NPAFC
Doc. 346

Survey of Juvenile Salmon in the Marine Waters of Southeastern Alaska, May–August 1998

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Submitted to the

NORTH PACIFIC ANADROMOUS FISH COMMISSION

by the

United States of America

September 1998

THIS DOCUMENT MAY BE CITED IN THE FOLLOWING MANNER:

Orsi, J. A., J. M. Murphy, and D. G. Mortensen. 1998. Survey of juvenile salmon in the marine waters of southeastern Alaska, May–August 1998. (NPAFC Doc. 346) Auke Bay Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, NOAA, 11305 Glacier Highway, Juneau, AK 99801-8626, USA. 26 p.

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Abstract

Twenty four stations were sampled monthly along a primary marine migration corridor in the northern region of southeastern Alaska to assess the distribution, growth, mortality, and diet of wild and hatchery stocks of juvenile (age -.0) Pacific salmon (*Oncorhynchus* spp.). Stations were stratified into three different habitats—inshore (Taku Inlet and near Auke Bay), strait (Chatham Strait and Icy Strait), and coastal (Cross Sound, Icy Point, and Cape Edward)—and sampled aboard the NOAA ship *John N. Cobb* from May to August 1998. At each station, fish, zooplankton, temperature, and salinity data were collected during daylight with a surface rope trawl, conical nets, bongo nets, and a conductivity, temperature, and depth profiler. Surface (2-m) temperatures and salinities during the survey ranged from 7.6 to 14.2°C and 16.4 to 32.0‰. A total of 12,814 fish and squid were captured with the rope trawl, representing 30 taxa. All five species of juvenile Pacific salmon and steelhead (*O. mykiss*) were captured and comprised 85% of the total catch. Of the 10,895 salmonids caught, over 99% were juveniles, and less than 1% were immatures or adults. Non-salmonid species making up >1% of the catch included Pacific herring (*Clupea harengus*), capelin (*Mallotus villosus*), squid (Gonatidae), and sablefish (*Anoplopoma fimbria*). The highest frequency of occurrence (>25%) in the trawl catches was observed for chum (*O. keta*), coho (*O. kisutch*), sockeye (*O. nerka*), pink (*O. gorbuscha*), and chinook (*O. tshawytscha*) salmon, and wolf-eels (*Anarrhichthys ocellatus*). Overall catch rates of juvenile salmon were highest in June and July, intermediate in August, and zero in May. Catch rates of pink and chum salmon were highest in June, whereas catch rates of sockeye, coho, and chinook salmon were highest in July. Catch rates of juvenile salmon except chinook salmon were highest in strait habitat and lowest in inshore habitat; chinook salmon catch rates were highest in inshore habitat. Overall catch rates for juvenile salmon along the offshore transect declined with distance offshore: most juveniles were captured within 25 km of shore, and only one juvenile salmon was found beyond 40 km. Mean fork lengths of juvenile salmon in June–July–August were: pink (94–127–162 mm), chum (102–134–164 mm), sockeye (112–139–153 mm), coho (166–213–253 mm), and chinook salmon (160–166–190 mm). Twenty-four juvenile and immature salmon (13 chinook and 11 coho) containing internally planted coded-wire tags were recovered; 20 originated from Alaska, 3 from the Columbia River Basin, and 1 from Washington. Recoveries of juvenile chinook salmon from the Columbia River Basin are some of the earliest documented recoveries of these stream-type stocks in Alaska during their first summer at sea. Onboard stomach analysis of potential predators of juvenile salmon indicated a low level of salmon predation by sablefish, spiny dogfish (*Squalus acanthias)*, and adult coho salmon. Results from this study and further laboratory analysis of otolith-marked fish will be used to assess potential competitive interactions between wild and hatchery stocks and stock-specific life history characteristics.

Introduction

Increasing evidence for relationships between Pacific salmon (*Oncorhynchus* spp.) production and shifts in climate conditions has renewed interest in processes governing year-class strength in salmon (Beamish 1995). However, actual links tying salmon production to climate variability are understood poorly due to a lack of adequate time-series data (Pearcy 1997). In addition, mixed stocks with different life history characteristics confound attempts to accurately assess growth, survival, distribution, and migratory rates of specific stocks. Synoptic time series of ocean conditions and stock-specific life history characteristics of salmon are needed to adequately identify mechanisms linking salmon production to climate change. Until recently, stock-specific information relied on labor-intensive methods such as coded-wire tagging (CWT; Jefferts 1963). However, advances in mass-marking methods using thermally induced otolith marks (Hagen and Munk 1994) offer an opportunity to examine growth, survival, distribution, and migratory rates of specific stocks.

In 1997, we initiated a survey along sampling stations in marine waters of the northern region of southeastern Alaska to build time series data on specific stocks of salmon and oceanographic conditions (Orsi et al. 1997). In 1998, our object was to repetitively sample the same stations as 1997, including an additional coastal transect. As in 1997, juvenile chum salmon (*O. keta*) were a primary focus in 1998 because each year over 100 million otolith-marked juveniles were released from two major enhancement facilities in the northern region of southeastern Alaska. In our survey we sampled juvenile salmon seasonally along a seaward migration corridor to determine whether competitive interactions between hatchery and wild stocks exist and to obtain stock-specific life history characteristics such as growth, migration, diet, condition, and size-selective mortality.

Methods

Twenty four stations were sampled each month, as conditions permitted, in inside and coastal marine waters of the northern region of southeastern Alaska aboard the NOAA ship *John N. Cobb* from May-August 1998 (Table 1). Stations were located along the primary seaward migration corridor used by juvenile salmon. This corridor extends from inshore waters within the Alexander Archipelago along Chatham Strait and Icy Strait, through Cross Sound, and out into offshore waters in the Gulf of Alaska (Figure 1). At each station, the physical environment was sampled with a CTD (conductivity, temperature, and depth profiler), zooplankton were sampled with oblique bongo and vertical conical nets, and fish were sampled with a rope trawl. All sampling occurred during daylight, between 0700 and 2000 hours.

The selection of sampling stations was determined by 1) the presence of historical time series of biological or oceanographic data in the region, 2) the locality of the primary migration corridor used by juvenile salmon, and 3) restrictions in vessel operations. Historical data exist for Auke Bay Monitor, False Point Retreat, Lower Favorite Channel, and Icy Strait stations

(Mattson and Wing 1972; Bruce et al. 1977; Orsi unpublished data); therefore, these stations were selected initially. The Chatham Strait transect was selected because juvenile otolith-marked chum salmon from both the south (Hidden Falls Hatchery) and north (Douglas Island Pink and Chum Hatchery) enter Icy Strait there. The Cross Sound, Icy Point, and Cape Edward transects were included to monitor conditions adjacent to and in the Gulf of Alaska where juveniles enter the coastal habitat. Taku Inlet was selected to characterize physical and biological conditions near a large glacial, transboundary river system along the mainland coast. Vessel and sampling gear constraints limited operations to onshore distances of ≥1.5 km, offshore distances of ≤65 km, and bottom depths of ≥75 m; this precluded trawling at the Auke Bay Monitor station (Table 1). Sea conditions of <2.5 m and winds <12.5 m/sec were usually necessary to operate the sampling gear safely; this influenced sampling opportunities, particularly in coastal waters.

Oceanography

Oceanographic data were collected at each station before or immediately after the trawl haul. Oceanographic data collected at each station consisted of one CTD cast, one or more vertical plankton tows with conical nets, and one double oblique plankton tow with a bongo net. The CTD data were collected with a Sea-Bird[1] SBE 19 Seacat profiler to 200 m or within 10 m of the bottom. Surface (2-m) temperature and salinity data were also collected at 1-minute intervals with an onboard thermosalinograph. Conical plankton nets were used to perform at least one shallow (20-m) vertical tow at each station and two deep (to 200 m or within 20 m of bottom) vertical tows at the Icy Point and Auke Bay Monitor stations (Table 2). A conical NORPAC net (50 cm, 243 micron mesh), which had been used in previous zooplankton sampling programs in the region, was used for the shallow vertical tows; a conical WP-2 net (57 cm, 202 micron mesh) is the standard recommended by GLOBEC (U.S. Globec 1996) and was used for the deep vertical tows. A double oblique bongo tow was taken at each station to a depth of 200 m or within 20 m of the bottom using a 60-cm diameter frame with 505 and 333 micron mesh nets. A Bendix time and depth recorder was used with the oblique bongo hauls to determine the maximum sampling depths. General Oceanics or Roshiga flow meters were placed inside the bongo and deep conical nets to determine filtered volumes. Ambient light intensities (W/m^2) were recorded at each station with a Li-Cor Model 189 radiometer.

Fish sampling

Fish sampling was accomplished using a Nordic 264 rope trawl modified to fish the surface water directly astern of the ship. The trawl was 184 m long and had a mouth opening of 24 m × 30 m (depth × width). A pair of 3-m foam-filled Lite trawl doors, each weighing 544 kg (91 kg submerged), were used to spread the trawl open. The NOAA ship *John N. Cobb* is a 29-m

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[1]Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

research vessel built in 1950 with a main engine of 325 horsepower and a cruising speed of 10 knots. Earlier gear trials with this vessel and trawl indicated the actual fishing dimensions of the trawl to be 18 m vertical (head rope to foot rope) and 24 m horizontal (wingtip to wingtip), with a spread between the trawl doors ranging from 52 to 60 m (unpubl. cruise report). Trawl mesh sizes from the jib lines aft to the cod end were 162.6 cm, 81.3 cm, 40.6 cm, 20.3 cm, 12.7 cm, and 10.1 cm over the 129.6 m meshed portion of the rope trawl. A 6.1 m long, 0.8-cm knotless liner was sewn into the cod end. To keep the trawl headrope at the surface, a cluster of three meshed A-4 Polyform buoys were tethered to each wingtip of the headrope and one A-3 Polyform float was clipped onto the center of the headrope. The trawl also contained a small mesh panel of 10.2 cm mesh sewn along the jib lines on the top panel of the trawl between the head rope and 162.6 cm mesh to reduce loss of small fish. The trawl was fished with 137 m of 1.6-cm wire main warp attached to each door with three 55-m, two 1.0-cm, and one 1.3-cm wire bridles.

Each trawl was fished 20 min at 1.5 m/sec (3 knots), covering approximately 1.9 km (1.0 nautical miles) across a station. Over-water trawl speed was monitored from the vessel using an electromagnetic current meter (Marsh McBirney, Inc., Model 2000-21). Station coordinates were targeted as the midpoint of the trawl haul; however, current, swell, and wind conditions dictated the direction the trawl was set.

After each haul, the fish were anesthetized, identified, enumerated, measured, labeled, bagged, and frozen. Tricaine methanesulfonate (MS-222) was used to anesthetize the fish. After the catch was sorted, fish and squid were measured to the nearest mm fork length (FL) (squid: mantle length) with a Limnotera FMB IV electronic measuring board (Chaput et al. 1992). Usually all fish and squid were measured. When catches of certain species were large a subsample was measured for lengths. Most juvenile salmon were bagged individually and placed in a freezer immediately. For large catches of juvenile salmon, ice packs were used to chill the fish which minimized tissue decomposition and gastric activity in the stomachs during extended processing. All but the largest juvenile salmon were poured through a portable CWT detector onboard the vessel. Larger salmon were examined for missing adipose fins, indicating the presence of CWTs. The snouts of all adipose fin-clipped juvenile salmon were dissected later in the laboratory to recover CWTs.

After the juvenile salmon in each haul were processed, potential predators were identified, measured, and weighed. Stomachs were excised, weighed, and classified by fullness. Stomach contents were removed and generally identified to the family level and quantified to the nearest 10% of total volume. Empty stomachs were weighed, and content weight was determined by subtraction.

Results

During the 4-month survey, data were collected from 90 rope trawl hauls, 95 CTD casts, 84 bongo net tows, and 128 conical net tows (104 to 20-m and 24 to 200-m) (Table 2). Each month, the 24 core stations were sampled as conditions permitted; the Cape Edward and Icy Point transects were not sampled in May because of limited time and poor weather conditions, and the Cape Edward stations were again not sampled in August due to poor weather conditions. A few additional stations were partially sampled because of marginal weather.

Sea surface (2-m) temperature and salinity data recorded by the thermosalinograph differed monthly and between inside and outside waters. Temperatures and salinities in the survey ranged from 7.6 to 14.2°C and 16.4 to 32.0‰ (Table 3). At most stations, temperatures increased from May until July, then declined in August. Salinities decreased from May until July and increased in August in inside waters, however, salinities were relatively stable seasonally in outside waters. Ambient light intensities during the sampling ranged from 8 to 890 W/m^2.

Plankton abundance was highly variable among habitats. Cursory examination of samples indicated a wide diversity of zooplankton and ichthyoplankton species. Samples from the coastal and offshore stations contained limited amounts of phytoplankton and zooplankton, whereas samples from the inside stations had dense, patchy concentrations of phytoplankton and zooplankton.

A total of 12,814 fish and squid representing 30 taxa were sampled with the rope trawl (Table 4). All five species of juvenile Pacific salmon and steelhead (*O. mykiss*) were captured, comprising 85% of the total catch. Of the 10,895 salmonids sampled, over 99% were juveniles: 7,241 pink salmon (*O. gorbuscha*), 2,735 chum salmon, 388 sockeye salmon (*O. nerka*), 350 coho salmon (*O. kisutch*), and 78 chinook salmon (*O. tshawytscha*); only 59 were immatures (58 chinook and 1 chum salmon) and 44 were adults. Non-salmonid species comprising >1% of the catch included: 769 Pacific herring (*Clupea harengus*), 533 capelin (*Mallotus villosus*), 166 squid (Gonatidae), and 147 sablefish (*Anoplopoma fimbria*). Frequency of occurrence was highest (>25%) for chum, coho, sockeye, pink, and chinook salmon and wolf-eels (*Anarrhichthys ocellatus*) (Table 5). Catches and life history stages of salmonids are listed in Appendix 1 by date, haul number, and station.

Distribution of juvenile salmon differed among months sampled, species, and habitats. Overall catch rates for juvenile salmon were lowest in May (none caught), highest in June and July, and intermediate in August (Figure 2). Chum and pink salmon were most abundant in June, whereas sockeye, coho, and chinook salmon were most abundant in July. Catch rates of all juvenile salmon, except chinook salmon, were highest in strait habitat; chinook salmon were caught primarily in inshore habitat. Relatively few salmon were caught in coastal habitat. Along the coastal offshore transects, catch rates of juvenile salmon declined with distance offshore; most juveniles were within 25 km of shore and only one juvenile was found beyond 40 km (Figure 3; Appendix 1).

Mean fork length (FL) of juvenile salmon differed markedly among species and sampling periods. Juvenile coho and chinook salmon were consistently 25–100 mm longer than sockeye, chum, and pink salmon each sampling period (Figure 4). Mean FL for each species of juvenile salmon in June–July–August were: pink (94–127–162 mm), chum (102–134–164 mm), sockeye (112–139–153 mm), coho (166–213–253 mm), and chinook (160–166–190 mm) (Table 6).

Twenty-four juvenile and immature salmon containing CWTs were recovered: 13 chinook and 11 coho salmon—20 originated in Alaska, 3 from the Columbia River Basin, and 1 from Washington (Table 7). Migrations of the CWT juvenile coho salmon, which all originated from Alaska and were recovered in inside waters, ranged 65-375 km in 22-85 days. Conversely, CWT chinook salmon had both slow and rapid migration rates depending on their origin and recovery locality. The 9 CWT chinook from Alaska were all recovered in inside waters and had migrated 5-105 km in 26-91 days, whereas the 3 CWT chinook from the Columbia River Basin were all recovered in outside waters and migrated approximately 1,550 km in 73-99 days.

Stomachs of 223 potential predators of juvenile salmon were examined from 12 species of fish: 81 adult spiny dogfish (*Squalus acanthias*), 31 walleye pollock (*Theragra chalcogramma*), 56 immature chinook salmon, 3 Pacific sandfish (*Trichodon trichodon*), 17 adult coho salmon, 13 adult pink salmon, 11 adult chum salmon, 4 adult black rockfish (*Sebastes melanops*), 3 immature sablefish, 2 adult starry flounder (*Platichthys stellatus*), 1 adult sockeye salmon, and 1 blue shark (*Prionace glauca*). Of all the stomachs examined, we observed a total of three incidences of predation on juvenile pink salmon by three different species: adult coho, adult spiny dogfish, and immature sablefish.

Discussion

Seasonal abundance and distribution of juvenile salmon in the marine waters of the northern region were relatively consistent between our findings in 1998 and 1997 (Orsi et al. 1997). In both years, juvenile salmon were absent at all stations in May, and a month later in June, all five species were present. At strait stations, the highest catch rates of juveniles in both years occurred in June and July, and catch rates declined over 5 fold from July to August. At coastal stations, the highest catch rates in both years occurred in July and August. These data indicate that the primary migration of juvenile salmon within marine waters of the northern region of southeastern Alaska occurs from nearshore localities to strait stations between May and June, and progresses seaward from strait to coastal stations from July to August.

Juvenile salmon were not caught in May, perhaps because of their distribution pattern and the habitats sampled. As juveniles enter the marine environment in spring, they initially distribute along shallow, nearshore habitats and move progressively into deeper waters. Consequently, in May we only caught immature age -.1 and older chinook salmon in 1998 and 1997 (Orsi et al. 1997). Another survey, conducted with a small mesh purse seine in southeastern Alaska, also did not catch juvenile salmon in May, only immature chinook salmon (Cruise report JC-84-01). However, sampling with small mesh seines within 20 m of shore, documented peak catches of juvenile pink and chum salmon occurring from mid-May to early June in southeastern Alaska (Jaenicke et al. 1985). Gear and vessel operation constraints in our study limited our station selections to localities deeper than 75 m and $\geq$1.5 km offshore. Therefore, the absence of juveniles in our catches in May, could be a result of fish being distributed closer to shore and unavailable to our sampling gear.

We found the offshore distribution of juvenile salmon in outside coastal waters to be similar to reported distributions from other studies conducted off southeastern Alaska. Hartt and

Dell (1986) characterized the coastal migration band of juvenile pink, chum, and sockeye salmon as 37 km wide off the coast of southeastern Alaska, where the continental shelf is narrow. Conversely, Jaenicke and Celewycz (1994) found juvenile salmon to at least 74 km in offshore waters of southeastern Alaska in August. In 1997, along the offshore coastal transect, we observed most juvenile salmon to occur within 25 km of shore, and none beyond 40 km. This furthest offshore station sampled in 1997 had the warmest monthly water temperatures in July and August, which may have influenced the extent of offshore migration. In 1998, cooler temperatures prevailed at this station and we still found juveniles distributed primarily within 40 km from shore. Our sampling in 1998 also included an additional offshore transect situated over a relatively narrow breadth of continental shelf that we sampled in July and August with the same results.

Recoveries of CWT juvenile chinook and coho salmon from this study suggest rapid migrations of some stocks through the region, and a more localized distribution of others. Previous studies found juvenile stream-type chinook salmon from the Columbia River Basin off the coast of southeastern Alaska in September and October (Hartt and Dell 1986; Orsi and Jaenicke 1996). In 1997, we recovered one juvenile stream-type CWT chinook from the Columbia River Basin in coastal waters in June (Orsi et al. 1997). This single recovery extends the coastal migration arrival window of this stock by about two months. This year, and again in June, we corroborated this result with the recovery of three additional juvenile stream-type CWT chinook off the coast of Alaska. Marine migration rates of these juveniles from the Columbia River Basin were rapid, with all migrating >1550 km in less than 100 days. Conversely, CWTs recovered from stocks of Alaska stream-type chinook occurred over several months in both years and exclusively in inside waters, with juveniles seldom traveling over 100 km. Juveniles and immatures of these stocks indicated a high degree of residency. In 1997, CWT juvenile coho salmon recovered in the study area in June originated in the northern region of southeastern Alaska, whereas coho salmon recovered in the study area in July originated in southern southeastern Alaska and the Columbia River Basin. In 1998, CWT juvenile coho all originated exclusively from the northern region of southeastern Alaska and were recovered primarily in June and July. These data suggest that stocks of coho salmon of Alaska origin and some stocks of coho and stream-type chinook salmon from Columbia River Basin migrate through the marine waters of the northern region of southeastern Alaska in June and July.

Although only a few juvenile salmon were observed in the predators examined, overall predation on juvenile salmon could still be significant. Three instances of predation were documented from 223 stomachs examined in 1998 and no predation on juveniles was observed in 119 stomachs examined in 1997 (Orsi et al. 1997). The fact that three of the twelve species examined for predation in 1998 were feeding on juvenile salmon suggest that predation is probably an opportunistic event. Moreover, observing predation on juvenile salmon at sea is rare, so even the low level of predation observed may be biologically significant if extrapolated over a more extensive temporal and spatial period.

Further analysis from these data requires separation of hatchery and wild salmon stocks. This can be accomplished by examining the otoliths for thermally induced marks. After stock separation is complete, analyses will be conducted to determine if differences exist between hatchery and wild stocks of salmon in the northern region of southeastern Alaska. Stock-specific growth rates, migration rates, lipid levels, condition factors, prey fields, and size-selective mortality will be among the interactions examined. A subsequent survey of selected stations in the northern region of southeastern Alaska is planned for October of 1998.

Acknowledgments

Special thanks to Auke Bay Laboratory personnel Bill Heard, Lee Hulbert, Molly Sturdevant, Alex Wertheimer, Bruce Wing, and volunteer Jennifer Boldt, who participated in the cruises; their invaluable onboard assistance was greatly appreciated. In addition, we would like to commend the command and crew of the NOAA ship *John N. Cobb*—Bill Cobb, Mike Devaney, Shannon King, Bill Lamoureux, Dan Roby, Del Sharp, John Sikes, and Brad Sopher—for their superb cooperation and performance throughout the cruises. We also acknowledge David King and Jim Smart of the Alaska Fisheries Science Center, Seattle, for their excellent support on trawl gear setup.

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Table 1.—Localities and coordinates of stations sampled monthly in marine waters of the northern region of southeastern Alaska, May–August 1998.

Locality	Station	Latitude	Longitude	Offshore distance (km)	Bottom depth (m)
		Inside waters			
Inshore					
Auke Bay Monitor	ABM	58°22.00′N	134°40.00′W	1.5	60
Taku Inlet	TKI	58°11.19′N	134°11.71′W	2.2	175
False Point Retreat	FPR	58°22.00′N	135°00.00′W	1.8	680
Lower Favorite Channel	LFC	58°20.98′N	134°43.73′W	1.5	75
Strait					
Upper Chatham Strait	UCA	58°04.57′N	135°00.08′W	3.2	400
Upper Chatham Strait	UCB	58°06.22′N	135°00.91′W	6.4	100
Upper Chatham Strait	UCC	58°07.95′N	135°04.00′W	6.4	100
Upper Chatham Strait	UCD	58°09.64′N	135°02.52′W	3.2	200
Icy Strait	ISA	58°13.25′N	135°31.76′W	3.2	128
Icy Strait	ISB	58°14.22′N	135°29.26′W	6.4	200
Icy Strait	ISC	58°15.28′N	135°26.65′W	6.4	200
Icy Strait	ISD	58°16.38′N	135°23.98′W	3.2	234
		Outside waters			
Coastal					
Cross Sound	CSA	58°09.53′N	136°26.96′W	3.2	300
Cross Sound	CSB	58°10.91′N	136°28.68′W	6.4	60
Cross Sound	CSC	58°12.39′N	136°30.46′W	6.4	200
Cross Sound	CSD	58°13.84′N	136°32.23′W	3.2	200
Icy Point	IPA	58°20.12′N	137°07.16′W	6.9	160
Icy Point	IPB	58°12.71′N	137°16.96′W	23.4	130
Icy Point	IPC	58°05.28′N	137°26.75′W	40.2	150
Icy Point	IPD	57°53.50′N	137°42.60′W	65.0	1300
Cape Edward	EDA	57° 39.00' N	136° 23.20' W	8.0	90
Cape Edward	EDB	57° 36.00' N	136° 34.40' W	20.0	185
Cape Edward	EDC	57° 32.50' N	136° 46.60' W	33.0	1,270
Cape Edward	EDD	57° 28.75' N	136° 56.60' W	47.0	1,800

Table 2.—Numbers and types of data collected at different habitat types sampled monthly in marine waters of the northern region of southeastern Alaska, May–August 1998.

		Data collection type*				
Dates	Habitat	Rope trawl	CTD cast	Bongo tow	20-m vertical	WP-2 vertical
14–18 May	Inshore	2	4	4	7	1
	Strait	9	8	8	8	0
	Coastal	0	1	1	1	1
	All May	11	13	13	16	2
24–30 June	Inshore	3	4	4	7	1
	Strait	8	8	8	8	0
	Coastal	12	12	12	12	8
	All June	23	24	24	27	9
20-28 July	Inshore	3	4	4	6	1
	Strait	12	12	8	12	0
	Coastal	16	16	12	16	8
	All July	31	32	24	34	9
24–30 August	Inshore	5	6	4	8	1
	Strait	12	12	12	12	0
	Coastal	8	8	7	7	3
	All August	25	26	23	27	4
Total		90	95	84	104	24

*Rope trawl = 20-min hauls; CTD casts = to 200 m or within 10 m of the bottom; Bongo tow = 60-cm diameter frame, 505 and 333 micron meshes, double oblique haul to 200 m or within 20 m of the bottom; 20-m vertical = 50-cm diameter frame, 243 micron conical net towed vertically from 20 m; WP-2 vertical = 57-cm diameter frame, 202 micron conical net towed vertically from 200 m or within 20 m of the bottom.

Table 3.—Surface (2-m) temperature and salinity data sampled monthly in marine waters of the northern region of southeastern Alaska, May–August 1998. Station code acronyms are defined in Table 1. NS denotes no sampling.

Locality	Month	Temp. (°C)	(Salin.) (‰)	Temp. (°C)	(Salin.) (‰)	Temp. (°C)	(Salin.) (‰)	Temp. (°C)	(Salin.) (‰)
Inside waters									
Inshore		TKI		ABM		LFC		FPR	
	May	7.7	(26.1)	10.4	(27.2)	10.0	(28.0)	7.9	(29.3)
	June	9.5	(20.8)	13.6	(21.4)	11.3	(22.4)	13.9	(30.1)
	July	10.7	(16.4)	13.1	(20.3)	13.1	(20.3)	13.4	(23.3)
	August	10.6	(20.6)	10.9	(19.9)	10.3	(18.9)	12.9	(25.1)
Upper Chatham		UCA		UCB		UCC		UCD	
Strait	May	7.9	(29.5)	8.0	(29.6)	8.0	(30.1)	8.2	(30.0)
	June	12.7	(27.6)	12.9	(25.5)	12.9	(25.4)	12.9	(29.7)
	July	12.3	(27.2)	12.9	(26.2)	13.4	(24.6)	13.5	(21.4)
	August	10.0	(29.8)	10.2	(29.8)	11.2	(28.0)	11.2	(27.6)
Icy Strait		ISA		ISB		ISC		ISD	
	May	7.7	(30.6)	7.8	(30.7)	8.0	(30.6)	8.1	(30.4)
	June	11.1	(28.8)	11.2	(27.9)	11.2	(28.6)	11.1	(28.8)
	July	13.2	(24.1)	13.4	(22.6)	14.2	(20.9)	13.9	(20.2)
	August	9.1	(30.0)	10.0	(29.6)	10.9	(28.8)	11.7	(27.8)
Outside waters									
Cross Sound		CSA		CSB		CSC		CSD	
	May	NS	(NS)	NS	(NS)	NS	(NS)	NS	(NS)
	June	8.4	(31.7)	8.4	(31.7)	7.7	(32.0)	7.6	(31.7)
	July	12.1	(31.0)	9.6	(31.4)	9.7	(31.3)	8.5	(31.4)
	August	12.3	(30.9)	12.2	(30.8)	9.4	(30.8)	10.1	(30.8)
Icy Point		IPA		IPB		IPC		IPD	
	May	NS	(NS)	NS	(NS)	NS	(NS)	NS	(NS)
	June	10.9	(30.7)	12.3	(30.6)	11.3	(30.9)	12.6	(31.0)
	July	12.4	(30.2)	13.1	(30.8)	13.4	(31.0)	13.5	(31.2)
	August	11.2	(29.7)	12.4	(31.0)	11.8	(31.8)	11.9	(31.2)
Cape Edward		EDA		EDB		EDC		EDD	
	May	NS	(NS)	NS	(NS)	NS	(NS)	NS	(NS)
	June	12.4	(31.3)	11.9	(31.1)	12.4	(31.3)	12.3	(31.3)
	July	13.7	(31.1)	13.6	(31.1)	13.6	(31.1)	13.8	(31.1)
	August	NS	(NS)	NS	(NS)	NS	(NS)	NS	(NS)

Table 4.—Monthly catches of fishes and squid sampled with a rope trawl in marine waters of the northern region of southeastern Alaska, May–August 1998.

Common name		Scientific name	Number caught				
			May	June	July	August	Total
Pink salmon	(juvenile)	*Oncorhynchus gorbuscha*	0	4,424	2,673	144	7,241
Chum salmon	(juvenile)	*O. keta*	0	1,700	917	118	2,735
Sockeye salmon	(juvenile)	*O. nerka*	0	116	255	17	388
Coho salmon	(juvenile)	*O. kisutch*	0	90	203	57	350
Chinook salmon	(juvenile)	*O. tshawytscha*	0	25	33	20	78
Chinook salmon	(immature)	*O. tshawytscha*	26	17	12	3	58
Chum salmon	(immature)	*O. keta*	0	0	1	0	1
Coho salmon	(adult)	*O. kisutch*	0	4	2	11	17
Pink salmon	(adult)	*O. gorbuscha*	0	2	12	0	14
Chum salmon	(adult)	*O. keta*	0	0	2	9	11
Sockeye salmon	(adult)	*O. nerka*	0	0	1	0	1
Steelhead	(adult)	*O. mykiss*	0	0	0	1	1
Pacific herring		*Clupea harengus*	0	183	507	79	769
Capelin		*Mallotus villosus*	525	0	3	5	533
Squid		Gonatidae	0	2	141	23	166
Sablefish		*Anoplopoma fimbria*	1	4	59	83	147
Spiny dogfish		*Squalus acanthias*	0	15	66	0	81
Wolf-eel		*Anarrhichthys ocellatus*	0	8	44	5	57
Walleye pollock		*Theragra chalcogramma*	30	3	12	0	45
Soft sculpin		*Psychrolutes sigalutes*	30	1	0	0	31
Crested sculpin		*Blepsias bilobus*	0	3	9	14	26
Greenling		Hexagrammidae	0	18	0	0	18
Pacific spiny lumpsucker		*Eumicrotremus orbis*	1	2	2	6	11
Rockfish		*Sebastes* spp.	0	2	2	1	5
Prowfish		*Zaprora silenus*	0	0	3	2	5
Black rockfish		*Sebastes melanops*	0	2	1	1	4
Three-spined stickleback		*Gasterosteus aculeatus*	4	0	0	0	4
Pacific sandfish		*Trichodon trichodon*	2	2	0	0	4
Bigmouth sculpin		*Hemitripterus bolini*	3	0	0	0	3
Starry flounder		*Platichthys stellatus*	1	1	1	0	3
Arrowtooth flounder		*Atheresthes stomias*	0	2	0	0	2
Lingcod		*Ophiodon elongatus*	0	1	0	0	1
Poacher		Agonidae	0	0	1	0	1
Smooth lumpsucker		*Aptocyclus ventricosus*	0	0	0	1	1
Blue shark		*Prionace glauca*	0	0	0	1	1
Pacific saury		*Cololabis saira*	0	0	0	1	1
Total			623	6,627	4,962	602	12,814

Table 5.—Frequency of occurrence for fishes and squid sampled with a rope trawl in marine waters of the northern region of southeastern Alaska, May–August 1998. Percentage occurrence per 91 hauls shown in parentheses.

Common name		Scientific name	Frequency of occurrence					
			May	June	July	August	Total	(%)
Pink salmon	(juvenile)	*Oncorhynchus gorbuscha*	0	12	24	13	49	(54)
Chum salmon	(juvenile)	*O. keta*	0	10	24	10	44	(48)
Sockeye salmon	(juvenile)	*O. nerka*	0	15	23	9	47	(52)
Coho salmon	(juvenile)	*O. kisutch*	0	12	23	15	50	(55)
Chinook salmon	(juvenile)	*O. tshawytscha*	0	6	4	5	15	(16)
Chinook salmon	(immature)	*O. tshawytscha*	9	5	7	3	24	(26)
Chum salmon	(immature)	*O. keta*	0	0	1	0	1	(1)
Coho salmon	(adult)	*O. kisutch*	0	3	2	7	12	(13)
Pink salmon	(adult)	*O. gorbuscha*	0	2	8	0	10	(11)
Chum salmon	(adult)	*O. keta*	0	3	5	0	8	(9)
Sockeye salmon	(adult)	*O. nerka*	0	0	1	0	1	(1)
Steelhead	(adult)	*O. mykiss*	0	0	0	1	1	(1)
Pacific herring		*Clupea harengus*	0	6	2	5	13	(14)
Capelin		*Mallotus villosus*	4	0	1	1	6	(7)
Squid		Gonatidae	0	2	3	1	6	(7)
Sablefish		*Anoplopoma fimbria*	1	1	2	4	8	(9)
Spiny dogfish		*Squalus acanthias*	0	4	1	0	5	(5)
Wolf-eel		*Anarrhichthys ocellatus*	0	6	14	5	25	(27)
Walleye pollock		*Theragra chalcogramma*	8	1	4	0	13	(14)
Soft sculpin		*Psychrolutes sigalutes*	8	1	0	0	9	(10)
Crested sculpin		*Blepsias bilobus*	0	2	5	10	17	(19)
Greenling		Hexagrammidae	0	2	0	0	2	(2)
Pacific spiny lumpsucker		*Eumicrotremus orbis*	1	2	2	5	10	(11)
Rockfish		*Sebastes* spp.	0	1	2	1	4	(4)
Prowfish		*Zaprora silenus*	0	0	3	1	4	(4)
Black rockfish		*Sebastes melanops*	0	1	1	1	3	(3)
Three-spined stickleback		*Gasterosteus aculeatus*	3	0	0	0	3	(3)
Pacific sandfish		*Trichodon trichodon*	1	2	0	0	3	(3)
Bigmouth sculpin		*Hemitripterus bolini*	3	0	0	0	3	(3)
Starry flounder		*Platichthys stellatus*	1	1	1	0	3	(3)
Arrowtooth flounder		*Atheresthes stomias*	0	2	0	0	2	(2)
Lingcod		*Ophiodon elongatus*	0	1	0	0	1	(1)
Poacher		Agonidae	0	0	1	0	1	(1)
Smooth lumpsucker		*Aptocyclus ventricosus*	0	0	0	1	1	(1)
Blue shark		*Prionace glauca*	0	0	0	1	1	(1)
Pacific saury		*Cololabis saira*	0	0	0	1	1	(1)

Table 6.—Fork lengths of juvenile salmon captured in different marine habitats of the northern region of southeastern Alaska by rope trawl, May–August 1998. No juvenile salmon were captured in May. NS denotes no sampling.

Locality	June				July				August			
	n	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd
Pink salmon												
Inshore	38	99–141	122.4	11.6	4	131–150	137.8	8.4	3	150–173	163.3	11.9
Upper Chatham	803	71–135	98.7	10.5	200	107–175	130.5	11.2	1	173	173.0	—
Icy Strait	754	65–113	88.4	7.7	840	89–150	129.3	13.5	16	135–221	174.6	25.4
Cross Sound	1	104	104.0	—	27	91–153	113.7	18.9	97	135–175	159.7	8.9
Icy Point	1	93	93.0	—	387	88–171	124.1	15.0	27	135–190	160.0	9.4
Cape Edward	1	161	161.0	—	119	89–177	122.9	21.0	NS	NS	NS	NS
Pink total	1,598	65–161	94.4	11.6	1,579	88–177	127.4	14.8	144	135–221	161.6	12.7
Chum salmon												
Inshore	60	87–153	117.7	13.0	3	120–143	132.0	11.5	3	127–179	154.0	26.1
Upper Chatham	747	65–150	105.5	9.5	69	115–163	137.4	10.4	0	—	—	—
Icy Strait	436	67–123	92.6	10.1	616	81–188	132.1	15.0	2	153–157	155.0	2.8
Cross Sound	0	—	—	—	13	97–152	115.9	17.7	89	139–234	162.7	14.5
Icy Point	5	98–144	120.8	20.7	126	95–188	136.6	19.0	24	135–204	171.4	15.6
Cape Edward	0	—	—	—	36	93–189	151.9	18.2	NS	NS	NS	NS
Chum total	1,248	65–153	101.6	12.3	863	81–189	133.7	16.2	118	127–234	164.1	15.3

Table 6.—(cont.)

Locality	June				July				August			
	n	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd
Sockeye salmon												
Inshore	3	93–135	111.0	21.6	8	79–157	116.6	31.9	6	100–203	152.5	43.4
Upper Chatham	69	81–169	104.3	16.5	22	110–169	145.1	15.1	0	—	—	—
Icy Strait	25	79–188	106.3	23.2	202	89–187	139.6	13.7	1	168	168.0	—
Cross Sound	2	91–111	101.0	14.1	1	122	122.0	—	4	139–164	151.0	11.9
Icy Point	5	119–165	148.0	17.9	17	107–190	133.6	18.7	6	147–159	152.7	4.3
Cape Edward	12	129–192	154.9	19.4	5	133–153	147.2	8.3	NS	NS	NS	NS
Sockeye total	116	79–192	112.1	24.9	255	79–190	139.0	15.6	17	100–203	153.1	25.2
Coho salmon												
Inshore	18	111–177	152.1	18.0	12	111–223	193.5	29.7	4	220–280	247.5	24.9
Upper Chatham	44	140–197	167.1	12.6	60	160–259	210.8	20.5	20	213–291	250.4	19.9
Icy Strait	23	145–207	170.4	16.4	117	165–255	212.4	17.7	24	209–284	251.3	19.3
Cross Sound	4	184–195	189.5	4.5	3	213–217	215.0	2.0	9	230–311	264.2	24.4
Icy Point	0	—	—	—	7	233–335	264.6	33.8	0	—	—	—
Cape Edward	1	199	199.0	—	4	215–273	238.5	27.8	NS	NS	NS	NS
Coho total	90	111–207	166.3	17.0	203	111–335	213.2	22.9	57	209–311	252.7	20.8
Chinook salmon												
Inshore	18	103–169	135.4	21.5	29	114–199	161.7	23.8	19	144–233	184.4	24.6
Upper Chatham	1	191	191.0	—	3	192–224	205.7	16.5	0	—	—	—
Icy Strait	0	—	—	—	1	169	169.0	—	1	301	301.0	—
Cross Sound	0	—	—	—	0	—	—	—	0	—	—	—
Icy Point	3	205–280	234.7	39.9	0	—	—	—	0	—	—	—
Cape Edward	3	204–243	220.7	20.1	0	—	—	—	NS	NS	NS	NS
Chinook total	25	103–280	160.2	46.1	33	114–224	165.9	30.0	20	144–301	190.2	35.4

Table 7.—Release and recovery information for coded-wire tagged juvenile salmon captured in marine waters of the northern region of southeastern Alaska by rope trawl, May—August 1998.

			Release information					Recovery information						Days	Distance
Species	Coded-wire tag code	Brood year	Agency*	Locality	Date	Size (mm)	Size (g)	Locality	(station code)	Date	Size (mm)	Size (g)	Age	since release	traveled (km)
							June								
Chinook	21:29/61	1996	QDNR	Salmon R., WA	07/31/97	-	10.1	Icy Point	(IPA)	06/26/98	327	257.9	0.1	400	1,400
Chinook	10:51/26	1996	IDFG	S. Fk. Salmon R., ID	~03/20/98	-	-	Herbert Graves	(HGA)	06/27/98	210	118.4	1.0	99	1,550
Chinook	09:22/27	1996	ODFW	W. Fk. Hood R., OR	~04/07/98	-	56.8	Herbert Graves	(HGA)	06/27/98	241	182.1	1.0	79	1,550
Chinook	05:49/58	1996	FWS	Deschutes R., OR	04/15/98	-	20.6	Herbert Graves	(HGA)	06/27/98	206	97.2	1.0	73	1,550
Chinook	04:48/17	1996	HDFAL	Hidden Falls, AK	05/29/98	-	39.2	Taku Inlet	(TKI)	06/24/98	168	54.5	1.0	26	190
Chinook	03:62/34	1996	NMFS	Little Port Walter, AK	05/15/98	-	19.0	Taku Inlet	(TKI)	06/24/98	146	37.3	1.0	40	220
Coho	04:49/10	1996	HDFAL	Hidden Falls, AK	06/03/98	-	-	Chatham Strait	(UCB)	06/29/98	148	39.8	1.0	26	100
Coho	04:45/30	1996	ADFG	Berners R., AK (Wild)	05/18/98**	108	-	Chatham Strait	(UCB)	06/29/98	159	49.5	1.0	39	50
Coho	04:45/30	1996	ADFG	Berners R., AK (Wild)	05/18/98**	108	-	Chatham Strait	(UCB)	06/29/98	154	39.5	1.0	39	50
Coho	04:49/08	1996	HDFAL	Hidden Falls, AK	06/03/98	-	25.0	Icy Strait	(ISD)	06/25/98	162	54.8	1.0	22	120
Coho	04:46/43	1996	ADFG	Taku Inlet, AK	~05/15/98	89	-	Chatham Strait	(UCD)	06/29/98	157	46.4	1.0	~45	130
							July								
Chinook	50:04/43	1996	DIPAC	Gastineau Channel, AK	06/02/98	-	24.1	Taku Inlet	(TKI)	07/20/98	195	95.1	1.0	48	25
Chinook	50:04/41	1996	DIPAC	Fish Creek, AK	05/28/98	-	27.2	Taku Inlet	(TKI)	07/20/98	192	85.5	1.0	53	35
Chinook	04:48/17	1996	HDFAL	Hidden Falls, AK	05/29/98	-	39.2	Chatham Strait	(UCA)	07/22/98	224	160.2	1.0	54	95
Coho	04:01/03/11/03	1996	SSRAA	Neck Lake, AK	10/--/97	-	-	Chatham Strait	(UCC)	07/22/98	244	159.1	1.0	-	375
Coho	04:49/11	1996	HDFAL	Kasnyku Bay, AK	06/03/98	-	22.2	Icy Strait	(ISA)	07/23/98	209	112.8	1.0	50	130
Coho	04:49/10	1996	HDFAL	Kasnyku Bay, AK	06/03/98	-	25.7	Icy Strait	(ISA)	07/23/98	209	104.4	1.0	50	130
Coho	04:49/10	1996	HDFAL	Kasnyku Bay, AK	06/03/98	-	25.7	Icy Strait	(ISA)	07/21/98	214	119.4	1.0	48	130
Coho	50:04/31	1996	DIPAC	Gastineau Channel, AK	06/02/98	-	17.0	Icy Strait	(ISD)	07/23/98	203	99.4	1.0	51	70
Coho	No Tag	-	-	-	-	-	-	Icy Point	(IPB)	07/26/98	253	191.0	-	-	-
Coho	No Tag	-	-	-	-	-	-	Icy Point	(IPD)	07/24/98	335	407.8	-	-	-
Coho	No Tag	-	-	-	-	-	-	Cape Edward	(EDC)	07/25/98	273	271.5	-	-	-
Coho	No Tag	-	-	-	-	-	-	Icy Strait	(ISA)	07/23/98	207	109.8	-	-	-

Table 7.—(cont.)

		Release information						Recovery information							
														Days	Distance
	Coded-wire	Brood				Size					Size			since	traveled
Species	tag code	year	Agency*	Locality	Date	(mm)	(g)	Locality	(station code)	Date	(mm)	(g)	Age	release	(km)
						August									
Chinook	04:46/44	1996	ADFG	Taku River (Wild), AK	05/19/98***	75	4.3	L. Favorite Chan	(LFC)	08/27/98	159	49.4	1.0	~99	105
Chinook	50:04/39	1996	DIPAC	Fish Creek, AK	05/28/98	-	27.2	L. Favorite Chan.	(LFC)	08/27/98	205	107.8	1.0	91	5
Chinook	50:04/40	1996	DIPAC	Fish Creek, AK	05/28/98	-	27.2	L. Favorite Chan.	(LFC)	08/27/98	213	111.9	1.0	91	5
Chinook	50:04/41	1996	DIPAC	Fish Creek, AK	05/28/98	-	27.2	L. Favorite Chan.	(LFC)	08/27/98	207	113.5	1.0	91	5
Chum	No Tag	-	-	-	-	-	-	Icy Strait	(ISD)	08/27/98	157	35.4	-	-	-

*ADFG = Alaska Department of Fish and Game; DIPAC = Douglas Island Pink and Chum; FWS = US Fish and Wildlife Service; HDFAL = Hidden Falls Hatchery; IDFG = Idaho Department of Fish and Game; NMFS = National Marine Fisheries Service; ODFW = Oregon Department of Fish and Wildlife; QDNR = Quilalt Department of Natural Resources; SSRAA = Southern Southeast Regional Aquaculture Association.

**Fish tagged sometime between 10-26 May 1998

***Fish tagged sometime between 15-24 May 1998.

Appendix 1.—Catches and life history stage of salmonids captured in marine waters of the northern region of southeastern Alaska by rope trawl, May–August 1998. NS denotes no sampling.

			Juvenile					Immature		Adult				
Date	Haul#	Station	Pink	Chum	Sockeye	Coho	Chinook	Chinook	Chum	Coho	Pink	Chum	Sockeye	Steelhead
14 May	2001	TKI	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
15 May	2002	IPB	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
16 May	2003	ISB	—	—	—	—	—	1	—	—	—	—	—	—
16 May	2004	ISA	—	—	—	—	—	4	—	—	—	—	—	—
16 May	2005	ISC	—	—	—	—	—	—	—	—	—	—	—	—
16 May	2006	ISD	—	—	—	—	—	—	—	—	—	—	—	—
17 May	2007	UCA	—	—	—	—	—	12	—	—	—	—	—	—
17 May	2008	UCB	—	—	—	—	—	3	—	—	—	—	—	—
17 May	2009	UCC	—	—	—	—	—	1	—	—	—	—	—	—
17 May	2010	UCD	—	—	—	—	—	1	—	—	—	—	—	—
17 May	2011	FPR	—	—	—	—	—	3	—	—	—	—	—	—
18 May	2012	ABM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
18 May	2013	LFC	—	—	—	—	—	1	—	—	—	—	—	—
24 June	2014	TKI	—	—	—	—	9	3	—	—	—	—	—	—
24 June	2015	LFC	—	1	1	4	9	1	—	—	—	—	—	—
25 June	2016	ISA	1	—	—	3	—	8	—	1	1	—	—	—
25 June	2017	ISB	1,262	242	11	8	—	—	—	—	—	—	—	—
25 June	2018	ISC	363	96	4	1	—	—	—	—	—	—	—	—
25 June	2019	ISD	511	146	10	11	—	4	—	—	—	—	—	—
26 June	2020	IPA	1	5	1	—	—	—	—	—	—	—	—	—
26 June	2021	IPB	—	—	3	—	2	—	—	—	—	1	—	—
26 June	2022	IPC	—	—	1	—	1	—	—	—	—	—	—	—
26 June	2023	IPD	—	—	—	—	—	—	—	2	1	1	—	—
27 June	2024	EDA	1	—	9	1	3	—	—	—	—	1	—	—
27 June	2025	EDB	—	—	—	—	—	—	—	—	—	—	—	—
27 June	2026	EDC	—	—	3	—	—	—	—	—	—	—	—	—
27 June	2027	EDD	—	—	—	—	—	—	—	—	—	—	—	—
28 June	2028	CSA	—	—	—	—	—	—	—	—	—	—	—	—
28 June	2029	CSB	—	—	2	4	—	—	—	1	—	—	—	—
28 June	2030	CSC	1	—	—	—	—	—	—	—	—	—	—	—
28 June	2031	CSD	—	—	—	—	—	—	—	—	—	—	—	—
29 June	2032	UCA	732	321	4	3	—	—	—	—	—	—	—	—
29 June	2033	UCC	371	296	32	13	1	—	—	—	—	—	—	—
29 June	2034	UCB	819	415	22	24	—	—	—	—	—	—	—	—

Appendix 1.—Continued.

Date	Haul#	Station	Juvenile					Immature		Adult				
			Pink	Chum	Sockeye	Coho	Chinook	Chinook	Chum	Coho	Pink	Chum	Sockeye	Steelhead
29 June	2035	UCD	324	119	11	4	—	1	—	—	—	—	—	—
29 June	2036	FPR	38	59	2	14	—	—	—	—	—	—	—	—
30 June	2037	ABM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
20 July	2038	TKI	—	—	3	6	29	—	—	—	1	—	—	—
20 July	2039	FPR	4	3	4	5	—	—	—	—	1	—	—	—
21 July	2040	ISA	107	47	26	21	—	2	—	—	—	—	—	—
21 July	2041	ISB	135	55	29	25	—	5	—	—	—	1	—	—
21 July	2042	ISC	1	1	1	—	—	—	—	—	—	—	—	—
21 July	2043	ISD	89	50	32	24	—	—	—	—	1	—	—	—
22 July	2044	UCA	3	3	—	22	2	1	—	—	4	2	—	—
22 July	2045	UCB	35	7	2	6	—	—	—	—	—	—	—	—
22 July	2046	UCC	111	34	11	21	—	1	—	1	2	—	—	—
22 July	2047	UCD	51	25	9	11	1	—	—	—	1	—	—	—
23 July	2048	ISA	523	214	27	17	1	1	—	—	—	—	—	—
23 July	2049	ISB	973	236	70	17	—	—	—	—	—	—	—	—
23 July	2050	ISC	100	61	15	6	—	1	—	—	—	—	—	—
23 July	2051	ISD	8	5	2	7	—	1	—	—	—	—	—	—
24 July	2052	IPA	23	14	1	—	—	—	—	—	—	—	—	—
24 July	2053	IPB	74	21	5	3	—	—	—	—	—	—	—	—
24 July	2054	IPC	59	19	3	—	—	—	—	—	—	—	—	—
24 July	2055	IPD	—	—	—	1	—	—	—	—	—	—	—	—
25 July	2056	EDA	—	—	—	2	—	—	—	—	—	—	—	—
25 July	2057	EDB	61	4	1	1	—	—	—	—	—	—	—	—
25 July	2058	EDC	58	32	4	1	—	—	1	—	—	—	—	—
25 July	2059	EDD	—	—	—	—	—	—	—	1	1	—	—	—
26 July	2060	IPA	193	62	4	—	—	—	—	—	—	3	1	—
26 July	2061	IPB	33	10	1	1	—	—	—	—	—	—	—	—
26 July	2062	IPC	5	1	3	2	—	—	—	—	—	—	—	—
26 July	2063	IPD	—	—	—	—	—	—	—	—	—	—	—	—
27 July	2064	CSA	—	—	—	—	—	—	—	—	—	—	—	—
27 July	2065	CSB	12	9	1	1	—	—	—	—	1	—	—	—
27 July	2066	CSC	13	2	—	—	—	—	—	—	—	1	—	—
27 July	2067	CSD	2	2	—	2	—	—	—	—	—	1	—	—
28 July	2068	ABM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
28 July	2069	LFC	—	—	1	1	—	—	—	—	—	—	—	—

Appendix 1.—Continued.

Date	Haul#	Station	Juvenile					Immature		Adult				
			Pink	Chum	Sockeye	Coho	Chinook	Chinook	Chum	Coho	Pink	Chum	Sockeye	Steelhead
24 August	2070	TKI	—	—	1	—	4	—	—	—	—	—	—	—
24 August	2071	FPR	3	2	2	2	1	—	—	—	—	—	—	—
25 August	2072	ISA	—	—	—	2	—	—	—	—	—	—	—	—
25 August	2073	ISB	4	—	—	—	—	—	—	—	—	—	—	—
25 August	2074	ISC	4	—	1	5	—	—	—	—	—	—	—	—
25 August	2075	ISD	—	—	—	7	—	—	—	—	—	—	—	—
26 August	2076	UCA	—	—	—	1	—	—	—	—	—	—	—	—
26 August	2077	UCB	—	—	—	1	—	1	—	—	—	—	—	—
26 August	2078	UCC	—	—	—	14	—	—	—	—	—	—	—	—
26 August	2079	UCD	1	—	—	4	—	—	—	1	—	—	—	—
27 August	2080	ISA	1	—	—	6	—	—	—	—	—	—	—	—
27 August	2081	ISB	—	—	—	—	—	1	—	—	—	—	—	—
27 August	2082	ISC	6	—	—	1	—	—	—	1	—	—	—	—
27 August	2083	ISD	1	2	—	3	1	—	—	—	—	—	—	—
27 August	2084	LFC	—	—	—	2	13	1	—	1	—	—	—	1
27 August	2085	ABM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
28 August	2086	FPR	—	1	1	—	—	—	—	—	—	—	—	—
28 August	2087	LFC	—	—	2	—	1	—	—	—	—	—	—	—
29 August	2088	CSD	26	15	1	5	—	—	—	3	—	—	—	—
29 August	2089	CSC	10	6	—	—	—	—	—	2	—	—	—	—
29 August	2090	CSB	25	11	1	1	—	—	—	1	—	—	—	—
29 August	2091	CSA	36	57	2	3	—	—	—	—	—	—	—	—
30 August	2092	IPA	26	12	6	—	—	—	—	—	—	—	—	—
30 August	2093	IPB	1	7	—	—	—	—	—	—	—	—	—	—
30 August	2094	IPC	—	5	—	—	—	—	—	—	—	—	—	—
30 August	2095	IPD	—	—	—	—	—	—	—	2	—	—	—	—
Total catch			7,241	2,735	388	350	78	58	1	17	14	11	1	1

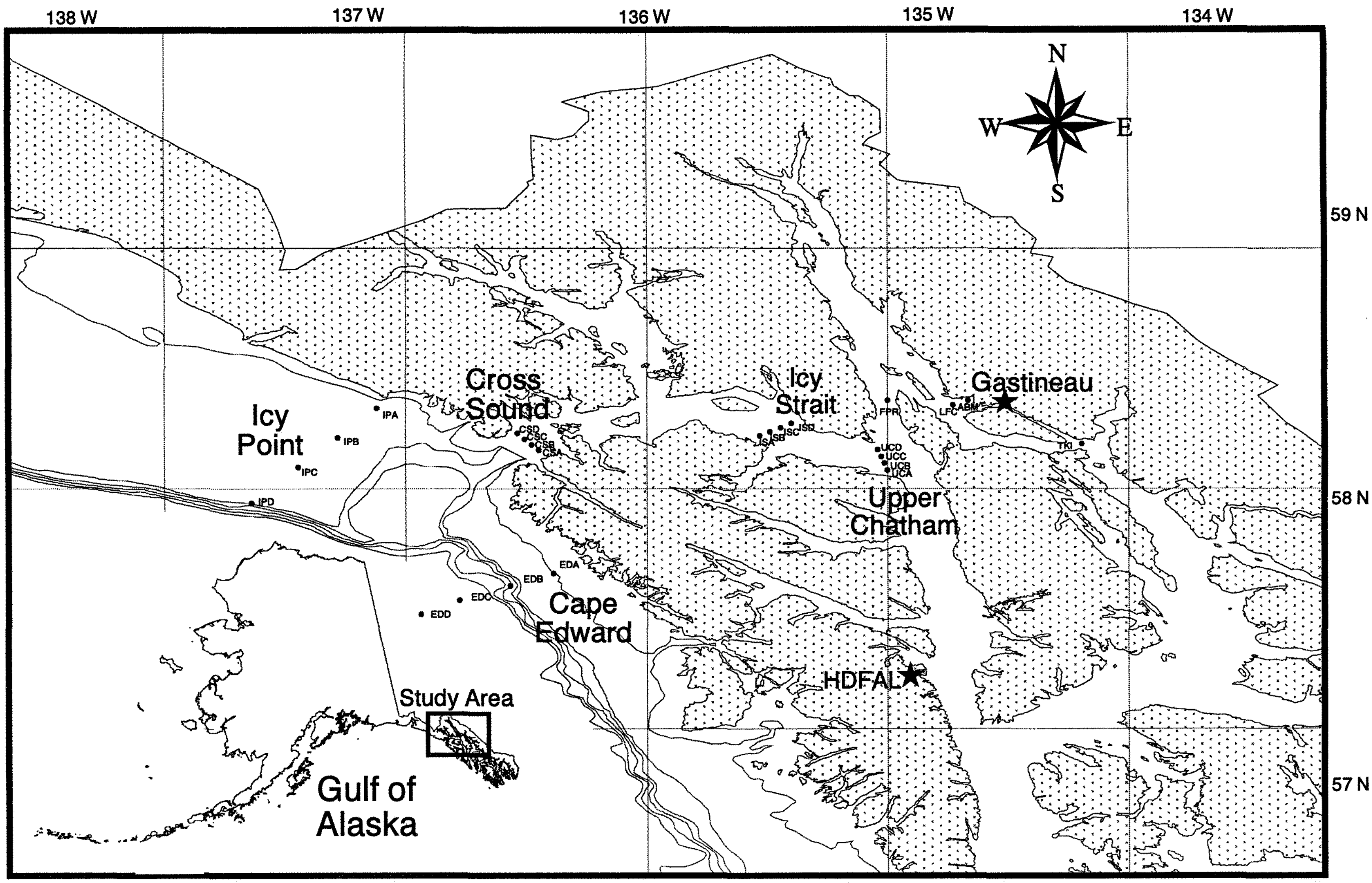

Figure 1.—Stations sampled monthly in marine waters of the northern region of southeastern Alaska, May–August 1998. Stars mark the location of two major enhancement facilities: DIPAC (Douglas Island Pink and Chum Hatchery) and HDFAL (Hidden Falls Hatchery).

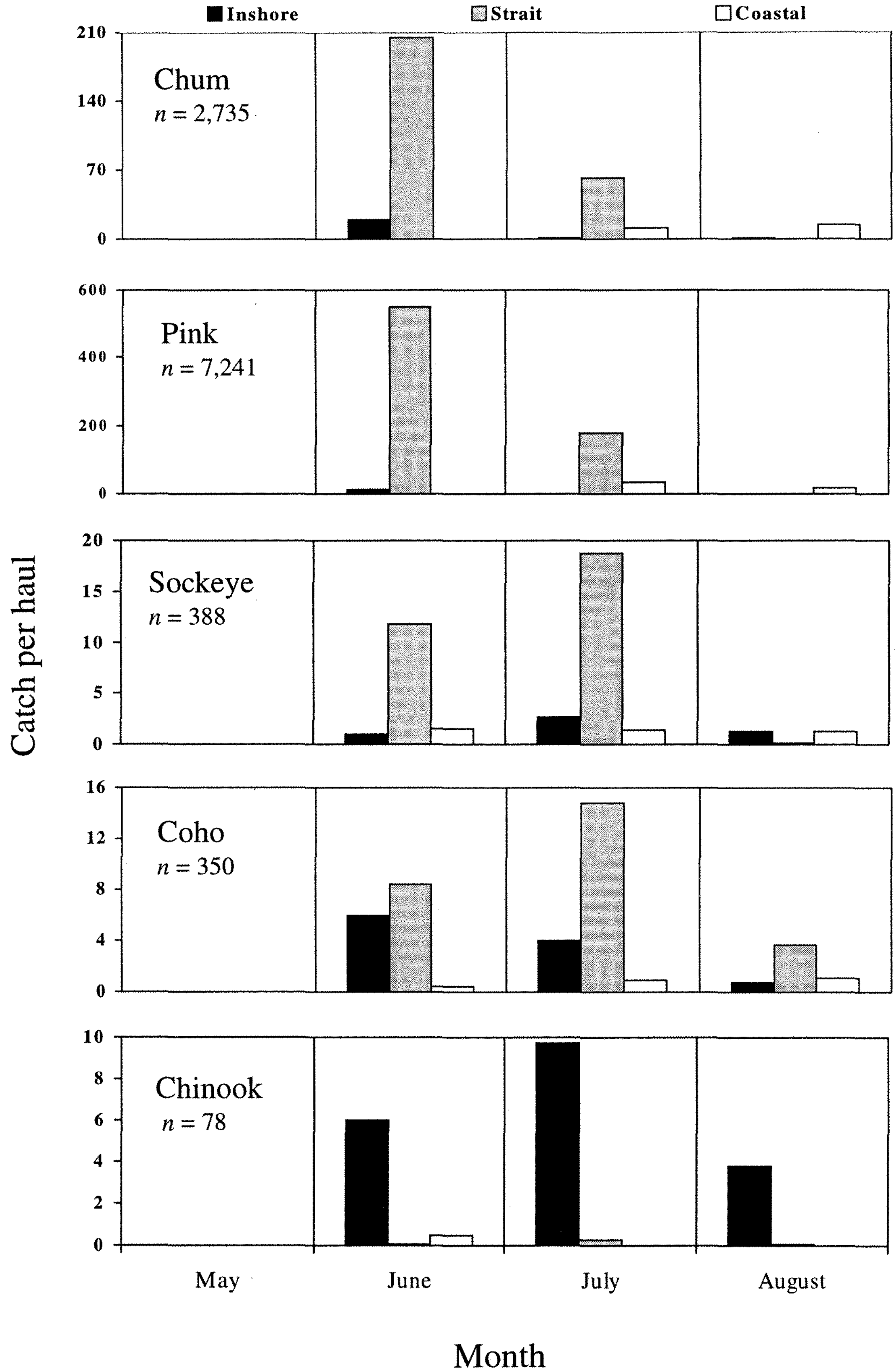

Figure 2.—Catch per rope trawl haul of juvenile salmon in inshore, strait, and coastal marine habitats of the northern region of southeastern Alaska, May–August 1998.

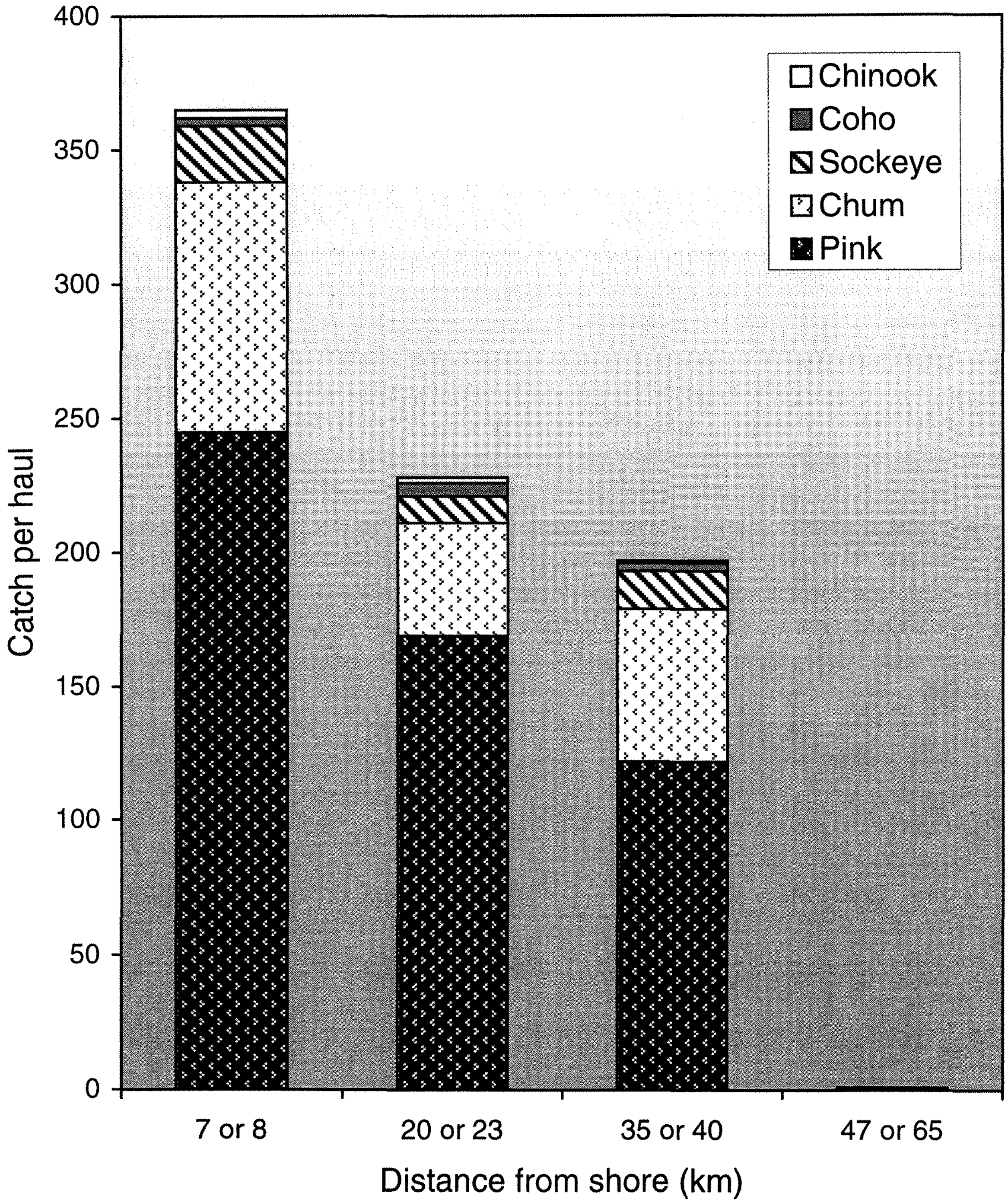

Figure 3.—Number of juvenile salmon captured by rope trawl along the Icy Point and Cape Edward transects in marine waters of the northern region of southeastern Alaska, May–August 1998.

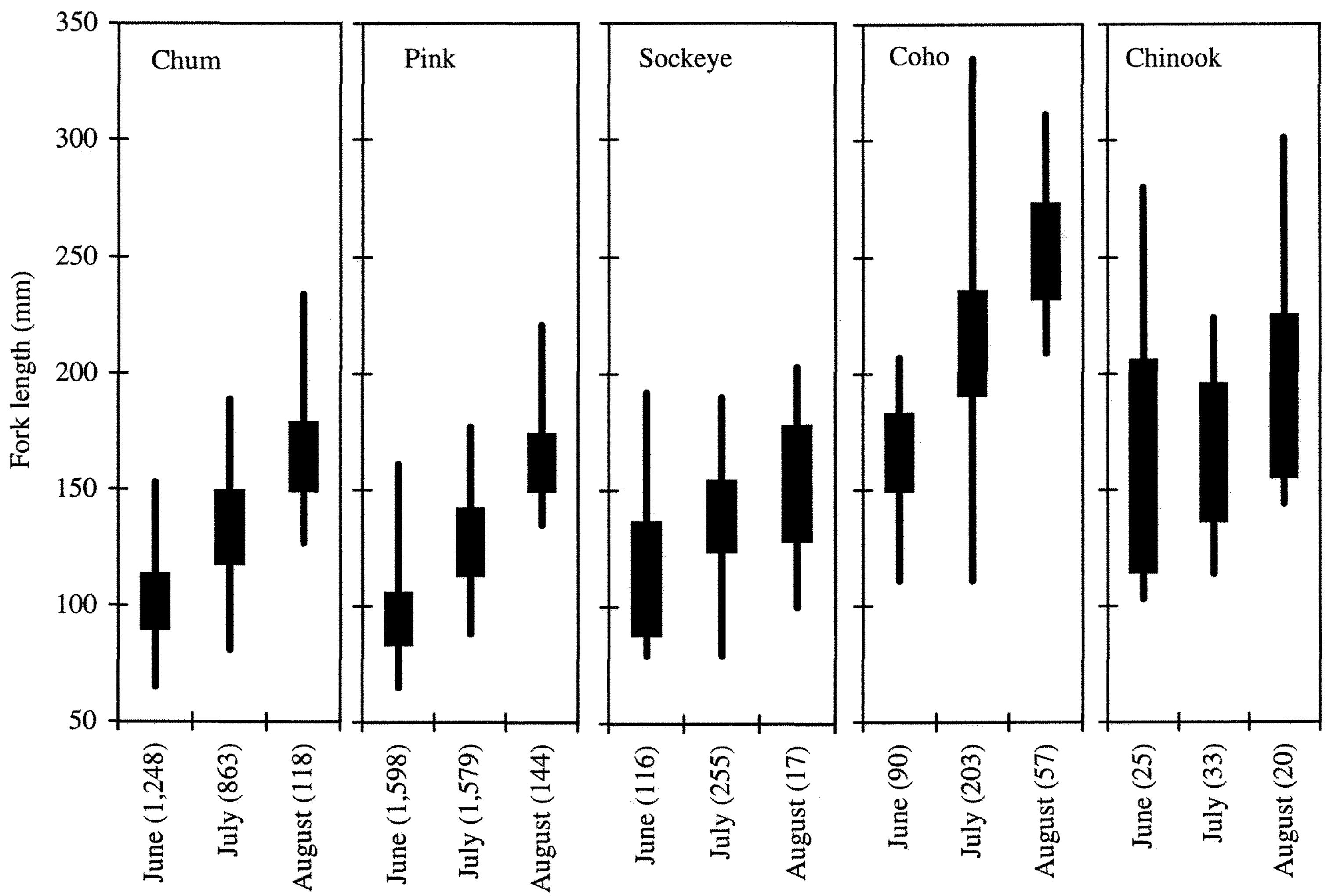

Figure 4.—Fork lengths of juvenile salmon captured in marine waters of the northern region of southeastern Alaska by rope trawl, May–August 1998. No juvenile salmon were captured in May. Length of vertical bars is the size range for each sample, and the boxes within the size range are one standard deviation on either side of the mean. Sample sizes are shown in parentheses.