

6.0 ENVIRONMENTAL STUDIES - SUMMARY

Environmental studies were conducted within the Chakachatna and McArthur River drainages during both 1981 and 1982. The 1981 studies included investigations of the hydrology, aquatic and terrestrial biology and human resources of the area. These studies were limited in scope due to the short-time frame which was available for conducting field investigations. Studies conducted in 1982 emphasized aquatic biological investigations (seasonal sampling), but also included supplemental hydrological studies. The following section presents summary information for each of the 1981-1982 studies. The complete detailed reports for the environmental studies are presented in the APPENDIX to Section 6.0 in Volume II of this report.

6.1 Environmental Studies - 1981

In 1981, two environmental reconnaissance level surveys were conducted in the project area. The first was conducted in August to document the presence of sockeye salmon (Oncorhynchus nerka) in the project waters, and to survey the site in preparation for the fall field reconnaissance. The second investigation, conducted in mid-September, involved two weeks of field data collection. Coincident with these studies were ongoing reviews of the literature and discussions with key agency and native corporation personnel.

6.1.1 Environmental Hydrology

Hydrology field studies were conducted for Chakachamna Lake, several of its tributary streams, and the

Chakachatna and McArthur Rivers. The hydrologic field data collected included measurements of discharge taken at eight study locations, a water level survey of Chakachatna Lake, a wetland/river level survey taken in a channel of the Noaukta Slough, and a characterization of channel pattern and configuration including the composition of bed and bank materials.

Office evaluations were also conducted to synthesize hydrologic data at eight study locations. Data that were developed included mean monthly flows, mean annual flows, flood flow frequency, and low flow frequency. In addition, using the Montana Method, preliminary instream flow recommendations for maintaining fisheries habitat were calculated on a monthly basis for the outlet of Chakachamna Lake.

The field data collected from the various streams were typical of glacial rivers, with low flows in late winter, large glacier melt flows in July and August, and annual peaks due to fall rains. The reaches of the McArthur and Chakachatna Rivers vary from mountainous through braided and meandering streams. All except the most infrequent large floods are contained within the unvegetated flood plain. Sedimentation characteristics in the streams appear to be typical of glacial systems with very fine suspended sediments and substantial bed load transport. The water level of Chakachamna Lake (measured in September) was 1,142 feet which was typical for the lake in September based on 12 years of past records.

6.1.2

Aquatic Biology

Two reconnaissance level surveys were conducted in Chakachamna Lake, and in the Chakachatna, Chilligan and McArthur Rivers and tributaries. The first reconnaissance occurred during 17-18 August and consisted of aerial observations of the project area.

The second reconnaissance, conducted 15-28 September, involved the collection of data from areas identified during the initial survey. This effort employed both field sampling and visual observations. The major objectives of this reconnaissance were to identify the fish species and life stages during the fall, to identify potential critical fisheries habitats in the system, and to provide information on the species composition of fish and their habitat use occurring at different times of the year.

A total of 14 species of fish were collected from the waters of the project area including all five species of Pacific salmon found in Alaska (Table 6.1). Some of the streams flowing into Chakachamna Lake contained large areas used by sockeye salmon for spawning. Substantial numbers of sockeye were found in the Igitna and Chilligan Rivers, and there was some evidence of potential sockeye spawning in Chakachamna Lake. Juvenile sockeye salmon used Chakachamna and Kenibuna Lakes as nursery habitat. Lake trout (Salvelinus namaycush), Dolly Varden (Salvelinus malma), round whitefish (Prosopium cylindraceum) and slimy sculpin (Cottus cognatus) were also found in Chakachamna Lake.

Side channels and tributaries of the Chakachatna and McArthur Rivers contained salmonid spawning sites and

Table 6.1 Species list and drainage of occurrence August-September 1981.

Species	Drainage of Occurrence	
	Chakachatna River ¹	McArthur River
pygmy whitefish	+	+
round whitefish	+	+
Dolly Varden	+	+
lake trout	+	+
rainbow trout	+	+
pink salmon	+	+
chum salmon	+	+
coho salmon	+	+
sockeye salmon	+	+
chinook salmon	+	+
arctic grayling	+	+
slimy sculpin	+	+
threespine stickleback	+	+
ninespine stickleback	+	+
<u>Prosopium coulteri</u>	+	+
<u>Prosopium cylindraceum</u>	+	+
<u>Salvelinus malma</u>	+	+
<u>Salvelinus namaycush</u>	+	+
<u>Salmo gairdneri</u>	+	+
<u>Oncorhynchus gorbuscha</u>	+	+
<u>Oncorhynchus keta</u>	+	+
<u>Oncorhynchus kisutch</u>	+	+
<u>Oncorhynchus nerka</u>	+	+
<u>Oncorhynchus tshawytscha</u>	+	+
<u>Thymallus arcticus</u>	+	+
<u>Cottus cognatus</u>	+	+
<u>Gasterosteus aculeatus</u>	+	+
<u>Pungitius pungitius</u>	+	+

¹ Includes Lake Chakachamna and Middle River

numerous fish were observed using them. These habitats were also used as juvenile rearing areas. The Noaukta Slough, a heavily braided reach of the Chakachatna River, was used extensively as a nursery area by juvenile fishes, particularly coho (Oncorhynchus kisutch) and sockeye salmon. Juvenile pygmy whitefish (Prosopium coulteri) and Dolly Varden were also abundant in the slough. The intertidal ranges of both river systems do not contain suitable habitat for salmonid spawning or juvenile rearing.

Lake trout appeared to occur only in Chakachamna Lake, while Dolly Varden were ubiquitous throughout both the Chakachatna River and McArthur drainages. Rainbow trout (Salmo gairdneri) were collected only in the lower portions of the drainages. Round and pygmy whitefish were found in most areas of the drainages, although pygmy whitefish were not found in Chakachamna Lake or drainages above it. Slimy sculpin were found throughout both systems and in tributary streams. Sticklebacks, however, were only found in backwater areas and among vegetation, usually in the lower reaches of the rivers. Only a single grayling (Thymallus arcticus) was observed in a side channel in the upper Nagishlamina River, and none were collected or observed at any other location. It was clear that most of the species found inhabit both drainages.

In general, the fish in this area may be classified into two primary groups, forage fish, and commercial and sport fish. Forage fish in the project area include threespine stickleback (Gasterosteus aculeatus), ninespine stickleback (Pungitius pungitius), slimy sculpin, pygmy whitefish, and round whitefish.

Although the round whitefish is probably not used as a subsistence species in these drainages, it is eaten by lake trout and other species of fish. Sport and commercial fishes include pink (Oncorhynchus gorbuscha), chum (Oncorhynchus keta), sockeye, coho and chinook salmon (Oncorhynchus tshawytscha), and Dolly Varden, lake trout, rainbow trout, and grayling.

6.1.3

Terrestrial Vegetation and Wildlife

The objective of the terrestrial component for the environmental study was to characterize the vegetative and wildlife communities within the project area.

Because this project would affect the lands and waters of both the Chakachatna and McArthur drainage systems, qualitative data were collected throughout the study area and vegetation and wildlife habitat maps were prepared so that areas of a sensitive or critical nature could be identified.

Previous investigations conducted in the general area by the Alaskan Department of Fish and Game (ADF&G) and the U.S. Fish and Wildlife Service (USFWS) have concentrated on documenting waterfowl utilization of the coastal marshes of Cook Inlet. In addition to annual aerial surveys of the Trading Bay State Game Refuge performed by the personnel of ADF&G, personnel of USFWS have conducted aerial swan surveys encompassing the lands in and adjacent to the refuge. Although the main purpose of these surveys has been to census waterfowl, information has also been gathered on bald eagle nest sites, moose calving grounds, and the occurrence of Beluga whales near the McArthur River.

Table 6.2 The species composition and relative abundance of mammals identified within the study area for each of the habitat types. (1=Abundant 3=Common 5=Occasional)

Species	Habitat ^a							
	UAT	HAR	BCR	CMR	BST	RBB	WTR	BSR
grizzly bear	3	1	3	3	5	5	3	3
black bear	1	1	3	3	5	3	3	3
gray wolf	5	3	5	5	5		5	
coyote	3	3	3	1	3	3	3	3
moose	5	1	1	3	3	3	3	3
barren ground caribou		5						
wolverine	5	5	5				5	5
mink	5	5	3				5	3
river otter			5				5	5
beaver			3				5	5
muskrat			3				3	3
red squirrel		5	3				3	3
tundra redback vole	5	5	5		5			5
tundra vole	1	3	3		3	3		3
porcupine		3	3					
dusky shrew ^b		3	3		5			
harbor seal ^b	3	3	3					
beluga whale ^b								5
								5

^a Upland Alder Thicket (UAT);
 High Altitude Riparian (HAR);
 Black Cottonwood Riparian (BCR);
 Coastal Marsh Riparian (CMR);
 Black Spruce Transitional (BST);
 Resin Birch Bog (RBB);
 Willow Thicket Riparian (STR); and
 Black Spruce Riparian (BSR).

^b sighted offshore near the mouth of the McArthur River.

During the 1981 studies, eight types of vegetation habitats were delineated based on their structural and species composition. These ranged from dense alder thickets in the canyons to vast areas of coastal marsh. The riparian communities were the most prevalent, varying from rivers with emergent vegetation to those with broad floodplains scattered with lichen, willow and alder.

Evaluation of wildlife communities in the project area identified sixteen species of mammals (Table 6.2). Moose, coyote, grizzly bear and black bear occur throughout the area. Birds also were abundant, fifty-six species having been identified, with the coastal marshes along Trading Bay containing the largest diversity.

None of the species of plants, mammals and birds that were found are listed as threatened or endangered, although in May 1981 it was proposed that the tule white-fronted goose, which nests immediately south of the study area, be considered for threatened or endangered status.

6.1.4

Human Resources

These studies were organized into the following six elements:

- Archaeological and historical resources
- Land ownership and use
- Recreational resources
- Socioeconomic characteristics
- Transportation
- Visual resources

Contacts with both state and federal agencies and Native organizations, and a limited reconnaissance of the project area were made during the 1981 studies. No known cultural sites were identified and the field reconnaissance indicated that the proposed sites for the power intake and powerhouses have a low potential for cultural sites.

Land owners in the area comprise federal, state, and borough agencies, Native Corporations and private parties. Land use is related to resource extraction (timber, oil and gas), subsistence, and the rural residential Village of Tyonek. Recreational activity occurs but little data is available to the extent or frequency with which the area is used.

Regional data on population, employment and income characteristics are relatively good. However, employment level and occupational skill data are limited and need to be developed together with information on local employment preferences.

Transportation facilities in the area are few and small in size. There is an airstrip on the shoreline at Trading Bay and a woodchip loading pier near Tyonek. Several miles of logging roads exist between Tyonek and the mouth of the Chakachatna Valley. The Chakachatna River is bridged near its confluence with Straight Creek. There is no permanent road between the project area and any part of the Alaska road system.

Because of the project area's scenic characteristics and its proximity with BLM lands, the Lake Clark National

Park and the Trading Bay State Game Refuge, visual resource management is a significant concern.

6.2 Environmental Studies - 1982

The 1982 environmental studies included both hydrological and aquatic biological investigations with primary emphasis on the latter. The hydrologic studies were conducted during the fall of 1982 (August and October); aquatic biological studies were conducted seasonally, with the major sampling effort occurring during the summer and fall periods.

6.2.1 Environmental Hydrology

The objective of the 1982 environmental hydrology studies was to collect baseline data to assist in future evaluations of the physical process of the Chakachatna and McArthur River systems, and facilitate the correlation of these processes with fish and wildlife habitats.

During August, two recording gages capable of recording river stage and water temperature were installed, one on the Chakachatna River near the lake outlet, the other on the McArthur River downstream of the powerhouse location. Staff gages were installed at an additional 15 sites and were periodically monitored. In October, discharge measurements and water surface profiles were made at 12 gage stations, and a generalized sediment characterization made for the various stream reaches. Manning's equation was used in the hydraulic analyses to establish preliminary rating curves.

Overall, the discharges at gauge site No. 6 in the lower Chakachatna River, downstream of the fork which discharges into the Noaukta slough but above the split with the Middle River, correlated reasonably well with the discharges at the Chakachatna River recording gage at the lake outlet. The flows averaged about 17 percent of the flow at the lake outlet. The average discharge at the lake outlet during the study period was significantly less than the average for the 13 years of U.S.G.S. records, with August flows well below average. A September rainstorm resulted in a short duration flood flow in the upper McArthur River with a peak flow of about 4500 cfs. This discharge is estimated to have a recurrence interval of about 25 years.

Mean daily water temperatures in the Chakachatna River at the lake outlet ranged from 8°C in August to 6°C in October. Water temperatures in the McArthur River at the rapids exhibited large diurnal variations in August; temperatures varied from 3.0°C to 9.5°C in a six-hour period. Temperatures in the McArthur River from mid-August to mid-September averaged 1.6°C less at the powerhouse than at the recording gage.

The Chakachatna and McArthur River systems are glacial and thus carry fine glacial silts through much of the open water season. The main channel substrate of these river systems appears to be quite unstable.

6.2.2 Aquatic Biology

The 1982 aquatic biology studies concentrated on the fishery resources of the study area. Two series of programs were conducted, one during the winter and

spring, the other during the summer and fall. The winter-spring studies were designed to extend the data base on seasonal habitat use and distribution of fish, to identify the time spring spawning migration begins, and to examine for the presence of outmigrants. The summer-fall studies were directed at investigating both the adult anadromous fish, and the resident and juvenile anadromous fish in the study areas. A separate program for sampling the fisheries in Chakachamna Lake was also conducted during the summer-fall studies.

A variety of methodologies were utilized to sample and count fish in the study area during the 1982 program. Selected sampling techniques included the use of fyke nets, minnow traps, seines, hook and line, electrofishing, and gill netting. Hydroacoustic sampling was used to examine the relative distribution of fish in Chakachamna Lake.

A total of 18 fish species were identified and/or collected during the 1982 studies, including four species not collected in 1981: Bering cisco (Coregonus laurettae), longfin smelt (Spirinchus thaleichthys), rainbow smelt (Osmerus mordax and eulachon (Thaleichthys pacificus). The species of commercial, subsistence and sport interest utilizing the Chakachamna and McArthur River systems included sockeye, chinook, pink, chum and coho salmon, Dolly Varden and rainbow trout. Summary information for these seven species is presented below. Detailed analyses of the 1982 studies are presented in the APPENDIX to Section 6.0 in Volume 2 of this report.

6.2.2.1 Sockeye Salmon

Sockeye salmon adults probably enter the Chakachatna and the McArthur Rivers in early July. Sockeye first appeared on the spawning streams on July 22, 1982. Spawning continued through the first week of October in various parts of the system and few spawning sockeye were present past early October.

The timing and duration of sockeye-runs varied with location. Runs in the McArthur River tributaries peaked earlier than most of those on the Chakachatna River. Spawning adults were present in the Chilligan River and sloughs at station 17 longer than at other sites.

Sockeye escapements were estimated for all identified spawning areas and are presented in Table 6.3. The largest estimated escapement was for the Chilligan River: 38,576 sockeye. A total of 41,357 sockeye (total of the Igitna and Chilligan River escapements) were estimated to spawn above Lake Chakachamna. Of the other sockeye estimated to spawn in the Chakachatna drainage, 1788 spawned in sloughs or side channel spawning areas receiving slough flow. In the McArthur drainage, of the 34,933 fish, 98.1 percent of the estimated sockeye escapement occurred in tributary streams. Overall, 44.7 percent of the total estimated escapement of sockeye occurred in the McArthur drainage.

Sockeye which are spawned in the Chilligan and Igitna Rivers, rear in Chakachamna and Kenibuna Lakes. The Chakachatna River across from Straight Creek, the Noaukta Slough, and portions of the lower McArthur River also appear to be used as rearing areas. Juvenile

Table 6.3 Summary of estimated salmon escapement by waterbody and drainage for 1982.

Species	CHAKACHATNA RIVER DRAINAGE							Drainage Total	
	Straight Creek Mouth	Chakachatna Bridge Side Channels and Sloughs	Chakachatna Canyon Sloughs	Chakachatna Tributary (CI)	Igitna River	Chilligan River	Straight Creek		Straight Creek Tributary
Sockeye Salmon	203	1,193	392	238	2,781	38,576	0	254	43,637
Chinook Salmon	0	0	0	0	0	0	0	1,422	1,422
Pink Salmon	0	59	279	0	0	0	0	7,925	8,263
Chum Salmon	152	1,482	121	165	0	0	0	0	1,920
Coho Salmon	76	1,560	608	183	0	0	0	172	2,599

Species	MCARTHUR RIVER DRAINAGE							Drainage Total	
	McArthur Canyon	Stream 13X	Stream 13U	12.1	12.2	12.3	12.4		12.5
Sockeye Salmon	666	5,416	1,213	16,711	6,085	2,512	2,328	0	34,933
Chinook Salmon	0	452	1,633	0	22	0	0	0	2,107
Pink Salmon	60	4,225	5,402	8,499	1,566	4	18	3	19,777
Chum Salmon	1	0	23	4	0	0	1	0	29
Coho Salmon	1,182	1,378	32	2,000	46	89	0	0	4,729

Note: Figure 6.30 shows locations in Chakachatna River drainage. Figures 6.47 and 6.48 show locations in McArthur River drainage.

sockeye appear to rear in the system from as short a time as their first summer to as long as their third year (age II+) prior to migrating to the sea.

6.2.2.2 Chinook Salmon

Based upon 1982 observations, chinook salmon adults were entering the river systems prior to late June. Chinook spawning was first observed in the study area on July 17 at Stream 13U in the McArthur system, but spawning could have started as early as the end of June. Spawning adults were observed as late as August 25.

The largest estimated escapement for chinook salmon occurred in Stream 13U in the McArthur drainage (1633 fish) and the second largest in the clearwater tributary to Straight Creek (1422 fish) (Table 6.3). All chinook spawning observed during 1982 occurred in tributary streams. The majority of spawning occurred within the McArthur drainage.

Chinook salmon juveniles rear in fresh water from as short as three months to well into their third year of life. Juvenile chinook salmon collected in the study area ranged in age from 0+ to II+. Chinook salmon juvenile rearing areas consisted of spawning streams (Streams 13U and 19), low velocity side channel and slough areas (stations 17, 15 and 13) and many areas within the Noaukta Slough. Chinook outmigration may start as early as June and appears to continue into the fall.

Fish collected are listed by method and sampling location. Locations of the sampling stations are as follows:

Station Number	Location	Map Coordinate
1	Confluence of Chakachatna River with McArthur River	R. 14 W., T. 10 N.
1D	McArthur River	R. 14 W., T. 10 N.
2	Lower Chakachatna River	R. 14 W., T. 11 N.
3	Lower Chakachatna River	R. 14 W., T. 11 N.
4	Upper Middle River	R. 14 W., T. 11 N.
5	Lower Middle River	R. 13 W., T. 11 N.
6	Chakachatna River above Middle River	R. 14 W., T. 11 N.
6A	Chakachatna River above Middle River	R. 14 W., T. 11 N.
8	Upper Nouakta Slough	R. 14 W., T. 11 N.
9	Lower Nouakta Slough	R. 14 W., T. 11 N.
10	West Nouakta Slough	R. 15 W., T. 11 N.
11	Lower McArthur River	R. 14 W., T. 10 N.
12	McArthur River above Noauakta Slough	R. 15 W., T. 11 N.
13	Upper McArthur River	R. 16 W., T. 11 N.
14	Lower McArthur Canyon	R. 16 W., T. 12 N.
15	McArthur Canyon	R. 17 W., T. 12 N.
16	Upper Noauakta Slough	R. 14 W., T. 12 N.
16A	Upper Noauakta Slough	R. 14 W., T. 11 N.
17	Chakachatna River at DNR Bridge	R. 14 W., T. 12 N.
17D	Chakachatna River Below 17	R. 14 W., T. 12 N.
18	Straight Creek	R. 15 W., T. 12 N.
19	Clearwater tributary to Straight Creek	R. 14 W., T. 12 N.
19A	Clearwater tributary to Straight Creek	R. 14 W., T. 12 N.
20	Chakachatna River across from Straight Creek	R. 15 W., T. 12 N.
21	Chakachatna River across from Straight Creek	R. 15 W., T. 12 N.
22	Chakachatna River at base of canyon	R. 15 W., T. 13 N.
23	Chakachatna River in canyon	R. 15 W., T. 13 N.
24	Chakachatna River in canyon	R. 16 W., T. 13 N.
25	Chakachamna Lake	R. 17 W., T. 13 N.
26	Nagishlamina River delta	R. 18 W., T. 13 N.
27	Chakachamna Lake N. Side	R. 18 W., T. 13 N.
28	Chakachamna Lake S. Side	R. 18 W., T. 13 N.
29	Kenibuna Lake outlet	R. 20 W., T. 13 N.
30	Chilligan River	R. 20 W., T. 13 N.
31	Neacola River	R. 21 W., T. 12 N.
32	Igitna River	R. 21 W., T. 12 N.
33	Another River	R. 21 W., T. 13 N.
Streams	12.1 through 12.4, 13X	R. 15 W., T. 11 N.
Streams	12.1 through 12.4	R. 15 W., T. 12 N.
Stream	12.5	R. 14 W., T. 11 N.
Stream	13U	R. 15 W., T. 11 N.
Stream	13U	R. 16 W., T. 11 N.

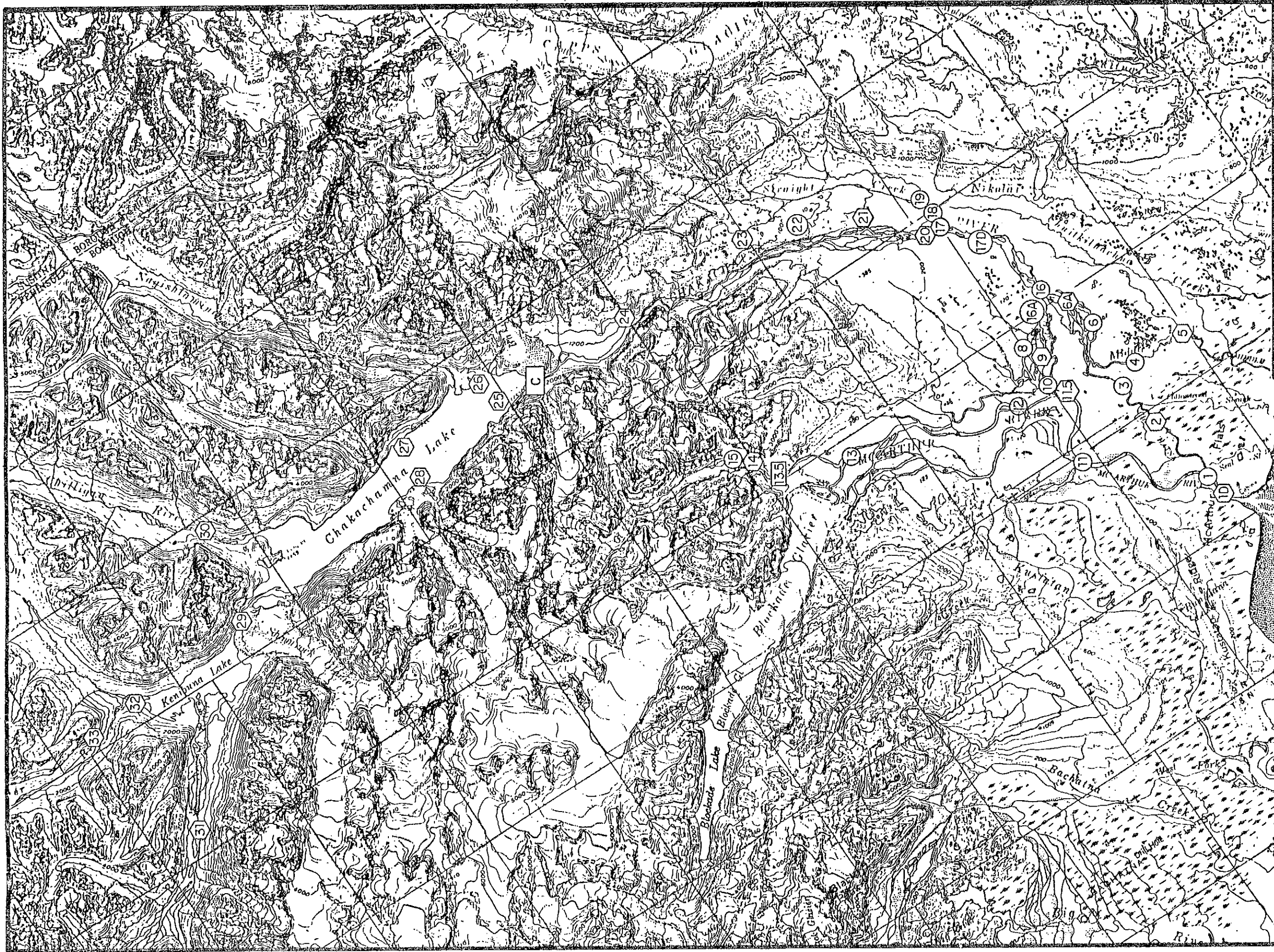
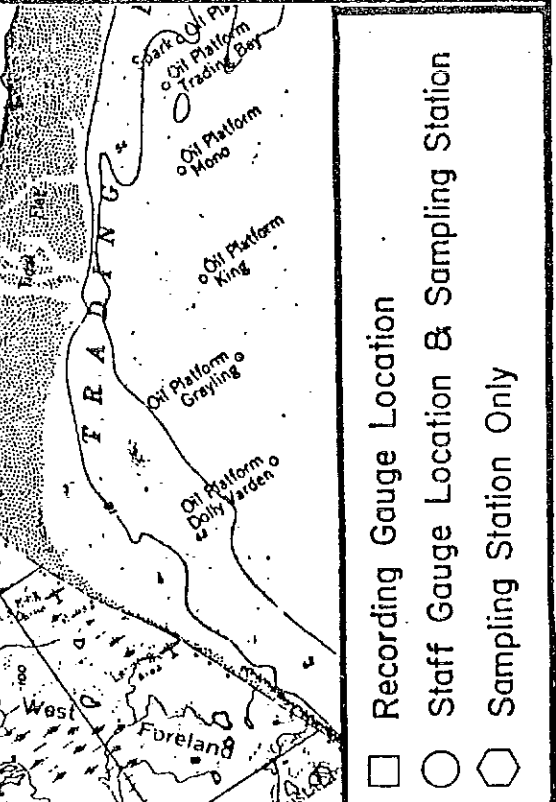
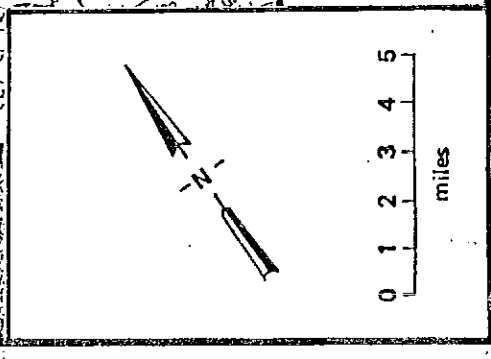


FIGURE 6.30

LOCATION AND IDENTIFICATION OF 1962 SAMPLING STATIONS



- Recording Gauge Location
- Staff Gauge Location & Sampling Station
- ◇ Sampling Station Only



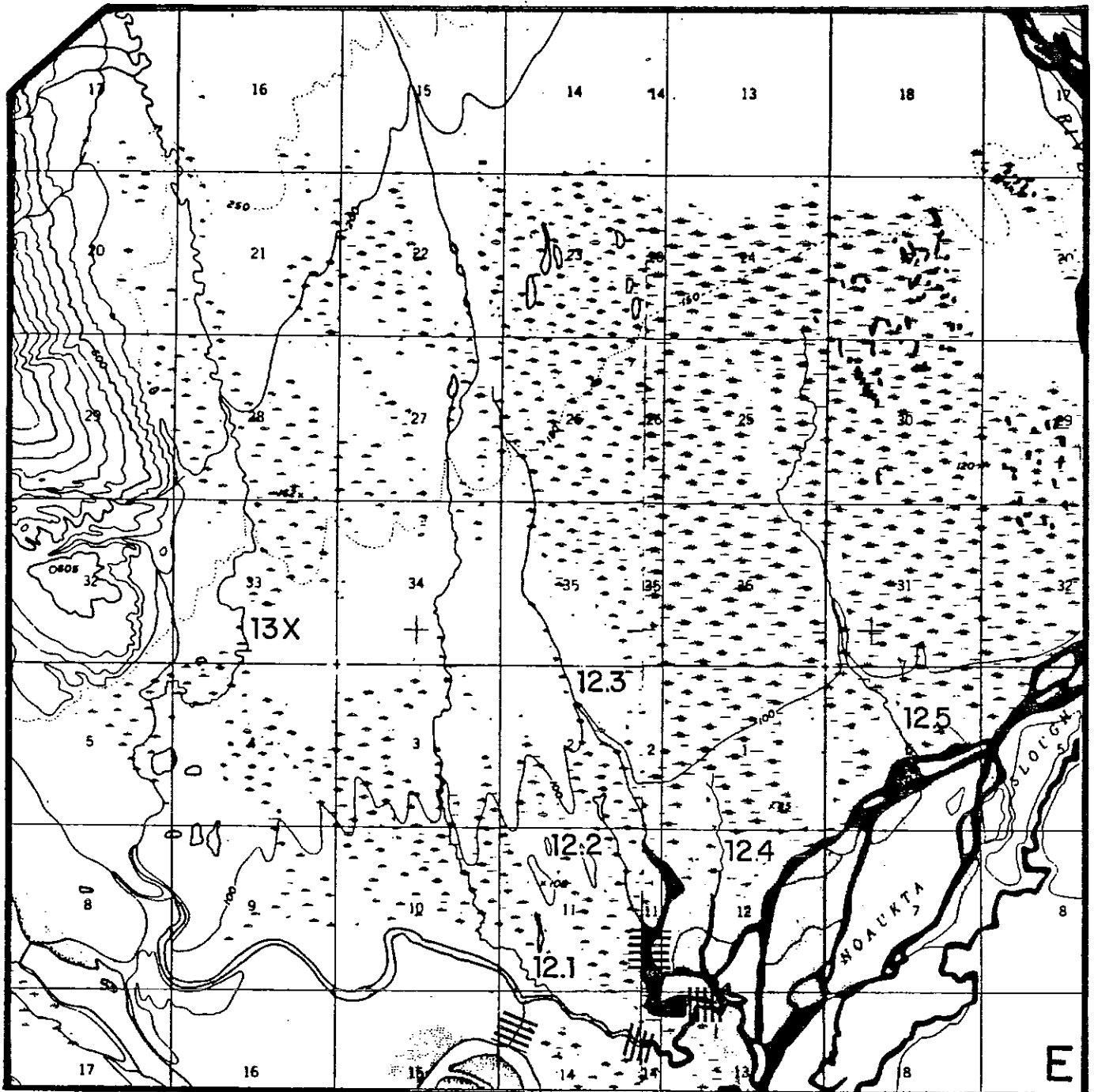
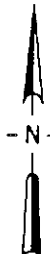
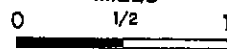


Figure 6.47

 Milling Areas

MILES



Sockeye Milling Areas
Streams 13X, 12.1,
12.2, 12.3
1982

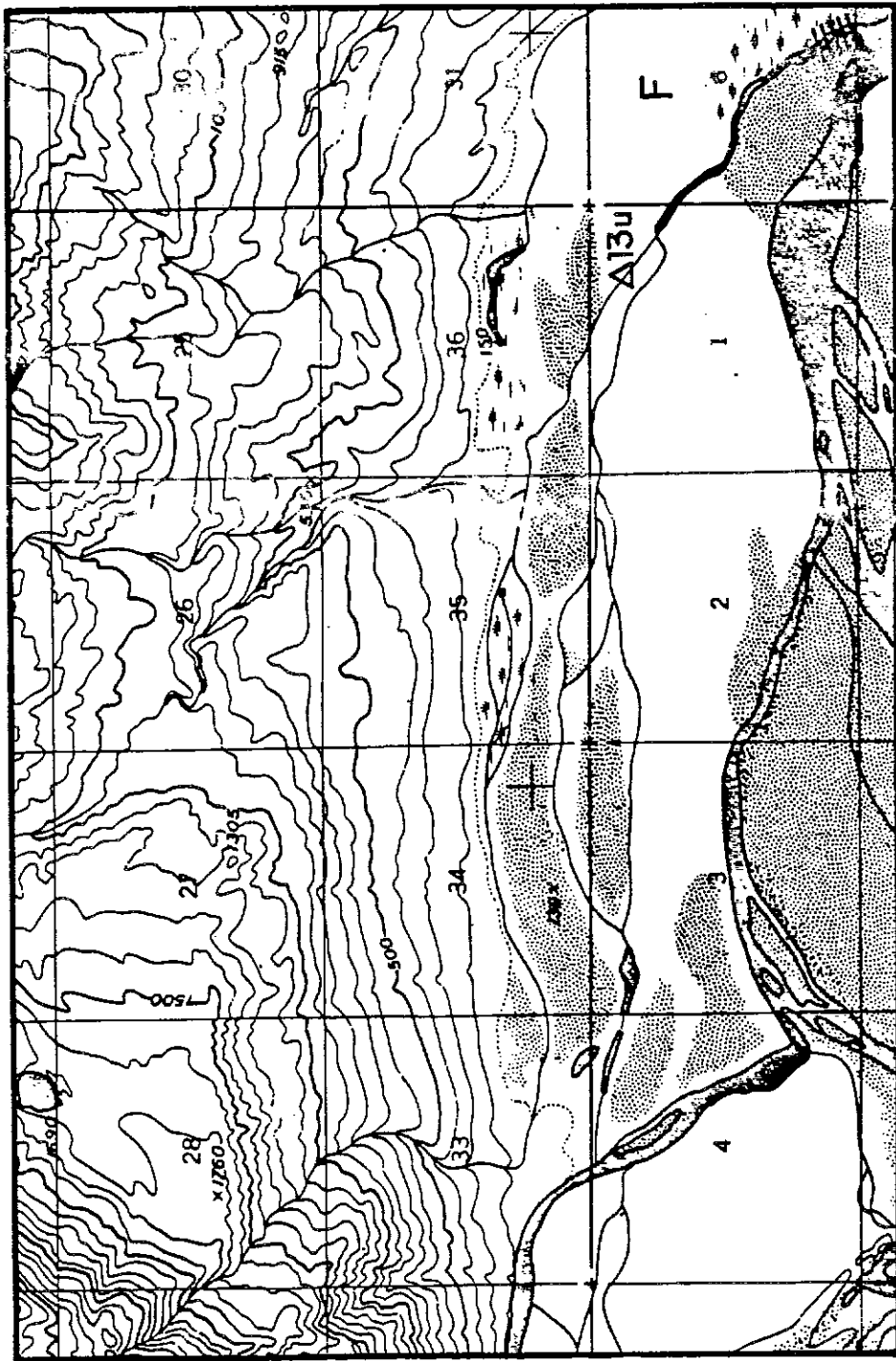


Figure 6.48

Sockeye Milling Area
at Stream 13u
1982

Milling Areas

MILES



6.2.2.3 Pink Salmon

Pink salmon were first observed milling in fresh water in late July (July 22) and first observed in the spawning streams on July 31. Pinks continued to be observed in the McArthur and Chakachatna River tributaries until mid-September with peak counts made in August.

In Cook Inlet, pink salmon runs in even numbered years are generally larger than runs occurring during odd numbered years. Since 1982 was an even year, larger than average escapements were expected. However, preliminary commercial catch data indicate that 1982 had a lower than average run for an even-numbered year. Estimated escapements for the various water bodies in the system are shown in Table 6.3.

The vast majority of pink spawning occurred in tributary streams. In the Chakachatna drainage, 4.1 percent of the 8,263 estimated pink escapement for that drainage occurred in sloughs and side channels, and in the McArthur drainage less than 0.3 percent of the estimated pink escapement occurred in sloughs or side channels. The majority of the total estimated pink escapement, 70.5 percent or 19,777 fish, occurred in the McArthur drainage. No pinks spawned above the sloughs at the base of the Chakachatna River Canyon.

Emergent pink salmon fry probably move directly down river to the sea. Rearing in fresh water may be for a period as short as one day, and thus, no rearing areas were identified during the 1981 and 1982 studies.

6.2.2.4 Chum Salmon

Chum salmon were in the spawning streams on August 25 and were found at most spawning areas by September 1.

The total estimated spawnings escapement for both the Chakachatna and McArthur River drainages was 1949 fish, which was less than any of the other four salmon species (Table 6.3). The majority of these fish (77 percent - 1481 fish) spawned in the sloughs at station 17 on the Chakachatna River. Over 90 percent of the estimated escapement occurred in sloughs or areas receiving upwelling flow

In early June, chum salmon fry had moved into lower portions of the river systems and smolts were found at collecting stations near the mouth of the McArthur River. By the end of June, only a few smolts were collected near the mouth of the McArthur River, suggesting that the peak downstream migration had occurred. Because of the relatively short rearing period of chum salmon in freshwater, no specific rearing areas were identified during the 1981-1982 studies.

6.2.2.5 Coho Salmon

Coho salmon were first observed in fresh water in mid-August. At that time fairly large numbers of coho were observed milling at the mouths of streams on the McArthur River. Coho were observed on spawning streams on September 1 and peak numbers were observed in mid to late September in most water bodies. Spawning was still in progress when the study was concluded in late October and may have continued under the ice in the Chakachatna Canyon sloughs.

The majority (64.5 percent) of the estimated total coho escapement for the study area occurred in the McArthur River. In the McArthur system, 75 percent (3547 fish) of the estimated escapement of 4729 coho occurred in tributaries (Table 6.3) The other 25.0 percent took place in side channel and slough areas. Spawning occurred in both tributaries and sloughs. The majority (86.3 percent) of the estimated escapement of 2599 coho in the Chakachatna drainage were observed in sloughs and side channels receiving upwelling or slough flow. No coho were observed spawning above the Chakachatna Canyon sloughs.

Yolk-sac fry and emergent fry were found in spawning areas in the study area in late March. Coho juveniles may remain in fresh water for up to four years. Coho of up to age II+ were common in the Chakachatna and McArthur River systems. Juvenile coho salmon were among the more widely distributed fish present in the study area below the lake. Coho juveniles were generally abundant in tributaries, the Noaukta Slough, and areas in the lower portions of both rivers. Observed increases in the abundance of coho in the Noaukta Slough, lower river systems and upper McArthur River probably represented a combination of movement to overwintering habitat and outmigration. The outmigration of some coho was confirmed by the collection of smolts in the lower portions of the rivers. Coho smolts were collected in the Chakachatna and McArthur River systems from early June into October.

6.2.2.6 Dolly Varden

Dolly Varden was the most widely distributed species collected in the study area and was found at almost every site at which fish were collected. They numerically dominated collections made below Chakachamna Lake. Dolly Varden may be resident or anadromous; both types are probably present within the study area. Dolly Varden were observed spawning from July 31 through October in the Chilligan River.

During late October, sexually mature upstream migrants were still being collected in the lower portions of the river systems, and Dolly Varden spawning was still occurring. Dolly Varden spawning was also common in the McArthur River and its tributaries during October. Some upstream migrants which spawned in the McArthur River were observed entering the river systems from the Middle River and then moving through the Chakachatna River.

Dolly Varden juveniles were widely distributed in the river systems. They were collected from every river sampled, including the the Neacola and Another Rivers. Juvenile (ages I+ to II+) appear to be common throughout the river system with larger, older fish, including age III+, more abundant in the Noaukta Slough and lower portions of the river. Dolly Varden appear to move freely within and between the two river systems.

6.2.2.7 Rainbow Trout

Rainbow trout were regularly collected in portions of the lower river systems and tributaries. Rainbow trout

were collected most frequently in October when large numbers had moved into the lower river system.

Little is known about the spawning of rainbow trout in the Chakackatna and McArthur River systems and few rainbow trout under 10 cm (4.0 inches) were collected.

The distribution of rainbow trout in the Chakachatna River appears to be limited to areas below the Chakachatna River Canyon. During the summer and fall of 1982, juvenile rainbow trout were collected in the Straight Creek clearwater tributary (19), in the McArthur River (Stations 13, and 11) and in the lower Chakachatna River (Stations 3, 4, and 6). Rainbow trout are a resident species and therefore rear in freshwater throughout the year. Based upon tag return data, rainbow trout appear to move freely within and between the middle and lower portions of both river systems.