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Survey of Juvenile Pacific Salmon in the Northern Region of Southeastern Alaska, May-October 1997

by
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U.S. DEPARTMENT OF COMMERCE
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ABSTRACT

This report summarizes the initial findings of a 1997 juvenile Pacific salmon (*Oncorhynchus* spp.) rope trawl survey in the northern region of southeastern Alaska. We include surface ocean conditions, distribution and abundance of juvenile salmon and associated species, coded-wire tag (CWT) recoveries, juvenile salmon fork lengths, and onboard diet analysis. Fish and oceanographic data were collected during daylight hours in May, June, July, August, and October at 20 stations in inside (inshore and strait) and outside (coastal) waters. Mean sea surface (≤ 2 m) temperature and salinity data ranged from 6.7° to 15.1°C and 15.1 to 31.6‰ respectively and differed between inside and outside waters. Mean settled zooplankton volumes ranged from 1.0 to 28.3 ml and were highest in inside waters from May through July. A total of 31 taxa of fish and squid (Gonatidae) were captured. Pacific salmon, sablefish (*Anoplopoma fimbria*), Pacific herring (*Clupea pallasi*), and capelin (*Mallotus villosus*) made up 95% of the catch. All species of Pacific salmon native to North America were caught. Over 99% of the total salmon catch were juveniles. Chum (*O. keta*) and pink salmon (*O. gorbuscha)* made up 89% of the juvenile salmon catch. At the strait stations, catch rates of juvenile pink and chum salmon were highest in July, and declined from July–October with a corresponding decrease in zooplankton abundance. Along the outer coast, catch rates of juvenile salmon were also highest in July, and most juvenile salmon were captured within 25 km from shore. The most notable CWT recovery was from a juvenile Umatilla River chinook salmon (*O. tshawytscha*) captured along the outer coast in June. This recovery documents the arrival of Columbia River chinook salmon off the coast of southeastern Alaska three months earlier than previously reported information. Pacific herring, capelin, and Pacific sand lance (*Ammodytes hexapterus*) were the predominant fish prey in predator stomachs examined, and minimal predation on juvenile salmon was observed.

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INTRODUCTION

In an effort to identify how life-history characteristics of juvenile[1] Pacific salmon (*Oncorhynchus* spp.) such as migration and growth are affected by their abundance and ocean carrying capacity, a seasonal rope trawl survey was initiated in 1997 by personnel from the Auke Bay Laboratory (ABL). The survey was conducted along the primary salmonid out-migration corridors in the northern region of southeastern Alaska. The existence of regional mass-marking programs for otoliths using thermal techniques (Hagen and Munk 1994) and historical data collections in the region (Packard 1967; Bruce et al. 1977; Mattson and Wing 1978; Coyle and Shirley 1990; Ziemann and Fulton-Bennett 1990; Orsi[2]) were additional factors supporting the location of the survey. This report summarizes initial findings of the survey and includes data on surface ocean conditions, distribution and abundance of juvenile salmon and associated species, coded-wire tag (CWT; Jefferts et al. 1963) recoveries, juvenile salmon fork lengths, and onboard diet analysis. Further analysis of otolith-marked fish will be used to determine stock-specific life-history characteristics and will enable comparative analyses of diets, lipid levels, and growth among hatchery and wild stocks.

METHODS

Juvenile salmon were sampled during May, June, July, August, and October in inshore, strait, and coastal habitats during daylight hours aboard the NOAA ship *John N. Cobb*—a 28.3-m research vessel with a 325-hp main engine. Data were collected at twenty stations along the primary salmonid out-migration corridors in the northern region of southeastern Alaska (Fig. 1; Table 1). Vessel and sampling gear constraints limited operations to onshore distances greater than 1.5 km, offshore distances less than 65 km, and bottom depths greater than 75 m. This prevented trawling at the Auke Bay Monitor station, located near ABL. Sea conditions less than 2.5 m and winds less than 12.5 m/second were usually necessary to operate the sampling gear safely.

Oceanography

Oceanographic data included CTD (conductivity, temperature, depth) profiles, sea surface temperature and salinity measurements, vertical plankton hauls, and double oblique bongo net hauls. CTD data were collected to a depth of 200 m or within 10 m of the bottom with a Sea-Bird SBE 19 Seacat profiler. Surface ($\leq$2 m) temperature and salinity were measured at one-minute intervals using the ship's Sea-Bird SBE 23 thermosalinograph. Conical plankton nets were used for shallow vertical zooplankton hauls from 20 m at each station, and deep vertical zooplankton hauls from 200 m or

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[1]All salmon species that have yet to spend their first winter in the ocean are referred to as juvenile, regardless of their freshwater age.

[2]J. A. Orsi, Auke Bay Laboratory, unpubl. data, 1993–96.

within 20 m of bottom at Icy Point and Auke Bay Monitor stations (Table 2). A conical NORPAC net (50 cm diameter, 243-μm mesh) was used for shallow and deep vertical zooplankton hauls, and a conical WP-2 net (57 cm diameter, 202-μm mesh) was used for deep vertical zooplankton hauls. Double oblique bongo hauls were 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-μm mesh nets. A Bendix time and depth recorder was used with the bongo hauls to determine maximum sampling depth. Filtered seawater volumes were determined for all zooplankton samples except the shallow NORPAC net samples using General Oceanics (bongo) and Roshiga (conical) flow meters. Ambient light intensities were recorded at each station with a Li-Cor LI-189 quantum photometer. Zooplankton settled volumes (SVs) were determined in the laboratory for the shallow NORPAC net samples by estimating the volume of zooplankton that settled in a one-liter Imhof cone after 24 hours.

Fish Sampling

Two Nordic 264 rope trawls with 3-m foam-filled Lite trawl doors were used to collect all fish. The first trawl had a small panel of 10.2-cm mesh sewn to the jib lines along the head rope to reduce loss of small fish at the surface; the second trawl did not. The second trawl was used in June, July, August, and October, after the first trawl was torn by the ship's propellor. No significant difference was found in average length or catch rates between the trawls when both were fished in June. Main warp was set at 137 m, and 55-m wire bridles were used to attach the trawl to the trawl doors. Fishing dimensions of the trawl were estimated as 18 m (vertical, head rope to foot rope) by 24 m (horizontal, wingtip to wingtip), with a spread between the trawl doors ranging from 52 to 60 m (Orsi[3]). Trawl mesh sizes from the jib lines aft to the cod end were 162.6, 81.3, 40.6, 20.3, 12.7, and 10.1 cm. A 6.1-m long, 0.8-cm knotless liner was sewn into the cod end. The trawls were modified to fish at the surface by altering trawl-door configuration, by attaching a cluster of three meshed A-4 Polyform buoys to each wingtip of the headrope, and by attaching a single A-3 Polyform float to the center of the headrope. Trawls were fished for 20 minutes at approximately 1.5 m/second (3 knots), and covered approximately 1.85 km (1.0 nautical mile) across each station. Trawling speed was monitored with an electromagnetic current meter (Marsh McBirney, Inc., Model 2000-21) mounted to the side of the ship. Station coordinates were targeted as the midpoint of the trawl haul.

Fish and squid captured in the trawl were identified, counted, measured, labeled, bagged, and frozen. Tricaine methane sulfonate (MS-222) was used to anesthetize the fish. Fish fork length (FL) and squid mantle length (ML) were measured to the nearest millimeter with a Limnotera FMB IV electronic measuring board (Chaput et al. 1992).

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[3]Orsi, J. A. 1996. NOAA ship *John N. Cobb* cruise report JC-96-01. Auke Bay Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, NOAA, 11305 Glacier Highway, Juneau, AK 99801-8626, 2 p. (unpublished)

All fish and squid were measured except for a few large catches of juvenile sablefish (*Anoplopoma fimbria*), juvenile chum salmon (*O. keta*), and Pacific herring (*Clupea harengus*). Large catches were subsampled for lengths. Juvenile salmon were kept on blue-ice packs during processing to minimize tissue decomposition and decrease gastric activity. Immediately after processing, they were placed in a freezer.

All but the largest juvenile salmon were tested for CWTs using a portable CWT detector onboard the vessel. Larger salmon were examined visually for missing adipose fins; those missing adipose fins were examined in the laboratory for CWTs.

Stomach contents of potential juvenile salmon predators (all fish large enough to prey on juvenile salmon) were examined onboard the vessel. Stomachs were examined principally to estimate the incidence of predation on juvenile salmon. Stomachs were excised and classified by percent fullness. Stomach contents were removed and identified to the lowest practical taxon discernable by naked eye, generally to order, occasionally to genus (e.g., Euphausiacea, Calanoida, Decapoda (crab megalopae), *Oikopleura* sp., *Limacina* sp.). Stomach content weight was determined by subtracting empty stomach weight from full stomach weight.

RESULTS

Sampling effort during the survey included 90 rope trawl hauls, 100 CTD casts, 98 bongo net hauls, 110 shallow (20 m) conical net hauls, and 50 deep (200 m) conical net hauls (Table 2). Rope trawl sampling was conducted at 19 stations each month except October. Inclement weather prevented rope trawl sampling at all Upper Chatham Strait stations and the False Point Retreat station in October (Table 2; Appendix).

Ocean Conditions

Sea surface temperature and salinity data were averaged for each locality and ranged from 6.7° to 15.1°C and 15.1 to 31.6‰ respectively (Table 3; Fig. 2). Mean surface temperatures were lowest at the Cross Sound stations between May and August, and at the inshore stations in October. Mean surface temperatures were highest at inshore stations in May and June and at the Icy Point stations between July and October. Mean surface salinities were higher along the outer coast (30.4–31.6‰) than inside waters (15.1–30.0‰) throughout the survey. Surface salinities were lowest during July at stations located in inside waters, and typically increased with proximity to the outer coast. A more complete description of temperature and salinity data collecting during the survey can be found in Murphy and Orsi (1999).

Zooplankton SVs averaged for each locality ranged from 1.0 to 28.3 ml (Table 4). In the inside waters, zooplankton SVs ranged from 1.0 ml at the Upper Chatham stations in August and October, to 28.3 ml at the Icy Strait stations in June. In the outside waters, mean SVs ranged from 3.0 ml at the Cross Sound stations in October to 12.8 ml at the Icy Point stations in May and July.

Rope Trawl Catch

A total of 11,648 fish and squid representing 31 taxa were collected during the survey (Table 5). All five species of Pacific salmon native to North America and steelhead (*O. mykiss*) were collected, and these six species made up 45% of the total catch. Over 99% of the salmon collected were juveniles: 3,565 (68%) chum salmon, 1,108 (21%) pink salmon (*O. gorbuscha*), 237 (4%) sockeye salmon (*O. nerka*), 215 (4%) coho salmon (*O. kisutch*), 113 (2%) chinook salmon (*O. tshawytscha*), and 1 (< 1%) steelhead. A total of 29 immature chinook salmon, 5 adult pink salmon, and 5 adult coho salmon were also captured. Chum, pink, and coho salmon were captured more frequently in the trawl catches than other species or species groups (≥ 42%) (Table 6). However, the numbers of chum and pink salmon were considerably greater than the number of coho salmon (Table 5).

Non-salmonid species making up more than 1% of the catch included sablefish (41%), Pacific herring (5%), capelin (*Mallotus villosus*) (3%), squid (2%), and walleye pollock (*Theragra chalcogramma*) (1%) (Table 5). Pacific herring, capelin, and crested sculpin (*Blepsias bilobus*) were the most frequently (> 24%) captured non-salmonids. However, only 46 crested sculpin were captured. Juvenile sablefish were the most abundant species captured during the survey, but occurred in only 11% of the trawl hauls (Table 6).

Species Distribution

Distribution of juvenile salmon differed by month, species, and location. Chum, pink, and chinook salmon were most abundant in July, whereas sockeye and coho salmon were most abundant in June (Fig. 3). Catch rates of all juvenile salmon, except chinook salmon, were highest at the strait stations; chinook salmon were caught primarily at the inshore stations. At the Icy Point stations, catch rates of juvenile salmon declined with distance offshore; most juveniles were captured within 25 km of shore and no juveniles were caught beyond 40 km (Fig. 4).

Catch rates of the predominant fish species varied by sea surface temperature (Fig. 5). Catch rates of capelin were highest at temperatures less than or equal to 9°C. Catch rates of Pacific herring were highest between 9° and 12°C. Catch rates of juvenile salmon increased with increasing sea surface temperature, but declined at temperatures greater than or equal to 15°C. Sablefish catch rates were the highest of all species at temperatures greater than or equal to 15°C.

Overall composition of fish species varied by habitat and season (Fig. 6). Pacific herring were caught throughout the summer at the inshore stations, but catch rates declined in the fall. Juvenile salmon were the predominant species captured at the strait stations, and made up over 90% of the catch during June, July, and August. Immature chinook and pollock were the predominant species in May. Species composition varied by month at the coastal stations. The predominant taxa were squid in May; capelin and Pacific sand lance in June; juvenile salmon in July; juvenile salmon, juvenile sablefish, and herring in August; and juvenile sablefish in October.

Coded-wire Tag Recoveries

Twenty-three juvenile and immature salmon containing CWTs were captured: 13 chinook, 9 coho, and 1 chum salmon. Twenty-one of the CWTs originated in Alaska and 2 in Oregon (1 chinook and 1 coho salmon; Table 7). Estimated migration rates of coho salmon ranged from 3.3 to 5.0 km/day in inside waters and from 11.4 to 28.6 km/day in outside waters. Migration rates for chinook salmon ranged from 0.2 to 1.3 km/day in inside waters; the chinook salmon captured in outside waters had migrated 19.7 km/day.

Juvenile Salmon Fork Lengths

Mean fork lengths of sampled juvenile salmon ranged from 95.8 to 290.3 mm (Table 8; Fig. 7) throughout the survey. Coho salmon were longest each month, and their mean length increased faster than those of all other salmon species. Mean lengths of chum and pink salmon were similar, typically differing by only 1 or 2 mm each month. Pink salmon were shortest each month except October. Mean lengths of sockeye salmon increased more slowly than those of other salmon species; in October, they were the shortest salmon species.

Mean fork lengths also differed between localities (Table 8). Sockeye and coho salmon were consistently larger at the Icy Point stations than at the strait stations. Pink salmon were consistently larger at the strait stations than at the Icy Point stations. Chum salmon were larger at the strait stations each month they were captured except July. The larger average size of juvenile chum salmon at the Icy Point stations in July was due to the presence of a larger, second mode in the distribution of lengths (Fig. 8).

Predator Diets

Stomachs of 130 potential predators of juvenile salmon were examined and included: adult walleye pollock, immature chinook salmon, adult Pacific herring, adult spiny dogfish (*Squalus acanthias*), Pacific sandfish (*Trichodon trichodon*), adult pink salmon, adult coho salmon, pomfret (*Brama japonica*), jack mackerel (*Trachurus symmetricus*), and juvenile sablefish (Fig. 9). The stomach contents of the one jack mackerel was also examined; it was empty and, therefore, was not included in the figure.

Eighteen percent of the stomachs examined were empty. Mean fullness of non-empty stomachs was 50%. Piscivory was most common in pomfret, adult Pacific sandfish, immature chinook salmon, and adult coho salmon. Most fish prey were highly digested. Identifiable fish in the stomachs included juvenile Pacific sand lance (*Ammodytes hexapterus*), capelin, and Pacific herring. Few predators (two Pacific sandfish) had juvenile salmon in their stomachs. Primary invertebrate prey included decapods (crab megalopae) for pink salmon and sablefish, *Oikopleura* sp. for pollock, and lesser amounts of Euphausiids for several species.

The large number (4,512) of sablefish captured at Icy Point Station (IPA) in October required subsampling of the catch for diet analysis. We randomly selected 10 sablefish for onboard diet analysis. As the remainder of the catch was being processed, we observed a caudal fin protruding from the mouth of a juvenile sablefish (222 mm). The fish was removed from the stomach of the juvenile sablefish and identified as a juvenile chum salmon (121 mm). This chum salmon was 87 mm shorter than the shortest chum salmon captured at the Icy Point stations and 93 mm shorter than chum salmon captured at all stations during October (Table 8), which emphasizes the importance of size in determining predation risk. This predation event is not included in the summary of predator diets (Fig. 9) because it was not part of the subsample of fish selected for onboard diet analysis and herding action of the trawl may have led to this predation event.

DISCUSSION

Juvenile salmon initially distribute along shallow, estuarine habitats before dispersing into deeper pelagic waters. Our peak catches of sockeye and coho salmon in the deeper pelagic waters occurred in June, whereas peak catches of pink and chum salmon occurred in July. The difference in timing may reflect different nearshore residencies of these species. Coho and sockeye (except sea-type sockeye) salmon stocks are older and larger than pink and chum salmon at ocean entry, and have a shorter estuarine residency.

Sea-type sockeye salmon typically remain in estuarine habitats until late July in southeastern Alaska due to a lower salinity tolerance at smaller sizes (Heifetz et al. 1989). This is consistent with sockeye salmon length distributions observed in our survey; the drop in minimum size between July and August suggests the presence of sea-type sockeye salmon in our August samples (Fig. 7). Although it is reasonable to assume that sea-type sockeye salmon are present in our samples, they are uncommon in our study area. The Taku River is the only river system known to produce significant numbers (~13% of returning adults) of sea-type sockeye salmon in our survey area (McPherson et al. 1988), largely due to habitat conditions that allow for persistent riverine spawning (Eiler et al. 1992).

After juveniles disperse from the nearshore habitat, their migratory rates can be high. The juvenile chinook and coho salmon captured along the outer coast from Washington and Oregon had migration rates of 19.7 and 28.6 km/day. The Umatilla River chinook salmon recovered in June is significant in that it is the earliest recovery of Columbia River chinook salmon stocks off southeastern Alaska. Peak catches of pink and chum salmon occurred simultaneously in inside and coastal waters, suggesting fairly rapid migration through the survey area. Catches of pink salmon, however, did not decline as rapidly as catches of chum salmon.

During the first year of ocean life, salmon migration is thought to be size-dependent (Hart and Dell 1986; Jaenicke and Celewycz 1996). Sockeye and coho salmon were larger on the outer coast than in inside waters, supporting the concept of size-dependent migration. However, larger sizes on the outer coast may simply reflect the presence of earlier-migrating sockeye and coho salmon from the Pacific Northwest and British Columbia, not size-dependent migration. Pink and chum salmon were not consistently larger along the outer coast, suggesting that body size may not be the primary factor determining their migration from inside to coastal waters. Migration of pink and chum salmon from inside to coastal waters may be more directly related to food availability (Healey 1980) than to a threshold size; their decline in inside waters corresponded with a decrease in zooplankton abundance, which could result in increased competition and dispersal into coastal waters.

The distribution of juvenile chum salmon lengths in July along the outer coast was distinctively bimodal, suggesting a mixture of stocks. Significant differences in age due to stock mixtures will confound attempts to infer growth from length distributions. However, these differences may be used to help separate stocks when a proportion of the fish has stock-identification information (e.g., CWTs and thermal-marked otoliths). The stock information obtained from CWTs and thermal-marked otoliths could be apportioned to the entire sample based on the length distribution.

The width of the coastal migration corridor of juvenile salmon in the Gulf of Alaska is an important aspect of their early marine ecology (Walters et al. 1978). Using purse seines, Hartt and Dell (1986) estimated the coastal migration corridor to be within 37 km from the coast along southeastern Alaska, similar to what was observed during our survey. Most of our juveniles were captured within 25 km of shore and no juvenile was captured beyond 40 km. Other ocean surveys along the coast of southeastern Alaska have captured juvenile salmon farther offshore: Jaenicke and Celewycz (1994) captured them as far as 74 km from shore with purse seines in 1984, and Carlson et al. (1996) captured them as far as 100 km from shore with a rope trawl in 1996 along the coast of southeastern Alaska. A variety of factors such as deflections of the Alaska Coastal Current by bottom topography, surface temperatures, food availability, and proximity to primary outmigration corridors could affect the juveniles' distance from shore. However, other factors related to sampling, such as sampling effort, gear type, and weather conditions play an important role in the ability to capture juvenile salmon. The distinction between the two types of factors is important when comparing results between different ocean surveys. Until sampling effects have been identified, it will be difficult to compare results, especially presence or absence of juvenile salmon.

During exceptionally warm periods, such as the El Niño (Wooster and Fluharty 1985) conditions during this survey, sea surface temperatures may significantly influence juvenile salmon distribution and migration (Chung 1985). Pacific salmon may actively avoid temperatures greater than 15°C, due to its debilitating effects on metabolic functions in salmon (Brett 1971). Our catch rates of juvenile salmon declined abruptly at sea surface temperatures greater than 15°C, suggesting that they may avoid warmer water.

Predation is thought to be one of the primary sources of marine mortality in juvenile salmon (Bax 1983; Pearcy 1997). Our examination of predator stomachs did not indicate high levels of predation on juvenile salmon; however, predation could be high in areas not sampled, such as shallow nearshore habitats (most of Bax's sampling). Fish size is thought to be an important factor in determining predation risk of juvenile salmon (Parker 1971; Healey 1982; Holtby et al. 1990). Slower-growing individuals are vulnerable to more predators for a longer time. The relatively small size of the chum salmon found in the sablefish stomach during our survey emphasizes the importance of size in determining predation risk. Changes in the abundance or distribution of predators and alternative prey populations can modify levels of predation on juvenile salmon independently of their growth and may be an important factor determining actual predation levels (Fisher and Pearcy 1988; Holtby et al. 1990). Fish from stomachs of potential predators of juvenile salmon were predominately capelin, Pacific sand lance, and Pacific herring. Changes in the abundance or distribution of these fish species could substantially alter predation pressure on juvenile salmon.

This report constitutes a preliminary summary of findings of the ocean survey of juvenile salmon in the northern region of southeastern Alaska. Further analyses will include an examination of otoliths for hatchery thermal marks. From the thermal-mark information, competitive interactions between hatchery and wild salmon stocks will be studied, and thermally marked hatchery fish will be used to obtain stock-specific life-history characteristics.

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TABLES

Table 1.--Coordinates of stations sampled during a juvenile salmon rope trawl survey in marine waters of the northern region of southeastern Alaska, May–October 1997.

Habitat/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	1,300

Table 2.--Numbers and types of data collected during a juvenile salmon rope trawl survey in marine waters of the northern region of southeastern Alaska, May–October 1997. Station abbreviations are defined in Table 1.

		Data Collection Type[a]					
Dates	Habitat	Trawl	CTD	Bongo	NORPAC Shallow	NORPAC Deep	WP-2 Deep
20–26 May	Inshore	3	4	4	6	1	1
	Strait	8	8	8	8	0	0
	Coastal	8	8	8	8	4	4
	May total	19	20	20	22	5	5
22–26 June	Inshore	3	4	4	6	1	1
	Strait	8	8	8	8	0	0
	Coastal	8	8	8	8	4	4
	June total	19	20	20	22	5	5
17–27 July	Inshore[b]	3	5	5	5	1	1
	Strait[c]	8	9	9	9	0	0
	Coastal	8	8	8	8	4	4
	July total	19	22	22	24	5	5
22–28 August	Inshore	3	4	4	6	1	1
	Strait[d]	8	9	9	9	0	0
	Coastal	8	8	8	8	4	4
	August total	19	21	21	23	5	5
2-7 October	Inshore[e]	2	4	3	6	1	1
	Strait[f]	4	5	4	5	0	0
	Coastal	8	8	8	8	4	4
	October total	14	17	15	19	5	5
	1997 Totals	90	100	98	110	25	25

[a]Trawl = 20-min rope trawl hauls; CTD = profiles to 200 m or within 10 m of the bottom; Bongo = double oblique tows to 200 m or 20 m of bottom using a 60-cm diameter bongo frame, and 505- and 333-μm meshes; NORPAC Shallow = 20-m vertical hauls using a 50-cm diameter conical net with 243-μm mesh; NORPAC Deep = vertical hauls from 200 m or 20 m of bottom using a 50-cm conical net with 243-μm mesh; WP-2 Deep = vertical hauls from 200 m or within 20 m of bottom using a 57-cm diameter conical net with 202-μm mesh.

[b]Oceanographic data collection at TKI was repeated because of trawl gear complications during first attempt at trawling.

[c]Oceanographic data collection at UCC was repeated because of trawl gear complications during first attempt at trawling.

[d]Oceanographic data collection at UCD was repeated because of trawl gear complications during first attempt at trawling.

[e]Inclement weather prevented trawl and bongo data collection at FPR.

[f]Only one CTD cast and one shallow NORPAC zooplankton sample were collected at the Upper Chatham stations (station UCA), because of inclement weather.

Table 3.--Surface (≤2 m) temperature (Temp.) and salinity (Salin.) data sampled monthly in marine waters of the northern region of southeastern Alaska, May–October 1997. Station code abbreviations are defined in Table 1. Dash means station was not sampled.

Locality	Month	Temp. (°C) (Salin.) (‰)	Temp. (°C) (Salin.) (‰)	Temp. (°C) (Salin.) (‰)	Temp. (°C) (Salin.) (‰)	Temp. (°C) (Salin.) (‰)
		Inside Waters				
Inshore		TKI	ABM	LFC	FPR	Mean
	May	10.0 (17.9)	8.7 (26.7)	11.2 (25.4)	7.9 (29.5)	9.5 (24.9)
	June	10.2 (16.6)	12.0 (21.3)	12.8 (22.3)	13.9 (23.1)	12.2 (20.8)
	July	10.5 (15.3)	11.9 (14.7)	11.0 (15.2)	13.4 (15.2)	11.7 (15.1)
	August	11.5 (17.5)	12.6 (18.0)	12.6 (20.1)	12.9 (19.8)	12.4 (18.9)
	October	8.7 (20.7)	8.6 (24.2)	8.5 (24.3)	8.4 (27.8)	8.6 (24.3)
Upper Chatham Strait		UCA	UCB	UCC	UCD	Mean
	May	9.4 (28.6)	8.7 (28.0)	7.8 (28.7)	7.9 (28.8)	8.5 (28.5)
	June	14.3 (22.4)	12.9 (22.5)	12.9 (22.5)	13.2 (22.1)	13.3 (22.4)
	July	13.6 (23.1)	13.7 (23.3)	13.1 (17.1)	13.2 (16.1)	13.4 (19.9)
	August	11.2 (28.5)	11.3 (28.2)	12.5 (26.3)	12.0 (28.1)	11.8 (27.8)
	October	8.7 (29.1)	— (—)	— (—)	— (—)	8.7 (29.1)
Icy Strait		ISA	ISB	ISC	ISD	Mean
	May	8.1 (30.8)	8.5 (29.9)	8.6 (29.9)	9.0 (29.4)	8.6 (30.0)
	June	12.2 (27.6)	12.9 (27.4)	12.4 (27.7)	13.0 (27.9)	12.6 (27.7)
	July	12.0 (24.1)	13.2 (20.3)	13.5 (20.2)	13.9 (20.4)	13.2 (21.3)
	August	11.2 (27.0)	11.5 (26.1)	12.3 (24.5)	12.8 (23.7)	12.0 (25.3)
	October	8.6 (28.7)	8.7 (28.4)	8.9 (28.0)	8.9 (26.4)	8.8 (27.9)
		Outside Waters				
Cross Sound		CSA	CSB	CSC	CSD	Mean
	May	6.9 (31.4)	6.6 (31.4)	6.6 (31.7)	6.5 (31.8)	6.7 (31.6)
	June	9.8 (31.1)	8.2 (31.6)	7.4 (31.8)	7.3 (31.8)	8.2 (31.6)
	July	11.3 (30.9)	8.2 (31.7)	8.3 (31.6)	8.0 (30.9)	9.0 (31.3)
	August	15.2 (30.8)	10.7 (30.9)	10.2 (30.5)	9.4 (30.1)	11.4 (30.6)
	October	11.5 (30.8)	9.2 (31.1)	8.3 (31.2)	8.4 (30.9)	9.4 (31.0)
Icy Point		IPA	IPB	IPC	IPD	Mean
	May	8.2 (30.8)	8.7 (31.2)	9.1 (31.3)	9.4 (31.3)	8.9 (31.2)
	June	11.2 (30.9)	12.4 (31.4)	13.4 (31.5)	13.3 (31.5)	12.6 (31.3)
	July	13.9 (30.9)	14.5 (31.2)	14.4 (31.4)	14.6 (31.9)	14.4 (31.4)
	August	15.0 (31.0)	14.1 (30.7)	15.0 (31.1)	16.3 (31.1)	15.1 (31.0)
	October	11.1 (29.6)	12.5 (30.7)	12.4 (30.7)	12.3 (30.6)	12.1 (30.4)

Table 4.--Settled zooplankton volumes, and associated light intensity, collected in marine waters of the northern region of southeastern Alaska, May–October 1997. Zooplankton were collected with a 0.5-m diameter conical net with 243-μm mesh and towed vertically from 20 m to the surface. Station code abbreviations are defined in Table 1. Dash means station was not sampled.

Locality	Month	Volume (ml) (Light) (W/m^2)	Volume (ml) (Light) (W/m^2)	Volume (ml) (Light) (W/m^2)	Volume (ml) (Light) (W/m^2)	Volume (ml) (Light) (W/m^2)
Inside Waters						
Inshore		TKI	ABM	LFC	FPR	Mean
	May	22 (345.0)	21 (—)	20 (22.0)	15 (—)	19.5 (183.5)
	June	20 (365.6)	20 (844.0)	28 (182.7)	23 (566.9)	22.8 (489.8)
	July	7 (43.1)	14 (39.4)	30 (161.6)	11 (205.0)	15.5 (112.3)
	August	12 (177.6)	9 (301.1)	10 (148.3)	2 (108.8)	8.3 (184.0)
	October	4 (14.5)	10 (164.0)	8 (70.0)	1 (46.0)	5.8 (73.6)
Upper Chatham Strait		UCA	UCB	UCC	UCD	Mean
	May	30 (652.9)	40 (765.8)	16 (617.7)	25 (100.4)	27.8 (361.7)
	June	32 (815.5)	28 (832.9)	25 (174.5)	24 (191.2)	27.3 (503.5)
	July	4 (85.3)	8 (213.8)	12 (140.2)	28 (79.4)	13.0 (129.7)
	August	1 (116.6)	1 (140.7)	1 (169.2)	1 (82.9)	1.0 (127.4)
	October	1 (29.0)	— (—)	— (—)	— (—)	1.0 (29.0)
Icy Strait		ISA	ISB	ISC	ISD	Mean
	May	19 (19.0)	20 (143.0)	33 (197.0)	29 (748.8)	25.3 (277.0)
	June	27 (—)	25 (240.9)	26 (340.2)	35 (466.6)	28.3 (349.2)
	July	18 (102.8)	23 (180.3)	35 (149.1)	28 (248.2)	26.0 (170.1)
	August	8 (14.9)	5 (28.3)	11 (108.7)	8 (38.4)	8.0 (47.6)
	October	1 (21.0)	2 (43.0)	2 (280.0)	2 (134.0)	1.8 (119.5)
Outside Waters						
Cross Sound		CSA	CSB	CSC	CSD	Mean
	May	10 (—)	8 (127.1)	9 (257.0)	7 (—)	8.5 (192.1)
	June	5 (220.0)	5 (128.3)	4 (97.7)	3 (91.6)	4.3 (134.4)
	July	7 (85.0)	4 (71.3)	4 (94.5)	5 (123.0)	5.0 (93.5)
	August	7 (64.8)	4 (160.0)	4 (172.4)	4 (608.5)	4.8 (450.0)
	October	5 (35.0)	3 (190.0)	3 (250.0)	1 (304.0)	3.0 (194.8)
Icy Point		IPA	IPB	IPC	IPD	Mean
	May	7 (93.1)	13 (182.4)	15 (334.9)	16 (193.4)	12.8 (201.0)
	June	3 (282.0)	2 (660.5)	2 (825.0)	13 (622.0)	5.0 (597.4)
	July	14 (38.1)	11 (155.1)	14 (140.3)	12 (390.0)	12.8 (180.9)
	August	12 (83.4)	10 (163.6)	13 (489.9)	8 (372.6)	10.8 (277.4)
	October	8 (6.3)	12 (—)	7 (320.0)	7 (300.0)	8.5 (208.8)

Table 5.--Numbers of fish and squid captured by rope trawl in marine waters of the northern region of southeastern Alaska, May–October 1997. Dash means none captured.

Common Name		Scientific Name	Number Caught					
			May	June	July	August	October	Total
Chum salmon	(juvenile)	*Oncorhynchus keta*	—	783	2,499	245	38	3,565
Pink salmon	(juvenile)	*O. gorbuscha*	—	124	499	284	201	1,108
	(adult)		—	2	2	1	—	5
Sockeye salmon	(juvenile)	*O. nerka*	—	116	73	32	16	237
Coho salmon	(juvenile)	*O. kisutch*	—	123	47	36	9	215
	(adult)		—	—	—	5	—	5
Chinook salmon	(juvenile)	*O. tshawytscha*	—	28	52	19	14	113
	(immature)		18	8	—	3	—	29
Steelhead	(juvenile)	*O. mykiss*	—	1	—	—	—	1
Sablefish		*Anoplopoma fimbria*	—	—	—	85	4,710	4,795
Pacific herring		*Clupea harengus*	237	157	43	135	27	599
Capelin		*Mallotus villosus*	10	96	4	33	257	400
Squid		Gonatidae	128	4	2	—	97	231
Walleye pollock		*Theragra chalcogramma*	77	17	3	2	1	100
Pacific sand lance		*Ammodytes hexapterus*	—	53	—	—	—	53
Crested sculpin		*Blepsias bilobus*	—	8	26	12	—	46
Pacific spiny lumpsucker		*Eumicrotremus orbis*	3	3	17	13	10	46
Soft sculpin		*Psychrolutes sigalutes*	14	3	—	—	12	29
Rockfish		*Sebastes* spp.	—	—	12	1	—	13
Pacific sandfish		*Trichodon trichodon*	6	1	2	2	1	12
Spiny dogfish		*Squalus acanthias*	—	10	—	—	—	10
Prowfish		*Zaprora silenus*	—	—	5	4	—	9
Starry flounder		*Platichthys stellatus*	5	—	—	—	2	7
Bigmouth sculpin		*Hemitripterus bolini*	3	3	—	—	—	6
Lingcod		*Ophiodon elongatus*	—	3	—	—	—	3
Smooth lumpsucker		*Aptocyclus ventricosus*	—	—	1	1	1	3
Arrowtooth flounder		*Atheresthes stomias*	—	2	—	—	—	2
Three-spined stickleback		*Gasterosteus aculeatus*	1	—	—	—	—	1
Wolf-eel		*Anarrhichthys ocellatus*	1	—	—	—	—	1
Salmon shark		*Lamna ditropis*	1	—	—	—	—	1
Poacher		Agonidae	—	1	—	—	—	1
Quillfish		*Ptilichthys goodei*	—	—	1	—	—	1
Pomfret		*Brama japonica*	—	—	1	—	—	1
Jack mackerel		*Trachurus symmetricus*	—	—	—	1	—	1
Total			504	1,546	3,289	913	5,396	11,648

Table 6.--Frequency of occurrence for fish and squid captured by rope trawl in marine waters of the northern region of southeastern Alaska, May–October 1997. Percent occurrence per 90 rope trawl hauls is shown in parentheses. Dash means none captured.

Common Name		Scientific Name	Frequency of Occurrence						
			May	June	July	August	October	Total	(%)
Chum salmon	(juvenile)	*Oncorhynchus keta*	—	9	15	10	7	41	(46)
Pink salmon	(juvenile)	*O. gorbuscha*	—	8	10	10	11	39	(43)
	(adult)		—	1	2	1	—	4	(4)
Sockeye salmon	(juvenile)	*O. nerka*	—	9	9	6	6	30	(33)
Coho salmon	(juvenile)	*O. kisutch*	—	11	11	10	6	38	(42)
	(adult)		—	—	—	4	—	4	(4)
Chinook salmon	(juvenile)	*O. tshawytscha*	—	7	3	8	3	21	(23)
	(immature)		9	5	—	2	—	16	(18)
Steelhead	(juvenile)	*O. mykiss*	—	1	—	—	—	1	(1)
Sablefish		*Anoplopoma fimbria*	—	—	—	4	6	10	(11)
Pacific herring		*Clupea harengus*	3	4	3	7	5	22	(24)
Capelin		*Mallotus villosus*	4	6	2	6	4	22	(24)
Squid		Gonatidae	4	3	2	—	1	10	(11)
Walleye pollock		*Theragra chalcogramma*	5	6	3	2	1	17	(19)
Pacific sand lance		*Ammodytes hexapterus*	—	7	—	—	—	7	(8)
Crested sculpin		*Blepsias bilobus*	—	6	10	7	—	23	(26)
Pacific spiny lumpsucker		*Eumicrotremus orbis*	2	3	5	2	5	17	(19)
Soft sculpin		*Psychrolutes sigalutes*	8	2	—	—	4	14	(16)
Rockfish		*Sebastes* spp.	—	—	2	1	—	3	(3)
Pacific sandfish		*Trichodon trichodon*	1	1	1	1	1	5	(6)
Spiny dogfish		*Squalus acanthias*	—	1	—	—	—	1	(1)
Prowfish		*Zaprora silenus*	—	—	5	4	—	9	(10)
Starry flounder		*Platichthys stellatus*	1	—	—	—	2	3	(3)
Bigmouth sculpin		*Hemitripterus bolini*	3	2	—	—	—	5	(6)
Lingcod		*Ophiodon elongatus*	—	3	—	—	—	3	(3)
Smooth lumpsucker		*Aptocyclus ventricosus*	—	—	1	1	1	3	(3)
Arrowtooth flounder		*Atheresthes stomias*	—	1	—	—	—	1	(1)
Three-spined stickleback		*Gasterosteus aculeatus*	1	—	—	—	—	1	(1)
Wolf-eel		*Anarrhichthys ocellatus*	1	—	—	—	—	1	(1)
Salmon shark		*Lamna ditropis*	1	—	—	—	—	1	(1)
Poacher		Agonidae	—	1	—	—	—	1	(1)
Quillfish		*Ptilichthys goodei*	—	—	1	—	—	1	(1)
Pomfret		*Brama japonica*	—	—	1	—	—	1	(1)
Jack mackerel		*Trachurus symmetricus*	—	—	—	1	—	1	(1)
Total			19	19	19	19	14	90	

Table 7.--Release and recovery information for coded-wire tagged juvenile salmon captured by rope trawl in marine waters of the northern region of southeastern Alaska, May–October 1997. Station code abbreviations are defined in Table 1.

		Release Information						Recovery Information						
						Size				Size				
Species	Coded-wire Tag Code	Year	Brood Agency[a]	Locality	Date	(mm)	(g)	Locality (Station Code)	Date	(mm)	(g)	Age	Days Since Release	Distance Traveled (km)
May														
Chinook	04:45/21	1994	HDFAL	Hidden Falls, AK	06/05/96	—	28.4	Icy Strait (ICC)	05/24/97	326	505.0	1.1	352	135
Chinook	50:04/04	1994	DIPAC	Gastineau Channel, AK	06/12/96	147	23.5	Upper Chatham (UCD)	05/21/97	310	410.0	1.1	344	70
June														
Chinook	09:17/50	1995	ODFW	Umatilla River, OR	03/26/97	—	48.8	Icy Point (IPB)	06/25/97	231	160.9	1.0	91	1,800
Chinook	50:04/22	1995	DIPAC	Gastineau Channel, AK	06/10/97	—	18.7	Favorite Channel (LFC)	06/26/97	104	13.6	1.0	16	20
Chinook	50:04/26	1995	DIPAC	Fish Creek, AK	06/10/97	—	24.9	Favorite Channel (LFC)	06/26/97	127	22.1	1.0	16	20
Chinook	No tag	—	—	—	—	—	—	Favorite Channel (LFC)	06/26/97	139	—	1.0	—	—
Coho	50:04/12	1995	DIPAC	Gastineau Channel, AK	06/10/97	—	16.2	Upper Chatham (UCA)	06/23/97	139	32.2	1.0	13	75
Coho	50:04/13	1995	DIPAC	Gastineau Channel, AK	06/10/97	—	16.2	Icy Strait (ISA)	06/26/97	144	30.7	1.0	16	95
Coho	50:04/13	1995	DIPAC	Gastineau Channel, AK	06/10/97	—	16.2	Upper Chatham (UCA)	06/23/97	125	18.9	1.0	13	75
Coho	50:04/15	1995	DIPAC	Gastineau Channel, AK	06/10/97	—	16.2	Upper Chatham (UCA)	06/23/97	140	29.8	1.0	13	75
Coho	04:47/02	1995	HDFAL	Hidden Falls, AK	06/02/97	—	18.0	Upper Chatham (UCD)	06/23/97	156	44.3	1.0	21	110
Coho	04:49/37	1995	NMFS	Duck Creek, AK	~05/15/97	—	—	Icy Strait (ISC)	06/26/97	182	67.2	1.0	~42	85
Coho	04:07/18	1995	NMFS	Auke Creek, AK	05/24/97	~90	—	Upper Chatham (UCA)	06/23/97	121	20.1	1.0	30	65
July														
Chinook	50:04/25	1995	DIPAC	Auke Bay, AK	06/10/97	—	26.6	Favorite Channel (LFC)	07/22/97	165	58.7	1.0	42	20
Chinook	50:04/25	1995	DIPAC	Auke Bay, AK	06/10/97	—	26.6	Favorite Channel (LFC)	07/22/97	193	95.0	1.0	42	20
Chinook	50:04/26	1995	DIPAC	Fish Creek, AK	06/10/97	—	24.9	Favorite Channel (LFC)	07/22/97	184	89.3	1.0	42	20
Chinook	50:04/26	1995	DIPAC	Fish Creek, AK	06/10/97	—	24.9	Favorite Channel (LFC)	07/22/97	165	56.0	1.0	42	20
Chinook	50:04/27	1995	DIPAC	Fish Creek, AK	06/10/97	—	24.9	Favorite Channel (LFC)	07/22/97	158	45.9	1.0	42	20
Chinook	50:04/27	1995	DIPAC	Fish Creek, AK	06/10/97	—	24.9	Favorite Channel (LFC)	07/22/97	157	47.4	1.0	42	20
Chinook	04:47/11	1995	HDFAL	Hidden Falls, AK	05/27/97	—	38.3	False Pt. Retreat (FPR)	07/22/97	224	156.5	1.0	56	130
Coho	04:47/50	1995	SSRAA	Neets Bay, AK	06/01/97	—	20.9	Icy Point (IPB)	07/25/97	234	156.1	1.0	54	620

Table 7.--Continued.

Species	Coded-wire Tag Code	Year	Brood Agency[a]	Release Information: Locality	Release Date	Release Size (mm)	Release Size (g)	Recovery Information: Locality (Station Code)		Recovery Date	Recovery Size (mm)	Recovery Size (g)	Age	Days Since Release	Distance Traveled (km)
Coho	07:09/46	1995	ODFW	Columbia River, OR (Big Creek)	05/30/97	—	37.5	Icy Point	(IPA)	07/25/97	227	177.9	1.0	56	1,600
Chum[b]	04:48/02	1995	BUROC	Burro Creek, AK	06/21/97	—	12.3	Icy Strait	(ISC)	07/21/97	162	42.3	1.0	30	150
August															
Chinook	04:40/51	1992	ADFG	Fish Creek, AK	06/20/94	110	18.8	Upper Chatham	(UCA)	08/23/97	685	4400.0	1.3	794	65
Coho	No tag	—	—	—	—	—	—	Cross Sound	(CSB)	08/26/97	247	299.0	—	—	—

[a]ADFG = Alaska Department of Fish and Game; BUROC = Burro Creek; DIPAC = Douglas Island Pink and Chum; HDFAL = Hidden Falls Hatchery; NMFS = National Marine Fisheries Service; ODFW = Oregon Department of Fish and Wildlife; SSRAA = Southern Southeast Regional Aquaculture Association.

[b]Tag code on this fish identified it as a chinook salmon; however, it was identified in the field as a chum salmon and verified as such in the laboratory using starch-gel electrophoresis. Further correspondence with a mark coordinator revealed that chum salmon may accidentally overwinter with chinook salmon at this facility.

Table 8.--Fork lengths of juvenile salmon captured by rope trawl in marine waters of the northern region of southeastern Alaska, May–October 1997. sd = standard deviation; ns = station not sampled.

Locality	June				July				August				October			
	n	Size Range (mm)	$\bar{x}$	sd	*n*	Size Range (mm)	$\bar{x}$	sd	*n*	Size Range (mm)	$\bar{x}$	sd	*n*	Size Range (mm)	$\bar{x}$	sd
								Chum Salmon								
Inshore	0	—	—	—	4	103–140	116.5	16.6	0	—	—	—	1	221	221.0	—
Upper Chatham	124	71–136	94.5	12.2	612	88–175	133.4	12.4	48	116–210	167.3	22.6	ns	—	—	—
Icy Strait	408	65–147	97.1	10.8	678	115–175	137.5	8.4	181	107–196	161.8	18.9	11	171–225	204.6	18.5
Cross Sound	1	97	97.0	—	7	115–145	126.0	11.4	14	131–159	143.7	9.5	15	160–235	201.2	22.2
Icy Point	3	132–135	133.0	1.7	146	104–207	148.7	26.1	2	140–154	147.0	9.9	11	145–243	199.8	28.7
All	536	65–147	96.7	11.5	1,447	88–207	136.8	13.7	245	107–210	161.7	19.9	38	145–243	202.3	22.7
								Pink Salmon								
Inshore	1	119	119.0	—	0	—	—	—	1	150	150.0	—	7	199–216	206.7	7.0
Upper Chatham	68	78–127	97.5	13.9	150	82–173	135.4	13.7	39	123–218	163.7	22.5	ns	—	—	—
Icy Strait	55	73–136	93.4	12.8	269	112–175	136.1	10.9	211	129–207	155.8	15.5	19	190–243	214.1	14.2
Cross Sound	0	—	—	—	2	117–130	123.5	9.2	28	131–171	144.5	9.1	54	183–239	203.6	11.7
Icy Point	0	—	—	—	73	109–179	136.6	17.3	5	133–162	145.6	10.6	121	159–236	195.5	14.3
All	124	73–136	95.8	13.6	494	82–179	135.9	12.9	284	123–218	155.5	16.7	201	159–243	199.9	14.7

Table 8.--Continued.

Locality	June				July				August				October			
	n	Size Range (mm)	$\bar{x}$	sd	*n*	Size Range (mm)	$\bar{x}$	sd	*n*	Size Range (mm)	$\bar{x}$	sd	*n*	Size Range (mm)	$\bar{x}$	sd
Sockeye Salmon																
Inshore	3	129–144	134.3	8.4	3	101–161	127.7	30.6	1	129	129.0	—	0	—	—	—
Upper Chatham	48	78–137	103.3	16.5	21	113–175	141.0	16.7	8	147–210	179.9	20.2	ns	—	—	—
Icy Strait	64	84–193	112.6	20.2	22	125–167	138.7	9.7	23	96–195	152.8	26.4	4	157–169	165.3	5.7
Cross Sound	1	141	141.0	—	0	—	—	—	0	—	—	—	6	139–195	175.2	20.5
Icy Point	0	—	—	—	27	119–175	156.7	13.4	0	—	—	—	6	168–213	187.7	15.2
All	116	78–193	109.6	19.5	73	101–175	145.6	16.6	32	96–210	158.8	27.5	16	139–195	177.4	17.5
Coho Salmon																
Inshore	4	116–140	131.0	11.5	17	162–230	200.8	18.5	0	—	—	—	0	—	—	—
Upper Chatham	66	107–220	137.7	18.4	9	169–236	203.2	19.7	21	219–286	245.4	19.4	ns	—	—	—
Icy Strait	50	100–205	159.4	20.4	11	199–241	216.7	14.4	6	205–259	236.0	20.8	3	277–298	285.7	11.0
Cross Sound	0	—	—	—	3	175–190	181.7	7.6	8	225–273	246.6	16.4	5	269–318	291.0	21.9
Icy Point	3	183–202	189.3	11.0	7	203–238	223.6	12.2	1	349	349.0	—	1	301	301.0	—
All	123	100–220	147.5	22.7	47	162–241	207.1	19.4	36	205–286	247.0	25.5	9	269–318	290.3	17.1
Chinook Salmon																
Inshore	24	93–187	135.7	25.6	52	131–230	172.0	19.1	7	161–205	193.0	15.2	8	195–234	220.1	14.5
Upper Chatham	3	167–177	172.3	5.0	0	—	—	—	4	201–256	226.8	27.8	ns	—	—	—
Icy Strait	0	—	—	—	0	—	—	—	8	217–314	245.9	28.9	4	283–311	296.8	14.3
Cross Sound	0	—	—	—	0	—	—	—	0	—	—	—	2	237–287	262.0	35.4
Icy Point	1	231	231.0	—	0	—	—	—	0	—	—	—	—	—	—	—
All	28	93–231	143.0	31.5	52	131–230	172.0	19.1	19	161–314	222.4	33.4	14	195–311	248.0	38.7

FIGURES

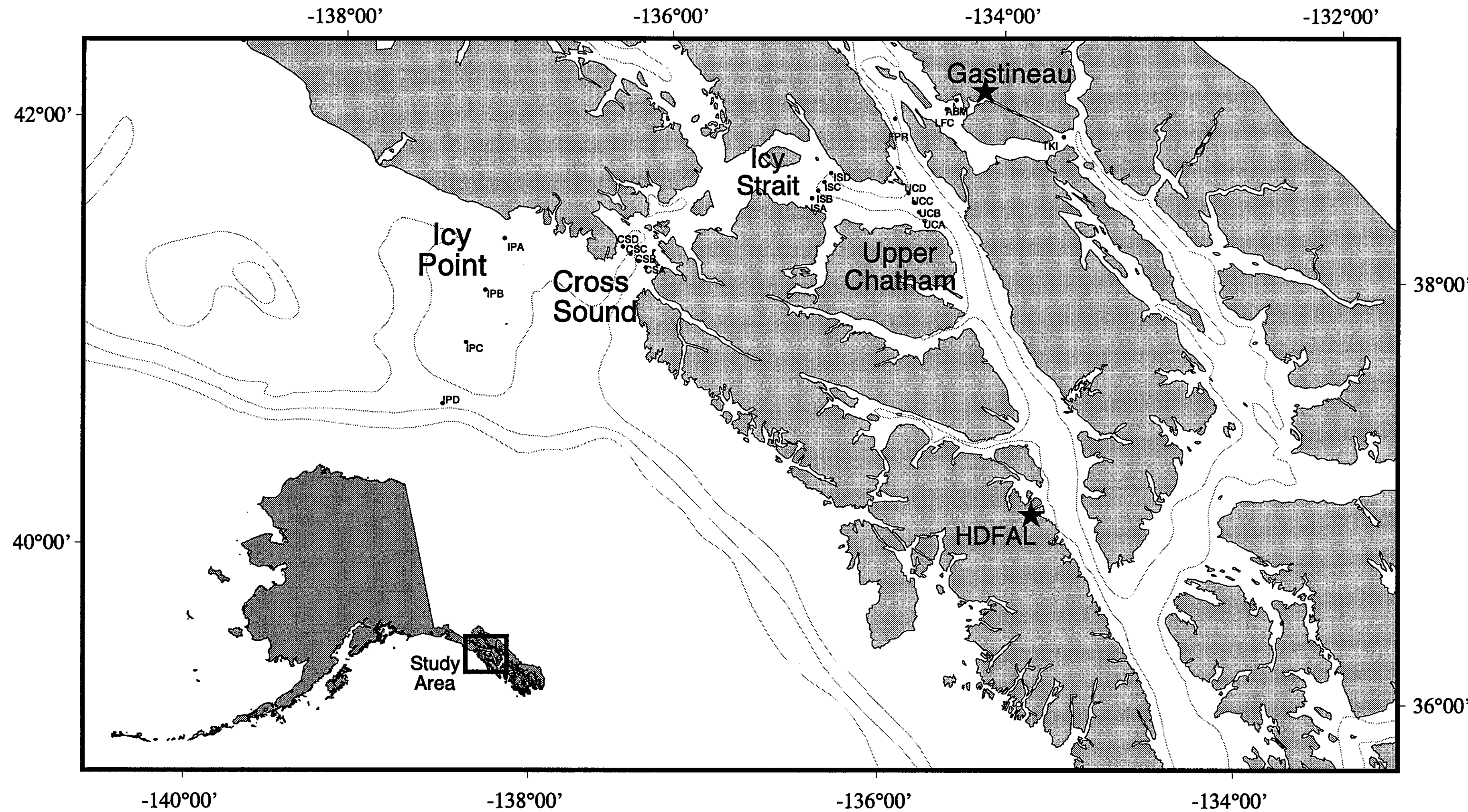

Figure 1.--Stations sampled during a survey of juvenile salmon in marine waters of the northern region of southeastern Alaska, May–October 1997. Stars identify the location of two major enhancement facilities in the region: Gastineau (Douglas Island Pink and Chum Hatchery) and HDFAL (Hidden Falls Hatchery).

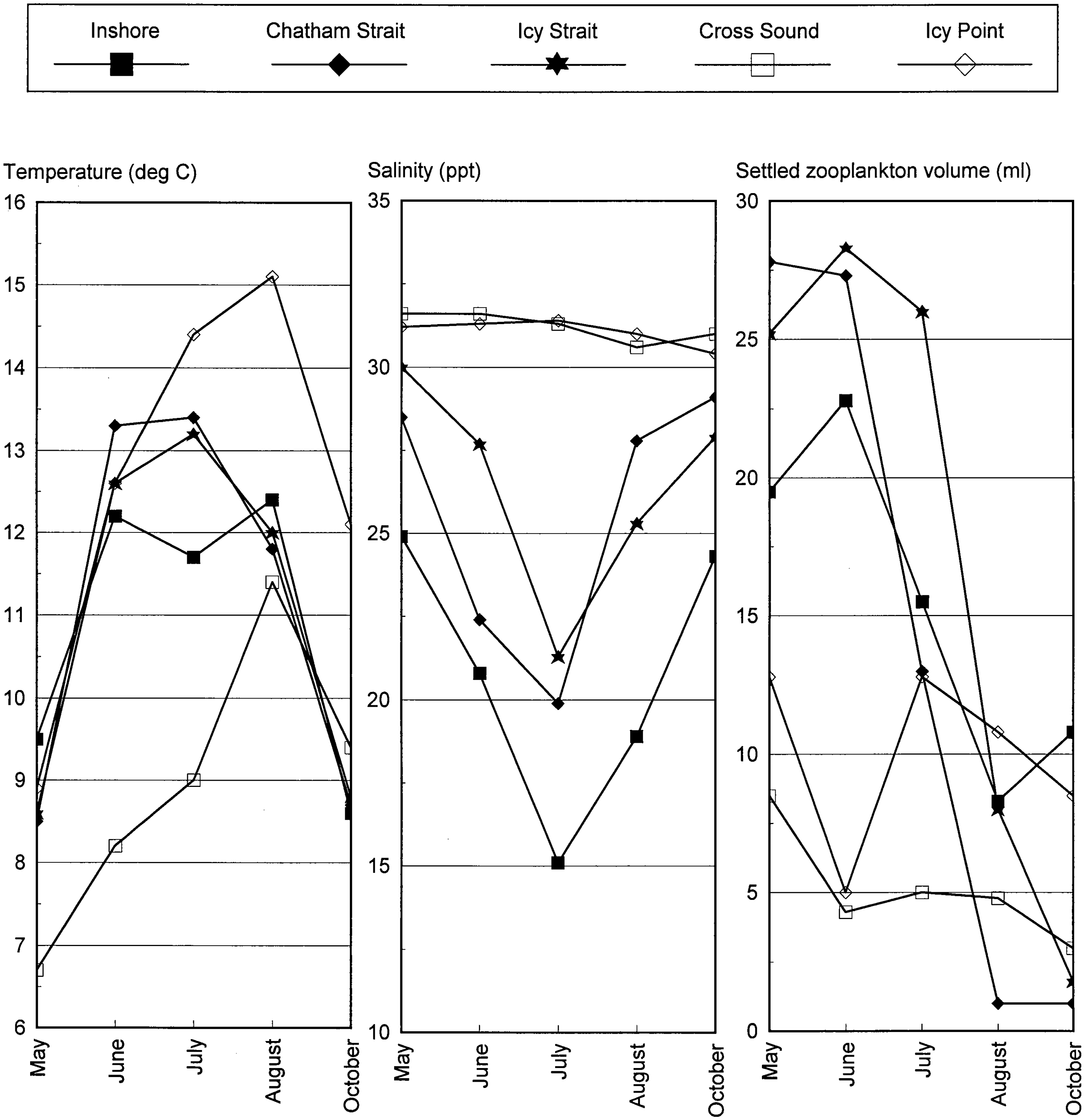

Figure 2.--Surface (≤2 m) temperature, salinity, and zooplankton settled volumes sampled in marine waters of the northern region of southeastern Alaska, May–October 1997.

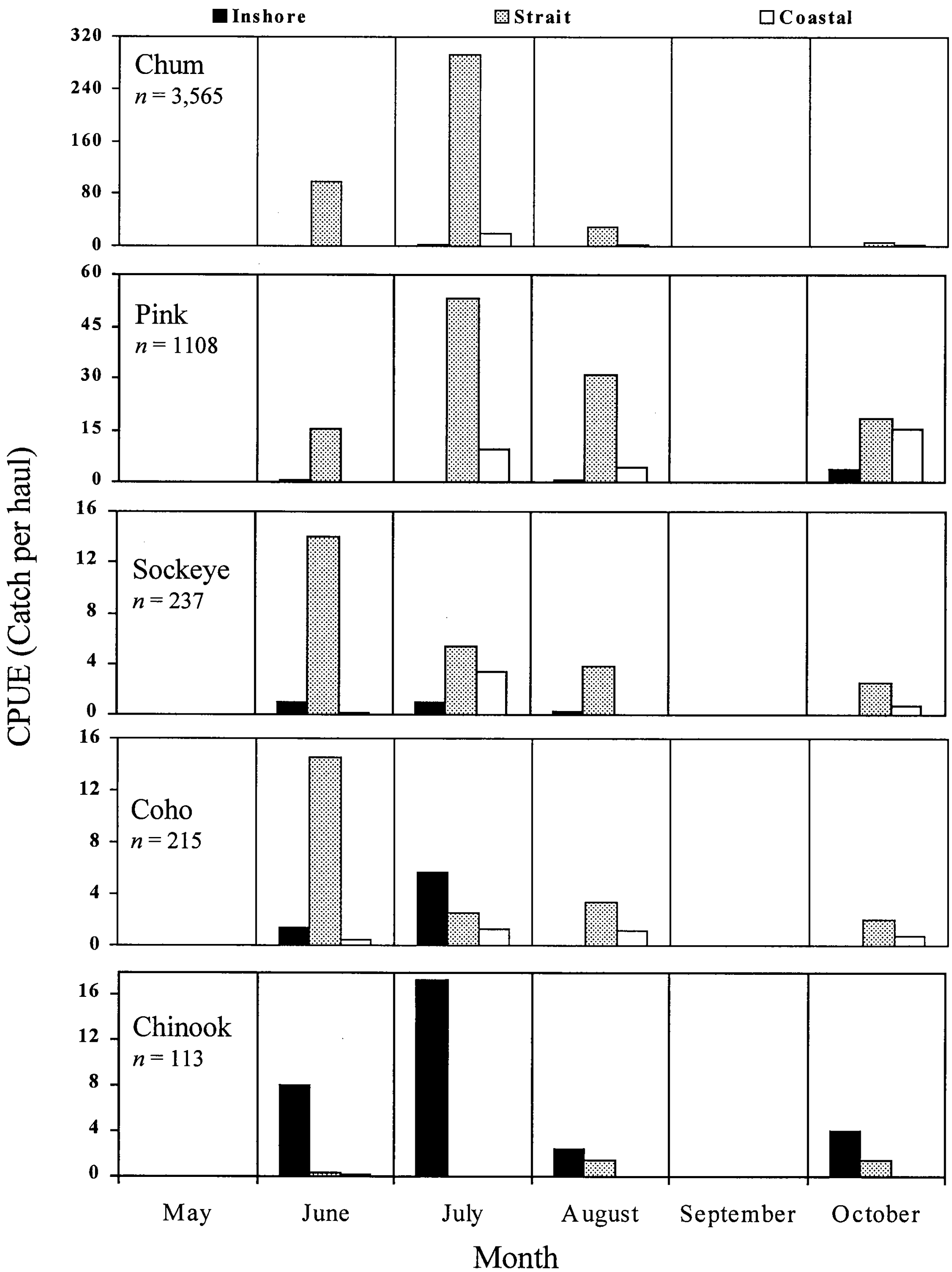

Figure 3.--Catch per rope trawl haul of juvenile salmon in inshore, strait, and coastal stations in marine waters of the northern region of southeastern Alaska, May–October 1997.

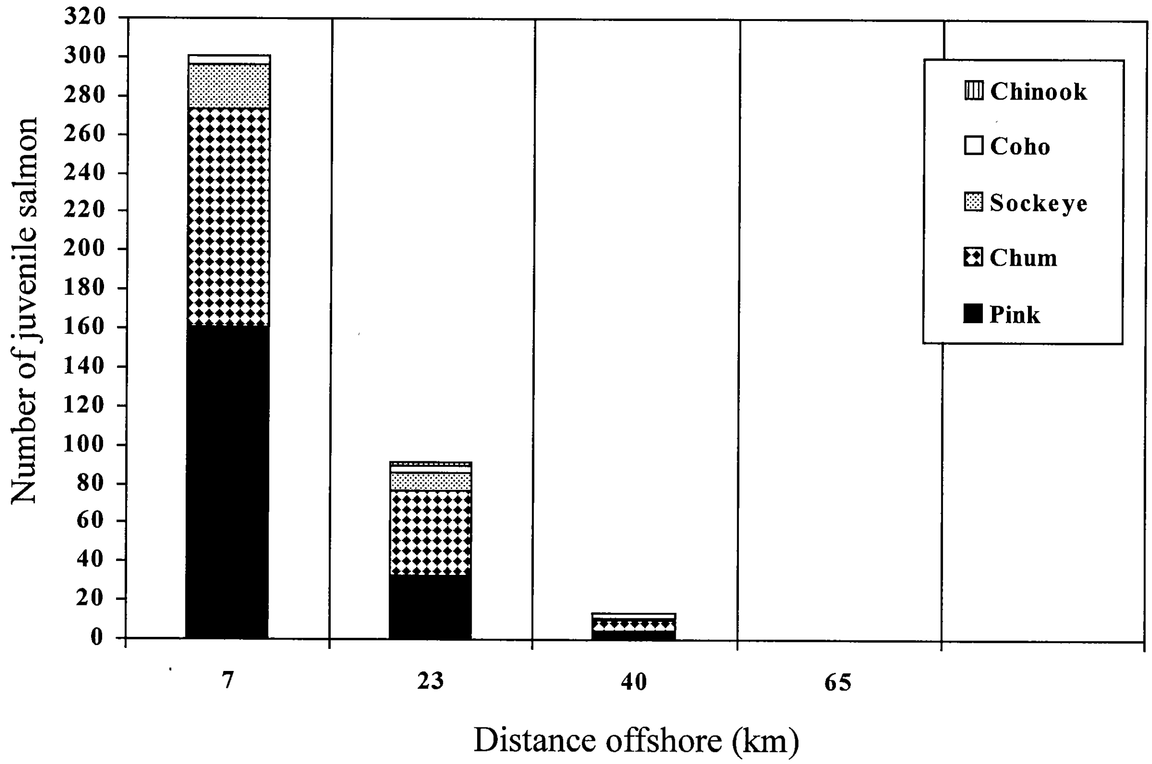

Figure 4.--Number of juvenile salmon captured by rope trawl at the Icy Point stations, May–October 1997.

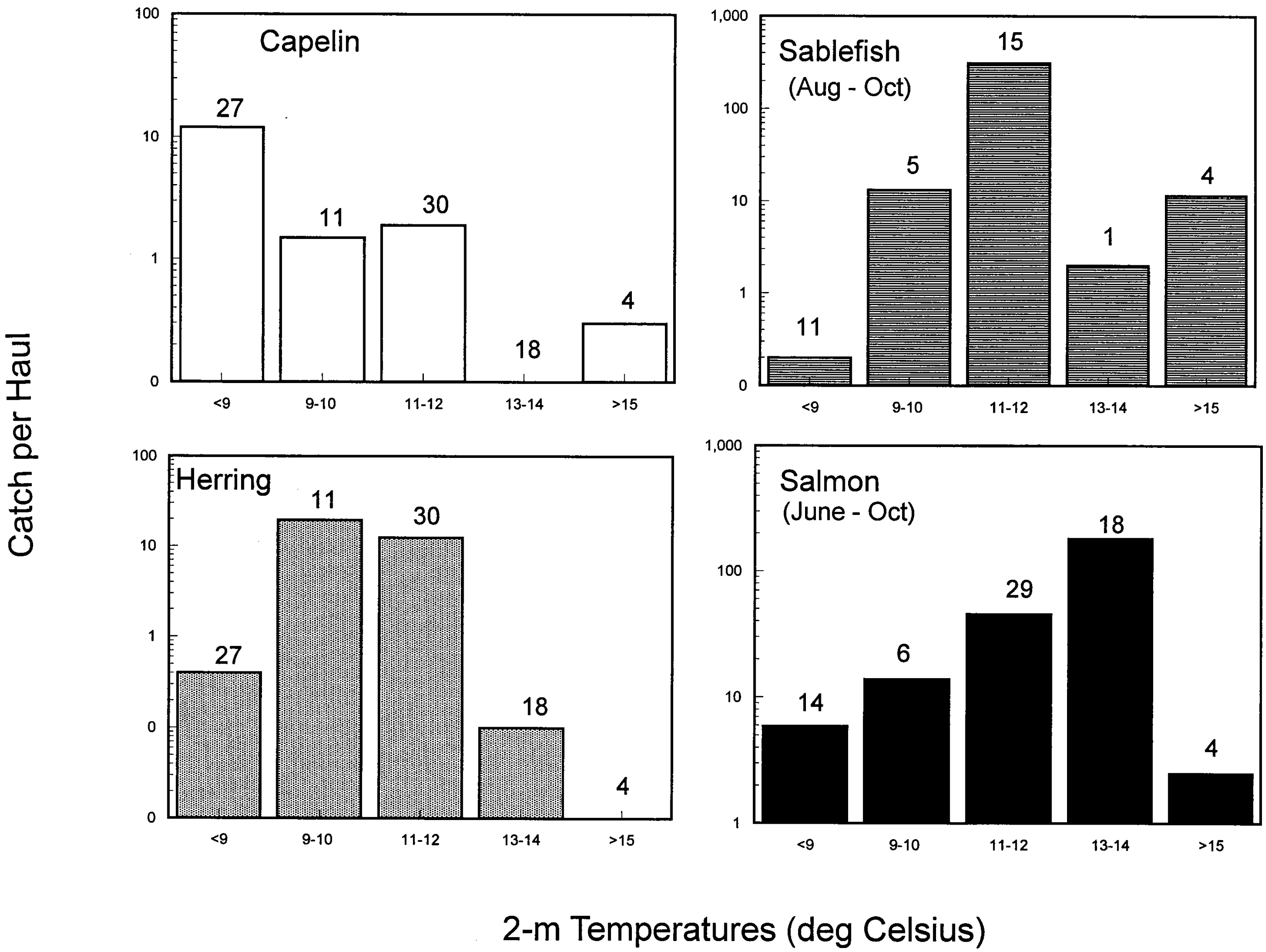

Figure 5.--The association between surface (≤2 m) temperature and catch per haul of predominant taxa captured by rope trawl in the northern region of southeastern Alaska, May–October 1997.

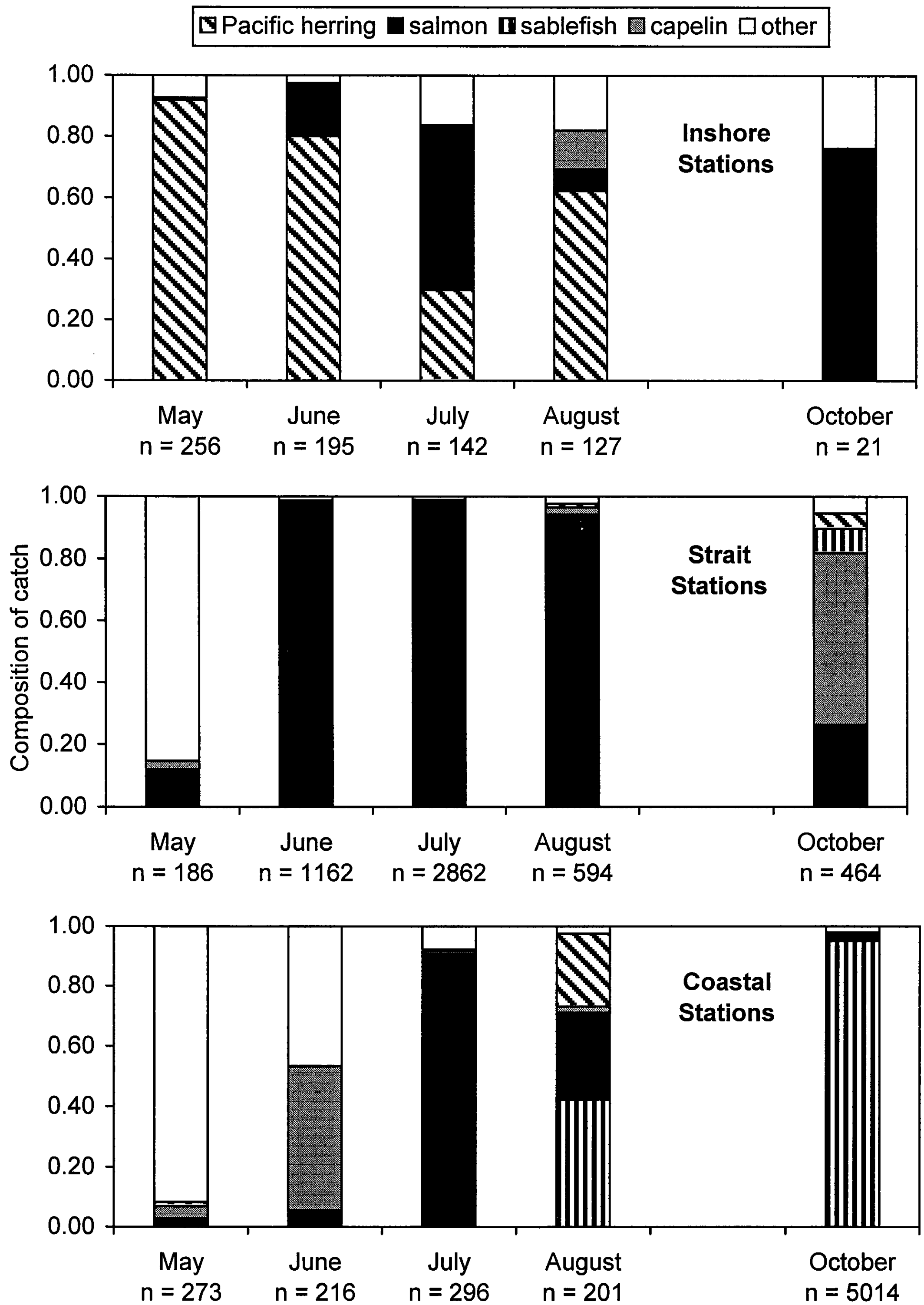

Figure 6.--Species composition of predominant fish and squid species captured by rope trawl in marine waters of the northern region of southeastern Alaska, May–October 1997.

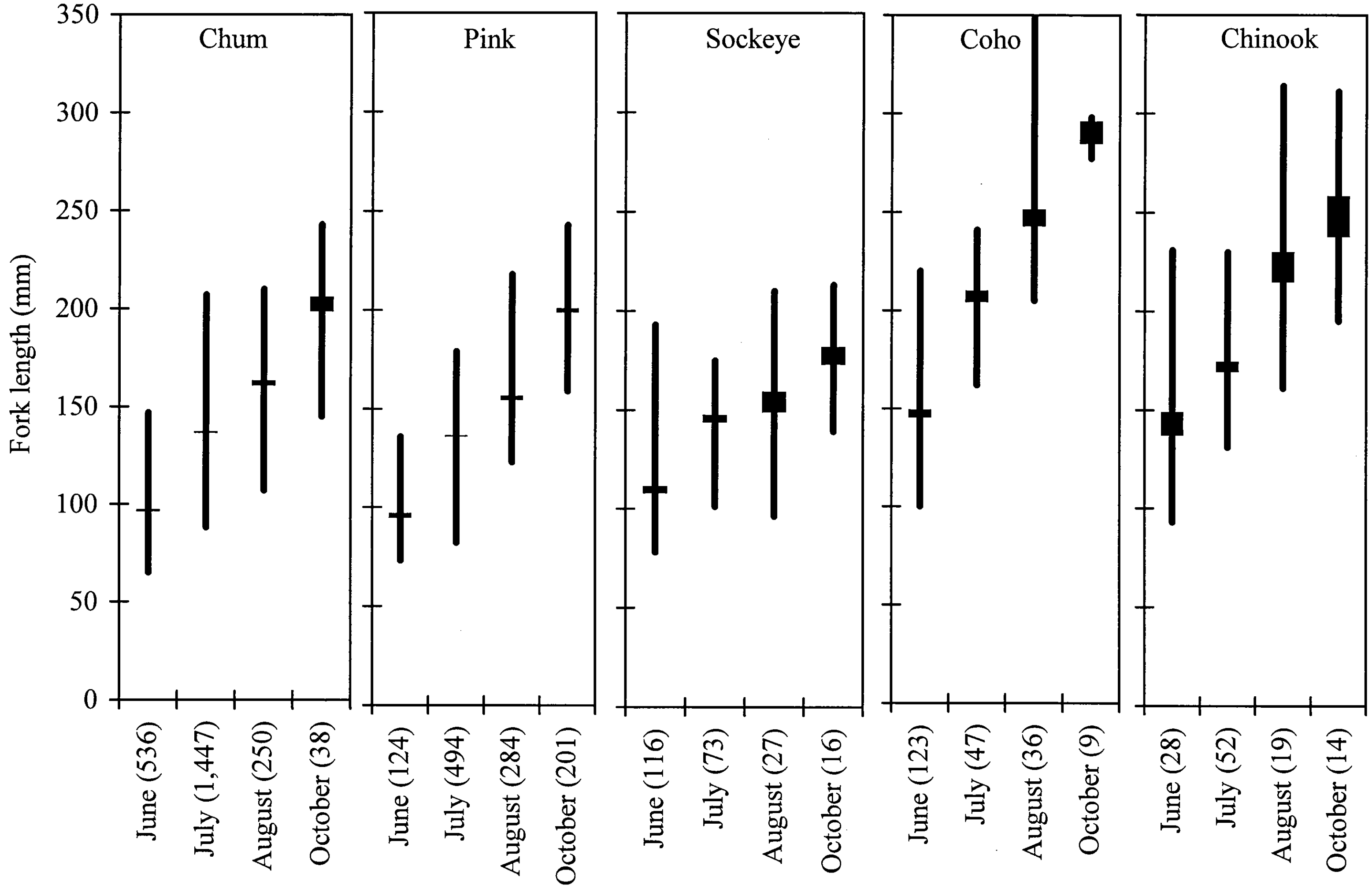

Figure 7.--Fork lengths of juvenile salmon captured by rope trawl in marine waters of the northern region of southeastern Alaska, May–October 1997. Length of vertical bars is the size range for each sample, and the boxes within the size range are one standard error on either side of the mean. Sample sizes are shown in parentheses.

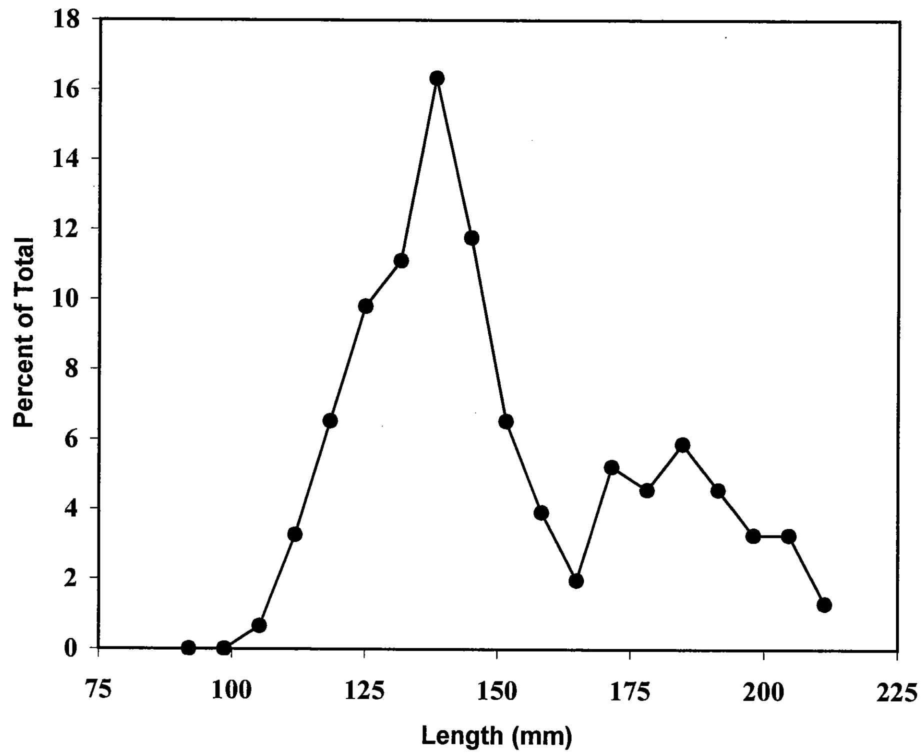

Figure 8.--Bimodal length distribution of juvenile chum salmon captured by rope trawl in coastal waters of the northern region of southeastern Alaska, July 1997.

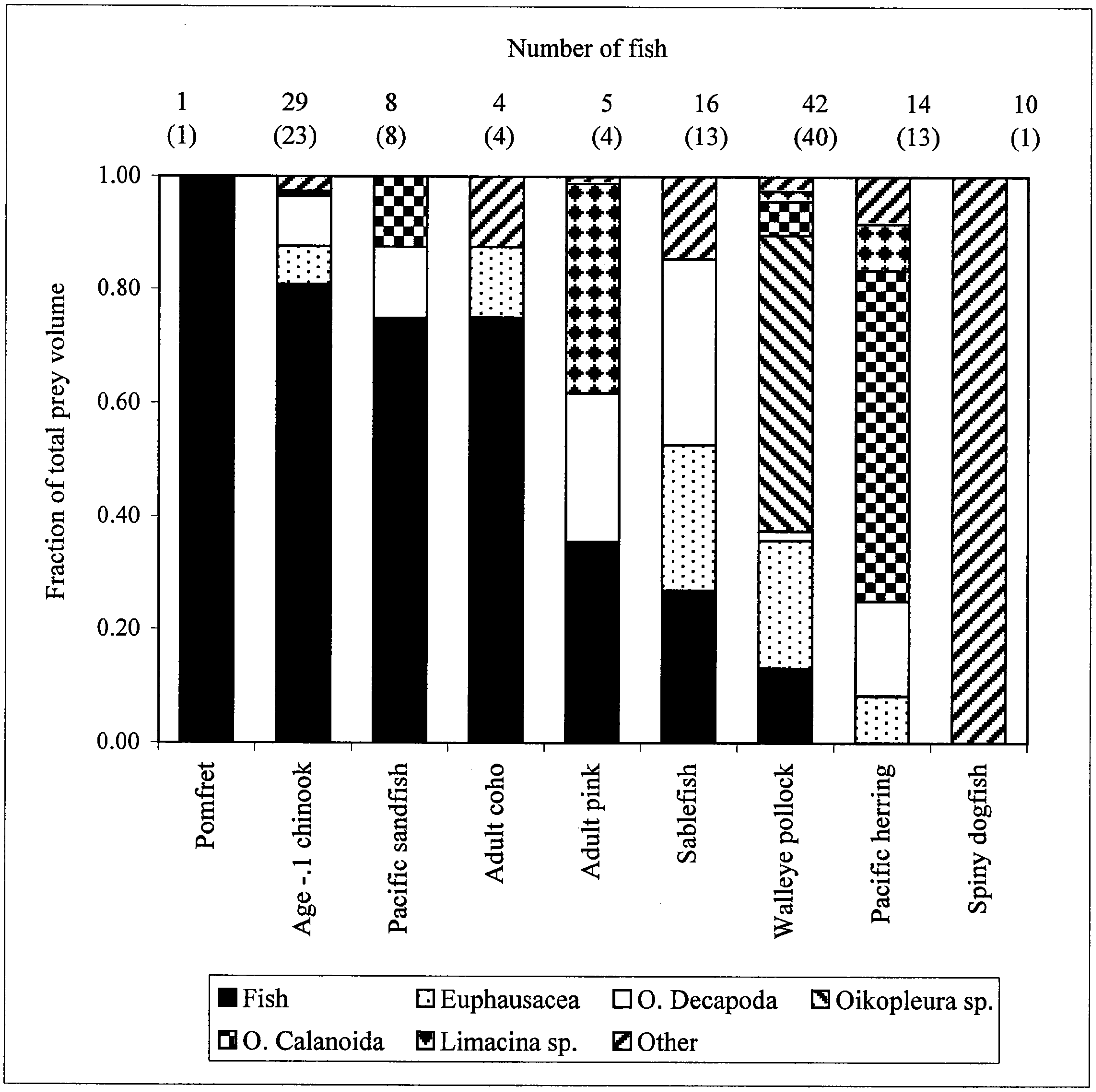

Figure 9.--Diets of potential juvenile salmon predators captured by rope trawl in marine waters of the northern region of southeastern Alaska, May–October 1997. Sample sizes are shown above stacked bars; values in parentheses are the number of fish containing at least one prey item.

APPENDIX

Appendix.--Catches and life-history stage of salmonids and commercially[a] important non-salmonids captured by rope trawl in marine waters of the northern region of southeastern Alaska, May–October 1997. Dash means none captured.

			Juvenile												Immature	Adult
Date	Haul No.	Station	Chum	Pink	Sockeye	Coho	Chinook	Steelhead	Sablefish	Herring	Pollock	Chinook	Herring	Pollock	Coho	Pink
20 May	1001	TKI	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20 May	1002	ABM	b	b	b	b	b	b	b	b	b	b	b	b	b	b
20 May	1003	FPR	—	—	—	—	—	—	—	—	—	—	—	—	—	—
21 May	1004	UCD	—	—	—	—	—	—	—	—	—	4	—	—	—	—
21 May	1005	UCC	—	—	—	—	—	—	—	—	—	1	—	—	—	—
21 May	1006	UCB	—	—	—	—	—	—	—	—	—	—	—	3	—	—
21 May	1007	UCA	—	—	—	—	—	—	—	—	—	2	—	56	—	—
22 May	1008	IPA	—	—	—	—	—	—	—	—	—	—	—	—	—	—
22 May	1009	IPB	—	—	—	—	—	—	—	—	—	3	1	—	—	—
22 May	1010	IPC	—	—	—	—	—	—	—	—	—	1	—	—	—	—
22 May	1011	IPD	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23 May	1012	CSA	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23 May	1013	CSB	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23 May	1014	CSC	—	—	—	—	—	—	—	—	—	—	1	—	—	—
23 May	1015	CSD	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24 May	1016	ISA	—	—	—	—	—	—	—	—	—	1	—	2	—	—
24 May	1017	ISB	—	—	—	—	—	—	—	—	—	4	—	10	—	—
24 May	1018	ISC	—	—	—	—	—	—	—	—	—	1	—	6	—	—
24 May	1019	ISD	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25 May	1020	LFC	—	—	—	—	—	—	—	—	—	1	235	—	—	—
22 June	1021	TKI	—	—	—	—	1	—	—	—	—	1	154	—	—	—
22 June	1022	ABM	b	b	b	b	b	b	b	b	b	b	b	b	b	b
22 June	1023	FPR	—	1	3	4	7	—	—	—	—	—	1	—	—	—
23 June	1024	UCD	—	—	—	7	1	—	—	—	—	—	—	—	—	—
23 June	1025	UCC	—	3	2	16	1	—	—	—	—	—	—	—	—	—
23 June	1026	UCB	101	59	40	6	—	—	—	—	2	1	—	—	—	—
23 June	1027	UCA	23	6	6	37	1	—	—	—	—	2	1	—	—	—
24 June	1028	CSA	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24 June	1029	CSB	—	—	—	—	—	—	—	—	3	—	—	—	—	—
24 June	1030	CSC	—	—	—	—	—	—	—	—	—	—	—	7	—	—
24 June	1031	CSD	1	—	1	—	—	1	—	—	1	—	—	—	—	—

Appendix.--Continued.

Date	Haul No.	Station	Juvenile Chum	Pink	Sockeye	Coho	Chinook	Steelhead	Sablefish	Herring	Pollock	Chinook	Herring	Pollock	Immature Coho	Adult Pink
25 June	1032	IPA	1	—	—	1	—	—	—	—	1	—	—	2	—	—
25 June	1033	IPB	1	—	—	—	1	—	—	—	—	—	—	—	—	2
25 June	1034	IPC	—	—	—	2	—	—	—	—	—	—	—	—	—	—
25 June	1035	IPD	—	—	—	—	—	—	—	—	1	—	—	—	—	—
26 June	1036	ISA	49	1	7	5	—	—	—	—	—	—	—	—	—	—
26 June	1037	ISB	18	1	8	2	—	—	—	—	—	—	—	—	—	—
26 June	1038	ISC	524	33	43	42	—	—	—	—	—	3	—	—	—	—
26 June	1039	ISD	65	20	6	1	—	—	—	—	—	1	—	—	—	—
26 June	1040	LFC	—	—	—	—	16	—	—	—	—	—	1	—	—	—
19 July	1041	UCA	227	45	11	4	—	—	—	—	1	—	—	—	—	—
19 July	1042	UCD	3	2	—	—	—	—	—	—	1	—	—	—	—	—
19 July	1043	UCC	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]
20 July	1044	UCB	378	102	10	4	—	—	—	—	—	—	—	—	—	—
21 July	1045	ISA	4	—	—	—	—	—	—	—	—	—	—	—	—	—
21 July	1046	ISB	4	—	1	3	—	—	—	—	—	—	—	—	—	—
21 July	1047	ISC	491	68	9	6	—	—	—	—	—	—	—	—	—	—
21 July	1048	ISD	1231	206	12	2	—	—	—	—	—	—	—	—	—	—
22 July	1049	UCC	4	1	—	1	—	—	—	—	—	—	—	—	—	—
22 July	1050	FPR	3	—	2	17	1	—	—	—	—	—	—	—	—	—
22 July	1051	LFC	1	—	1	—	48	—	—	—	—	—	12	—	—	—
23 July	1052	ABM	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]
23 July	1053	TKI	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]
24 July	1054	CSA	1	—	—	1	—	—	—	—	—	—	—	—	—	—
24 July	1055	CSB	—	—	—	2	—	—	—	—	—	—	—	—	—	1
24 July	1056	CSC	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25 July	1057	IPA	98	42	20	3	—	—	—	—	—	—	—	—	—	—
25 July	1058	IPB	43	30	7	4	—	—	—	—	—	—	—	—	—	1
25 July	1059	IPC	5	1	—	—	—	—	—	—	—	—	—	—	—	—
25 July	1060	IPD	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26 July	1061	CSD	6	2	—	—	—	—	—	—	—	—	1	—	—	—

Appendix.--Continued.

Date	Haul No.	Station	Juvenile Chum	Juvenile Pink	Juvenile Sockeye	Juvenile Coho	Juvenile Chinook	Juvenile Steelhead	Juvenile Sablefish	Juvenile Herring	Juvenile Pollock	Chinook	Herring	Pollock	Immature Coho	Adult Pink
27 July	1062	TKI	—	—	—	—	3	—	—	—	1	—	30	—	—	—
22 Aug	1063	ISA	—	—	—	2	—	—	—	—	—	—	—	—	—	—
22 Aug	1064	ISB	115	161	12	3	2	—	—	—	—	—	6	—	—	—
22 Aug	1065	ISC	45	41	5	—	—	—	—	—	—	—	—	—	1	1
22 Aug	1066	ISD	21	9	6	1	6	—	—	—	—	—	—	—	2	—
23 Aug	1067	UCD	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]
23 Aug	1068	UCC	10	5	2	—	—	—	—	—	—	—	1	—	1	—
23 Aug	1069	UCB	10	12	1	9	1	—	—	—	—	2	—	1	1	—
23 Aug	1070	UCA	—	—	5	11	1	—	—	—	—	1	—	1	—	—
24 Aug	1071	UCD	28	22	—	1	2	—	—	—	—	—	—	—	—	—
25 Aug	1072	IPA	2	5	—	—	—	—	—	—	—	—	—	—	—	—
25 Aug	1073	IPB	—	—	—	—	—	—	2	—	—	—	—	—	—	—
25 Aug	1074	IPC	—	—	—	1	—	—	20	—	—	—	—	—	—	—
25 Aug	1075	IPD	—	—	—	—	—	—	26	—	—	—	—	—	—	—
26 Aug	1076	CSA	—	—	—	2	—	—	—	—	—	—	—	—	—	—
26 Aug	1077	CSB	5	6	—	3	—	—	—	45	—	—	—	—	—	—
26 Aug	1078	CSC	—	—	—	3	—	—	37	3	—	—	—	—	—	—
26 Aug	1079	CSD	9	22	—	—	—	—	—	1	—	—	—	—	—	—
27 Aug	1080	FPR	—	1	—	—	1	—	—	—	—	—	—	—	—	—
27 Aug	1081	LFC	—	—	—	—	3	—	—	—	—	—	9	—	—	—
27 Aug	1082	ABM	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]
27 Aug	1083	TKI	—	—	1	—	3	—	—	—	—	—	70	—	—	—
02 Oct	1084	TKI	—	—	—	—	8	—	—	—	—	—	—	—	—	—
03 Oct	1085	IPA	11	114	3	1	—	—	4512	—	—	—	4	—	—	—
03 Oct	1086	IPB	—	3	2	—	—	—	51	—	—	—	—	—	—	—
03 Oct	1087	IPC	—	4	1	—	—	—	111	—	—	—	—	—	—	—
03 Oct	1088	IPD	—	—	—	—	—	—	—	—	—	—	—	—	—	—
04 Oct	1089	CSA	8	24	2	1	—	—	5	—	—	—	3	—	—	—
04 Oct	1090	CSB	3	24	4	3	—	—	29	—	—	—	11	—	—	—
04 Oct	1091	CSC	—	4	—	—	—	—	—	1	—	—	—	—	—	—
04 Oct	1092	CSD	4	2	2	1	2	—	—	4	—	—	4	—	—	—

Appendix 1.--Continued.

Date	Haul#	Station	Juvenile Chum	Juvenile Pink	Juvenile Sockeye	Juvenile Coho	Juvenile Chinook	Juvenile Steelhead	Juvenile Sablefish	Juvenile Herring	Juvenile Pollock	Chinook	Herring	Pollock	Immature Coho	Adult Pink
05 Oct	1093	ISA	4	4	—	—	—	—	—	—	—	—	—	—	—	—
05 Oct	1094	ISB	—	—	—	—	—	—	—	—	—	—	—	—	—	—
05 Oct	1095	ISC	7	9		1	4	—	2	—	—	—	—	1	—	—
05 Oct	1096	ISD	—	6	4	2	—	—	—	—	—	—	—	—	—	—
06 Oct	1097	UCA	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]
06 Oct	1098	LFC	1	7	—	—	—	—	—	—	—	—	—	—	—	—
06 Oct	1099	ABM	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]
07 Oct	1100	FPR	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]
		Total	3,565	1108	237	215	113	1	4,795	54	11	29	545	89	5	5

[a]Additional commercially important species captured included 3 juvenile lingcod and 13 juvenile rockfish. The lingcod were caught in June in outside waters (stations CSA, IPA, and IPB). The rockfish were captured in July (12) and August (1) in outside waters (stations IPC and IPD in July; CSB in August).

[b]No trawling was done at this station.

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