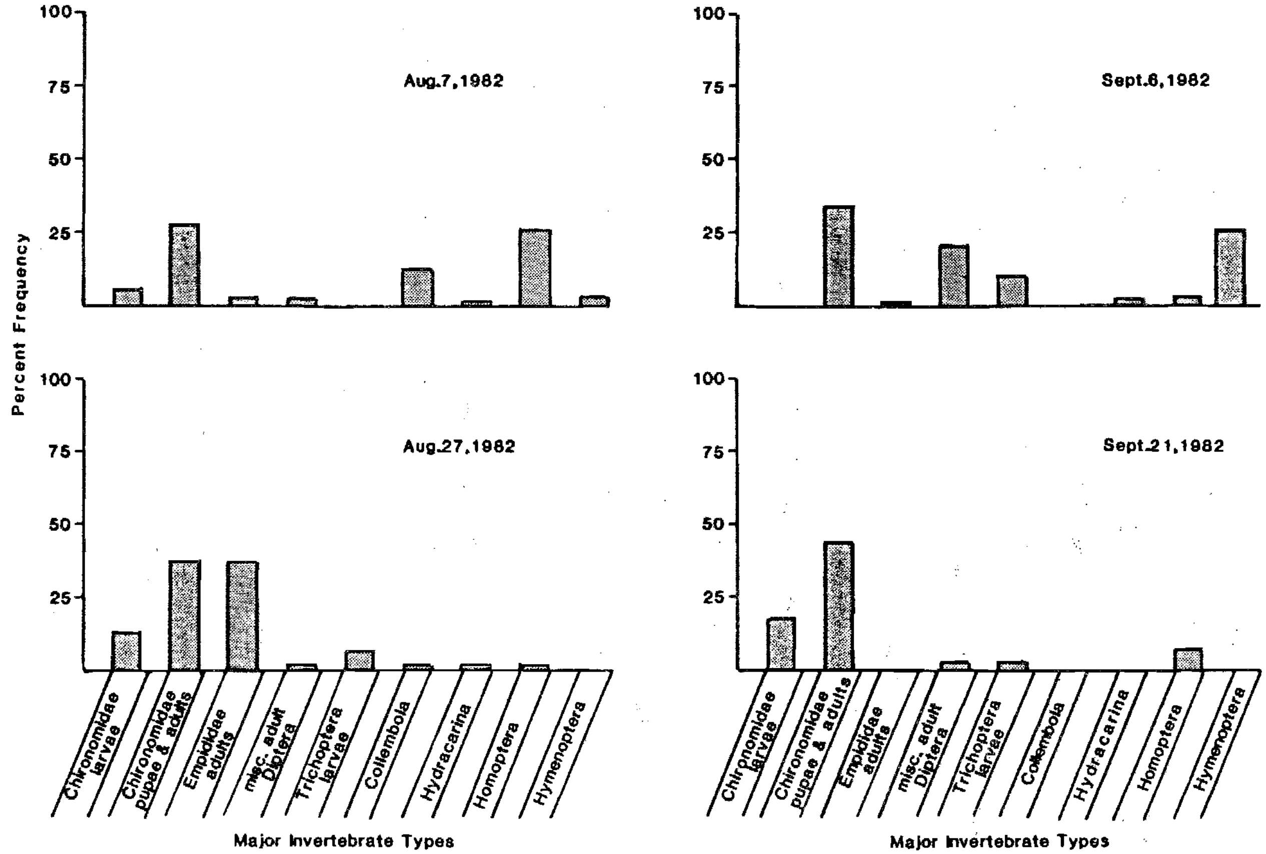


Figure 3-3-35. Percent frequency of major invertebrate types found in drift net samples taken in Slough 21 during August and September, 1982. Percent frequency was calculated using numbers of individuals and is given for those types representing over two percent of the total.

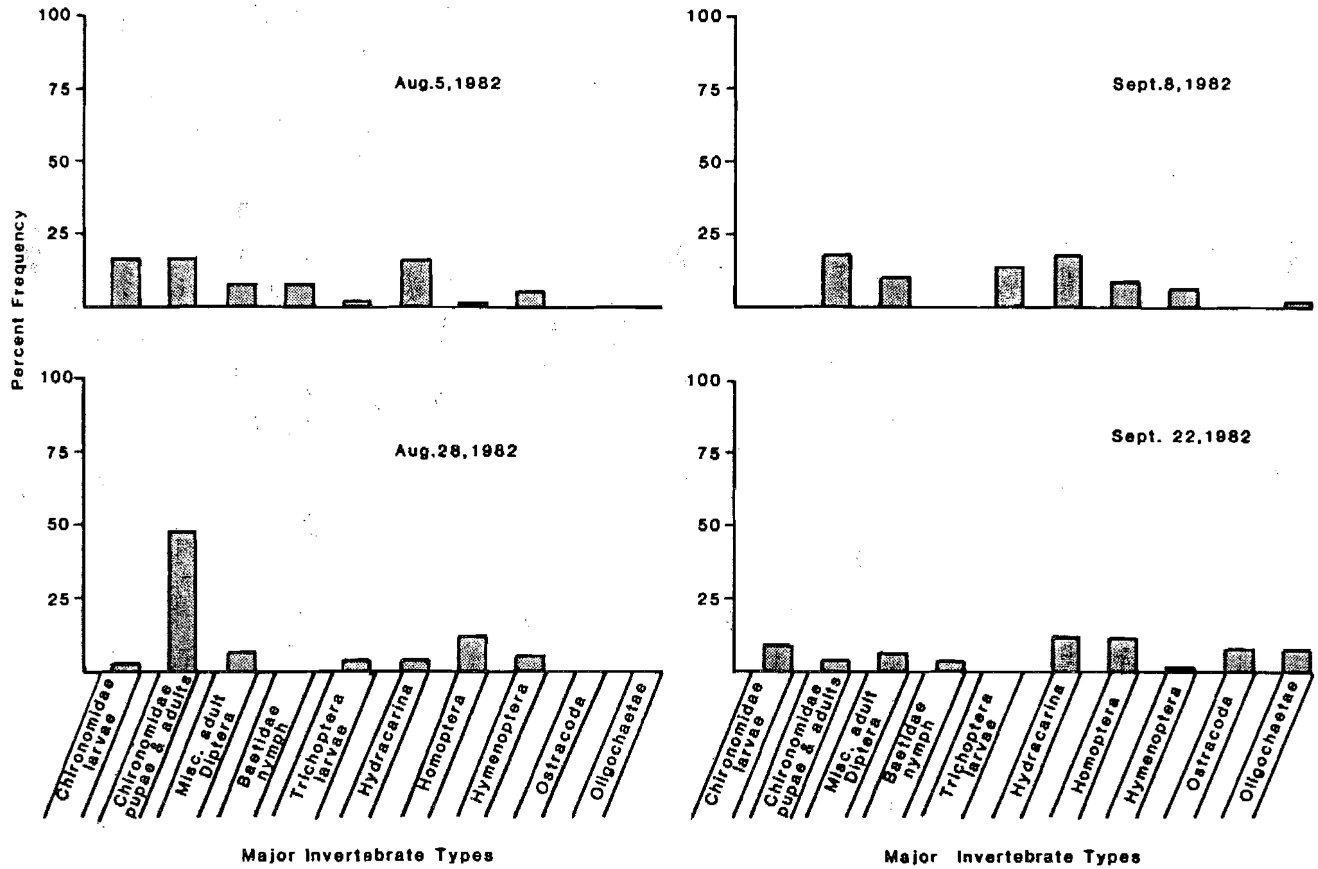


Figure 3-3-36. Percent frequency of major invertebrate types found in drift net samples taken in Fourth of July Creek during August and September, 1982. Percent frequency was calculated using numbers of individuals and is given for those types representing over two percent of the total.

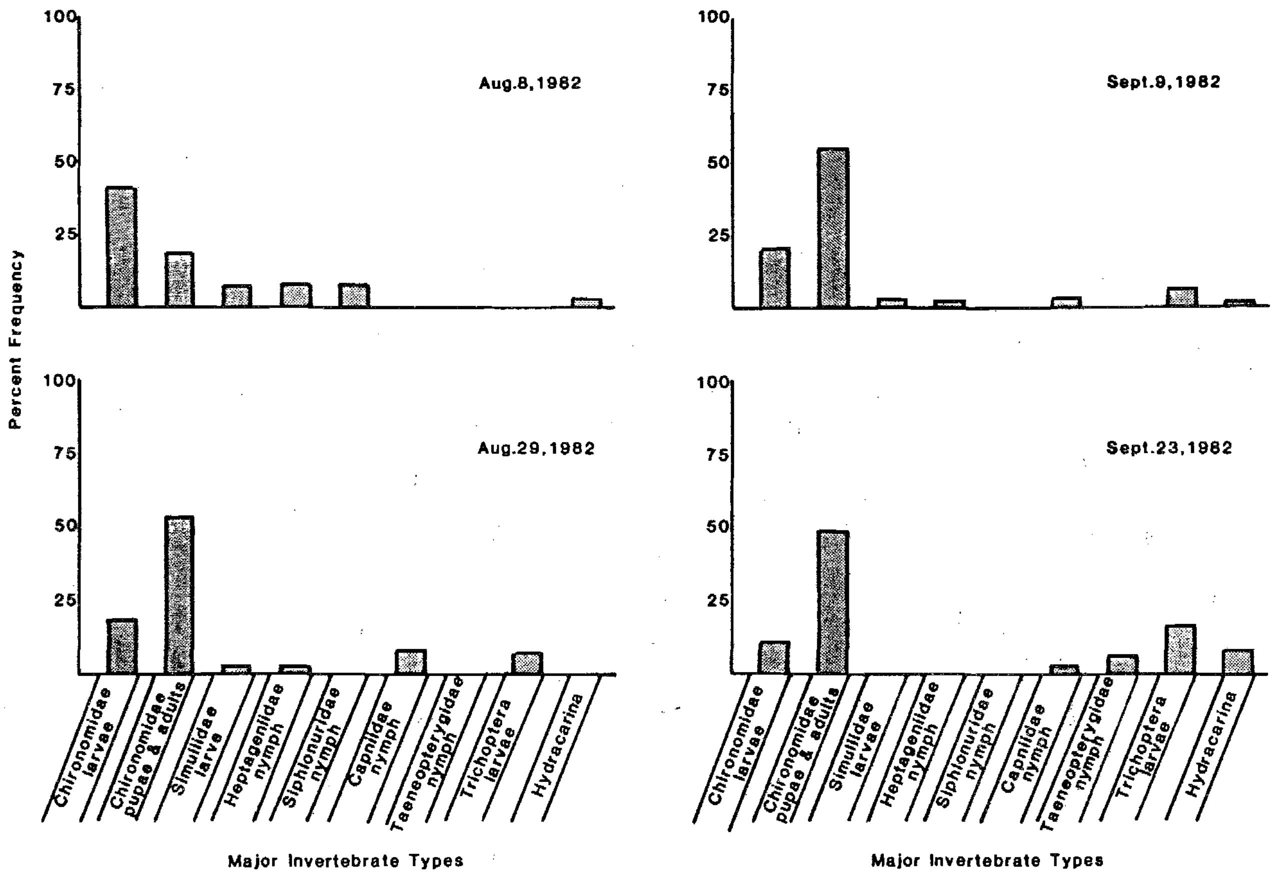


Figure 3-3-37. Percent frequency of major invertebrate types found in drift net samples taken in Indian River during August and September, 1982. Percent frequency was calculated using numbers of individuals and is given for those types representing over two percent of the total.

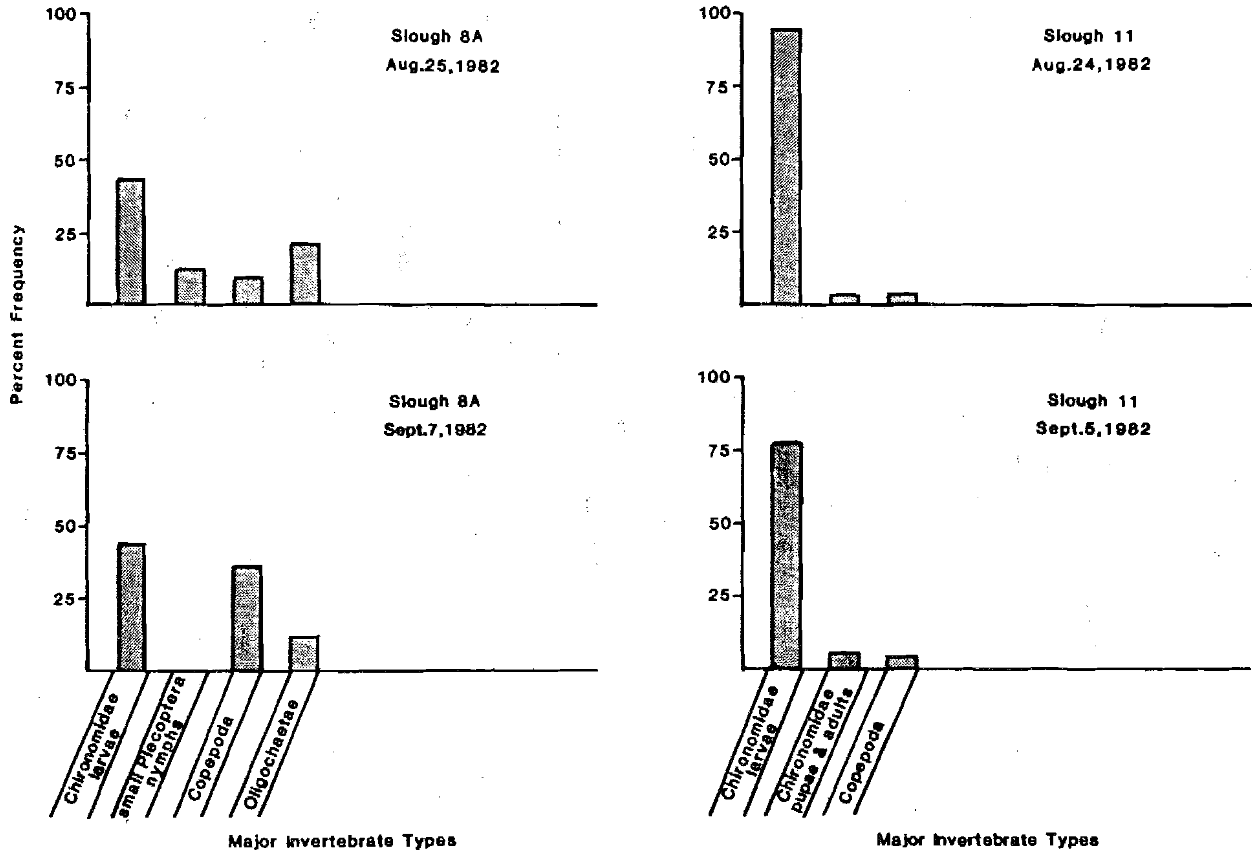


Figure 3-3-38. Percent frequency of major invertebrate types found in kick screen samples taken in Slough 8A and Slough 11 during August and September, 1982. Percent frequency was calculated using numbers of individuals and is given for those types representing over two percent of the total.

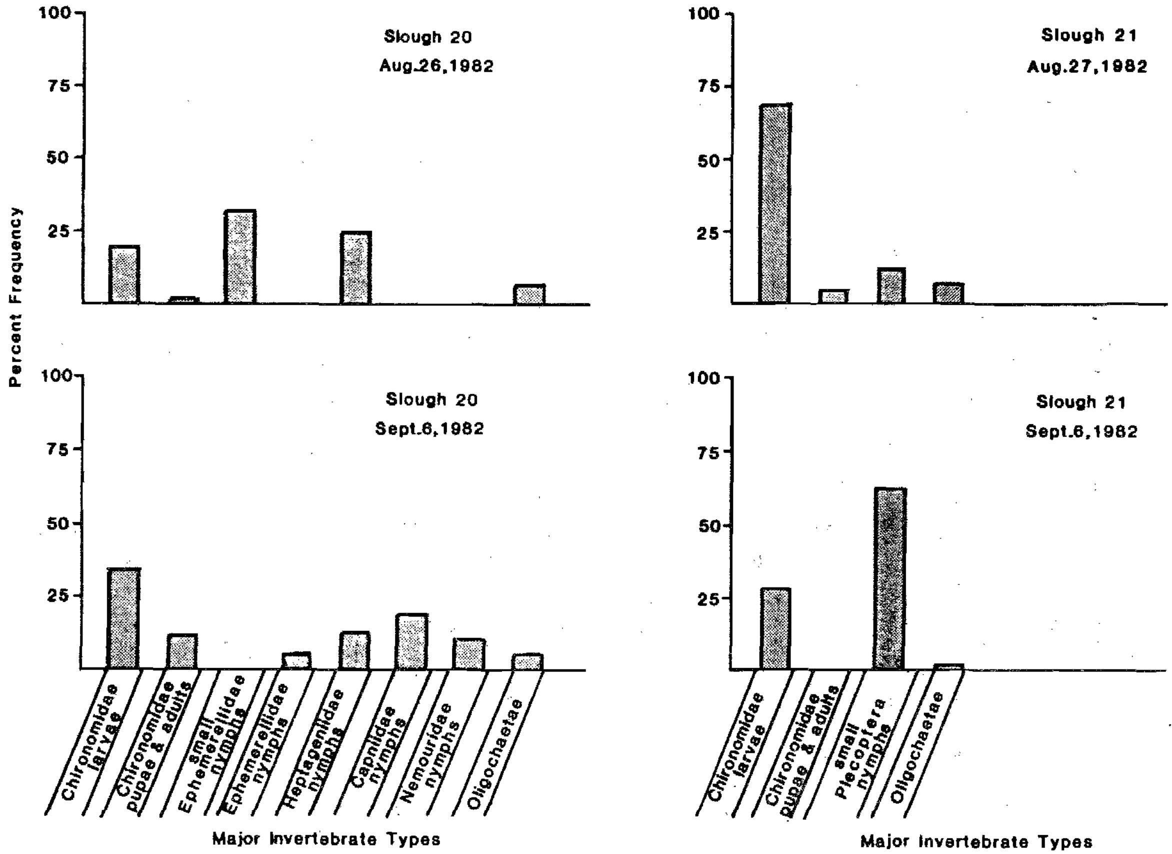


Figure 3-3-39. Percent frequency of major invertebrate types found in kick screen samples taken in Slough 20 and Slough 21 during August and September, 1982. Percent frequency was calculated using numbers of individuals and is given for those types representing over two percent of the total.

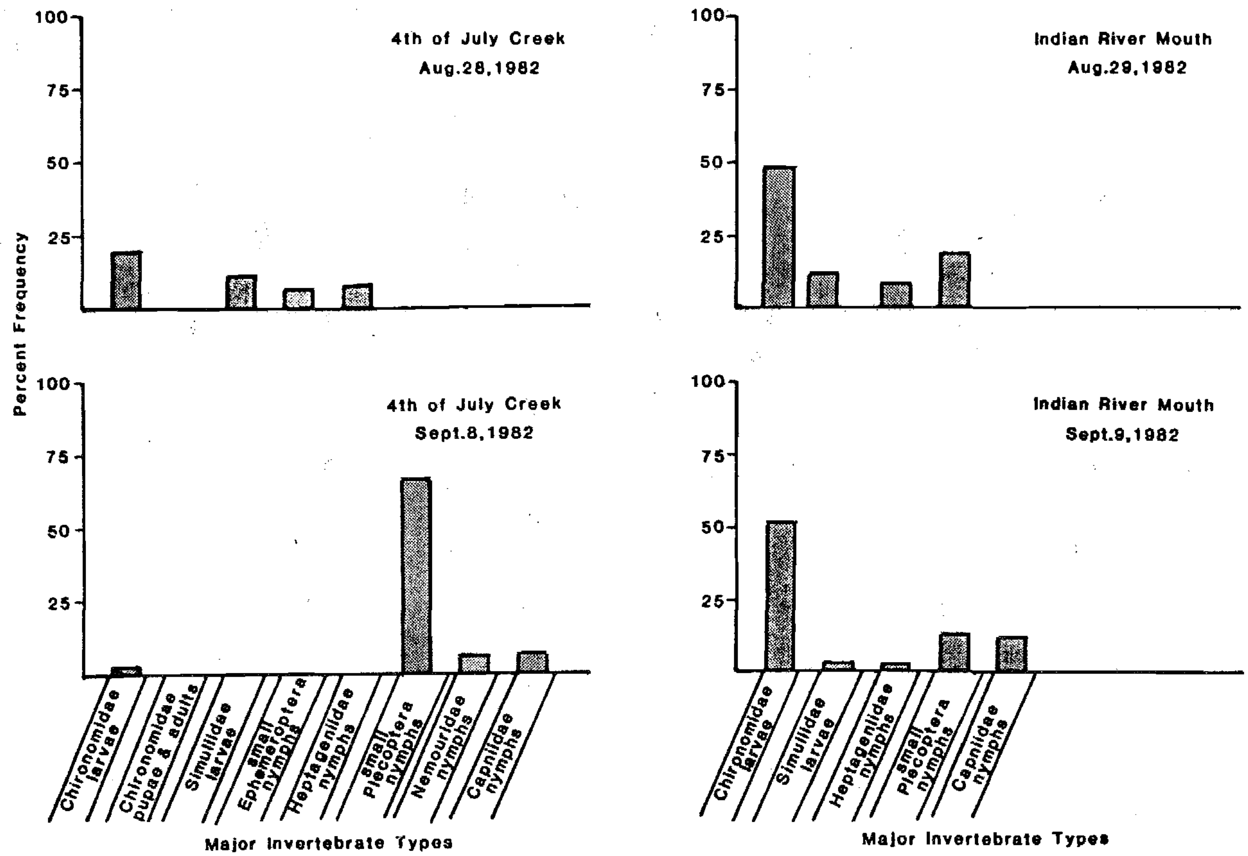


Figure 3-3-40. Percent frequency of major invertebrate types found in kick screen samples taken in Fourth of July Creek and Indian River during August and September, 1982. Percent frequency was calculated using numbers of individuals and is given for those types representing over two percent of the total.

Table 3-3-41. Results of chi-square analyses comparing percent composition of invertebrate taxa in drift samples. H_o: proportions of invertebrate taxa are the same at all sites is tested at the 95% confidence level. Degrees of freedom for testing (DF), and chi-square values (X^2) are also shown. a/

Date	Sites Compared	Test Results	DF	X^2
82/08/05 82/08/08	4th of July Creek and Indian River	Accept H_o	12	23
82/08/06 82/08/07 82/08/04	Slough 8A Slough 21 Slough 20	Reject H_o	26	661
82/08/28 82/08/29	4th of July Creek and Indian River	Reject H_o	11	57
82/08/25 82/08/24 82/08/26	Slough 8A Slough 11 Slough 20	Reject H_o	20	422
82/09/08 82/09/09	4th of July Creek and Indian River	Reject H_o	10	110
82/09/07 82/09/08	Slough 8A and Slough 20	Reject H_o	14	219
82/09/22 82/09/23	4th of July Creek and Indian River	Reject H_o	13	194
82/09/20 82/09/21	Slough 11 and Slough 20	Reject H_o	9	335
82/08/03 to 82/08/08	Tributaries and Sloughs	Reject H_o	13	155
82/08/24 to 82/08/29	Tributaries and Sloughs	Reject H_o	14	135

Table 3-3-41 . concluded.

Date	Sites Compared	Test Results	Df	X^2
82/09/05 to 82/09/09	Tributaries and Sloughs	Reject H_o	17	257
82/09/20 82/09/23	Tributaries and Sloughs	Reject H_o	15	290

a/ Taxa with less than five individuals found at all sites were not used in analyses. Slough 11 in early September, and Slough 8A in late September were not included in this analysis due to small sample sizes (115 and 22 respectively).

samples from all tributaries in another group for each date. The results demonstrated that the invertebrate populations were not the same. The proportions of invertebrate taxa in the sloughs and tributaries were significantly different on every date sampled.

4. DISCUSSION

4.1 Distribution and Abundance

4.1.1 Resident Fish Species

4.1.1.1 Rainbow Trout

Rainbow trout were distributed throughout the Susitna River below Devil Canyon but were most commonly captured at tributary sites on the Susitna River above the Chulitna River confluence. Most adult rainbow trout move into the mainstem Susitna in September from clear water tributaries and then remain there until after breakup when they move back into their natal tributary to spawn. After spawning occurs, the adults are fairly sedentary until September. Adults also make use of many clear water sloughs in the Susitna River above the Chulitna River confluence during the summer. Most juvenile rainbow trout are believed to rear in the tributaries but a few make use of tributary mouths and clear water sloughs.

Distribution and Relative Abundance

Rainbow trout were captured in both 1981 and 1982 at all of the 12 DFH sites that were sampled in both years (ADF&G 1981c). The general distribution of catches was also similar during both years at these 12 DFH sites. In general, catches of rainbow trout were highest at tributary mouths such as 4th of July Creek and at clear water sloughs such as

Slough 8A. Catches at all DFH sites were typically higher in June and September than in July and August. Most rainbow trout probably move well up into the tributaries in July and August.

In the reach of river between the Chulitna River confluence and Devil Canyon, catch data indicate that some rainbow trout inhabit clear water sloughs during the summer. Rainbow trout were documented to occur during July and August at all the DFH slough sites above the confluence, as well as Slough 10 (RM 133.8) and Slough 22 (RM 144.3). Populations within these sloughs are of unknown size but are probably small in comparison to tributary populations.

Boat electrofishing catch per unit effort (CPUE) for rainbow trout varied greatly over the season and between tributary or slough and mainstem sites in 1982 (Figure 3-4-1). Rainbow trout CPUE's were also usually greater in the Susitna River above the Chulitna River confluence in comparison to sites located below the confluence. In general, CPUE's were greater at tributary or slough sites rather than in the mainstem. CPUE's in late May, June, and late September were higher than in July and August, indicating definite seasonal trends in abundance.

Adult Movement and Migration Patterns

Recapture data and observations of the radio tagged fish suggest that rainbow trout are relatively nonmigratory and inhabit relatively short sections of the Susitna River. Similar results are cited by McPhail and Lindsey (1970) and Morrow (1980).

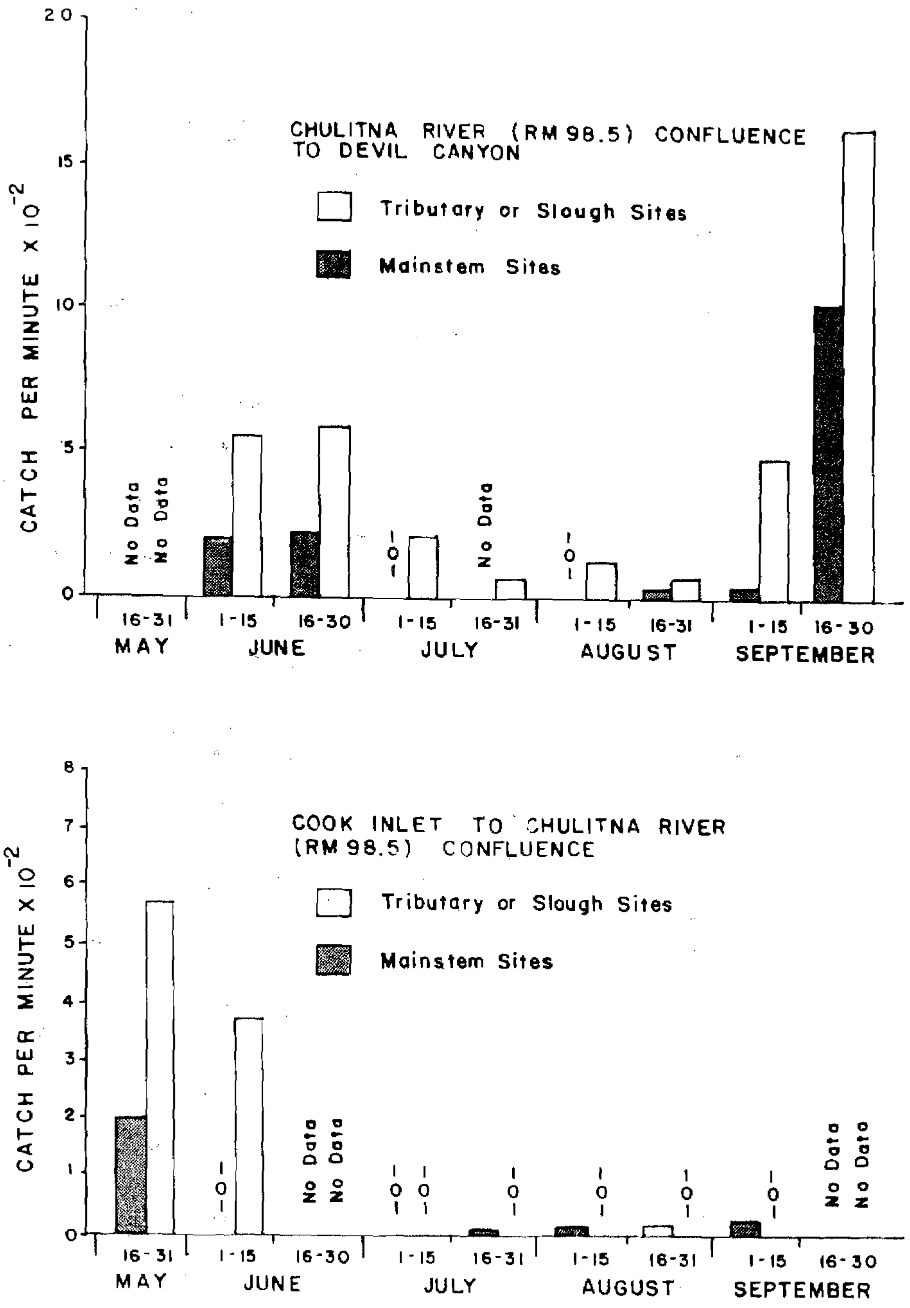


Figure 3-4-1. Rainbow trout catch per unit of boat electrofishing effort at tributary and mainstem sites on the Susitna River between Cook Inlet and Devil Canyon, May to September, 1982.

Evidence that rainbow trout in the Susitna River remain in a relatively small range is indicated by examining 12 tag recoveries made in 1982 of fish tagged in 1981. During the interim overwintering, only three of these recaptured fish were found more than five miles from the site of tagging. Five of the fish were recaptured in the same location where tagged.

Rainbow trout, however, do exhibit seasonal migrations. A rainbow trout that was tagged and recaptured during 1981, moved 34.5 river miles downstream. Recapture data and catch per unit effort data indicate that rainbow trout begin to out-migrate from tributaries in September, overwinter in the Susitna River in the proximity of the mouth of their natal tributary, and then migrate back to that tributary in May.

Rainbow trout are relatively sedentary during the winter months and inhabit the mainstem. The five radio tagged rainbow trout monitored during the winter moved a maximum of 23.3 miles, and one fish was later captured in May only 0.6 miles from where it was originally captured and tagged. Three of the fish, however, increased movements for unknown reasons between early December and mid-January after remaining in approximately the same location for 45 days (Figure 3-3-1).

Winter sampling efforts did not recapture the radio tagged fish, however, four other adult rainbow trout were captured in the vicinities of the tagged fish. These fish were captured with relatively little effort in comparison to other winter sampling which captured only two other adult rainbow trout although much more effort was expended. Indications are that rainbow trout inhabit areas with specific habitat characteristics during the winter months in the Susitna River.

Spawning

Limited catches of mature adult rainbow trout indicate that rainbow trout probably spawn between late May and June in tributaries of the Susitna River. By early July, all adult rainbow trout captured and necropsied at sites on the Susitna River had spawned.

Juvenile Rearing Areas

Catches of juvenile rainbow trout have been very limited and therefore most juveniles are believed to rear in the upper reaches of clear water tributaries. Juveniles have been captured at most of the tributary and slough mouths where adult catches were high. Use of the mainstem is very limited, only six juvenile rainbow trout were captured in the downstream migrant trap. No major seasonal differences in catch or distribution of juvenile rainbow trout have been noted. During the ice covered months, juveniles have been captured only at Slough 10 (RM 135.3) and Slough 22 (RM 144.3). McPhail and Lindsey (1970) report that stream dwelling juveniles make use of riffle areas in summer and then move into pools for the winter.

4.1.1.2 Arctic Grayling

Arctic grayling are most abundant in the Susitna River above the Chulitna River confluence, but they are also widely distributed below the confluence. After spring breakup, adult Arctic grayling move into the tributaries to spawn and then rear for the summer. Many juvenile (less than 200 mm) Arctic grayling inhabit confluence areas of tributaries and sloughs and also the mainstem during June through August. Adult grayling migrate out of the tributaries in September and then remain in the mainstem for the winter. Young of the year Arctic grayling remain in the tributary headwaters until September when some of them move down to tributary mouths.

Distribution and Relative Abundance

Primarily due to the extensive use of boat mounted electrofishing units in 1982, the catch of Arctic grayling below Devil Canyon increased from 498 in 1981 to 1,023 in 1982 (ADF&G 1981c, Table 3-3-2). In 1981, Arctic grayling were captured as far downstream as RM 10.1, while in 1982, none were captured below RM 30.0. Sampling efforts in 1982, however, was not as intensive as the 1981 effort below RM 60.0. In general, Arctic grayling were found throughout the Susitna River basin below Devil Canyon during the ice free months. The distribution of wintering fish is yet unknown but a few catches have been made at scattered locations.

The distribution of Arctic grayling at the 12 DFH sites sampled during both 1981 and 1982 were similar. In 1982, Arctic grayling were captured at 11 of the sites but in 1981 Arctic grayling were found only at eight of the sites. This is explained, however, by the intensive use of electrofishing equipment and beach seines in 1982 which were used to capture fish at two of the remaining sites. The only DFH sites sampled both years where Arctic grayling were not captured was at Sunshine Creek and Side Channel. Other ADF&G biologists have also failed to observe Arctic grayling in that tributary system (Dave Watsjold, pers. comm.).

Few seasonal comparisons can be made between 1981 and 1982 Arctic grayling CPUE data due to inconsistent sampling efforts during the ice free season. Gillnet and boat electrofishing CPUE's were high in June and September and October in 1981, and in the same months of 1982.

A comparison of pooled CPUE rates for boat electrofishing at mainstem and tributary or slough sites in 1982 reveals that CPUE's at tributary or slough sites upstream of the Chulitna River confluence were consistently higher than at mainstem sites above the confluence or at any sites below the confluence (Figure 3-4-2). Although Arctic grayling were most numerous at tributary mouths above the confluence, the high CPUE's at mainstem sites above the confluence in June indicate that significant numbers of Arctic grayling utilize the mainstem at this time. Since the high catch rate in the mainstem is recorded in spring, it is probable that Arctic grayling use this reach of river in large numbers to overwinter and then later migrate into tributaries or sloughs. The use of the mainstem during winter is further substantiated by observing the catch rates in late summer. As the season progresses, the catch rate at tributaries decreases and correspondingly increases at mainstem sites.

For the reach of river below the Chulitna River confluence, the only apparent seasonal trend is in June when higher catch rates were recorded

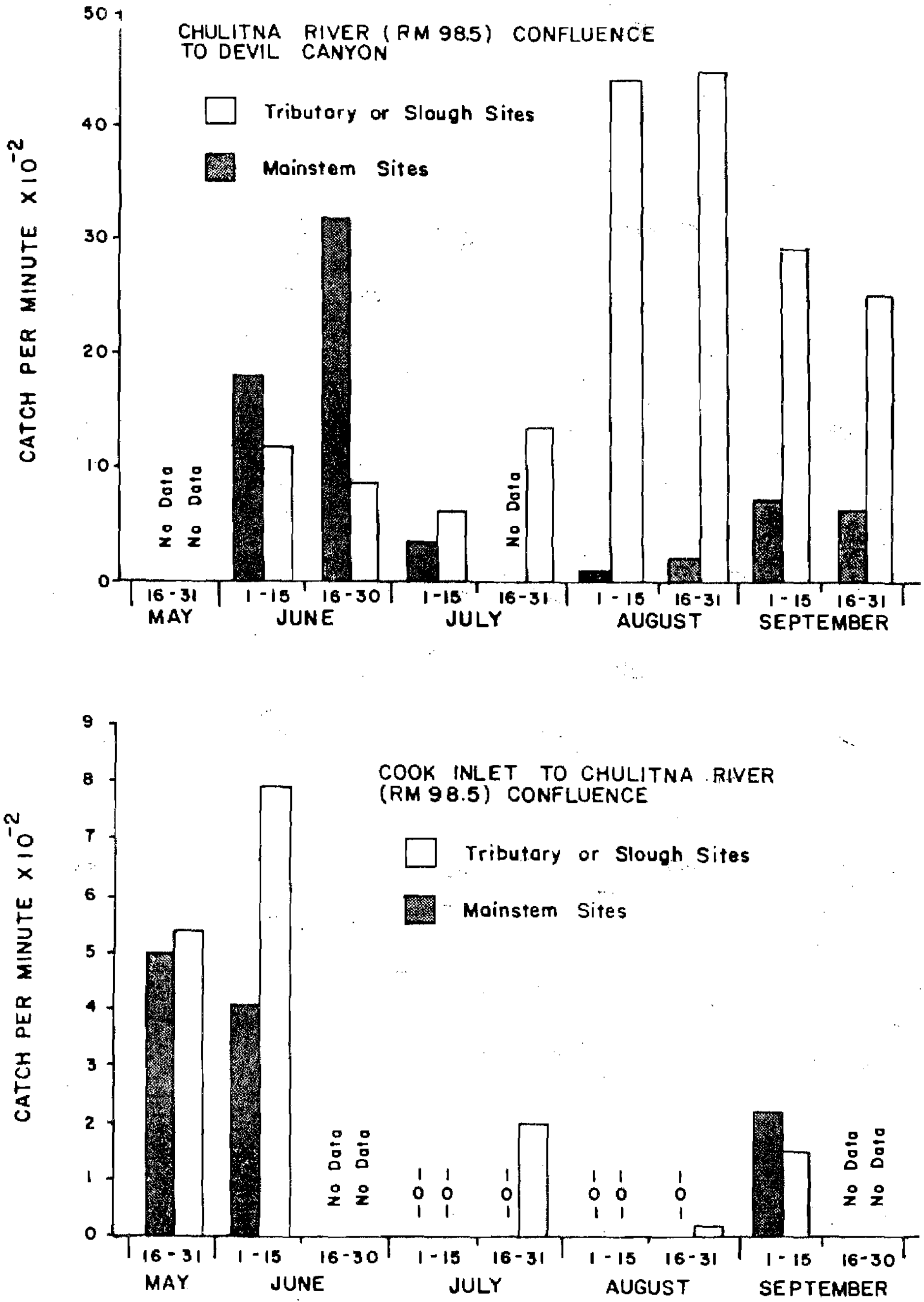


Figure 3-4-2. Arctic grayling catch per unit of boat electrofishing effort at tributary and mainstem sites on the Susitna River between Cook Inlet and Devil Canyon, May to September, 1982.

at all sites. The greater catches during the year above the confluence in comparison to below the confluence was probably due to more preferable habitat in that reach of the river.

The length percent frequencies of Arctic grayling captured by boat electrofishing varies by season and by type of site (Figure 3-4-3). Arctic grayling caught at mainstem sites were typically smaller in size than those caught at tributary sites. In May, June, and September, Arctic grayling over 250 mm in fork length comprised a larger proportion of the catch than in July and August. In July and August most of the use of mainstem and tributary or slough sites is by Arctic grayling with fork lengths less than 250 mm.

Adult Movement and Migration Patterns

A large percentage of the adult Arctic grayling population probably migrated up tributaries immediately after ice out and prior to spring sampling. This appears to occur at least for the larger fish (fork length over 300 mm) since very few large adults were captured during spring and summer at mainstem or tributary mouth sites (Figure 3-4-3). Morrow (1980) states this movement is composed of the largest fish which exhibits a social heirarchy and territorialism upon residence. Similar Arctic grayling behavior was observed in 1982 at most of the tributary sites in the proposed impoundment with the smaller adults being supplanted to less preferable habitat at the foot of pools or at tributary mouths (Volume 5).

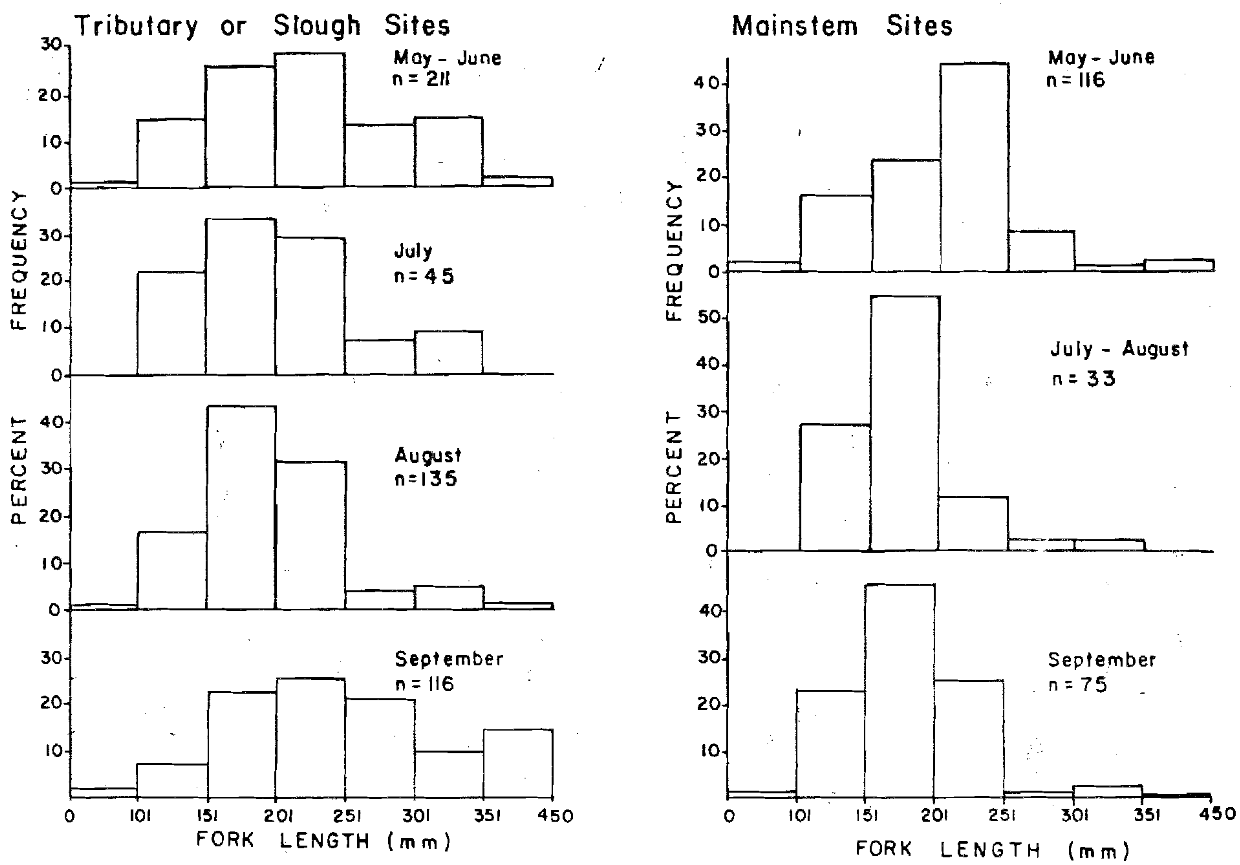


Figure 3-4-3. Length percent frequencies of Arctic grayling captured by boat electrofishing at tributary or slough and mainstem sites in the Susitna River below Devil Canyon, May through September, 1982.

Recapture data indicate that Arctic grayling tend to restrict movements except during a spring spawning run and a fall outmigration from tributaries. Only 15 of the 48 fish recaptured in 1982 had moved from their tagging location since the time of tagging. Of these 15 fish, seven moved during the spawning period in May and June. The maximum movement evidenced by an Arctic grayling was during this time, when an Arctic grayling was recaptured in late June 13.3 miles upstream from where it was tagged.

During the summer, most of the recaptured Arctic grayling were caught at the same location where tagged indicating a sedentary behavior during this time period. Most of the fish recaptured between July and mid September were caught at the mouths of clear water tributaries upstream of Talkeetna. Since most Arctic grayling were captured in backwater pools or mixing zones at the mouths of the tributaries, it is probable that these fish were at their permanent summer residence.

The outmigration of adult Arctic grayling from the tributaries to the mainstem Susitna River begins to occur in mid-September. Between mid-September and mid-October electrofishing CPUE's for Arctic grayling progressively increased during 1981 and 1982 in the mainstem Susitna River. Catch per unit effort was also relatively high in comparison to summer months at the mouths of various tributaries during this time indicating that Arctic grayling were outmigrating to overwinter in the mainstem Susitna.

Although a fall outmigration is evident, there is little knowledge of where the fish overwinter in the Susitna River. The fish probably overwinter in schools near the mouths of their natal tributaries, however, two fish tagged in May, 1981 and subsequently recaptured later in 1981 moved 9.9 and 32.5 miles upstream (ADF&G 1981c). This movement indicates that Arctic grayling may overwinter in the Susitna River at various distances below their natal tributary.

Spawning

Catch data on juvenile and adult Arctic grayling and observation of spent adults indicate that Arctic grayling probably spawn in tributaries of the Susitna River prior to June.

Juvenile Rearing Areas

Juvenile (fork length under 200 mm) Arctic grayling were found rearing at both tributary and mainstem sites during the summer of 1982. Most of the juveniles were captured by boat electrofishing units at sites above the Chulitna River confluence such as Lane Creek and Slough 8, Skull Creek (RM 124.7), Indian River, Slough 20, Slough 22 (RM 144.2), and Jack Long Creek (RM 144.5). Juveniles were ubiquitous in the mainstem above the confluence, while below the confluence high catches were recorded only at Goose Creek 1 (RM 72.0) and Goose Creek 2 and Side Channel.

Juvenile Arctic grayling of ages 1+ and 2+ predominantly rear at the mouths of tributaries between May and August, and then appear to move into the mainstem during August. Although little data on juvenile

Arctic grayling has been collected in the winter, juveniles probably stay in the mainstem after August and remain through the winter.

The high catches of juvenile Arctic grayling at tributary mouths and at mainstem sites probably occur because the smaller fish are displaced by the larger fish to less preferable habitat (Morrow 1980).

Very few young of the year Arctic grayling were captured during 1982. These fish probably resided for the summer in the upper reaches of the tributaries near where they emerged. A large number of young of the year Arctic grayling moved into Whiskers Creek and Slough during September 1982. Since the downstream migrant trap captured very few Arctic grayling, these fish probably moved down from the upper reaches of Whiskers Creek instead of moving in from the mainstem. In 1981, young of the year Arctic grayling apparently moved down from the upper reaches of Cache Creek (RM 96.0) in late September. Grayling probably rear near these confluence zones until they are large enough to compete for territories in the desirable habitat upstream in the clearwater tributaries.

4.1.1.3 Burbot

Burbot are widely distributed throughout the mainstem Susitna River below Devil Canyon. Adults were found at tributary and slough mouths and they are also abundant at mainstem areas. Burbot are typically sedentary but may move long distances during a spawning migration in the fall and winter. The exact timing and locations of burbot spawning on the

Susitna River have not been documented, however local residents report that they spawn between November and February in tributaries and sloughs. Juvenile burbot were captured at tributary mouths, clear water sloughs, and at mainstem sites.

Distribution and Relative Abundance

Burbot distribution in 1982 was very similar to that found in 1981. All 12 DFH sites sampled in 1981 were found to have burbot present in both years and those sites having large burbot catches in 1981 had large catches in 1982. (ADF&G 1981c). Catches of burbot were generally highest at mainstem sites in 1981; little comparative data is available for 1982 sampling. Burbot abundance is probably greatest in mainstem areas but burbot were captured in 1981 about three miles up Alexander Creek (RM 10.1) and the Deshka River (RM 40.6). Burbot catches are typically smaller at tributary mouths above the confluence. The five DFH sites located between RM 131.0 and RM 140.1 recorded the lowest catches of all DFH sites. Apparently, this reach of river is less suitable for burbot than most other reaches of the river.

Adult Movement and Migration Patterns

Observations of the tagged burbot and also catch per unit effort data indicate that for the most part burbot are relatively sedentary, however, during spawning time a definite movement can take place. (Morrow, 1980) This movement is thought to begin in September for burbot in the Susitna River. Catch rates and percent incidence of burbot captured during 1981 and 1982 generally increased during the summer and reached their highest levels during September (ADF&G, 1981c; Appendix Table 3-A-23).

One radio tagged burbot and one recaptured disc dangler tagged burbot moved 60.3 miles and 70.9 miles respectively during or just prior to the indicated period of burbot spawning; spawning in the lower Susitna River occurs between November and February. The radio tagged fish moved downstream from RM 76.3 to RM 16.0 between October and February while the other fish was recaptured in the mainstem at RM 79.0 in mid-September, it was tagged one year earlier at Alexander Creek (RM 10.1) two miles upstream from its mouth (Appendix Tables 3-A-3 and 3-A-27).

Three other burbot were recaptured in the vicinity of their release during 1982. Although one of the burbot was recaptured only five days later, the other two burbot were recaptured 45 and 69 days after they were tagged. During this time these fish moved only 0.0 and 1.6 miles indicating a sedentary behavior.

Spawning

Although no burbot were observed spawning in the Susitna River between Cook Inlet and Devil Canyon during 1981 or 1982, examinations of sexual development in necropsied burbot and information gathered from personal interviews of local residents indicate the burbot spawn between November and February in tributaries and sloughs of the Susitna River.

Burbot necropsied in September and October had larger and more developed gonads than those examined in June, but they were not fully ripe (Appendix Table 3-A-28). By February, all mature burbot that were examined had spawned. Residents living near Alexander Creek (RM 10.1) and the Deshka River (RM 40.6) believe that burbot spawn enmasse at the mouths of these two tributaries between November and February.

Observation of enlarged gonads in necropsied burbot captured on the Susitna River during the 1981 and 1982 field seasons, indicates that both male and female burbot are sexually mature at ages III or IV (Appendix Table 3-A-28). The minimum length of sexually mature burbot captured was 310 mm for males and 330 mm for females. Scott and Crossman (1973) also report that sexual maturity in burbot is attained at ages III and IV (280-480mm total length) and that males can mature at smaller lengths than females. Several unripe burbot over 300 mm in length were found in the fall indicating that burbot may be nonconsecutive spawners in the Susitna River.

Juvenile Rearing Areas

Juvenile burbot have previously been found to be most numerous at sites below the Chulitna River confluence (ADF&G 1981c). They have been found at both mainstem locations and up to three miles above the mouths of tributaries such as Alexander Creek (RM 10.1) and the Deshka River (RM 40.6). Juvenile burbot in these tributaries are probably rearing near the area of hatch. Young of the year burbot were captured at Slough 9 (RM 129.2) and this suggests that some burbot spawn at sites well above the Chulitna River confluence. Other burbot juveniles were captured at scattered DFH sites above the confluence. The downstream migrant trap catch of burbot peaked in late June and late July. Burbot catches were minimal during normal downstream migrant trap operation when the trap was positioned at least six inches off the bottom. When the trap was fished on the bottom, however, the burbot catch increased, indicating the juveniles are closely associated with the bottom.

4.1.1.4 Round Whitefish

Round whitefish are most abundant in the Susitna River above the Chulitna River confluence and the numbers of them gradually decrease downstream from the confluence. Adult round whitefish move into clearwater tributaries in June to rear for the summer. Large numbers of juvenile (Fork length less than 200 mm) round whitefish rear at tributary or slough mouths and in the mainstem Susitna above the Chulitna River confluence during the summer. Young of the year emerge in June and are found in largest numbers at slough and tributary mouths above the confluence. In August and September, adult round whitefish drop out of the tributaries and gather for spawning. Spawning may occur in the tributaries or in the mainstem in October.

Distribution and Relative Abundance

Round whitefish were captured between RM 19.0 and RM 150.1 during 1982 and a similar distribution was evident during 1981 (ADF&G, 1981c).

A comparison of pooled CPUE rates for boat electrofishing at mainstem and tributary sites revealed that CPUE's at tributary or slough sites upstream of the Chulitna River confluence were much higher than at mainstem sites above the Chulitna River confluence or at all sites below the confluence in 1982 (Figure 3-4-4). During June, however, catches in the mainstem above the confluence were also high. The greater catches during the year above the confluence were probably due to more preferable habitat than that offered below the confluence.

The length percent frequencies of round whitefish captured by electrofishing were similar by season and by type of site where captured (Figure 3-4-5). Most of the catch was comprised of fish 200-300 mm in fork length. Young of the year round whitefish were very infrequently captured as electrofishing is biased toward the capture of larger fish. A few seasonal differences in electrofishing catches are most noticeable. At mainstem sites, most of the round whitefish captured during May through August were less than 300 mm in fork length, but a higher proportion of fish greater than 350 mm length were captured in September. At tributary or slough sites, fish over 300 mm fork length were most often found in September while juveniles under 150 mm were not frequently sampled at this time. In September, large adults have apparently moved out of tributaries and are getting ready to spawn. Juveniles are perhaps displaced at this time from favorable habitat at tributary mouths by the adults present.

The distribution of round whitefish captured at 12 DFH sites sampled during both 1981 and 1982 were similar. In 1982 round whitefish were

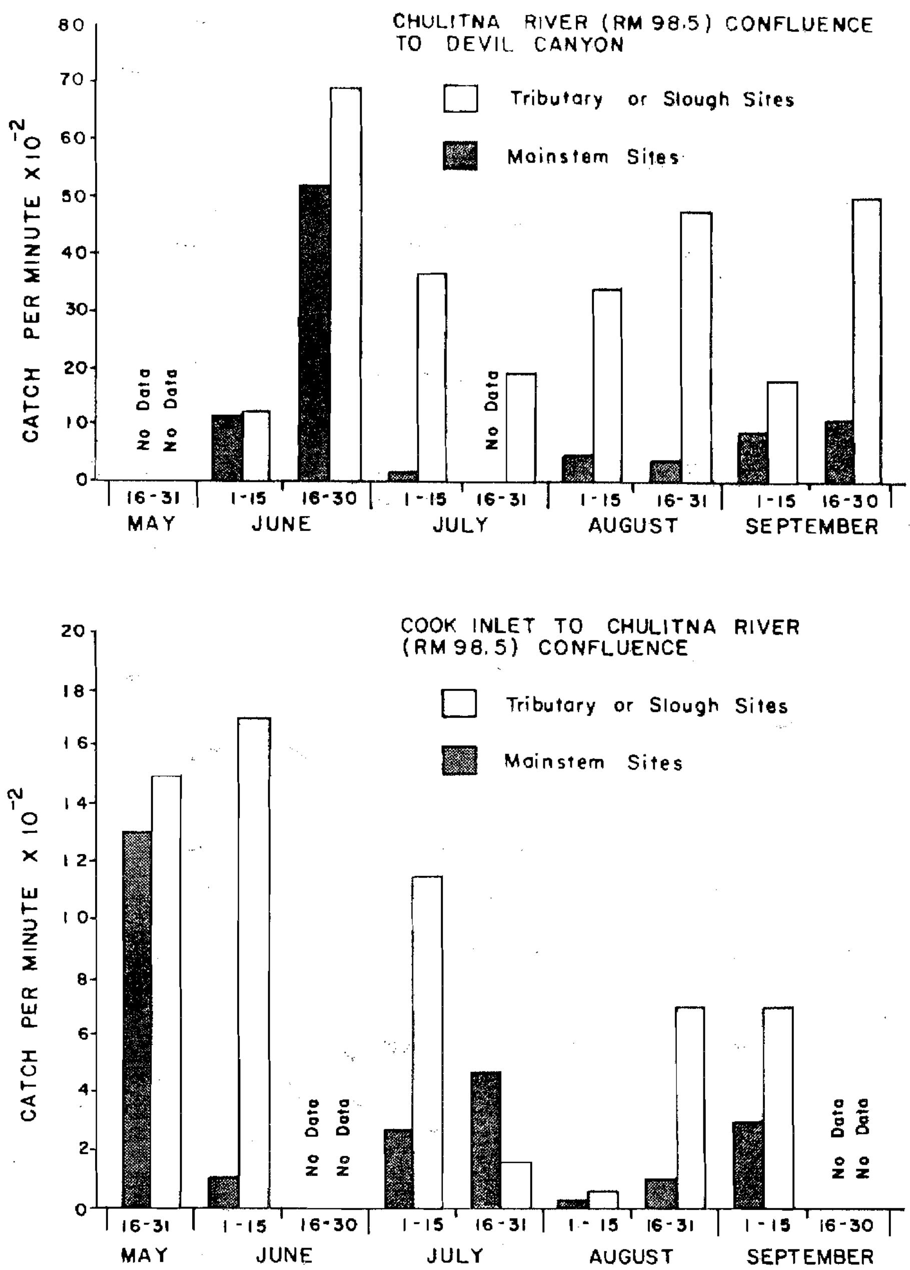


Figure 3-4-4. Round whitefish catch per unit of boat electrofishing effort at tributary and mainstem sites on the Susitna River between Cook Inlet and Devil Canyon, May to September, 1982.

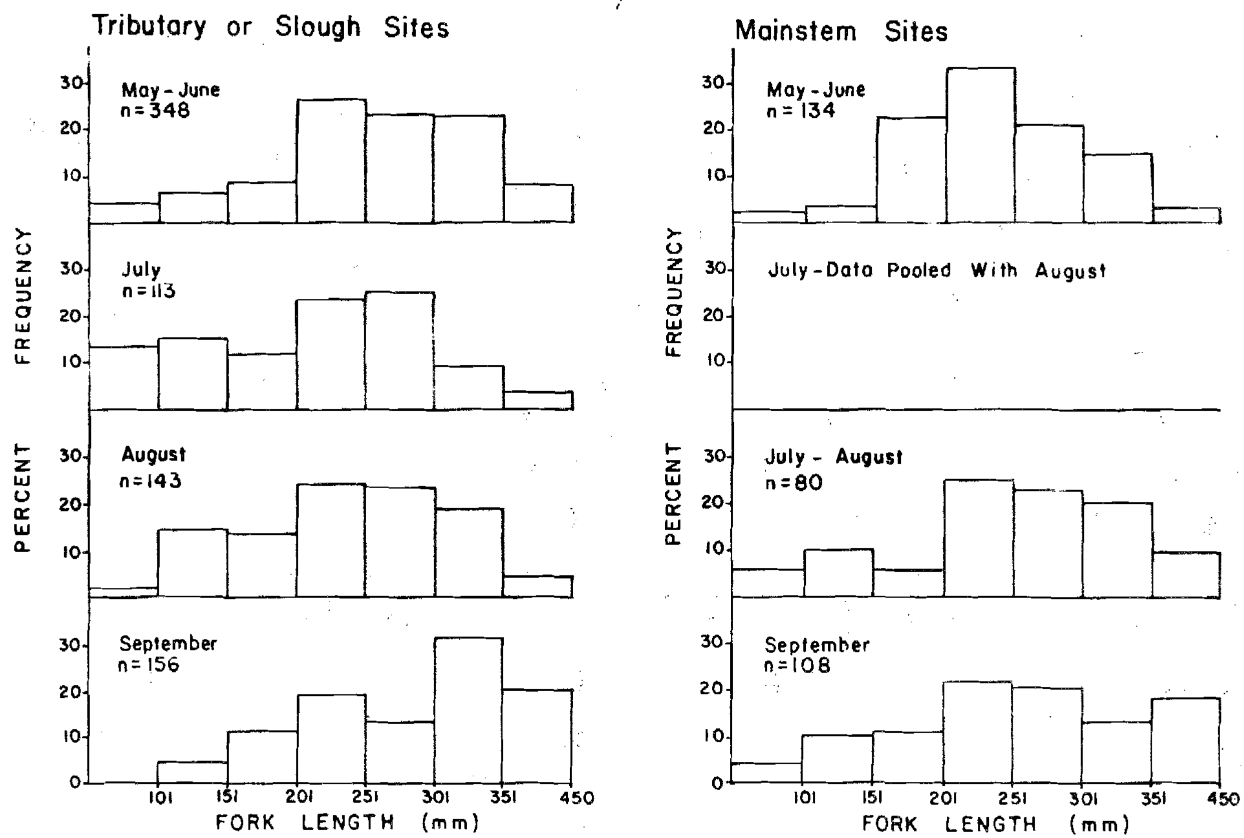


Figure 3-4-5. Length percent frequencies of round whitefish captured by boat electrofishing at tributary or slough and mainstem sites in the Susitna River below Devil Canyon, May through September, 1982.

captured at all 12 sites but in 1981 catches were made at only nine of the sites. This is explained, however, by the extensive use of boat mounted electrofishing units in 1982 which caught fish at the other three sites. This method proved to be most effective for capturing round whitefish in the Susitna River.

Due to the effectiveness of the boat mounted electrofishing units the round whitefish catch in 1982 was much greater than in 1981. The catch also increased in 1982 due to the addition of a downstream migrant trap (RM 103.0) which captured 95 more round whitefish in 1982 than all gear combined did in 1981. Although round whitefish have been captured in the summer between RM 19.0 and RM 150.1, the distribution of wintering fish in the Susitna River is unknown.

Adult Movement and Migration Patterns

Seasonal CPUE's at tributary sites above the confluence were highest during late June, late August and late September (Figure 3-4-4). During June and September the high catches were probably due to the in and out migration of fish to and from the tributaries. The high catches in late August may also have been due to movements out of the tributaries. Although catches were low at all mainstem sites and at tributaries below the confluence, catches progressively increased during the summer at these sites. This was also probably due to the outmigration from the streams. Length percent frequencies of electrofishing catches by month also indicate a movement of adult round whitefish out of tributaries in September (Figure 3-4-5). Although electrofishing was minimal during

1981 and a comparison of CPUE's for 1981 and 1982 is not possible, gillnet CPUE's in 1981 also indicate similar seasonal trends (ADF&G, 1981c).

Although several of the 36 round whitefish that have been recaptured thus far moved during the summer, most of the fish that moved were recaptured during the fall. This fall movement, in September, was probably due to a spawning migration. In other systems, this migration is annual and can be an upstream movement (Morrow 1980). Observations of tag recoveries also indicates that an upstream migration can occur in the Susitna River as five (29.4%) of 17 fish recaptured in September moved upstream from where they were tagged. Apparently the fish move relatively long distances to spawn as six moved over ten miles, either upstream or downstream during September. Only one other fish moved over ten miles and that was during late May. Although the only major seasonal movement is evident during fall, a spring migration from an overwintering area may be undertaken by some fish as one fish moved 32.6 miles between October 2, 1981 and May 22, 1982.

Spawning

The spawning of round whitefish in the Susitna River between Cook Inlet and Devil Canyon occurs after early October. Sexually mature round whitefish were captured in pairs and small groups in the mainstem Susitna River during early October at RM 100.8 in 1981 and at RM 102.6 in 1982. Similar observations of paired round whitefish were first noted in mid-September. The round whitefish may spawn in the mainstem but large schools of round whitefish were also gathered at the mouth of Portage Creek in late September. These fish might have been grouping for a spawning run up the creek or they may spawn at the creek mouth.

Juvenile Rearing Areas

Juvenile (fork length under 200 mm) round whitefish were found rearing mostly in clear water sloughs in the reach of river between the Chulitna River confluence and Devil Canyon. Although most of the juveniles captured by mobile gear were found in sloughs such as Slough 6A, Slough 8A, Slough 9, and Slough 21, juveniles were also captured at mouths of several tributaries above the confluence such as Gash Creek (RM 111.5) and Fourth of July Creek. The only site below the confluence where relatively large catches were made was at Goose Creek 2 and Side Channel.

Most of the juvenile round whitefish, however, were captured by a downstream migrant trap at RM 103.0. An early July movement of young of the year round whitefish was evident from trap catches (Table 3-3-4). The area where these fish were moving to, however, is not known. Low catches were recorded at all sites below the confluence except for Goose Creek 2 and Side Channel.

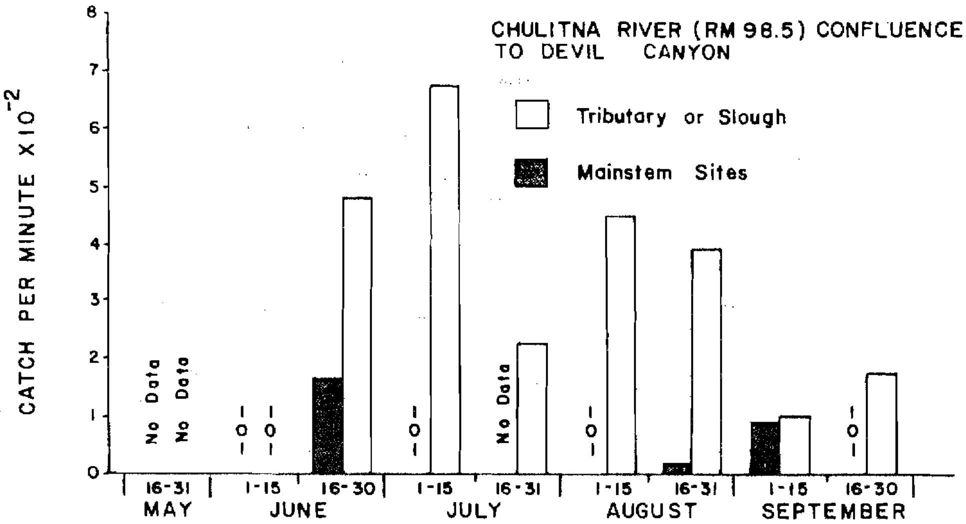
The majority of young of the year round whitefish, however, probably rear in the vicinity where hatched. The first observations of young of the year (fork length 23 mm) were recorded at Rabideux Creek and Slough and Slough 9 in late June. Although this was the only occurrence of young of the year at Rabideux, young of the year were consistently captured after June at Slough 9.

4.1.1.5 Humpback Whitefish

Humpback whitefish were distributed throughout the mainstem Susitna River below Devil Canyon but are more abundant below the Chulitna River confluence. Adult humpback whitefish (fork length over 200mm) are often found at tributary or slough mouths. They are not commonly captured in the mainstem except during their spawning run. Their spawning run begins in early August and runs well into September. Major rearing areas for juvenile (fork length under 200mm) humpback whitefish are believed to be located below the Chulitna River confluence but their exact locations are unknown.

Distribution and Relative Abundance

Humpback whitefish are widely distributed throughout the Susitna River system, but they were caught in relatively small numbers during 1982. A comparison of pooled CPUE rates for boat electrofishing at mainstem and tributary sites, (Figure 3-4-6) revealed that CPUE's at tributary or slough sites were much higher than in the mainstem. Seasonal CPUE's at mainstem sites sampled were higher in June, late August, and September than in July. These trends are apparent both above and below the confluence of the Chulitna River.



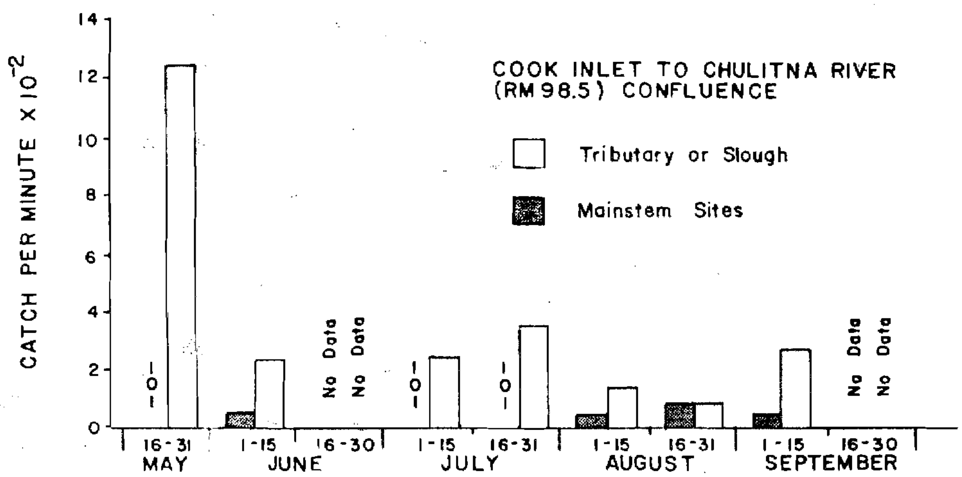


Figure 3-4-6. Humpback whitefish catch per unit of boat electrofishing effort at tributary and mainstem sites on the Susitna River between Cook Inlet and Devil Canyon, May to September, 1982.

The distribution and abundance of humpback whitefish in 1982 was very similar to that found in 1981 (ADF&G 1981c). At the 12 DFH sites sampled during both 1981 and 1982, humpback whitefish were captured at eight of the sites in both years, while at 4th of July Creek and Slough 20 no humpback whitefish catches were recorded in either year. Relatively large catches of humpback whitefish were made at Portage Creek and Sunshine Creek during both field seasons. More humpback whitefish were captured in 1982 due to the increased use of boat electroshockers which are more effective than other gear in capturing humpback whitefish in the Susitna River. Catches at the Sunshine fishwheels during mid-August to mid-September in both years were comparable, with 123 captured in 1981 and 103 captured in 1982.

Examination of necropsied humpback whitefish indicates that the species of humpback whitefish complex found in the Susitna River is Coregonus pidschian. A modal gill raker count of 22 was the same as reported by Morrow (1980) for C. pidschian (Appendix Table 3-A-35). The Alaska whitefish (C. nelsoni) and lake whitefish (C. clupeaformis) have modal counts of 24 or more. These data indicate a range extension of C. pidschian to that presented by Morrow (1980) who reported this species to be restricted to northern and western Alaska. It is possible that two fish examined with gill raker counts of 26 are individuals of one of the other two species, as Morrow (1980) reports maximum gill raker counts of 25 for C. pidschian. McPhail and Lindsey (1970), however, discuss the uses and limitations of gill raker counts and recommend characterizing a sample with a single mode as that of a single species.

Morrow (1980) refers to the humpback whitefish (C. pidschian) as an anadromous fish, but he also indicates that some humpback whitefish may not venture into estuary zones at all. In the Susitna River, 116 humpback whitefish were aged by scale analysis; of these, only one fish was found to have spent part of its life in the estuary or ocean. In the Susitna, the majority of humpback whitefish may spend most of their time, at least during the summer, in the river system. Adult humpback whitefish were found scattered throughout the mainstem Susitna or at tributary mouths below Devil Canyon during the months from May to October. The distribution of wintering fish in the Susitna is unknown.

Adult Movement and Migration Patterns

Morrow (1980) reports that the spawning run of humpback whitefish begins in June and runs throughout September. The fish spawn in the period from October to mid November. Apparently, most populations winter in an estuary environment.

In the Susitna, fishwheel catches indicate that there is a movement of fish from the lower river to upper reaches of the river in August and September (Appendix Table 3-A-40). Catches peaked at Yentna (RM 27.5, TRM 6.0) in early and late August, at Sunshine (RM 79.0) in late August, and at Talkeetna (RM 103.0) 120.0) in early September. Presumably these fish were moving upstream to their spawning areas.

Tagging efforts thus far have revealed little about the movements of adult humpbacked whitefish due to the small number of tag recoveries.

Four fish tagged in early to mid September, 1981 at the Sunshine fishwheels were recovered in 1982 (Appendix Table 3-A-41). Three of these fish were recovered in May and July from 16 to 38 miles downstream while the other fish was again recovered at the Sunshine fishwheels in September. It is likely that the three fish recaptured during May to July were initially captured during their spawning run and subsequently recovered at their summer habitat.

The humpback whitefish apparently moves all summer in the mainstem in small numbers but the spawning run is the major movement. Three of the four recoveries of humpback whitefish tagged in summer of 1982 reveal little movement. One fish, however, tagged on August 11 at the Yentna fishwheels was recovered 6 days later in the mainstem at RM 19.0, a downstream movement of 14.5 miles.

Spawning

Observations of gonadal development of necropsied humpback whitefish captured in the Susitna River during 1982 indicate that humpback whitefish spawn after early October in the Susitna River basin. Observations made during 1981 also indicated a similar timing of spawning (ADF&G 1981c).

Observation of catch data collected from fishwheels on the Susitna River at Yentna River (RM 27.5, TRM 6.0), Sunshine (RM 79.0), and Talkeetna (RM 103.0) indicates an upriver spawning migration of humpback whitefish beginning in mid August. The peak migration recorded at the fishwheels occurred first at Yentna River between August 8 and August 31, and then at Sunshine Station between August 16 and September 7. Catches at the Talkeetna and Curry fishwheels during September were small indicating that humpback whitefish spawn primarily below Talkeetna or else run up other tributaries such as the Talkeetna or Chulitna River.

No spawning or spent humpback whitefish were captured in the mainstem Susitna River. Humpback whitefish probably spawn in various tributaries rather than in the mainstem.

Observance of ripening eggs in all necropsied adult females over 300 mm fork length indicates that humpback whitefish are consecutive spawners in the Susitna River.

Juvenile Rearing Areas and Movements

The downstream migrant trap operated at Talkeetna station (RM 103.0) captured 47 young of the year humpback whitefish migrating downstream. It is not known where the fry came from or where they rear. Most of the humpback fry were captured in August but one was captured on July 8.

Other gear types were not effective in capturing juvenile humpback whitefish. No humpback whitefish juveniles (fork length under 200mm) have been captured above Whiskers Creek and Slough in the two years of study except at the downstream migrant trap located at Talkeetna station In 1981, juvenile humpback whitefish were captured with minnow traps at Alexander Creek (RM 10.1), Kroto Slough (RM 30.1), Deshka River (RM

40.6) and Whiskers Creek and Slough. In 1982, juvenile humpback whitefish were caught at Goose Creek 2 and Side Channel and at Sunshine Creek and Side Channel. Boat electrofishing gear was used to capture juveniles at Whitsol Lake Slough (RM 35.2), an unnamed tributary to Kroto Slough at RM 38.5, Sunshine Creek and Side Channel, below a beaver dam at RM 86.3, Trapper Creek (RM 91.5), and three mainstem sites below the Chulitna confluence. Apparently the juveniles rear in areas below the Chulitna confluence but the gear types deployed in the areas sampled have failed to reveal any large concentrations of rearing juveniles.

4.1.1.6 Longnose Sucker

Longnose suckers are an abundant resident species found throughout the Susitna River below Devil Canyon. Spawning occurs between late May and early June. During this time large concentrations and movements of longnose suckers may occur. During the rest of the year, longnose suckers appear to be more dispersed. Populations are highest near mouths of tributaries but juveniles and adults also make use of the mainstem during the ice free months. The winter distribution of longnose suckers is unknown as are the major rearing areas of juveniles.

Distribution and Relative Abundance

Longnose suckers occurred at all the DFH sites sampled in 1982 and were captured in large numbers at many of these sites. They were captured in small numbers at only 9 of the 12 DFH sites sampled in 1981. The more widespread distribution and greater abundance of longnose suckers at these DFH sites in 1982 is mostly due to the greatly increased use of electrofishing units and beach seines in 1982, rather than actual changes in abundance.

Since boat electrofishing gear was most effective for capturing longnose suckers, relative abundance is best studied by examining CPUE's at different sites sampled by this method (Figure 3-4-7). Boat electrofishing CPUE's for longnose suckers were typically higher at tributary or slough sites than at mainstem sites. At mainstem sites above the Chulitna River confluence, boat electrofishing CPUE's were typically higher than at mainstem sites below the confluence. No large seasonal trends are apparent, although CPUE's at tributary or slough sites above the confluence appear to be higher in August and September than in June and July. Possibly longnose suckers move into these tributary or slough sites to feed on salmon eggs.

Longnose sucker adults were found in number at both mainstem and tributary sampling sites. They are one of the few resident species which make use of the mainstem in number over the entire ice free season. In winter, little is known of the distribution of longnose suckers in the Susitna as very few have been captured anywhere. Schools of longnose suckers were encountered in the mainstem in early September but normally only scattered individuals were captured during the rest of the season. At tributary mouths, longnose suckers were often encountered in schools or in groups along a limited area of the site electrofished.

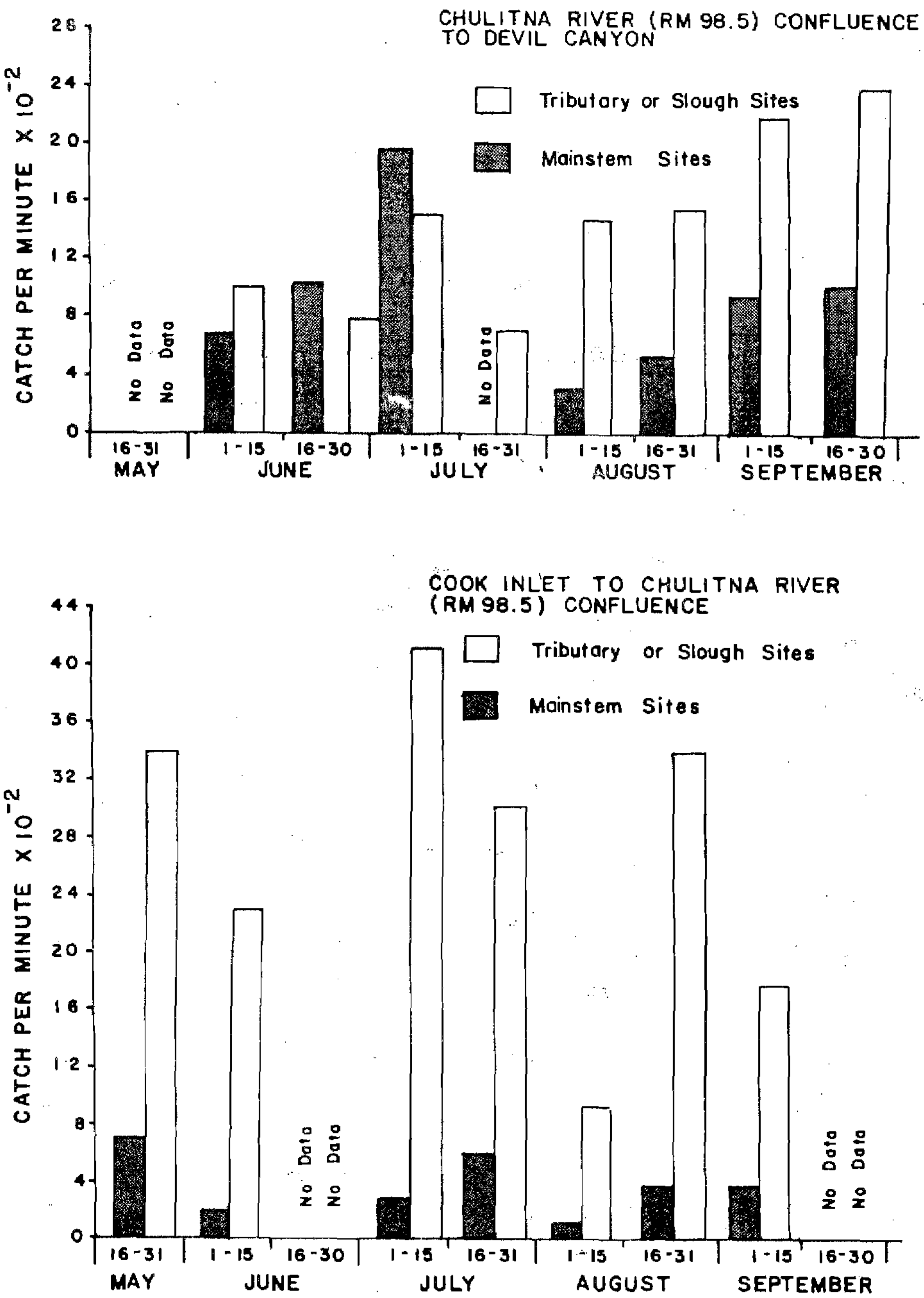


Figure 3-4-7. Longnose sucker catch per unit of boat electrofishing effort at tributary and mainstem sites on the Susitna River between Cook Inlet and Devil Canyon, May to September, 1982.

Adult Movement and Migration Patterns

None of 21 longnose suckers adults that had been tagged and recaptured moved over 8 miles and 14 of these fish were recovered at the same location where they were originally tagged (Appendix Table 3-A-47, ADF&G 1981c). Six of the fish which did move were recovered after August 1 indicating a possible pattern of movement beginning at this time. Catch rates at mainstem and tributary sites with boat electrofishing units increased after August 15, indicating that a movement was occurring into some areas and through others (Figure 3-4-7). Possibly the fish are moving toward the wintering grounds from clear water tributaries. Schools of longnose suckers were encountered below RM 50.0 in the mainstem in early September although very few longnose suckers had been encountered in August in the same area.

In the spring, catch data indicates that longnose suckers congregated at the mouths of the tributaries to spawn. The size of the spawning migration or movement is not known. Fishwheel catches at the three Susitna fishwheel sites were higher in June than in July indicating more movement in the mainstem early in the season. Mainstem catches were much lower than tributary catches during late May and early June at SFH sites.

Spawning

Longnose sucker spawning in the mainstem Susitna River was evidenced at two locations during late May and early June, 1982. Sexually mature and spent longnose suckers were captured at the mouth of Trapper Creek (RM 91.5) and at Sunshine Creek and Side Channel (Appendix Table 3-A-48). Catch per unit effort data indicate peak spawning occurred before June 10th at both sites (Appendix Tables 3-A-43 and 3-A-45).

Although relatively large concentrations of adult longnose suckers were captured at both locations, few adults were captured that were sexually mature or spent, indicating longnose suckers in the Susitna River drainage may be nonconsecutive spawners. Geen et al. (1966) reported that some longnose suckers spawn two of three consecutive years while others miss one or two years between spawnings.

Captured ripe male and female longnose suckers were a minimum five years of age (Appendix Table 3-A-48). McPhail and Lindsey (1970) reported that in central British Columbia males first spawned at age V while females first spawned at Age VI or VII.

Although no fall spawning of longnose suckers has been documented (Scott and Crossman 1973, Morrow 1980), observations of ripe males captured in September indicate spawning may also occur during late fall in the Susitna River (Appendix Table 3-A-48).

Juvenile Rearing Areas

Juvenile (fork length under 200 mm) longnose suckers were found rearing at a variety of sloughs and a few tributary mouths below Devil Canyon during summer 1982. They were often found in sloughs above the Chulitna

River confluence such as Slough 6A, Slough 8A, Slough 9, and Slough 22. The mouths of large tributaries such as Lane Creek and Slough 8, Fourth of July Creek, and Portage Creek were often used by adult longnose suckers but juveniles were only rarely found there. Below the Chulitna River confluence, a similar trend was apparent, many adult longnose suckers were captured at the mouths of Rabideux Creek and Slough and Sunshine Creek and Side Channel but few juvenile longnose suckers were found at those sites. Goose Creek 2 and Side Channel was an exception as both adults and juveniles were abundant there.

Morrow (1980) reports a downstream movement of longnose fry after emergence in some streams but this movement does not appear extensive in the Susitna River below Devil Canyon. The downstream migrant trap captured very few longnose suckers (Table 3-3-6) and very few of these were young of the year.

4.1.1.7 Dolly Varden

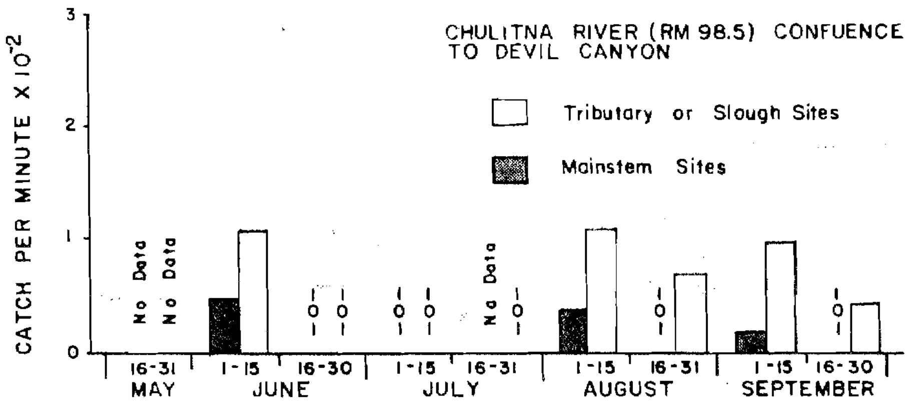
Adult Dolly Varden make use of the mainstem Susitna River from September through June, however no specific wintering areas for Dolly Varden have been documented. During July and August adults were found at tributary mouths, but most of the population is believed to reside in clear water tributaries well above their confluences with the Susitna. Populations of dwarf sized Dolly Varden may also inhabit the upper reaches of clear water tributaries above Talkeetna. Juvenile Dolly Varden are thought to be similarly distributed. There is no evidence to suggest that these juveniles overwinter in the mainstem Susitna. Anadromous Dolly Varden may also occur in the Susitna drainage but the majority of fish appear to be resident to the system. Dolly Varden are thought to spawn in clear water tributaries in October.

Distribution and Relative Abundance

Dolly Varden were sampled in relatively small numbers in comparison to other species of resident salmonids (rainbow trout, round and humpback whitefish, and grayling). A comparison of boat electrofishing CPUE's for tributary and mainstem sites above and below the confluence of the Chulitna River shows few trends (Figure 3-4-8). Catch per unit efforts at mainstem sites decreased in late June. Overall, the CPUE for mainstem sites (0.20 fish/minute x 10^{-2}) was much less than the CPUE for tributary sites (1.18 fish/minute x 10^{-2}). Catches at fishwheels in the mainstem Susitna indicated more use of the mainstem by Dolly Varden in June and September than during other times in the summer (Appendix Table 3-A-53). Catches were too low to show any apparent differences between mainstem use above and below the confluence.

The abundance and distribution of Dolly Varden was very similar in both 1981 and 1982. At the 12 DFH sites sampled in both 1981 and 1982, Dolly Varden were found at seven sites in 1981 and eight sites in 1982. They were present both years at Birch Creek and Slough, Lane Creek and Slough 8, 4th of July Creek, Indian River and Portage Creek. At Slough 11 and Slough 21, Dolly Varden have not been present.

During 1981 and 1982 sampling in the upper reaches of Portage Creek and Indian River, many small Dolly Varden were captured (ADF&G 1981c;



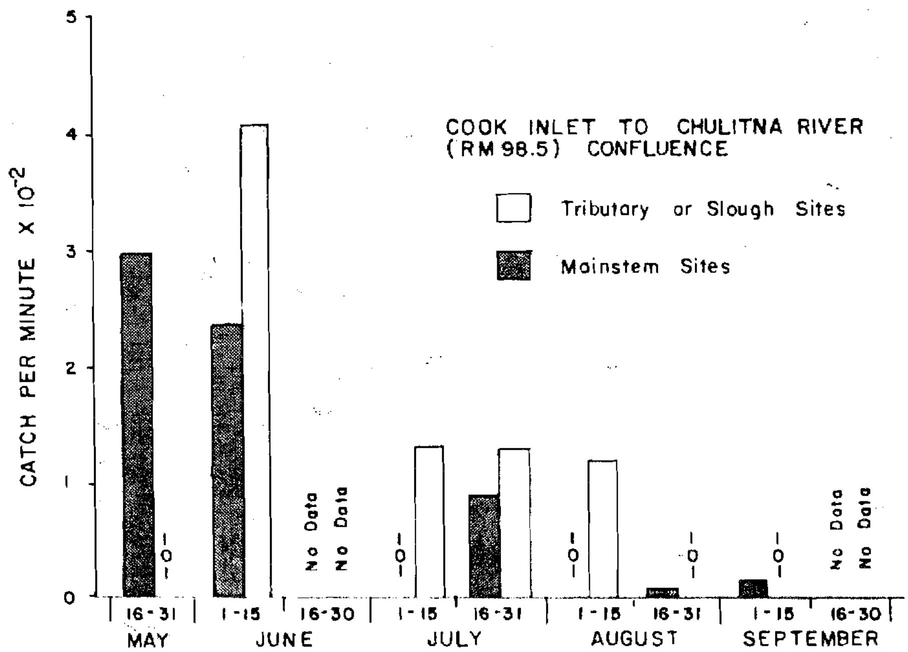


Figure 3-4-8. Dolly Varden catch per unit of boat electrofishing effort at tributary and mainstem sites on the Susitna River between Cook inlet and Devil Canyon, May to September, 1982.

Appendix Report 3-D-1). Dolly Varden in these areas are probably separate populations of stunted fish. Morrow (1980) reports this occurs in the upper reaches of many streams and mountain lakes. Stunted Dolly Varden were also collected in studies above Devil Canyon (Volume 5). At the sites sampled in upper Portage Creek and upper Indian River, 1981 minnow trap CPUE's were much greater than 1982 CPUE's. In 1981, Dolly Varden catch per trap unit was 0.46 in Indian River and 1.06 in Portage Creek while in 1982 catch per trap unit dropped to 0.03 in Indian River and 0.18 in Portage Creek. The causes of this yearly variation are unknown. The sampling effort was not constant over the season in 1981 and 1982 and this may have accounted for some of the difference. Also trap sets in 1981 were approximately 24 hours in length while sets made in 1982 were only three hours in length. It is possible that Dolly Varden feed primarily at twilight or during the night and therefore would not be caught in comparable numbers in three hour sets made during the middle of the day.

Morrow (1980) reported Dolly Varden to generally be found in the upper reaches of stream drainages. The limited catches of Dolly Varden in the Susitna drainage thus far indicate that this is the case in the Susitna drainage below Devil Canyon.

Adult Movement and Migration Patterns

In late June, boat electrofishing CPUE's (Figure 3-4-8) and fishwheel catches dropped indicating a movement of fish from the mainstem into tributaries. Catches indicate a few fish move about in the mainstem and just off tributary mouths all summer but the main populations are assumed to be in the upper reaches of tributaries. Clear water sloughs such as Slough 11 and Slough 21 do not appear to harbor fish over the summer. The few recoveries of tagged Dolly Varden made thus far indicate generally long migrations by Dolly Varden may occur in the Susitna River (Appendix Table 3-A-60). A Dolly Varden tagged on May 25 in the mainstem near Montana Creek (RM 77.0) was captured by a sport fisherman at Fish Creek, a tributary about six river miles up the Talkeetna River (RM 97.0), sometime later in the spring or summer, an upstream movement of 25 river miles. This fish probably spent the winter in the Susitna mainstem and then was moving to summer habitat when captured by the fisherman. Two other Dolly Varden tagged in June at the mouth of Lane Creek were captured in the mainstem in late August at the Curry fishwheel site (RM 120.0). These fish may have been moving upstream to spawn as Dolly Varden are fall spawners (Morrow, 1980).

Spawning

Spawning of Dolly Varden can occur between late August and November according to Morrow (1980). Adult Dolly Varden necropsied during September and October, 1981 evidenced enlarged gonads but were not yet sexually mature, indicating that they spawn after mid-October in the lower Susitna River.

During six sampling trips to upper Portage Creek and upper Indian River between May and August, no sexually mature "dwarf" Dolly Varden were captured.

Juvenile Rearing Areas and Movements

Little is known of juvenile Dolly Varden habits in the Susitna drainage below Devil Canyon. In the summer months minnow trap sampling at the mouths of many tributaries over the two years of study have only made occasional catches of juvenile Dolly Varden. These results suggest that juvenile Dolly Varden rear in tributaries well above the influence of the mainstem Susitna. In the winter, juveniles may move downstream in their tributaries but minnow trapping has not revealed the presence of any appreciable numbers of Dolly Varden at stream mouths or in the mainstem over the winter months.

4.1.1.8 Threespine Stickleback

Threespine stickleback are most abundant in the Susitna River below the Chulitna River confluence, and they are infrequently captured less frequently above RM 120.0. Populations of threespine stickleback were much lower in 1982 than in 1981. An upstream movement of threespine stickleback may occur in late May and early June in the lower 40 miles of the Susitna. Spawning occurs in June and July at tributary and slough mouths and subsequently juveniles rear at these sites. Fall movements and the distribution of threespine stickleback in the winter have not been delineated.

Distribution and Relative Abundance

In 1982, the distribution of threespine stickleback was more restricted and the catch was smaller than during the 1981 field season. At the 12

DFH sites sampled in both 1981 and 1982, threespine stickleback were found at nine of the sites in 1981 and only four of the sites in 1982. At Slough 6A, 773 stickleback were captured in early June, 1981 while not a single fish was captured at this site during the entire 1982 field season. At Sunshine Creek and Side Channel, Birch Creek and Slough, and Whiskers Creek and Slough, threespine stickleback were present in both years. At these three sites, average CPUE's of minnow traps for the three sites were much greater in 1981 than in 1982. Seasonally, the highest CPUE's were found in June and July in both years. No threespine stickleback were found at Indian River or Portage Creek in either year.

Goose Creek 2 was the only DFH site sampled in both 1981 and 1982 where threespine stickleback were not found in 1981. This site was not sampled, however, until late July in 1981. In 1982, only two threespine stickleback were captured in minnow traps at Goose Creek 2 after late June. The reason for this vast difference in yearly catches and CPUE's between 1981 and 1982 is unknown. A possibility is that the high water during the summer of 1981 flushed the fish downstream.

Threespine stickleback are potentially competitive with juvenile sockeye salmon and rainbow trout for food (Morrow 1980). Areas of threespine stickleback abundance however, such as Sunshine Creek and Side Channel, Birch Creek and Slough, and Whiskers Creek and Slough have few juvenile sockeye salmon or rainbow trout rearing in their confluence areas. Opportunities for competition (at least in these areas of direct Susitna River influence) are thus minimized, and threespine stickleback occurrence probably has very little effect on these salmonids.

Adult Movement and Migration Patterns

The threespine stickleback has an anadromous form and a freshwater form (Morrow 1980). The two forms are distinguished primarily by the number of bony plates, five to nine per side on freshwater forms and 27 to 37 plates per side on anadromous forms. Unfortunately, counts of plates on individual specimens captured during this study have not been made. It is not known, therefore, which of the two forms inhabit the Susitna drainage.

During late May and early June, 1982, up to 40 threespine stickleback were captured in one dipnet sweep at several sites in the mainstem below RM 40.0 (D. Lang and S. Krueger, pers. comm.). These fish were believed to be moving upstream enmasse to spawning sites or summer feeding grounds. They apparently had overwintered in the estuary or in deep water near the mouth of the Susitna.

In 1981, the numbers of threespine stickleback caught were very high at several sites sampled in June and then gradually decreased over the summer (ADF&G, 1981c). During the 1982 season, there never were any noticeable trends in numbers of threespine stickleback. The number of threespine stickleback stayed consistently low all through the summer sampling period.

Spawning

Threespine stickleback with total lengths as small as 50 mm were believed to have spawned in 1982. In 1981, only breeding male threespine stickleback with lengths greater than 70mm were observed in spawning colors and they were observed during the period from mid-June to early August.

Observations of carcasses of spawned out threespine stickleback and high catch rates of threespine stickleback indicate peak spawning occurred during early July in both 1981 and 1982. The period of peak spawning is thought to occur earlier in areas near the mouth of the Susitna River and then progress upriver.

Juvenile Rearing Areas

Young of the year threespine stickleback were found in late July and early August in the same areas that adults occupied. Catches of threespine stickleback fry in a downstream migrant trap in the mainstem were highest in late August and September suggesting a downstream movement of threespine stickleback fry occurs at this time.

4.1.1.9 Slimy Sculpin

Slimy sculpin were widely distributed throughout the Susitna River below Devil Canyon and occurred at nearly all sites studied. They are present year round and no large scale movements or migrations were evident. Spawning, juvenile rearing and adult movements all are confined to a limited area. Populations are greatest at the mouths of clear water tributaries but mainstem areas also harbor resident populations.

Distribution and Relative Abundance

Slimy sculpin were very widely distributed throughout the sites sampled and were captured all year long. At the 12 DFH sites sampled in 1981 and 1982, slimy sculpin were captured at all 12 sites during both years (ADF&G 1981c; Appendix Table 3-A-66). In 1982, catches at DFH sites above Slough 8A were generally much less than at sites below this slough.

At a given DFH site, however, cottids usually were not caught in number except after young of the year became readily catchable. Generally fish were scattered throughout a site. Morrow (1980) reports slimy sculpin to be generally abundant and limited catches of this species are probably a function of gear selectivity.

Adult Movement and Migration Pattern

No evidence of major movements or migration was gathered. Morrow (1980) also reports that slimy sculpins do not migrate (except for anadromous populations) and are sedentary. They may disperse somewhat during the breeding season as males set up territories in favorable breeding habitat.

Spawning

Catches of young of the year slimy sculpin in late July suggest spawning occurs about mid June. Morrow (1980) reports spawning occurs shortly after breakup.

Juvenile Rearing Areas

Juveniles were found in largest numbers wherever adults were found in large numbers. After hatching, they probably disperse into the area surrounding where they were hatched. The downstream migrant trap failed to pick up any young of the year slimy sculpin and this indicates there is probably not a long distance movement from areas of hatch.

4.1.1.10 Arctic Lamprey

Catches of Arctic lamprey were relatively low in 1982, but this is not indicative of the actual abundance of the species in the Susitna River. During 1981 studies (ADF&G 1981c), most of the tributary sites producing Arctic lamprey were located below RM 50.5 except for Goose Creek 1 (RM 72.0), Montana Creek (RM 77.0) and Whiskers Creek and Slough. Sampling effort at tributary sites below RM 50.5 in 1982 was limited to boat electrofishing at only a few sites. Arctic lamprey were captured or observed at most of these lower tributary sites electrofished and they are believed to be abundant at tributary mouths below RM 50.5.

Arctic lamprey are much less numerous above the confluence but there are localized concentrations at Whiskers Creek and Slough (RM 101.2) and Gash Creek (RM 111.5). Spawning occurs at these sites as ammoceotes were captured. Below the confluence, spawning was documented at Birch Creek and Slough during late June and probably occurs at other tributary mouths, especially those below RM 50.5.

Assuming 180 mm is the maximum length of the freshwater form of Arctic lamprey (McPhail and Lindsey 1980, Morrow 1980), only two anadromous Arctic lamprey were caught in 1982. In 1981 all Arctic lamprey greater than 180 mm were captured between RM 10.1 and 40.6. The capture sites (RM 88.4 and 103.0) of the two anadromous lamprey caught this year were considerably further upstream than the upstream limit observed in 1981. If these are indeed anadromous Arctic lampreys then a spawning run would occur in the spring. Other movements and migrations by freshwater populations present have not been delineated.

4.1.2 Juvenile Anadromous Fish Species

4.1.2.1 Chinook Salmon

Chinook salmon juveniles were distributed throughout the sampling area from Goose Creek to Slough 21 during the open water season of 1982. The only DFH site where juvenile chinooks were not captured was Portage Creek mouth. Seasonally, the highest catches in the lower reach (below the Chulitna River confluence) occurred in late June and July and the highest catches in the upper reach (above the Chulitna River confluence) were recorded in late June, late August, and early September.

Catches in the lower reach were generally higher than those observed in the upper reach. Relatively large numbers of chinooks were captured at four (Goose Creek 2 and Side Channel, Rabideux Creek and Slough, Sunshine Creek and Side Channel, and Birch Creek and Slough) of the five sites surveyed in the lower reach. In the upper reach, the site where the most chinook juveniles were caught was the most downstream DFH site in that reach, Whiskers's Creek and Slough.

The most noticeable difference between 1981 and 1982 catches of chinook salmon juveniles was the decrease in distribution and relative abundance of juvenile chinooks in 1982 in the reach above the Chulitna River confluence. The reason for this decrease is unknown but may be a result of one or more of several factors: the high flows recorded during the summer of 1981, severe conditions during 1981-1982 winter, or an unusually damaging ice-out in the spring of 1982.

Similarly, the catch of chinook salmon juveniles at the six SFH sites in upper Indian River and upper Portage Creek showed a dramatic decrease in 1982 compared to 1981 (see Appendix Report 3-D-1). Only one chinook salmon juvenile was captured in upper Indian River in 1982, while none were captured in upper Portage Creek (not sampled in August or September).

Although no chinook juveniles were captured in the upper reaches of Portage Creek or at Portage Creek mouth in 1982, age 0+ chinook salmon juveniles were captured at Slough 20 and Slough 21. The only presently known chinook spawning areas upriver of these sloughs are Portage Creek and two small creeks located in lower Devil Canyon. The chinook juveniles at Slough 20 may have originated in Portage Creek, but were not captured during the twice monthly sampling conducted at the mouth.

The highest numbers of juvenile chinook salmon observed at DFH tributary sites were collected in late June, early July, and during September in both the 1981 and 1982 seasons. The distribution and abundance of juvenile chinook salmon observed in 1982 at DFH and SFH sites in the Chulitna River to Goose Creek reach were similar to the distribution and abundance observed at many of these sites in the 1981 season. Catch rates at most sites in the Chulitna River to Goose Creek reach decreased in September during 1981 and 1982. An increase in the number of age 0+ chinook juveniles was apparent at most DFH sites in the reach above the Chulitna confluence during 1981 and 1982 as the open water season progressed. This was most obvious at Whiskers Creek and Slough 21, where catches increased during each two week interval from June to mid-September for age 0+ fish in 1982. Chinook juveniles collected from Slough 8A in late August 1982 probably originated from Fourth of July Creek, Indian River, and possibly Portage Creek. Maximum catches of juvenile chinook salmon were collected at Fourth of July Creek mouth and Indian River mouth in late August.

The low numbers of chinook salmon juveniles collected from February through April, 1982, make it difficult to identify any patterns. In general, chinook juveniles were captured throughout the reach sampled and no seasonal trends were apparent. Relatively higher numbers of chinook juveniles were captured at Slough 10 and Slough 20 in the winter. A similar trend was evident during the 1980-1981 winter sampl-ing. A movement by chinook salmon juveniles into these two sloughs in September has been noted in both 1981 and 1982. This is a time of year when juvenile salmon move out of tributaries. These two sloughs evidently provide important overwintering habitat for juvenile chinooks. Whiskers Creek and Slough is another site where chinook juveniles were relatively abundant during both winters. All three sites have fairly deep pools of calm water.

Chinook salmon juveniles were abundant at Whiskers Creek and Slough during the 1981 and 1982 open water season. However, they were less abundant at Slough 10 and Slough 20 during the 1981 and 1982 open water seasons, indicating that the use of these two sloughs is seasonal.

A seasonal separation by age class was apparent at several sites. A peak abundance of age 1+ fish occurred prior to the peak abundance of age 0+ fish. This separation could lessen competition between the two age classes at these areas.

4.1.2.2 Coho Salmon

A seasonal separation by age class was apparent at several sites. The peak abundance of age 1+ fish occurred prior to the peak abundance of age 0+ fish. This separation could lessen competition between the two age classes at these areas.

In general, juvenile coho salmon were more abundant at DFH sites in the lower reach of the Susitna River (Goose Creek and the Chulitna River confluence). In the reach above the Chulitna confluence, juvenile cohos were most numerous at DFH sites below Lane Creek. Two possible explanations for this distribution pattern are: (1) the three sites below the

Chulitna provide an abundance of excellent habitat for coho juveniles or (2) the coho juveniles were scarce in the upper reach (above Lane Creek) during the 1982 open water season. The reason for this scarcity is unknown but could have resulted from the high flows of 1981 in the tributaries where coho juveniles rear, or from severe winter conditions during 1981-1982, or from a destructive ice-out in the spring of 1982.

The seasonal distribution of coho salmon juveniles was somewhat different in the reaches above and below the Chulitna River confluence. Several sites in the upper reach showed an increase in numbers collected in September, while several sites in the lower reach showed a decrease in numbers during this period. The decrease in relative abundance in the lower reach was probably caused by lowered mainstem discharge which resulted in a loss of the mainstem backwater zone type of habitat. The September increase in the upper reach is most likely related to seasonal movement patterns such as the movement of juveniles out of tributaries. The peak catches in the lower reach in July are also likely related to seasonal migrations.

Coho salmon juveniles were most numerous during 1982 at Rabideux Creek and Slough, Sunshine Creek and Side Channel and Birch Creek and Slough. All three sites occur in a section of the river where the flood plain is much broader than it is above the Chulitna River. These three sites have low gradient streams and/or sloughs which lead to large areas of low velocity water and (except for Birch Creek and Slough) abundant aquatic vegetation. Further, adult cohos spawn in all three of these creeks.

Of the three sites above the Chulitna River confluence which had the largest coho juvenile catch in that reach, two were creeks which entered slough systems (Whiskers Creek and Slough and Lane Creek and Slough 8) and one was an upland slough with input from two very small creeks (Slough 6A).

The distribution of coho salmon juveniles was similar during 1981 and 1982, as gauged by the percentage of sites where juveniles were caught over the course of the open water season. However, the catch rates for minnow traps in 1982 were significantly lower than those recorded at these sites in 1981. Juvenile coho salmon were captured more frequently at tributary mouth sites than at sites without tributaries during both years. Six of the nine tributary mouth locations sampled in 1982 are associated with sloughs or side channels of the Susitna River. These tributary mouths associated with sloughs and side channels had a greater abundance of juvenile coho salmon than tributary mouths associated directly with the mainstem channel of the Susitna River.

The catch per minnow trap at Whiskers Creek and Slough was lower in 1982 than that recorded in 1981. Peak catches of juvenile coho salmon ages 0+, 1+, were reported in late August of 1981 and during September in 1982. Relatively high catch rates for juvenile coho salmon were recorded in the summer of 1981 and 1982 at Slough 6A. However, there was a high catch reported in late June of 1982 which was not reported at this site in the summer of 1981. The catch rate for coho salmon juveniles at Slough 8A, Slough 11 and Portage Creek, located on the Susitna River above the Chulitna confluence, was low during the open water season of both 1981 and 1982. Juvenile coho catches at Fourth of July Creek were more numerous in August and September of 1981, than during this period in 1982. The catch per trap at Goose Creek 2 and Side Channel was lower in the summer of 1982 than in 1981. The highest catch per trap was recorded at this site in late August, 1981. Sunshine Creek and Side channel recorded consistently high minnow trap catch rates of juvenile coho salmon between June and September, 1982. Relatively low catch rates were recorded at this site throughout the summer of 1981. Similar high catch rates were also recorded at Rabideux Creek and Slough in 1982. Catch rate data are limited to only one sampling trip to Rabideux Creek in the summer of 1981. Birch Creek and Slough had relatively low catch rates of juvenile coho salmon from June to September 1982, compared with catch data collected in the summer of 1981. The highest catch per trap of juvenile coho salmon in 1982 was recorded in July. Higher catch rates were recorded for this site from late July to September, 1981. The relative abundance appeared to decline during the summer of 1982 in contrast to increasing catch rates observed during the summer of 1981.

The distribution of coho salmon age 0+ at DFH sites in 1982 was somewhat similar to that of 1981. The distribution of age 0+ coho salmon was most extensive in September at sites on the Susitna River between the Chulitna River confluence and Portage Creek. Occurrence of age 0+ coho salmon were more consistent at tributary mouth locations in late June and September than at sloughs. However, Slough 6A and Slough 8 recorded significant numbers of age 0+ coho salmon in September.

Unlike chinook salmon juveniles, coho salmon juveniles of age class other than 0+ were present for the entire open water season. They were more abundant in June and July than later on and preceded the peak abundance of age 0+ fish at most sites.

No juvenile coho salmon from brood year 1978, age II+, were observed in the Chulitna River to Portage Creek catches during the summer, 1981. In the summer of 1982 one juvenile coho age II+ from brood year 1979, was captured in this reach at Slough 6A.

Age 0+ coho salmon were captured at Selected Fish Habitat sites in the upper reaches of Indian River and Portage Creek during the summer of 1981; however, no juvenile coho salmon were captured at Selected Fish Habitat sites in these tributaries in 1982 (see Appendix Report 3-D-1).

Little can be concluded about coho salmon juvenile distribution and abundance in the winter because of the low numbers of fish captured (a total of 92). Either the juveniles are present at the sites only in very low numbers or the sampling methods used in winter are not efficient. The sites sampled were mainly tributary mouth and slough sites, with a few mainstem sites, that were accessible through open leads or holes drilled by ice auger. Deep mainstem holes were not sampled, nor were tributaries above their mouth areas.

The pattern of winter distribution of coho salmon juveniles at DFH sites was not similar to the summer distribution except at the Whiskers Creek and Slough site and Slough 6A where relatively high catches were made during both seasons.

4.1.2.3 Chum Salmon

Chum salmon fry were caught primarily in June and early July. There is no catch data from May, a time when many chum salmon juveniles were probably outmigrating.

The catch is distributed over the entire study area in late June. The absence of catch in the upper area reflects, in part, less sampling effort at these sites due to logistical problems. The total number of chum fry sampled shows a steady decrease with a significant reduction in catch following the late June period. Also, chums were caught at fewer sites after this period.

The catch of chum salmon fry at the Designated Fish Habitat (DFH) sites corresponds with downstream migrant trap data for this species. The last trap catch for chum fry was on August 15, and the last positively identified juvenile chum caught at DFH sites was captured on August 9 at Birch Creek slough. This fry was 39 mm in length, the same as the mean length of chums caught at the same site during the late June period. This may be an individual from a group which emerged late or was isolated in a pool without an adequate food source and was subsequently flushed back into the Susitna River system by an increase in Susitna or tributary discharge.

Above the Chulitna River confluence, most of the sampling site sloughs where adult chums spawned in 1981 (Slough 8, Slough 8A, Slough 9, Slough 11, and Slough 21) had relatively high catches of juvenile chums in June of 1982. The only site where very large numbers of juvenile chums were captured was Slough 6A. However, approximately 1,000 fish were visually observed in Slough 8 in late June (a sub-sample was captured). Spawning by adult chums in 1981 was observed in Slough 8 but very little spawning by chums occurred in Slough 6A. The majority of the juvenile chums present in Slough 6A must have come from one of the spawning areas further upriver. This slough is an important holding/rearing area for juvenile chum salmon. Unfortunately, it is not possible to get an estimate of the total chum salmon juveniles present in Slough 6A; only a small section of the slough was sampled and the water was not clear enough for visual observation. The studies in 1983 will attempt to provide such an estimate.

In the lower reach of river (below the Chulitna River confluence), most chum salmon juveniles were captured in Birch Creek Slough. Chum juveniles were present at Birch Creek Slough longer into the summer than at other sites. This site is probably an important rearing area for juvenile chum salmon. The habitat rearing characteristics for this site and Slough 6A, will be examined in the Fish and Habitat Relationships Report.

Winter studies indicated large numbers of chum salmon juveniles were present in April at Sloughs 8A, 9A, 9B, 11, 20 and 21.

The data for length frequency distribution by two week period (presented in the downstream migrant trap results, Section 3.2.3) demonstrates growth by chum salmon in the Susitna River system. Studies of the food habits of juvenile salmon studies did not begin in 1982 until August, so no data were collected on the feeding of chum salmon juveniles. Stomach contents of chum juveniles will be examined during the spring and early summer of 1983.

4.1.2.4 Sockeye Salmon

In the 1981 open water season, only 29 sockeye salmon juveniles were caught in the area encompassed by the 1982 juvenile fisheries study area (RM 73.1 - RM 148.8). The increased use of beach seines and backpack electroshocking equipment in the 1982 open water season resulted in a greater catch of sockeye salmon juveniles this season (1,432 fish).

All three sites where juvenile sockeye salmon were captured in 1981 (Birch Creek and Slough, Slough 9 and Slough 11), also produced sockeye in the 1982 study. Sockeye salmon juveniles were captured at Slough 9 and Slough 11 during winter sampling in 1981 and 1982.

A difficulty in analyzing catch data regarding sockeye salmon juveniles is in standardization of catch per unit effort for the gear types which are most effective for this species. Beach seining produced most of the specimens caught, yet it is difficult to relate the data from one site to the next since the morphology of the site may affect the use of the gear. The use of the electrofishing is helpful in complementing beach seining efforts, but it is difficult to compare catches from the two gear types. By combining catches of all gear types, the data can be used to determine trends in the relative abundance and distribution of sockeye salmon juveniles.

Upland sloughs such as Whitefish Slough, Slough 6A and Slough 19 all had sockeye salmon juveniles present after the early August sampling trip. Whitefish Slough was consistently a low producer of salmon fry, never accounting for more than 2.0% of the total catch of juveniles of any anadromous species. The small amount of cover in this slough may be a factor.

Sockeye salmon fry were caught in large numbers in Slough 6A until shortly after the peak outmigration observed in early July. The significant reduction of catch of this species in early August in Slough 6A and Slough 8A suggested that the majority of fry had left these large rearing areas prior to August.

The large percentage of sockeye salmon fry taken at Slough 6A indicates that this slough offers suitable rearing habitat for large numbers of sockeye juveniles. Data from the adult anadromous studies project (ADF&G 1981a, Volume II, Appendix) indicates little or no spawning by sockeye adults at this site during 1981. This suggests that large numbers of age 0+ juveniles moved into this habitat from upstream spawning areas. In the early June samples, several age 1+ fish were captured. It is unknown where these fish overwintered. The closest slough to Slough 6A where spawning and large juvenile catches were documented was Slough 8A, 13.0 miles upriver. Tagging of pre-migrant age 0+ sockeye salmon fry and early season sampling is needed to ascertain the origin of sockeye juveniles in Slough 6A. Also, more frequent sampling during the early season would establish trends of movement into rearing areas and subsequent outmigration.

The relative clarity of water and morphology of Slough 8A optimizes observation (and subsequent catch) of fry during moderate to low discharge situations. The catch at Slough 8A (262 fry) reflects the high number of adult spawners in 1981 at this site (ADF&G 1981 a). The upper reaches of this slough offer an abundance of rearing habitat. The low discharges of 1982 appeared to reduce access to this area during the spawning season, relative to 1981.

The upper section of Slough 8A is a system of impoundments with abundant cover and excellent substrate for spawning and rearing. The presence of juveniles throughout the ice-free season and the collection of age 0+ fry during winter sampling coupled with observations of adult spawning indicates that this slough system offers important spawning and rearing habitat for this anadromous species.

Slough 11 is somewhat similar to Slough 8A morphologically in that there is an upper system of pools and riffles in which sockeye salmon spawning has been extensively documented (ADF&G 1981a, Volume II, Appendix). Fewer juvenile sockeye salmon were captured during 1982 at this site than 1981 spawning and winter catch data (Table 3-3-24) would suggest.

The fry may have migrated out of the slough prior to the deployment of efficient capture methods (beach seining and backpack electrofishing) in late June.

The numbers of sockeye salmon adults observed spawning in Slough 21 in 1981 would indicate that large numbers of juvenile sockeyes might be present during 1982. Sampling efforts produced low numbers of fry from this slough during the 1982 open water season. This site is difficult to sample with a beach seine, and the opening of the head in early season periods made visual observation impossible at that time. On the other hand, the juveniles may have left the slough prior to sampling in June. The site was relatively devoid of vegetative cover for most of the season. Sea gull predation in the shallow, clear water in this slough may be a factor. Another possible explanation for the low catch at Slough 11 and Slough 21 may be a low percentage of survival from spawning to emergence.

Some data suggests that rearing of sockeye salmon juveniles spawned in the Susitna River above the Chulitna River confluence is largely unsuccessful. The Stock Separation Biology report (see Volume II, Appendix) indicates that the sockeye salmon stock in the Susitna River above the Chulitna confluence is not separable by scale analysis from the sockeye stocks of the Talkeetna and Chulitna Rivers. Therefore, there is a possibility that adult sockeye salmon migrating up the Susitna River above the Chulitna River confluence may be strays from the other river systems. Insufficient data on sockeye salmon was collected by the food habitats study (Section 3.3), but sockeye juvenile stomachs collected at

Slough 8A and Slough 11 in August and September contained insects, as well as the usual plankton food common to lake reared sockeye salmon juveniles. Schools of smaller than normal sockeye juveniles were observed and sampled in Slough 8A and Slough 19 throughout the summer. The age class composition of this year's catch of sockeye juveniles above the Chulitna confluence (2,739 age 0+ and only 33 age 1+) could possibly be interpreted as evidence for unsuccessful rearing. However, age 1+ sockeye salmon may have migrated downstream below the Chulitna River confluence prior to placement of the downstream migrant trap in mid-June. Also, rearing could occur below the Chulitna River confluence.

Evidence suggesting the occurrence of some successful rearing exists in the demonstrated growth rates of age 0+ sockeye salmon between March and October (see Section 3.2.4 of this volume) and the capture of a few age 1+ sockeye juveniles above the Chulitna River confluence. The late beginning of both the downstream migrant trapping operation (mid-June) and of the food habits study (August 1), significantly limits the data base available for forming conclusions concerning rearing. Also, effective methods of capturing sockeye juveniles (beach seining and electrofishing) were not employed in the river above Curry until late June. The early season operation of all these studies should provide a more complete data base in 1983. Efforts to evaluate the migration and survival of sockeye salmon fry using coded wire tagging are also planned to begin in early 1983.

4.2 Emergence and Outmigration

4.2.1 Chinook Salmon

Juvenile chinook salmon were collected at almost all study sites during both the 1981 and 1982 field surveys (ADFG 1981b). Biological data collected for this species during the winter surveys suggested similar growth rates for overwintering fish during both years. The outmigration of juvenile chinook salmon from the reach of river above the Chulitna River confluence was observed primarily during May and June during both 1981 and 1982, and was composed predominantly of age 1+ fish averaging 90 mm total length. This age class was absent from the upper reach by the middle of August. Below the confluence of the Chulitna River, age 1+ fish were observed through early September.

Age 0+ chinook salmon were collected at Indian River (RM 138.6) during April, 1981, but this age class was not observed until early June during the 1982 studies due to the limited sampling conducted prior to early June. The mean length of post-emergent chinook salmon fry collected during the 1981 spring surveys was 34 mm.

Mean lengths for age 0+ chinook salmon collected between the Chulitna River confluence and Devil Canyon during 1981 increased from 46 mm in late June to 67 mm in late September. Age 0+ fish collected in this same reach during 1982 had a mean length of 49 mm during late June and reached an average length of 70 mm in September.

The adjusted cumulative catch data for juvenile chinook salmon collected in the downstream migrant trap in 1982 is presented in Figure 3-4-9. Although fewer juvenile chinook salmon than sockeye salmon were collected in the trap, the cumulative catches are very similar. This is probably due to the similarity in freshwater residence of the two species in that they usually spend one winter in freshwater prior to outmigration.

An outmigration of age 0+ fish observed in the Deshka River during the fall of 1980 was attributed to a size related movement (Delaney et al., 1981). They postulated that during years of high pink salmon spawning (even years), an abundant and available food source of salmon eggs results in increased growth enabling age 0+ chinook fry to reach a suitable smolting size without overwintering in fresh water. Data collected during 1982 (another even year for pink salmon spawning) does not show this pattern of outmigration from the reach between the Chulitna River confluence and Devil Canyon. The situation may exist at specific habitats such as the Deshka River but was not apparent for the primary study areas located between Goose Creek and Devil Canyon during the 1982 studies.

Emergence times for chinook salmon fry was not positively determined during the 1981 and 1982 surveys due to the lack of sampling at chinook salmon spawning sites. However, data collected from Portage Creek during 1981 showed that emergence had occurred prior to the sampling conducted in mid-April. Two age classes of fish are present in the

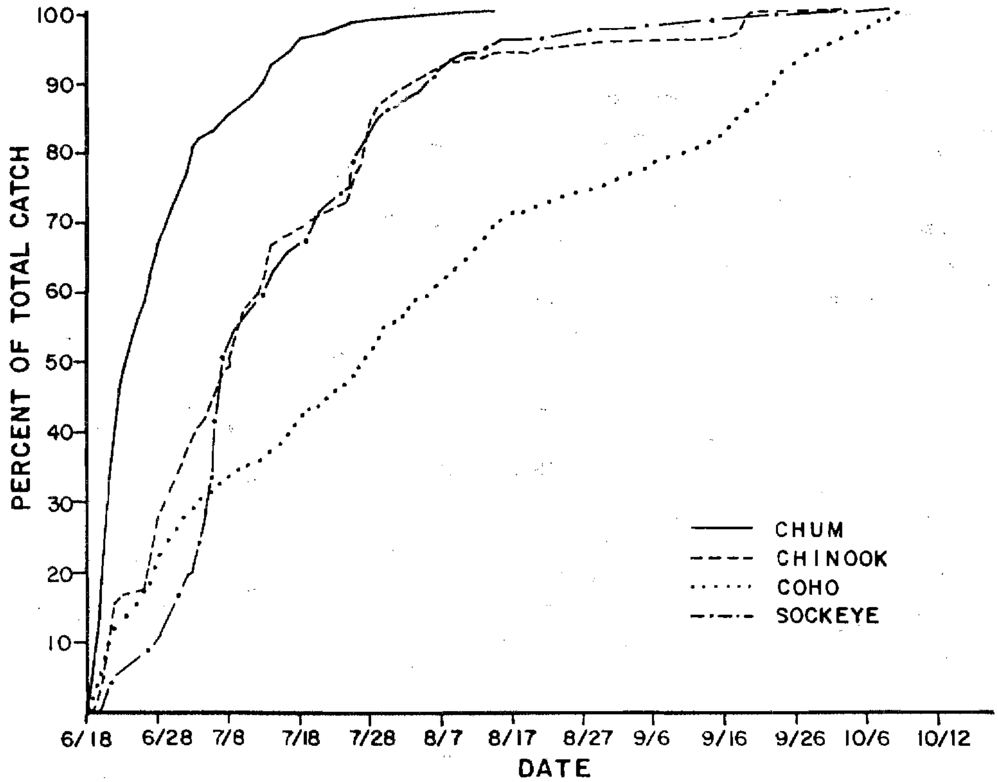


Figure 3-4-9. Adjusted cumulative catch data by species for juvenile chinook, coho, chum and sockeye salmon collected in the downstream migrant trap, June 18 through October 12, 1982.

Susitna River from the time of emergence through the period of outmigration of age 1+ fish. By early August, the majority of smolts have outmigrated from the Susitna River. The remaining young of year fish redistribute from high density areas of emergence to more optimum habitat to rear and overwinter. As indicated in Figure 3-4-9, this redistribution continues through the ice-free season.

Surveys conducted on the Susitna River during 1981 and 1982 show that juvenile chinook salmon vary in abundance and distribution by seasonal period. The migration of juvenile chinook salmon from the emergence sites to more favorable habitat conditions begin as the fish reach a size allowing mobility from their natal areas. Some age 0+ fish remain in the areas of emergence while others enter the mainstream river and associated tributaries and sloughs to spend the remainder of their freshwater period.

4.2.2 Coho Salmon

At least three age classes of coho salmon juveniles, ages 0+, 1+ and 2+ from brood years 1979 through 1981, were observed in the Susitna River during 1982. Comparisons of 1981 and 1982 fish distribution data indicate that the majority of coho salmon juveniles smolt as age 2+ fish, after spending two winters in fresh water (ADFG 1981b). The peak outmigration of coho salmon smolts occurs between May and early June between the Chulitna River confluence and Devil Canyon, and the peak extends through late June in the reach between Cook Inlet and the Chulitna River confluence. Large schools of coho salmon smolts were observed at the mouth of the Deshka River (RM 40.6) on June 1, 1981, and this schooling of smolts was observed on June 10 at Sunshine Creek (RM 85.7) during 1982.

Analysis of scales collected from returning adult coho salmon during 1982 at the Talkeetna fishwheel survey site indicates that 59.0 percent of the fish sampled had spent only one winter in freshwater and 41.0 percent had spent two winters in freshwater before undergoing smoltification (ADFG 1982a). About 12 percent of the adult coho salmon collected in 1981 at the Talkeetna fishwheel survey site had outmigrated after one year in freshwater, while 84.8 percent smolted as age 2+ fish (ADFG 1981a). A small percentage of coho salmon spend more than two winters in freshwater before outmigrating as smolts as indicated by the collection of one age 2+ fish in late September, and by the recovery of scales from returning adult fish having three or four freshwater annuli. These data indicate a variable age of outmigration for coho salmon juveniles from the Susitna River requiring future surveys to determine the primary age of outmigration for this species.

Age 1+ coho salmon juveniles were collected throughout the 1981 and 1982 field seasons and a seasonal increase in mean length was recorded. By the end of the sampling season, this age class had reached a mean length similar to that observed for outmigrating age 2+ fish collected during the spring.

Age 0+ fish were observed during June and were collected through the end of the open water survey periods in 1981 and 1982. In 1981, age 0+ coho salmon collected between the Chulitna River confluence and Devil Canyon had a mean length of 56 mm in late June. In 1982, a mean length of 41 mm was observed in late June for age 0+ fish in this reach. The difference of 15 mm in the mean lengths for age 0+ fish recorded in 1981 and 1982 was a result of two factors: (1) a point of separation between age 0+ and age 1+ fish during late June was determined to be 70 mm during 1981, while the point of separation between these age classes during 1982 was determined to be 65 mm; (2) the sampling techniques employed during 1982, including the downstream migrant trap and more intensive use of beach seines and backpack electroshocking, were more successful in the collection of smaller age 0+ fish.

Surveys conducted during 1981 and 1982 could not provide a time of emergence for coho salmon fry. The lower limits of the range of lengths for coho salmon age 0+ observed in June and July during 1982 indicated that the emergence time for this species extends over a wide period. The spring surveys during both years were not conducted at areas of documented coho salmon spawning.

Comparison of 1981 and 1982 data indicates that coho salmon predominantly smolt following one to two years of freshwater rearing, and the major outmigration from the Susitna River occurs from May through June, although some fish do not outmigrate until late summer. Age 0+ coho salmon undergo a downstream redistribution following emergence and this movement continues throughout the summer. Figure 3-4-9 presents the adjusted cumulative catch for juvenile coho salmon in the downstream migrant trap and shows that this downstream migration occurs steadily during the ice-free months. This movement is comprised of age 0+ and age 1+ fish which are presumably moving from high density areas of post-emergence to habitats more favorable for rearing and overwintering.

4.2.3 Chum Salmon

Surveys conducted on the Susitna River during 1981 collected juvenile chum salmon at only three of the designated fish habitat sites studied (ADFG 1981b). The low captures of this species was attributed to the reported short period of freshwater residence following emergence, and the use of inefficient collection techniques (primarily minnow traps).

Additional sampling techniques used in 1982 for the collection of juvenile salmon included beach seines, backpack electrofishing gear, and the downstream migrant trap. Large numbers of chum salmon fry were collected from Goose Creek (RM 73.1) upstream to Slough 21 (RM 142.0) from March to early September. The downstream migrant trap recorded 92.7 percent of the total trap catch of chum salmon fry from June 18 through July 15 (Figure 3-4-9).

Analysis of data collected during 1982 indicated that the major emergence of chum salmon fry occurs during late February and March with most fish completing yolk sac absorption during April at a length of approximately 35 mm. An increase in mean length occurs through June, during which time the peak outmigration was observed. Chum salmon fry are present above the Chulitna River confluence through early August.

The observed increase in mean lengths and in ranges of lengths demonstrates that chum salmon fry in the Susitna River grow between the period of yolk sac absorption and outmigration. A mean length of 35 mm during April compared to the largest chum salmon fry captured (a 62 mm fish in late July) shows a growth of up to 27 mm prior to outmigration. An extended period of freshwater rearing for chum salmon fry occurs following their emergence and prior to their outmigration. The low end of the ranges of length observed following the peak outmigration in June indicates that a broad range exists for the timing of emergence of chum salmon fry in the Susitna River.

4.2.4 Sockeye Salmon

Juvenile sockeye salmon were collected at only seven of the DFH sites surveyed in the Susitna River during 1982 (ADFG 1981b). A total of 35 fish were collected from March to early September from Alexander Creek (RM 10.1) upstream to Slough 11 (RM 135.3). The low recorded captures of juvenile sockeye salmon during the 1981 surveys was attributed to the ineffectiveness of the gear types utilized for the collection of this species. The incorporation of additional sampling techniques during 1982 including beach seines, electrofishing gear, and the downstream migrant trap resulted in a dramatic increase in the collection success for juvenile sockeye salmon.

Analysis of the combined data collected during the 1982 surveys showed a peak outmigration of age 1+ (1980 brood year) sockeye salmon from the reach of river above the Chulitna River confluence prior to late June.

Age 1+ fish accounted for a very small percentage of the sockeye salmon juveniles collected at this time.

Comparisons of 1981 and 1982 data indicate that the major emergence of sockeye salmon fry occurs during March with most fish completing yolk sac absorption by the end of April at a length of approximately 33 mm. A downstream redistribution of age 0+ fish from their natal streams and sloughs occurred throughout the season with the major movement observed during July. Over 85 percent of the adjusted cumulative catch for sockeye salmon juveniles in the downstream migrant trap occurred by the end of July (Figure 3-4-9).

The major portion of the age 0+ population of sockeye salmon undergo a downstream migration from areas of emergence, but at least a small percentage of fish overwinter in the Susitna River above the Chulitna River confluence, based on catch data at DFH sites.

Age 0+ fish migrating out of the reach above the Chulitna River confluence may continue to the ocean as age 0+ smolts, or they may migrate to more favorable overwintering habitat associated with the sloughs, tributaries, and lake systems located in the lower Susitna River. It appears that both situations may exist. Less than one percent of the returning adult sockeye salmon at the Curry fishwheel camp outmigrated as age 0+ fish while the remainder had spent one winter in freshwater before smolting (Volume II, Appendix). This indicates that although an outmigration to the ocean of age 0+ sockeye salmon may occur, the survival of these smolts to the returning adult stage is very low.

It has also been postulated that the sockeye salmon juveniles originating in the upper Susitna River may not survive to the adult stage, and thus fail to contribute to the freshwater life cycle of the species. Bernard et al. (1982), reported that returning adults collected at the Curry Fishwheel Camp (RM 120.0) were not separable by scale analysis from the stocks observed in the Chulitna and Talkeetna River drainages. Numerous hypotheses were formulated, but the probable situation was speculated to be that the sockeye salmon adults collected in the upper Susitna River are composed of strays from the much larger populations entering the Chulitna and Talkeetna Rivers. The fry migrate to the lower Susitna River to overwinter and smolt as age 1+ fish, or else do not survive.

The questions raised concerning the viability of Susitna River sockeye salmon stocks can be answered in part by conducting an intensive tagging program on sockeye salmon fry populations in the upper Susitna River and then collect returning tagged adult fish.

4.2.5 Pink Salmon

Small numbers of pink salmon fry were collected during the 1981 surveys of the Susitna River, and the low catches were attributed to the inability of the collection techniques utilized to successfully capture this species, in addition to the short freshwater residence times (ADFG 1981b). Even with the inclusion of additional sampling techniques in 1982, only small numbers of pink salmon fry were collected.

Two factors appear to have influenced the low catch rates of juvenile pink salmon during the 1982 surveys. Pink salmon fry remain in the river system for only a short period after emergence. It appears that the major outmigration occurred prior to the initiation of intensive sampling in June. Secondly, the fish were from the 1981 brood class. This was an "odd year" for adult returns and only an estimated 2,335 adult pink salmon went past the Talkeetna station (ADFG 1981a). Preliminary emergence studies indicate that pink salmon emerge as sac fry during March and some fish have a portion of the yolk sac present in May. All fry had outmigrated from the river above the Chulitna River confluence by late July.

The deployment of the downstream migrant traps immediately following spring break-up, the much larger observed escapement past Talkeetna of adult pink salmon during 1982 (13038 fish) (Volume II), and the more intensive surveys of spawning sites during the 1983 field season, should provide the data necessary to determine the early life history of this species in the Susitna River.

4.3 Food Habits and Distribution of Food Organisms

Dramatic changes in the invertebrate fauna often occur below hydroelectric projects (Ward and Stanford 1979). These changes may be associated with changes in the production potential of the downstream reaches for important fishery resources. The following discussion provides the initial information necessary to develop a data base capable of predicting the rearing potential of mainstem, side channel, and slough habitats under the post project flow.

A preliminary study of salmonid food habits in the Susitna River was conducted in 1978 by Riis and Friese (1978). They found that terrestrial insects appeared to make the greatest contribution volumetrically to the stomach contents of chinook, coho, and sockeye juveniles. In their study, chinook and coho were described as having similar food habits, while sockeye made greater use of crustacean zooplankton and diptera larvae. The food habits of the three species became more similar in the fall (September), when the sockeye switched to eating more adult insects.

Burger et al. (1982), in a study of chinook and coho juveniles in the Kenai River, found that both coho and chinook juveniles relied heavily on chironomids. Thirty-seven percent of the items in chinook stomachs and 51% in coho stomachs were chironimds. Homopterans were also important for chinook (15.0%), and eight percent of the items in coho stomachs were copepods.

Juvenile salmon food habits have also been examined in several earlier studies. Becker (1973) found Chironomidae adults and larvae made up 58 and 18 percent numerically of the diet of juvenile chinook in the Hanford area of the central Columbia River, Washington. His results were supported by Dauble et al. (1980) who also studied chinook in the Hanford reach of the Columbia, and found that chironomid pupae and larvae were the most important food item of fish under 66 mm in length.

Loftus and Lenon (1977) obtained similar results in their study of chinook salmon in the Salcha River southeast of Fairbanks, Alaska. These findings generally agree with the results of the present study in the Susitna River sloughs and tributaries where chironomids are numerically the most abundant prey taxa of the chinook salmon fry examined.

Loftus and Lenon concluded that chinook relied mainly on immature insects drifting in the water column, rather than adults and terrestrials drifting on the surface. In our results, and in those of Riis and Friese (1978), however, chironomid adults and terrestrial invertebrates caught on the water surface were often an important food item for the chinook salmon juveniles (Figures 3-3-21 to 3-3-25).

Several studies have also been done on the diet of coho juveniles. Johnson and Johnson (1981), in their study of coho at Orwell Brook, N.Y., found that coho fed mainly on terrestrial invertebrates during the day, and switched to aquatic forms (including adult chironomids) at night. They fed most heavily in late evening; overall, aquatic invertebrates were most important in the diet. Chironomids, as immatures and adults were the major aquatic taxa consumed (25% by dry weight). Johnson and Ringler (1980), in an earlier study of coho in Orwell Brook found that usually the coho fed most heavily on terrestrial invertebrates (mainly Hymenoptera, Homoptera, and Coleoptera), which made up 72% of their diet by dry weight. Their study had been conducted entirely during daylight hours, and so did not reflect the diet changes in coho food habits enumerated later. Our studies also were carried out only during daylight hours, and so may underestimate the importance of benthic invertebrates in the coho diet.

Mundie (1969) studied coho salmon juveniles in creeks and rivers on Vancouver Island. He found that the most frequent items appearing in the diet were Chironomidae larvae, but that larvae of Hydropsychid caddis flies (Trichoptera: Hydropsychidae), and nymphs of Baetis (Ephemeroptera: Baetidae), and Ephemerella (Ephemeroptera: Ephemerellidae) were most important in terms of biomass.

The food habits of coho in the Susitna River were similar to those described in the previous studies. The coho relied mainly on Chironomidae larvae, pupae, and adults (Figures 3-3-26 to 3-3-29). Terrestrial invertebrates, however, did not play as large a role here as Johnson and Ringler had found to be the case in New York. Johnson and Ringler's conclusions are based on dry weight measurements which were not taken in the Susitna. Terrestrials may have been more important by weight than they were numerically in the Susitna studies. The major components of the terrestrial diet, however, were usually small aphids (Homoptera: Aphididae), small adult Dipterans (Phoridae, Simuliidae, and Scaridae, for instance), and small (less than 5 mm) Hymenopterans, which probably do not contribute much in terms of dry weight.

Most sockeye food habits studies have been conducted on lake populations. Rogers (1968), however, did study sockeye juveniles in some streams connected to the Wood River lakes of Alaska. He found that generally Chironomidae larvae, pupae, and adults were the most important food items, though in one collection Plecoptera and Ephemeroptera nymphs predominated. Chapman and Qusitorff (1938) also studied sockeye in streams and found that insects were most important. Sockeye in lakes usually rely on zooplankton (Chapman and Qusitorff 1938, Rogers 1968).

In our studies, sockeye were only found at Slough 8A and Slough 11. Chironomidae usually were their major food type (Figure 3-3-30 and 3-3-31). On some dates, however, zooplankton became important. Since our results are in terms of numbers, the importance of the zooplankton may be artificially high. Zooplankton are very small and their volumetric contribution is not great. In August, however, the sockeye in Slough 11 were feeding heavily on copepods and cladocerans, and these zooplankton appeared to make a major contribution volumetrically. The fact that this is the only time copepods or cladocerans made a noticeable contribution to the diet suggests that the sockeye at that time were taking advantage of a transient bloom.

Although statistically significant differences did often occur between species, obvious similarities do exist in their diets. All species relied heavily on chironomids, all consumed terrestrials to some extent, and all occasionally consumed many other aquatic invertebrate taxa. Sockeye were the only fish to use zooplankton in large numbers.

Because of different distribution patterns of the species, significant differences may reflect food item availability at various microhabitats, rather than selectivity differences of these species. There was also a great deal of variation in food habits even within each species, presumably the result of individual preferences and variation in the location of individual fish. One coho at Indian River, for example, consumed Collembolans almost exclusively, probably because it happened to be in a spot where several Collembolans were gathered on the water surface.

Electivity values for all salmon species were usually positive for chironomid larvae, and negative for chironomid adults. These electivity values compare stomach contents only to the drift samples. Drift samples collect a higher percent of surface organisms than benthic samples do (Slack et al., 1976), and so were expected to be more comparable to the diets of fish which feed on invertebrates drifting in and on the surface of the water. However, Mundie (1969) compared the diet of coho salmon to drift samples taken where the coho were caught, and did not find any close similarity between the coho diet and the drift. Such discrepancies between invertebrate populations in the drift samples and in the stomachs may actually be due to several factors other than food preferences of the fish. The drift net is not as effective in collecting Chironomidae larvae and other benthic invertebrates as the kick screen is (Figure 3-3-32 to 3-3-40). It was not always possible to locate the drift net in areas closely adjacent to where fish were caught, so it is possible that the population observed in the drift sample is not the same as what the fish were exposed to. The positive selection shown for Chironomidae larvae may actually be due to preferences of fish, or it may appear only because the drift net underestimated the number of larvae available to the fish.

Chi-square tests (Table 3-3-41) demonstrated that the invertebrate populations at all sites were significantly different. This variability is probably the result of major hydraulic and physical differences between the sites.

Slough 8A is dominated by beaver dams, and the pools formed by them. Most fish in Slough 11 were found in a shallow area containing boulders and smaller cobble covered by filamentous algae. Waterfall Creek, a small clear tributary, flows into Slough 20. Most of the fish from Slough 21 were captured in shallow riffle areas.

The collections at Fourth of July Creek were usually in fast, shallow riffles near the bank. At Indian River, the collections usually were also in shallow riffles, but not as close to the banks.

There is also much habitat variability within each site, causing any comparisons between sites to be confounded. Some patterns, however, can be recognized. Slough 11, where the riffles seemed more sluggish, produced no mayflies (Ephemeroptera) (Appendix Tables 3-C-24 and 3-C-25). The invertebrate samples from Slough 11 usually produced mostly chironomids (Figure 3-3-33), though in early September, a large number of capniid stoneflies (Plecoptera: Capniidae) were found there. Capniids have been reported to prefer relatively still water (Minshall and Minshall 1977).

Samples from the tributary sites contained the most taxa of mayflies, and also produced more taxa of Trichoptera (caddis flies) than the sloughs (Appendix Tables 3-C-24 and 3-C-25). The general distribution of invertebrate taxa across major habitat types and the food habits of several of the important salmonid species have been identified. Important factors in providing quality rearing habitat for salmon juveniles are access from original spawning areas, cover, temperature, and presence of food resources. In the sloughs of the Susitna River, terrestrial invertebrates are important food items, suggesting that stream bank vegetation and "edge" may be important in providing a source for these food items.

For coho and chinook salmon, the range and diversity of invertebrates in their diet suggests an ability to adapt to variable conditions. Other factors, such as cover and velocity, may be more important in limiting their distribution and abundance. The numbers of invertebrates available, however, probably influence the density and perhaps the growth rates of the juvenile fish in these habitat areas.

Sockeye juveniles feed on a broad range of invertebrates, but the presence of zooplankton in their stomach contents suggests preferences different from the coho and chinook collected. The limited presence of zooplankton in the sloughs may partially explain the low numbers of sockeye found in the system. Sockeye, in their freshwater rearing cycle, are most often associated with lakes where zooplankton are abundant.

Chum salmon, which have limited rearing in freshwater, were not examined during this study, but will be included during the 1983 spring investigations. This species is much more abundant in, and apparently very dependent upon the slough areas for rearing. As freshwater rearing has been established to affect their survival (Houston 1961), information concerning the dependency of this species on the slough invertebrate fauna will be valuable.

Important questions not addressed in this study, but which will be included in the upcoming summer's work are the following:

1. How do the invertebrate communities respond to environmental variables such as turbidity, scouring frequency, and temperature?

2. What are the habitat variables that create "quality" invertebrate communities and associated salmonid rearing habitat?

Providing answers to these questions should allow one to predict the quality of mainstem and side channel environments under post project conditions for rearing juvenile salmon.

5.0 CONTRIBUTORS

RESIDENT AND JUVENILE ANADROMOUS PROJECT LEADER	Dana Schmidt
SUB-PROJECTS	
Electrofishing and Radio Telemetry Study	Rich Sundet (Sub-project Leader) Paul Suchanek Mark Wenger Drew Crawford
Fish Distribution Studies	Larry Dugan (Sub-project Leader) Stephen Hale Karl Kuntz Bob Marshall Dave Sterrit
Food Habits Study	Jim Mauney (Sub-project Leader) Sandra Sonnichsen Jim Quinn
Incubation, Emergence, and Outmigrant Studies	Kent Roth (Sub-project Leader) Dan Gray
EDITORS	Dana Schmidt Stephen Hale Drew Crawford Paul Suchanek
DATA PROCESSING	Allen Bingham (Biometrician) Kathy Rowell Gail Heinemann Donna Buchholz Carol Kerkvliet Katrine Zosel
DRAFTING	Sally Donovan

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