NPAFC
Doc. 497

Survey of Juvenile Salmon in the Marine Waters of Southeastern Alaska, May–October 1999

by

Joseph A. Orsi, Molly V. Sturdevant, James M. Murphy, Donald G. Mortensen,
Bruce L. Wing, and Brenda K. Krauss

Auke Bay Laboratory
Alaska Fisheries Science Center
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
United States Department of Commerce
11305 Glacier Highway
Juneau, AK 99801-8626 USA

Submitted to the

NORTH PACIFIC ANADROMOUS FISH COMMISSION

by the

United States of America

October 2000

THIS DOCUMENT MAY BE CITED IN THE FOLLOWING MANNER:

Orsi, J. A., M. V. Sturdevant, J. M. Murphy, D. G. Mortensen, B. L. Wing and B. K. Krauss 2000. Survey of juvenile salmon in the marine waters of southeastern Alaska, May–October 1999. (NPAFC Doc. 497) Auke Bay Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, NOAA, 11305 Glacier Highway, Juneau, AK 99801-8626, USA. 51 p.

Survey of Juvenile Salmon in the Marine Waters of Southeastern Alaska, May–October 1999

Abstract

In 1999, biophysical data were collected along a primary marine migration corridor of juvenile (age-.0) Pacific salmon (*Oncorhynchus* spp.) in the northern region of southeastern Alaska at 24 stations during five sampling intervals. This survey marks the third consecutive year of systematic sampling and monitoring within the region, and was implemented to identify the relationships among the habitat use, marine growth, predation, stock interactions, year-class strength, and ocean carrying capacity of salmon. Stations were stratified into three different habitats—inshore (Taku Inlet and three stations near Auke Bay), strait (four stations each at Chatham Strait and Icy Strait), and coastal (four stations each at Cross Sound, Icy Point, and Cape Edward)—and were sampled from the National Oceanic and Atmospheric Administration ship *John N. Cobb*, May to October. At each station, fish, zooplankton and surface water samples, and temperature and salinity profile data were collected during daylight using a surface rope trawl, conical and bongo nets, and a conductivity, temperature, and depth profiler.

Surface (2-m) temperatures and salinities during the survey ranged from 6.5 to 13.6 °C and 13.9 to 32.0 PSU. A total of 7,204 fish and squid, representing 29 taxa, were captured with the rope trawl. Five species of juvenile Pacific salmon comprised 47% of the total catch. Of the 3,535 salmonids caught, > 95% were juveniles, and < 5% were immatures or adults. Non-salmonid species making up > 2% of the catch included capelin (*Mallotus villosus*), Pacific herring (*Clupea harengus*), and sablefish (*Anoplopoma fimbria*).

Temporal and spatial differences were observed among juvenile salmon species in their catch rates, size, condition, stock of origin, and in predation rates. The most frequently occurring species in the trawl catches (> 25%) were coho salmon (*O. kisutch*), chum salmon (*O. keta*), pink salmon (*O. gorbuscha*), sockeye salmon (*O. nerka*), and walleye pollock (*Theragra chalcogramma*). Catches of juvenile salmon were highest in June for coho and in July for other species. By habitat type, juvenile salmon were most abundant in strait and inshore habitats, with the exception of sockeye salmon in coastal habitats. In the coastal habitat, catch rates along the 65 km transect at Icy Point were the highest within 25 km of shore. Lengths of juvenile salmon increased seasonally; in the five time periods mean FL (mm) were: pink (97–115–134–168), chum (103–130–139–165), sockeye (123–145–122–163), coho (154–207–225–279), and chinook salmon (139–160–190–214). Coded-wire tags were recovered from 7 juvenile and immature chinook and 15 juvenile coho salmon; all fish were of Alaska origin. In addition, Alaskan stocks were identified from thermal-marked otoliths of 447 juvenile chum and 47 juvenile sockeye salmon; marked stocks comprised 71% of the chum salmon and 19% of the sockeye salmon examined. Onboard stomach analysis of 307 fish of thirteen species of potential predators of juvenile salmon indicated that 36% of sablefish, 18% of adult coho salmon, and 10% of spiny dogfish (*Squalus acanthias)* preyed on juvenile salmon.

Results from this study suggest that, in southeastern Alaska, juvenile salmon exhibit seasonal patterns of habitat use synchronous with environmental change, and display species- and stock-dependent migration patterns. Long term monitoring of key stocks of juvenile salmon, both on intra- and inter-annual bases, will enable researchers to understand how growth, abundance, and ecological interactions affect year-class strength and ocean carrying capacity for salmon.

Introduction

Studies on the early marine ecology of Pacific salmon (*Oncorhynchus* spp.) require adequate time series of biophysical data to relate climate fluctuations to the distribution, abundance, and production of salmon in Alaska. Because salmon are keystone species and constitute important ecological links between marine and terrestrial habitats, fluctuations in the survival of this important living marine resource have broad ecological and socio-economic implications for coastal localities throughout the Pacific Rim. Increasing evidence for relationships between Pacific salmon production and shifts in climate conditions has renewed interest in processes governing their year-class strength (Beamish 1995). In particular, variations in climate have been associated with ocean production of salmon during El Niño and La Niña events. For example, recent warming trends have benefitted most wild and hatchery stocks of Alaskan salmon. However, a number of research areas are lacking information: 1) specific links between salmon production and climate variability are poorly understood because past research has not provided adequate time-series data (Pearcy 1997); 2) it is unknown how inter- and intra-specific competition of increasing numbers of Alaskan salmonids have affected the marine carrying capacity of the region; and 3) the presence of mixed stocks with different life history characteristics has confounded attempts to accurately assess growth, survival, distribution, and migratory rates of specific stocks.

To adequately identify mechanisms linking salmon production to climate change, a time series of information on stock-specific life history characteristics of salmon must be collected synoptically with data on ocean conditions. Until recently, stock-specific information relied on labor-intensive methods of marking individual fish, such as coded-wire tagging (CWT; Jefferts et al. 1963), which could not practically be applied to all of the fish released by enhancement facilities. However, recent methods of mass-marking with thermally induced otolith marks (Hagen and Munk 1994) have provided technological advances. The high incidence of such marking programs in southeastern Alaska (Courtney et al. 2000) offers an opportunity to examine growth, survival, and migratory rates of specific stocks in the region during the current record production of hatchery chum salmon and wild pink salmon in southeastern Alaska. Two enhancement facilities in the northern region of southeastern Alaska have produced over 100 million otolith-marked juvenile chum salmon (*O. keta*) annually in recent years. Consequently, since the mid-90s, average annual commercial harvests of about 14 million adult chum salmon have occurred in the common property fishery in the region (ADFG 2000), mostly comprised of otolith-marked fish. Examining the early marine ecology of these marked stocks provides an unprecedented opportunity to study stock-specific abundance, distribution, and species interactions of the juveniles that will later recruit to the fishery.

The coastal monitoring study in northern southeastern Alaska, initiated in 1997 and repeated in 1998 and 1999 (Orsi et al. 1997, 1998), was designed to address the problems of maintaining an annual time series of data and collecting stock-specific information. Data collections from prior years have been reported in several companion documents (Murphy and Orsi 1999; Murphy et al. 1999; Orsi et al. 1999; Orsi et al. In Press). This document summarizes the biophysical parameters collected from May-October 1999 for the coastal monitoring study in southeastern Alaska.

Methods

Twenty four stations were sampled each month, as conditions permitted, by the National Oceanic and Atmospheric Administration (NOAA) ship *John N. Cobb* in marine waters of the northern region of southeastern Alaska from May-October 1999 (Table 1). Stations were located along the primary seaward migration corridor used by juvenile salmon that originate in this region. 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, zooplankton, and fish were sampled. 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 biophysical data in the region, 2) the objective of sampling habitats that transition the primary seaward migration corridor used by juvenile salmon, and 3) the operational constraints of the vessel. Three inshore stations (Auke Bay Monitor, False Point Retreat, and Lower Favorite Channel) and the four Icy Strait stations were selected initially because historical data exist for them (Bruce et al. 1977; Mattson and Wing 1978; Jaenicke and Celewycz 1994; Landingham et al. 1997; Orsi et al. 1997, 1998). The fourth inshore station at Taku Inlet was selected to characterize biophysical conditions near a large, glacial, transboundary river system that produces major salmon runs along the mainland coast. The Chatham Strait transect was selected because juvenile otolith-marked chum salmon from both the south (i.e., Hidden Falls Hatchery (HFH) operated by Northern Southeast Alaska Aquaculture Association (NSRAA)) and from the north (i.e., Douglas Island Pink and Chum Hatchery (DIPAC) facilities) enter Icy Strait there (Figure 1). The 12 stations within these inshore and strait habitats were grouped to represent inside waters. The Cross Sound, Icy Point, and Cape Edward transects (12 stations representing outside waters) were included to monitor conditions at the point of entry into coastal habitat of the Gulf of Alaska. Vessel and sampling gear constraints limited operations to distances between1.5 km 65 km of shore, and to bottom depths $\geq$75 m, which precluded trawling at the Auke Bay Monitor station (Table 1). Sea conditions of < 2.5 m waves and < 12.5 m/sec winds were usually necessary to operate the sampling gear safely, which particularly influenced sampling opportunities in coastal waters.

Oceanography

Oceanographic data were collected at each station before or immediately after each trawl haul and consisted of one conductivity, temperature, and depth profiler (CTD) cast, one or more vertical plankton hauls with conical nets, and one double oblique plankton haul 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 (Sea-Bird SBE 21). Surface water samples were taken at selected stations for later nutrient and chlorophyll analysis conducted by the University of Washington School of Oceanography Marine Chemistry Laboratory. Conical nets were used for vertical plankton hauls. At least one shallow haul (20-m) was made at each station and one

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

deep haul (to 200 m or within 20 m of bottom) was made at the Icy Point and Auke Bay Monitor stations (Table 2). For the shallow vertical hauls, a NORPAC net (50 cm, 243 µ mesh) was used, following previous zooplankton sampling programs in the region; for the deep vertical hauls, a WP-2 net (57 cm, 202 µ mesh) was used, following GLOBEC standards (U.S. GLOBEC 1996). In addition, a double oblique bongo haul 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 µ and 333 µ mesh nets. A Bendix bathykymograph was used with the oblique bongo hauls to record the maximum sampling depths. General Oceanics or Roshiga flow meters were placed inside the bongo and deep conical nets for calculation of filtered volumes. Ambient light intensities (W/m^2) were recorded at each station with a Li-Cor Model 189 radiometer.

Zooplankton samples were preserved in 5% formalin-seawater solution. In the laboratory, zooplankton settled volumes (ml ZSV) and total settled volumes (ml TSV) of each 20-m vertical haul was measured after 24 hrs in Imhof cones. Volumetric density (ml/m^3) was computed by dividing the ml of ZSV by the water volume sampled, 3.9 m^3. Mean ZSV and mean volumetric density were determined for pooled stations by habitat and month.

Fish sampling

Fish sampling was accomplished with 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), was used to spread the trawl open. The NOAA ship *John N. Cobb* is a 29-m 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 A-4 Polyform buoys, each encased in a knotted mesh bag, was 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 the 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 and three 55-m (two 1.0-cm and one 1.3-cm) wire bridles.

Each trawl haul was fished for 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 in which the trawl was set.

After each trawl 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) or mantle length with a Limnotera FMB IV electronic measuring board (Chaput et al. 1992). Usually all fish and squid were measured, but very large catches were sub-sampled due to processing time constraints. Most juvenile salmon were bagged individually, but large catches were bagged in bulk; all were frozen immediately after measurement. During times of extended processing, fish were chilled with ice packs to minimize tissue decomposition and gastric activity. All but the largest juvenile salmon were poured through a portable CWT detector onboard the vessel. All chinook and coho salmon were examined onboard for missing adipose fins, indicating the presence of CWTs; those with adipose fins intact were again screened through a detector in the laboratory. The snouts of all of these salmon were dissected later in the laboratory to recover CWTs, which were then read and verified.

Individually frozen fish from each habitat and time period were thawed in the laboratory for measurement of length and weight and for the extraction of sagittal otoliths. Otoliths were preserved in vials of 95% ethyl alcohol for processing contracted to DIPAC laboratories. Otoliths were prepared for microscopic examination of potential thermal marks by mounting them on slides and grinding them down to the primordia (Secor et al. 1992). We also examined voucher specimens of marked salmon fry from the hatcheries for length and weight. Ambiguous otolith thermal marks were verified by personnel at the Alaska Department of Fish and Game (ADFG) otolith laboratory. Fulton condition factor was computed for individuals of each salmon species as g/FL^3*10^6 , where g = wet weight in grams (Cone 1989). Mean length, weight, and condition were computed for each species by habitat and sampling interval.

The percent composition of hatchery juvenile chum and sockeye salmon stocks that were thermally marked in the catch was computed by release group for each month and habitat. Because one hatchery released an unmarked component of juvenile chum salmon, we needed to adjust the numbers recovered from it. Therefore, the number of HFH chum salmon marks recovered were expanded by a factor of 1.5, since 48.9 of the 74.6 million fish released were marked. The numbers of DIPAC marks were not adjusted, since 100% of both chum and sockeye salmon released were marked. Conversely, the unmarked component, presumably wild chum salmon, was reduced to account for the HFH marks that were expanded.

After the juvenile salmon in each trawl haul were processed, potential predators were identified, measured, and weighed. Their stomachs were then excised, weighed, and classified by fullness. Stomach contents were removed, empty stomachs weighed, and total content weight determined by subtraction. Prey were identified onboard to the taxonomic level of order, in general; the contribution of each taxon to the diet was quantified to the nearest 10% of total volume. The wet weight contribution of each prey taxon was then computed as its percent volume times total content weight. Fish prey were identified to species, if possible, and lengths estimated. The incidence and rate of predation on juvenile salmon was computed for each potential predator species. Overall diets were summarized by percent weight of major prey taxa.

Results and Discussion

During the 5-month survey in 1999, data were collected from 90 rope trawl hauls, 106 CTD casts, 102 bongo net tows, 135 conical net tows (116 from 20-m depths and 19 from 200-m depths), and 72 surface water samples (Table 2). In May, oceanographic sampling was completed at all stations except the Icy Point and Cape Edward transects, and trawling was conducted only at the four stations in Icy Strait. Limited trawling was conducted in May because juvenile salmon were absent from trawl catches in previous years. After May, from 3-12 trawls were successfully fished in each habitat-sampling interval (Table 2), with more effort focused in strait and coastal habitats compared to inshore habitats. From June to September-October, all stations in inshore and strait habitats were trawled and sampled for oceanographic data. In coastal habitats, the Cross Sound and the Icy Point stations (with the exception of station IPD in June and July) were sampled every month, while the four Cape Edward stations were sampled only in June and July.

Oceanography

Sea surface (2 m) temperature and salinity data recorded by the thermosalinograph differed by month and between inside and outside waters. Surface temperatures and salinities during the survey ranged from 6.3 to 13.4°C and 13.9 to 32.0 PSU (Table 3). At most stations, temperatures increased from May until August, then declined in September-October (Figure 2). Salinities generally decreased from May until August and increased in September-October in inside waters, but in outside waters, salinities were relatively stable, seldom varying by more than 2 PSU. Ambient light intensities during the sampling season ranged from 2 to 927 W/m^2.

A total of 72 surface water samples were taken at 20 stations over the course of the season (Table 4). Nutrient value ranges and means were 0.4-3.6 and 1.2 µM for PO_4, 2.1-41.5 and 12.8 µM for $Si(OH)_4$, 0.8-23.7 and 5.5 µM for NO_3, 0.0-0.3 and 0.1 µM for NO_2, and 0.4-4.4 and 1.4 µM for NH_4. Chlorophyll and phaeopigment value ranges and means were 0.1-4.1 and 1.1 mg/m^3 for chlorophyll and 0.1-0.7 and 0.2 mg/m^3 for phaeopigment.

Plankton volumes were highly variable among habitats, but seasonal patterns were evident in the 20-m ZSV of NORPAC hauls (Table 5). Qualitative, visual examination of samples indicated a wide diversity of zooplankton taxa. 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. The temporal pattern in most habitats showed peak volumes in June, intermediate volumes in May, July, and August, and lowest volumes in September-October (Figure 2). The spatial pattern generally showed highest zooplankton volumes in inshore habitat and lowest volumes in coastal habitat. The peak mean volume for all stations and months was approximately 33 ml ZSV (8.5 ml/m^3) in inshore habitat, a value almost twice as great as the next highest value in strait habitat.

Catch composition

A total of 7,204 fish and squid, representing 29 taxa, were captured in the rope trawl throughout the season (Table 6). Five species of juvenile Pacific salmon were captured and comprised 47% of the total catch. Of the 3,535 salmonids caught, > 95% were juveniles, and < 5% were immature (age -.1+) or adult. Juvenile pink and chum salmon were the only species to occur in all of the three habitats with compositions of > 10% (Figure 3). Non-salmonid species making up > 2% of the catch in some habitats included capelin (*Mallotus villosus*), Pacific herring (*Clupea harengus*), and sablefish (*Anoplopoma fimbria*). The most frequently occurring species in the trawl catches (> 25%) were coho salmon (*O. kisutch*), chum salmon (*O. keta*), pink salmon (*O. gorbuscha*), sockeye salmon (*O. nerka*), and walleye pollock (*Theragra chalcogramma*). Catches and life history stages of salmonids are listed in Appendix 1 by date, haul number, and station.

The seasonality and habitat specificity of species considered to be abundant (> 100 individuals caught) were apparent. Among salmonids, pink, chum, sockeye, coho, and chinook salmon were captured primarily as juveniles in June and July (Table 6). By habitat type, all salmon species except sockeye were most abundant in strait and inshore habitats; sockeye salmon were most abundant in coastal habitats (Figure 3). Among non-salmonids, capelin occurred primarily as juveniles in strait and coastal habitats (32-39%); the largest catch was in Icy Strait in September-October, when light levels were low. Pacific herring were found primarily at inshore habitat as immatures and adults in June, July, and September-October. Sablefish were found primarily at inshore stations in June, July, and August as age 1+ fish. Soft sculpin (*Psychrolutes sigalutes*) were found as juveniles in strait habitat in September-October, while walleye pollock were primarily caught as adults in strait habitat in May (Figure 3). These catch patterns represent the abundance of species caught with our trawl gear during daylight hours; however, previous research showed that the catches were greater at night for vertically migrating species, such as walleye pollock and Pacific herring, than our data show (Orsi et al., unpubl cruise reports).

Distribution of juvenile salmon differed for the months, species, and habitats sampled. Overall catch rates for juvenile salmon were lowest (none) in May, when trawling was limited, were generally highest in June and July, and were intermediate in August and September-October (Figure 4). Coho salmon were most abundant in June, whereas pink, chum, sockeye, and chinook salmon were most abundant in July. Catch rates of all juvenile salmon, except chinook, were highest in strait habitat; chinook salmon were caught primarily in inshore habitat. In the coastal habitat, catch rates along the 65 km Icy Point offshore transect were the highest within 25 km of shore (Figure 5). The abundance of the most common species, juvenile pink and chum salmon, therefore peaked in the habitats and time periods when thermal conditions and zooplankton food resources were most favorable.

Size and condition of juvenile salmon differed among species and sampling periods (Tables 8-12; Figures 6-8). Juvenile coho and chinook salmon were consistently 25–100 mm longer than sockeye, chum, and pink salmon in each sampling period. All species increased in both length and weight in each period, indicating growth despite the influx of additional stocks with varied times of saltwater entry. Mean FL (mm) for each species of juvenile salmon in June–July–August–Sept./Oct. were: pink (97–115–134–168), chum (104–130–139–165), sockeye (123–145–122–163), coho (154–207–225–279), and chinook (139–160–190–214). Mean weight (g) for each species of juvenile salmon in June–July–August–Sept./Oct. were: pink (7.4–17.3–21.8–48.1), chum (10.9–22.8–25.1–44.1), sockeye (19.3–31.3–19.7–42.9), coho (43.5–107.2–140.7–280.5), and chinook (39.6–51.0–93.9–128.6). Species condition also generally increased monthly, indicating healthy feeding environments. Condition factors (g/FL^3) for each species of juvenile salmon in June–July–August–Sept./Oct. were: pink (8.6–8.9–8.7–9.3), chum (9.1–9.1–9.1–9.6), sockeye (9.6–10.3–9.6–9.7), coho (11.2–11.6–11.8–12.0), and chinook (10.4–11.3–12.0–12.3). However, juvenile chum and sockeye salmon condition increased less than the other salmon species, which may be related to the magnitude of hatchery releases into the region and its biophysical parameters. Further study on the bioenergetics of salmonids is needed to address these questions.

Twenty-two of the 29 juvenile and immature salmon with missing adipose fins contained CWTs (Table 13). We recovered 15 CWT from juvenile coho salmon and 7 CWT from juvenile and immature chinook salmon. All CWT fish, both hatchery and wild stocks, originated from the northern region of southeastern Alaska and most were recovered in the strait habitat. The seven adipose-clipped salmon that did not contain CWTs were all juvenile coho, mostly recovered in the coastal habitat. These adipose-clipped coho salmon without CWTs likely originated from Washington and Oregon, where all hatchery origin coho are adipose-clipped, but may not necessarily have CWTs implanted. The occurrence of these stocks in Alaskan waters is supported by the recovery of a CWT juvenile coho salmon of Oregon origin in the coastal habitat in 1997 (Orsi et al. 1997). Migration rates of the 15 CWT juvenile coho salmon ranged 0.3-5.0 km/d with a mean of 2.5 km/d. Migration rates of the 4 CWT juvenile chinook salmon ranged from 0.1-1.3 km/d with a mean of 0.5 km/d.

Stock-specific information was derived from the otoliths of a sub-sample of 633 juvenile chum salmon caught in trawl hauls (Table 14). These fish were the same individuals sampled for weight and condition, and represented 52% of all juvenile chum salmon caught throughout the sampling season. Of all chum salmon otoliths examined, 335 (53%) were marked: 225 (36%) were identified as HFH marks, while 110 (17%) were identified as DIPAC Gastineau Hatchery marks. The remaining 298 (47%) unmarked chum included both wild stocks and unmarked HFH stocks (Figure 9). By using the expansion rate of 1.5 for each HFH marked chum salmon, the adjusted marked proportion of HFH fish increases from 36% to 53% (337). Based on the numbers of fish released (171.2 million) and the proportions marked (44% from HFH and 56% from DIPAC (Table 16)), we expected to recover fewer HFH fish than DIPAC fish. Instead we recovered more than three times as many HFH fish as DIPAC fish. Unfortunately, the chum salmon accessory marks identifying the numerous release sites for DIPAC fish were not successful in brood year 1998; therefore, we could not partition the effects of release site on recovery of juveniles.

Stock-specific information was also derived from the otoliths of a sub-sample of 252 juvenile sockeye salmon, representing 82% of all juvenile sockeye salmon caught (Table 15). Only 19% (47) of the 252 sockeye salmon otoliths examined were marked. All came from the DIPAC Snettisham Hatchery (brood year 1997) and were marked to identify both hatchery and release site (Figure 10). Some of these sockeye were released into freshwater lakes in 1998, while some were released into saltwater in 1999 (Table 16). No 0-check sockeye are to known to occur from these lakes (pers. comm., DIPAC). Of the 47 marked sockeye caught in our trawls, approximately 75% (35) were Snettisham recoveries, 23% (11) were Sweetheart Lake recoveries, and 2% (1) were Tatsumenie Lake recoveries. By comparison, the relative proportions of sockeye released from the three sites were: 56% Snettisham, 41% Tatsumenie Lake, and 3% Sweetheart Lake. These differences in recovery and release rates suggest stock-specific migration timing or routes.

Although twenty times as many juvenile chum salmon as juvenile sockeye salmon were released from hatcheries, we only recovered ten times as many. The total chum released (171.2 million) outnumbered the total sockeye released (8.9 million) by a factor of 19:1 (Table 16). This could be explained by the relative abundance of wild stocks for the two species. However, in our catches, approximately 70% of juvenile chum salmon were derived from hatcheries, while only 20% of juvenile sockeye salmon were derived from hatcheries. It is unclear whether the recovery differential between the two species is related to gear vulnerability, habitat utilization, fishing effort, or an unknown factor.

Species-specific patterns in the distribution of the otolith-marks recovered were observed for juvenile chum and sockeye salmon. For juvenile chum salmon, marked fish in the catch were prominent in inshore and strait habitats in June and July, declined over time, and were absent in September-October (Figure 9). Conversely, marked chum salmon in coastal habitat occurred later; they were absent in June, present in July and August, and still present in September-

October. Stocks of chum salmon from HFH made up a greater proportion of the catch than DIPAC stocks in all habitat-sampling intervals where marks were recovered, even though the release timing was similar and HFH released fewer chum salmon than DIPAC (74.6 vs. 96.6 million; Table 16). For juvenile sockeye salmon, the greatest percentages of marked fish were captured in inshore and strait habitats in June and July; only one mark was recovered as late as September, in inshore habitat (Figure 10). The percentage of marked sockeye caught in coastal habitat was minimal and occurred only in July. Thus, juvenile sockeye salmon moved seaward through the habitats more rapidly than juvenile chum salmon.

The most complete size and condition data on release cohorts was derived from DIPAC Gastineau Hatchery voucher samples of juvenile chum salmon (Table 16). Fish from three release sites in mid-May and early June had mean condition factors ranging from 9.5 to 10.4, somewhat greater than the mean condition (9.1) of juvenile chum sampled by trawl during June-July-August, but similar to the mean condition (9.6) of juvenile chum salmon caught later, in September-October. Thus, juvenile chum salmon had relatively higher condition at the time of release, decreased in condition during summer, then increased in condition during fall. Consequently, there may be a period of adjustment to feeding in the wild after rearing in culture.

Stomachs of 307 potential predators of juvenile salmon were examined from 13 species of fish: 81 adult pink salmon, 66 immature sablefish, 64 walleye pollock (*Theragra chalcogramma*), 42 immature chinook salmon, 16 Pacific sandfish (*Trichodon trichodon*), 14 adult coho salmon, 10 adult spiny dogfish (*Squalus acanthias*), 4 adult starry flounder (*Platichthys stellatus*), 4 adult sockeye salmon, 3 Dolly Varden (*Salvelinus malma*), 1 immature chum salmon, 1 adult black rockfish (*Sebastes melanops*), and 1 Pacific cod (*Gadus macrocephalus*) (Table 17). In general, more than 75% of stomachs from each species contained food. We observed a total of 27 incidences of predation on juvenile salmon, by 36% of immature sablefish, 18% of adult coho salmon, and 10% of spiny dogfish (Table 17). These predation events occurred in all three habitats and spanned the four time intervals when trawling occurred. Sablefish preyed on juvenile salmon in both June and July at False Point Retreat and in Icy and Upper Chatham Straits, adult coho preyed on juvenile salmon in July and September in Icy Strait and Cross Sound, and spiny dogfish preyed on juvenile salmon in June on the Icy Point transect.

Although the monthly samples sizes of these potential predators were small, fish comprised the bulk of the prey weight for most species (Figure 11). The piscivorous feeding mode was consistent across months for chinook and coho salmon and for Pacific sandfish, less so for walleye pollock, and was minor for pink salmon. A variety of non-salmonid fish prey was consumed: larval and juvenile herring, osmerids (including capelin), sandlance, pollock, lanternfish, poachers, cottidae, quillfish, wolf eel, stichaedae, and unidentified remains. Common invertebrate prey included decapod larvae (zoeae and megalops), pteropods (mainly *Limacina helicina*, some *Clione*), hyperiid amphipods, euphausiids, and occasionally gelatinous taxa such as salps, and miscellaneous others including chaetognaths, shrimp, oikopleurans, and copepods.

Juvenile sablefish had the greatest rate of predation on juvenile salmon of all potential predators. Individual sablefish predators examined had consumed up to four juvenile salmon. Of the 42 juvenile salmon consumed by sablefish in July, approximately 36% were pink salmon, 56% were chum salmon, and 4% were sockeye salmon. We considered the possibility that these high rates of predation were induced by enclosure of predators and prey in the net. Two pieces of evidence suggested that the concentration of predators and prey in the trawl resulted in net feeding: 1) many salmon appeared freshly preyed upon by the sablefish, and 2) the rate of predation on salmon generally increased as the salmon to sablefish catch ratio increased. Two other pieces of evidence suggested that predation occurred outside the net: 1) some identifiable juvenile salmon remains were well-digested, and 2) a sablefish had fed on salmon when no salmon were caught in the trawl. The latter hypothesis is supported by a laboratory study (Sturdevant et al., In Prep.) which showed that, after approximately six-eight hours in sablefish stomachs, salmon prey were in a similar stage of digestion as those in the stomachs of the trawl-caught sablefish. Therefore, both net feeding and natural predation by sablefish on juvenile salmon are likely to have occurred.

This third year of monitoring in southeastern Alaska has shown patterns consistent with prior years with respect to the temporal and spatial occurrence of biophysical data, and some distinct differences. Each year, surface temperatures change seasonally and salinity levels increase progressively in habitats westward. When compared to the El Niño conditions of 1997-1998, the La Niña conditions of 1999 indicated lower temperatures and lower zooplankton volumes which may have led to the lower growth we observed for juvenile salmon in 1999 compared to 1997-98 (Orsi et al. In Press). The coastal monitoring of stations from May-October is currently ongoing in the northern region of southeastern Alaska in 2000. Long-term ecological monitoring of key juvenile salmon stocks, including ocean sampling programs that sample at appropriate spatial and temporal scales and encompass a variety of environmental conditions, is needed to understand relationships of habitat use, marine growth, and hatchery and wild stock interactions to year-class strength and ocean carrying capacity for salmon.

Acknowledgments

Special thanks to the additional Auke Bay Laboratory personnel Mike Byerly, Dean Courtney, Brandee Gerke, and Michele Masuda and Alaska Department of Fish and Game personnel Kris Munk 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, George Eimes, Sam Hardy, Scott Hill, Allen Harvison, 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. Finally, we thank Diana Tersteeg of DIPAC, for processing and reading otolith thermal marks and associated data from samples of juvenile salmon.

Literature Cited

ADFG. 2000. Salmon fisheries harvest statistics. Alaska Department of Fish and Game. Www.cf.adfg.state.ak.us.

Beamish, R. J. (editor) 1995. Climate change and northern fish populations. Can. Spec. Publ. Fish. Aquat. Sci. 121. 739 p.

Bruce, H. E., D. R. McLain, and B. L. Wing. 1977. Annual physical and chemical oceanographic cycles of Auke Bay, southeastern Alaska. NOAA Tech. Rep. NMFS SSRF-712. 11 p.

Chaput, G. J., C. H. LeBlanc, and C. Bourque. 1992. Evaluation of an electronic fish measuring board. ICES J. Mar. Sci., 49: 335–339.

Cone, R. S. 1989. The need to reconsider the use of condition indices in fishery science. Trans. Amer. Fish. Soc. 118:510-514.

Courtney, D. L., D. G. Mortensen, J. A. Orsi, and K. M. Munk. 2000. Origin of juvenile Pacific salmon recovered from coastal southeastern Alaska identified by otolith thermal marks and coded wire tags. Fisheries Research 46: 267-278.

Hagen, P. and K. Munk. 1994. Stock separation by thermally induced otolith microstructure marks. Pp. 149–156 *In:* Proceedings of the 16th Northeast Pacific Pink and Chum Salmon Workshop. Alaska Sea Grant College Program AK-SG-94-02, University of Alaska, Fairbanks.

Jaenicke, H. W. and A. C. Celewycz. 1994. Marine distribution and size of juvenile Pacific salmon in Southeast Alaska and northern British Columbia. Fish. Bull. 92:79-90.

Jefferts, K. B., P. K. Bergman, and H. F. Fiscus. 1963. A coded wire identification system for macro-organisms. Nature (Lond.) 198: 460–462

Landingham, J. H., M. V. Sturdevant, and R. D. Brodeur. 1997. Feeding habits of juvenile Pacific salmon in marine waters of southeastern Alaska and northern British Columbia. Fish. Bull. 96:285-302.

Mattson C. R. and B. L. Wing. 1978. Ichthyoplankton composition and plankton volumes from inland coastal waters of southeastern Alaska, April–November 1972. NOAA Tech. Rep. NMFS SSRF-723. 11 p.

Murphy, J. M. and J. A. Orsi. 1999. NOAA Processed Report 99-02. Physical oceanographic observations collected aboard the NOAA Ship John N. Cobb in the northern region of southeastern Alaska, 1997 and 1998. 239 p.

Murphy, J. M., A. L. J. Brase, and J. A. Orsi. 1999. NOAA Technical Memorandum NMFS-AFSC-105. An ocean survey of juvenile salmon in the northern region of southeastern Alaska, May-October. 40 p. Auke Bay Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, NOAA, 11305 Glacier Highway, Juneau, AK 99801-8626, USA.

Orsi, J. A., J. M. Murphy, and A. L. J. Brase. 1997. Survey of juvenile salmon in the marine waters of southeastern Alaska, May–August 1997. (NPAFC Doc. 277) 27 p. Auke Bay Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, NOAA, 11305 Glacier Highway, Juneau, AK 99801-8626, USA.

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) 27 p. Auke Bay Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, NOAA, 11305 Glacier Highway, Juneau, AK 99801-8626, USA.

Orsi, J. A., D. G. Mortensen, and J. M. Murphy. 1999. Early marine ecology of pink and chum salmon in southeastern Alaska. *In*: Proceeding of the 19th Northeast Pacific pink and chum workshop. Juneau, Alaska.

Orsi, J. A., M. V. Sturdevant, J. M. Murphy, D. G. Mortensen, and B. L. Wing. In Press. Seasonal habitat use and early marine ecology of juvenile Pacific salmon in southeastern Alaska. NPAFC Bull. 2.

Pearcy, W. G. 1997. What have we learned in the last decade? What are research priorities? Pp. 271–277 *In*: R. L. Emmett and M. H. Schiewe (eds.), Estuarine and ocean survival of northeastern Pacific salmon: Proceedings of the workshop. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-NWFSC-29.

Secor, D. H., Dean, J. M., and Laban, E. H. 1992. Otolith removal and preparation for microstructure examination. *In*: Stevenson, K. D., Campana, S. E. (eds.). Otolith microstructure, examination and analysis. Can. Spec. Publ. Fish. Aquat. Sci. 117:19-57.

Sturdevant, M. V., M. F. Sigler, and J. A. Orsi. In Prep. Experimental digestion rates of sablefish fed juvenile chum salmon and predation implications in coastal Alaska.

U.S. GLOBEC. 1996. U.S. GLOBEC northeast Pacific implementation plan. U.S. Global Ocean Ecosystems Dynamics Report No. 17. University of California, Davis. 60 p.

Table 1.—Localities and coordinates of stations sampled monthly in marine waters of the northern region of southeastern Alaska, May–October 1999.

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–October 1999.

		Data collection type*					
Dates	Habitat	Rope trawl	CTD cast	Bongo tow	20-m vertical	WP-2 vertical	Chlorophyll & nutrients
20–25 May	Inshore	0	4	4	6	1	2
	Strait	4	8	8	8	0	4
	Coastal	0	4	4	4	0	2
	All May	4	16	16	18	1	8
26 June–01 July	Inshore	3	4	4	6	1	5
	Strait	8	8	8	8	0	4
	Coastal	11	11	11	11	3	9
	All June	22	23	23	25	4	18
20-28 July	Inshore	3	4	4	6	1	4
	Strait	8	8	8	8	0	4
	Coastal	11	11	11	11	3	9
	All July	22	23	23	25	4	17
20–26 August	Inshore	3	5	6	6	1	4
	Strait	12	12	8	12	0	4
	Coastal	8	8	8	8	4	6
	All August	23	24	22	26	5	14
26 September–01 October	Inshore	3	4	4	6	1	4
	Strait	8	8	8	8	0	4
	Coastal	8	8	8	8	4	7
	All Sept./Oct.	19	20	20	22	5	15
Total		90	106	104	116	19	72

*Rope trawl = 20-min hauls with NORDIC 264 surface trawl 20 X 24 m; CTD casts = to 200 m or within 10 m of the bottom; Bongo tow = 60-cm diameter frame, 505 and 333 µ meshes, double oblique haul to 200 m or within 20 m of the bottom; 20-m vertical = 50-cm diameter frame, 243 µ conical net towed vertically from 20 m; WP-2 vertical = 57-cm diameter frame, 202 µ 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–October 1999. Station code acronyms are defined in Table 1. NS denotes no sampling.

Locality	Month	Temp. (°C)	Salin. (PSU)	Temp. (°C)	Salin. (PSU)	Temp. (°C)	Salin. (PSU)	Temp. (°C)	Salin. (PSU)
Inside waters									
Inshore		TKI		ABM		LFC		FPR	
	May	6.9	25.0	9.0	27.1	9.0	27.2	6.7	30.5
	June	11.1	14.4	13.6	17.4	12.7	17.5	11.5	25.4
	July	9.9	13.9	12.4	15.4	11.9	16.5	12.6	23.7
	August	10.7	14.4	11.3	16.5	13.0	20.1	13.6	15.7
	Sept./Oct.	7.3	16.4	8.3	17.9	7.2	18.3	9.4	24.1
Upper Chatham		UCA		UCB		UCC		UCD	
Strait	May	6.5	30.3	6.3	31.1	7.1	30.8	7.1	30.8
	June	10.9	29.1	10.2	26.6	11.2	28.9	11.4	26.9
	July	10.6	29.5	11.2	29.1	12.8	29.0	12.5	25.0
	August	12.7	24.7	12.9	23.8	13.4	18.8	13.3	18.6
	Sept./Oct.	9.0	25.0	9.0	26.1	8.9	23.5	8.9	24.0
Icy Strait		ISA		ISB		ISC		ISD	
	May	6.5	31.0	6.5	31.0	7.3	30.8	7.7	30.6
	June	8.4	30.2	10.3	29.1	11.1	27.3	11.5	26.7
	July	11.1	28.2	12.0	27.8	12.1	26.6	12.5	26.1
	August	11.0	26.8	12.9	21.4	13.4	17.9	13.4	18.3
	Sept./Oct.	8.3	29.4	8.3	29.3	8.7	28.1	9.2	25.4
Outside waters									
Cross Sound		CSA		CSB		CSC		CSD	
	May	7.9	31.6	6.9	31.9	7.0	31.9	6.8	31.9
	June	8.8	30.8	7.8	31.8	7.5	32.0	7.5	31.0
	July	11.3	31.7	7.7	31.8	7.8	31.8	7.8	31.5
	August	10.4	29.0	9.8	29.8	9.9	30.1	9.5	29.2
	Sept./Oct.	8.5	31.3	8.6	31.5	7.8	30.9	7.8	31.1
Icy Point		IPA		IPB		IPC		IPD	
	May	NS	NS	NS	NS	NS	NS	NS	NS
	June	10.6	31.5	11.5	31.8	11.0	32.0	NS	NS
	July	12.1	31.5	12.9	31.7	12.1	31.5	NS	NS
	August	10.5	29.5	13.0	31.2	12.1	31.4	13.0	31.4
	Sept./Oct.	10.6	31.0	10.2	30.5	10.3	30.4	10.3	31.2
Cape Edward		EDA		EDB		EDC		EDD	
	May	NS	NS	NS	NS	NS	NS	NS	NS
	June	10.9	31.5	10.9	31.5	10.1	31.4	10.9	31.9
	July	12.3	31.4	12.1	31.5	12.1	31.5	12.5	31.5
	August	NS	NS	NS	NS	NS	NS	NS	NS
	Sept./Oct.	NS	NS	NS	NS	NS	NS	NS	NS

Table 4.—Nutrient and chlorophyll measurements from surface water samples in marine waters of the northern region of southeastern Alaska, May–October 1999. Station code acronyms are defined in Table 1. NS denotes no sampling.

Station	Date	Nutrients [µM]					Chlorophyll	Phaeopigment
		[PO_4]	[$Si(OH)_4$]	[NO_3]	[NO_2]	[NH_4]	(mg/m^3)	(mg/m^3)
TKI	20 May	1.37	18.11	9.05	0.07	3.55	3.14	0.08
	26 June	1.24	32.40	5.09	0.12	4.35	0.54	0.20
	25 July	0.51	17.14	2.40	0.02	3.65	0.23	0.15
	20 August	0.35	15.24	2.58	0.04	1.61	0.23	0.22
	26 September	1.03	19.92	8.62	0.15	2.46	0.54	0.02
ABM	20 May	1.23	2.47	1.73	0.05	1.62	3.95	0.10
	01 July	0.56	7.43	1.24	0.05	0.78	0.42	0.15
	30 July	1.17	6.29	1.23	0.00	1.06	0.64	0.18
	26 August	0.22	3.18	1.16	0.01	0.89	1.54	0.26
	26 September	1.19	11.22	4.95	0.09	1.76	0.86	0.15
LFC	26 June	0.64	7.08	2.28	0.04	1.52	0.32	0.45
	01 July	0.77	9.51	1.76	0.01	1.05	1.54	0.14
	30 July	1.05	6.77	1.55	0.00	0.56	0.51	0.05
	20 August	0.73	4.02	1.47	0.00	0.74	NS	NS
	26 September	1.33	22.84	9.28	0.15	3.97	0.27	0.08
FPR	26 June	NS	NS	NS	NS	NS	0.88	0.24
	24 July	1.48	3.27	1.62	0.01	0.77	1.64	0.54
	20 August	0.04	10.30	1.29	0.00	0.72	0.30	0.11
	26 September	0.72	9.53	5.29	0.08	1.33	0.50	0.06
UCA	01 July	0.89	2.62	1.38	0.00	1.16	1.34	0.10
	29 July	0.94	11.03	3.91	0.08	0.91	1.09	0.28
	21 August	0.60	6.21	1.55	0.01	1.28	0.57	0.18
	23 August	3.55	23.05	11.63	0.18	1.52	0.61	0.32
	01 October	1.16	21.19	10.81	0.18	1.54	0.57	0.18
UCC	22 May	0.98	6.04	2.07	0.04	1.14	4.07	0.10
UCD	22 May	NS	NS	NS	NS	NS	5.17	0.13
	01 July	0.91	2.71	1.27	0.00	0.82	1.11	0.37
	29 July	0.68	2.61	1.21	0.02	1.08	0.97	0.24
	21 August	1.95	7.23	1.35	0.00	1.18	0.63	0.27
	01 October	1.94	21.09	10.93	0.20	1.82	0.75	0.14
ISA	21 May	1.73	19.33	9.05	0.20	3.05	1.40	0.03
	29 June	1.32	21.17	9.98	0.09	2.03	1.47	0.04
	27 July	1.79	10.90	5.53	0.11	1.22	2.30	0.65
	22 August	1.25	17.45	7.98	0.12	0.72	1.52	0.68
	27 September	1.86	29.27	16.38	0.30	0.76	0.47	0.22
ISB	21 May	1.46	15.99	7.27	0.16	2.93	4.06	0.10

Table 4.—(Cont.)

Station	Date	Nutrients [μM] $[PO_4]$	$[Si(OH)_4]$	$[NO_3]$	$[NO_2]$	$[NH_4]$	Chlorophyll (mg/m^3)	Phaeopigment (mg/m^3)
ISD	29 June	0.66	2.49	1.83	0.06	0.91	0.75	0.45
	27 July	0.85	2.11	1.54	0.01	1.25	1.41	0.44
	22 August	0.76	4.05	1.52	0.00	1.02	2.15	0.09
	27 September	0.93	16.61	9.70	0.15	1.48	0.45	0.06
CSA	22 May	0.83	6.53	5.05	0.17	0.74	3.54	0.09
	28 June	1.03	11.83	5.14	0.16	0.78	4.11	0.09
	26 July	0.99	9.74	5.13	0.06	1.36	0.68	0.21
	29 September	1.77	37.34	20.53	0.27	1.19	0.28	0.09
CSD	22 May	1.81	27.10	15.29	0.26	3.07	2.15	0.05
	28 June	1.83	31.17	16.75	0.17	1.80	1.16	0.05
	26 July	2.06	32.44	17.32	0.24	1.61	0.98	0.44
	23 August	1.35	27.09	13.80	0.16	1.28	0.50	0.25
	28 September	2.17	41.51	23.66	0.25	1.11	0.18	0.11
IPA	27 June	1.46	8.75	3.02	0.07	0.93	1.61	0.21
	25 July	1.65	5.41	1.94	0.08	2.26	0.64	0.11
	25 August	1.41	22.48	11.31	0.16	1.97	0.97	0.15
	28 September	1.05	10.84	5.54	0.17	1.16	0.59	0.13
IPB	27 June	0.98	3.85	1.87	0.01	0.63	0.36	0.03
	25 July	1.46	6.24	1.48	0.00	0.43	0.37	0.09
	25 August	0.59	17.22	1.73	0.03	0.95	0.89	0.31
	28 September	1.54	20.98	9.92	0.32	1.52	0.54	0.15
IPC	27 June	1.14	9.48	1.69	0.02	0.88	0.23	0.04
	25 July	1.54	6.33	1.42	0.02	0.79	0.72	0.25
	25 August	1.17	11.67	2.04	0.10	2.87	1.48	0.28
	28 September	2.48	17.38	7.74	0.25	1.67	0.82	0.24
	30 September	1.80	18.57	8.62	0.31	1.52	0.70	0.20
IPD	25 August	1.57	7.24	1.57	0.03	1.07	0.23	0.09
	30 September	1.26	21.07	9.89	0.25	0.71	0.95	0.15
EDA	30 June	0.86	5.17	1.48	0.07	0.83	0.63	0.28
	28 July	1.47	5.03	1.27	0.05	0.48	0.47	0.13
EDB	30 June	0.74	3.95	1.83	0.03	1.01	0.86	0.38
	28 July	1.72	4.83	1.70	0.13	0.93	0.25	0.06
EDC	30 June	0.72	4.77	1.34	0.03	0.78	0.45	0.21
	28 July	0.49	3.51	0.82	0.01	0.57	0.48	0.24
EDD	30 June	1.22	3.92	1.42	0.08	1.20	0.44	0.12
	28 July	1.22	5.08	0.86	0.04	0.63	0.12	0.07

Table 5.—Zooplankton (ZSV) and total plankton (TSV) settled volumes (ml) from 20-m NORPAC hauls sampled monthly in marine waters of the northern region of southeastern Alaska, May–October 1999. Station code acronyms are defined in Table 1. NS = no sampling. Asterisk denotes that separation of zooplankton was not distinct but was estimated.

Locality	Month	ZSV	TSV	ZSV	TSV	ZSV	TSV	ZSV	TSV
Inside waters									
Inshore		TKI		ABM		LFC		FPR	
	May	2	50	6*	122	3	110	10	90
	June	20	24	37*	63	40	55	30	40
	July	20	30	14*	18	15	25	14	14
	August	10	40	15	30	10	20	4	4
	Sept./Oct.	1	1	1	1	1	1	1	1
Upper Chatham		UCA		UCB		UCC		UCD	
Strait	May	11	21	5	25	13	23	10	20
	June	20	20	15	20	20	27	20	35
	July	8	8	1.5	1.5	19	19	10	10
	August	1	1	1	1	2	2	2	2
	Sept./Oct.	0.5	0.5	0.5	0.5	0.5	0.5	1	1
Icy Strait		ISA		ISB		ISC		ISD	
	May	6	20	10	22	22	40	16	26
	June	10	10	18	20	15	20	20	40
	July	11	11	4	4	8	8	8	8
	August	9	9	4	4	9*	9	8	8
	Sept./Oct.	2	2	1	1	1	1	0.5	0.5
Outside waters									
Cross Sound		CSA		CSB		CSC		CSD	
	May	7	38	7	36	6	60	3	6
	June	6	6	7	7	4	4	5	5
	July	12	12	5	5	6	6	5	5
	August	3	3	5	5	5	5	3	3
	Sept./Oct.	1	1	1	1	1	1	1	1
Icy Point		IPA		IPB		IPC		IPD	
	May	NS	NS	NS	NS	NS	NS	NS	NS
	June	10	12	15	20	10	35	NS	NS
	July	12	15	8	8	16	16	NS	NS
	August	10	10	11	11	1	1	0.5	0.5
	Sept./Oct.	3	3	3	3	10	10	4	4
Cape Edward		EDA		EDB		EDC		EDD	
	May	NS	NS	NS	NS	NS	NS	NS	NS
	June	23	23	23	23	25	35	20	25
	July	5	5	12	12	10	10	5	5
	August	NS	NS	NS	NS	NS	NS	NS	NS
	Sept./Oct.	NS	NS	NS	NS	NS	NS	NS	NS

Table 6.—Monthly catches of fishes and squid sampled with a rope trawl in marine waters of the northern region of southeastern Alaska, May–October 1999.

Common name	Scientific name	Number caught May	June	July	August	Sept./Oct.	Total
Pink salmon[1]	*Oncorhynchus gorbuscha*	0	32	670	47	241	990
Chum salmon[1]	*O. keta*	0	506	875	21	41	1,443
Sockeye salmon[1]	*O. nerka*	0	111	373	3	33	520
Coho salmon[1]	*O. kisutch*	0	194	117	49	18	378
Chinook salmon[1]	*O. tshawtscha*	0	4	22	11	24	61
Chum salmon[2]	*O. keta*	0	0	2	0	0	2
Sockeye salmon[2]	*O. nerka*	0	0	0	1	0	1
Chinook salmon[2]	*O. tshawtscha*	6	23	7	6	1	43
Pink salmon[3]	*O. gorbuscha*	0	14	45	21	0	80
Sockeye salmon[3]	*O. nerka*	0	2	0	2	0	4
Coho salmon[3]	*O. kisutch*	0	1	1	4	7	13
Capelin	*Mallotus villosus*	0	2	59	19	1,820	1,900
Pacific herring	*Clupea harengus*	1	317	569	6	398	1,291
Sablefish	*Anoplopoma fimbria*	0	5	149	7	0	161
Soft sculpin	*Psychrolutes sigalutes*	5	11	0	0	90	106
Walleye pollock	*Theragra chalcogramma*	62	15	7	8	10	102
Prowfish	*Zaprora silenus*	0	1	8	12	3	24
Pacific sandfish	*Trichodon trichodon*	0	2	2	0	13	17
Crested sculpin	*Blepsias bilobus*	0	0	4	10	2	16
Spiny dogfish	*Squalus acanthias*	0	10	0	0	0	10
Pacific spiny lumpsucker	*Eumicrotremus orbis*	0	0	4	1	4	9
Squid	Gonatidae	0	4	0	0	5	9
Starry flounder	*Platichthys stellatus*	0	2	1	0	1	4
Dolly Varden	*Salvelinus malma*	1	2	0	0	0	3
Bigmouth sculpin	*Hemitripterus bolini*	2	1	0	0	0	3
Silverspotted sculpin	*Blepsias cirrhosus*	0	1	0	0	1	2
Pacific sandlance	*Ammodytes hexapterus*	0	1	0	1	0	2
Wolf-eel	*Anarrhichthys ocellatus*	0	2	0	0	0	2
Lingcod	*Ophiodon elongatus*	0	2	0	0	0	2
Eulachon	*Thaleichthys pacificus*	0	0	0	0	1	1
Three-spined stickleback	*Gasterosteus aculeatus*	0	0	0	0	1	1
Pacific cod	*Gadus macrocephalus*	0	0	1	0	0	1
Black rockfish	*Sebastes melanops*	0	0	1	0	0	1
Smooth lumpsucker	*Aptocyclus ventricosus*	0	1	0	0	0	1
Blue shark	*Prionace glauca*	0	0	0	1	0	1
Total		77	1,265	2,917	230	2,715	7,204

[1] Juvenile
[2] Immature
[3] Adult

Table 7.—Frequency of occurrence for fishes and squid sampled with a rope trawl in marine waters of the northern region of southeastern Alaska, May–October 1999. Percentage occurrence per 90 hauls shown in parentheses.

		Frequency of occurrence					
Common name	Scientific name	May	June	July	Aug.	Sept./Oct.	Total
Pink salmon[1]	*Oncorhynchus gorbuscha*	0	5	9	8	10	32(36)
Chum salmon[1]	*O. keta*	0	11	11	6	6	34(38)
Sockeye salmon[1]	*O. nerka*	0	10	11	3	4	28(31)
Coho salmon[1]	*O. kisutch*	0	11	13	12	10	46(51)
Chinook salmon[1]	*O. tshawtscha*	0	2	3	4	7	16(18)
Chum salmon[2]	*O. keta*	0	0	2	0	0	2(2)
Sockeye salmon[2]	*O. nerka*	0	0	0	1	0	1(1)
Chinook salmon[2]	*O. tshawtscha*	3	7	4	3	1	18(20)
Pink salmon[3]	*O. gorbuscha*	0	7	9	8	0	24(27)
Sockeye salmon[3]	*O. nerka*	0	2	0	2	0	4(4)
Coho salmon[3]	*O. kisutch*	0	1	1	4	6	12(13)
Capelin	*Mallotus villosus*	0	1	3	3	9	16(18)
Pacific herring	*Clupea harengus*	1	3	2	4	4	14(16)
Sablefish	*Anoplopoma fimbria*	0	0	0	0	1	1(1)
Sablefish[2]	*Anoplopoma fimbria*	0	2	6	5	0	13(14)
Soft sculpin	*Psychrolutes sigalutes*	2	3	0	0	6	11(12)
Walleye pollock	*Theragra chalcogramma*	4	10	4	2	7	27(30)
Prowfish	*Zaprora silenus*	0	1	5	9	3	18(20)
Pacific sandfish	*Trichodon trichodon*	0	1	2	0	2	5(6)
Crested sculpin	*Blepsias bilobus*	0	0	4	8	2	14(16)
Spiny dogfish	*Squalus acanthias*	0	2	0	0	0	2(2)
Pacific spiny lumpsucker	*Eumicrotremus orbis*	0	0	1	1	2	4(4)
Squid	Gonatidae	0	4	0	0	2	6(7)
Starry flounder	*Platichthys stellatus*	0	1	1	0	1	3(3)
Dolly Varden	*Salvelinus malma*	1	2	0	0	0	3(3)
Bigmouth sculpin	*Hemitripterus bolini*	1	1	0	0	0	2(2)
Silverspotted sculpin	*Blepsias cirrhosus*	0	1	0	0	1	2(2)
Pacific sandlance	*Ammodytes hexapterus*	0	1	0	1	0	2(2)
Wolf-eel	*Anarrhichthys ocellatus*	0	2	0	0	0	2(2)
Lingcod	*Ophiodon elongatus*	0	1	0	0	0	1(1)
Eulachon	*Thaleichthys pacificus*	0	0	0	0	1	1(1)
Three-spined stickleback	*Gasterosteus aculeatus*	0	0	0	0	1	1(1)
Pacific cod	*Gadus macrocephalus*	0	0	1	0	1	1(1)
Black rockfish	*Sebastes melanops*	0	0	1	0	0	1(1)
Smooth lumpsucker	*Aptocyclus ventricosus*	0	1	0	0	0	1(1)
Blue shark	*Prionace glauca*	0	0	0	1	0	1(1)

[1]Juvenile
[2] Immature
[3] Adult

Table 8.— Juvenile pink salmon length (mm fork), weight (g), and condition (weight/length^3) in different marine habitats of the northern region of southeastern Alaska by rope trawl, June–October 1999. NS denotes no sampling.

		June				July				August				September-October			
Locality	Factor	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd
Inshore	Length	—	—	—	—	150	85-169	105.0	12.8	—	—	—	—	9	135-175	158.6	14.6
	Weight	—	—	—	—	50	4.8-43.3	11.2	6.5	—	—	—	—	9	20.7-47.3	35.4	9.5
	Condition	—	—	—	—	50	6.8-9.1	8.3	0.5	—	—	—	—	9	8.2-9.4	8.7	0.4
Upper Chatham Strait	Length	21	85-134	102.7	14.7	—	—	—	—	—	—	—	—	1	179	179.0	0
	Weight	18	4.9-20.5	8.2	3.4	—	—	—	—	—	—	—	—	9	65.1	65.1	0
	Condition	18	7.3-9.3	8.4	0.5	—	—	—	—	—	—	—	—	9	11.4	11.4	0
Icy Strait	Length	11	76-100	86.7	7.1	272	86-167	117.5	14.68	14	121-179	138.4	14.8	9	163-190	174.9	8.2
	Weight	11	3.7-9.3	5.9	1.7	35	8.9-35.6	22.1	6.7	13	16.4-53.1	25.8	9.9	9	41.2-64.3	50.1	6.4
	Condition	11	7.0-10.5	8.9	1.1	35	6.2-10.6	9.0	0.7	13	8.1-10.9	9.1	0.8	9	8.5-10.3	9.4	0.6
Cross Sound	Length	—	—	—	—	19	115-152	131.4	9.4	31	109-151	133.5	9.4	221	121-229	168.1	12.8
	Weight	—	—	—	—	19	10.8-30.1	19.7	4.6	31	9.8-30.2	20.7	4.7	51	28.4-114.5	49.3	15.0
	Condition	—	—	—	—	19	7.1-9.0	8.3	0.5	31	7.5-9.6	8.5	0.5	51	7.9-10.5	9.4	0.7
Icy Point	Length	—	—	—	—	59	84-153	122.8	15.4	2	107-121	114.0	9.9	1	186	186.0	0
	Weight	—	—	—	—	58	4.8-35.4	19.0	8.0	2	9.5-15.6	12.6	4.3	1	68.6	68.6	0
	Condition	—	—	—	—	58	7.3-12.6	9.6	1.1	2	7.8-8.8	8.3	0.7	1	10.7	10.7	0
Cape Edward	Length	—	—	—	—	1	121	121.0	0	NS	NS	NS	NS	NS	NS	NS	NS
	Weight	—	—	—	—	—	—	—	—	NS	NS	NS	NS	NS	NS	NS	NS
	Condition	—	—	—	—	—	—	—	—	NS	NS	NS	NS	NS	NS	NS	NS
Total	Length	32	46-134	97.2	14.7	501	84-169	114.9	15.7	47	107-179	134.2	12.0	241	121-229	168.0	12.9
	Weight	29	3.7-20.5	7.4	3.1	162	4.8-43.3	17.3	8.1	46	9.5-53.1	21.8	7.1	71	20.7-114.5	48.1	14.4
	Condition	29	7.0-10.5	8.6	0.8	162	6.2-12.6	8.9	1.0	46	7.5-10.9	8.7	0.7	71	7.9-11.4	9.3	0.7

Table 9.—Juvenile chum salmon length (mm fork), weight (g), and condition (weight/length^3) in different marine habitats of the northern region of southeastern Alaska by rope trawl, June–October 1999. NS denotes no sampling.

		June				July				August				September-October			
Locality	Factor	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd
Inshore	Length	8	77-125	98.6	16.2	150	93-153	122.3	12.5	—	—	—	—	2	141-169	155.0	19.8
	Weight	8	4.3-17.8	8.9	4.6	50	8.2-32.7	17.0	5.4	—	—	—	—	2	24.0-46.8	35.4	16.1
	Condition	8	7.8-9.6	8.7	0.6	50	4.2-9.5	8.6	0.8	—	—	—	—	2	8.6-9.7	9.1	0.8
Upper	Length	355	88-127	103.9	7.5	5	131-148	141.6	7.4	—	—	—	—	—	—	—	—
Chatham	Weight	199	5.9-19.4	11.1	2.7	5	18.8-31.5	26.1	4.9	—	—	—	—	—	—	—	—
Strait	Condition	199	6.5-11.3	9.1	0.7	5	8.4-9.7	9.1	0.6	—	—	—	—	—	—	—	—
Icy	Length	118	81-117	100.9	7.3	290	90-156	127.6	14.0	8	113-147	129.5	12.1	6	153-194	168.3	17.1
Strait	Weight	70	5.5-13.9	9.5	2.1	70	8.0-34.1	23.0	5.9	7	13.1-30.2	20.2	6.7	6	30.5-77.2	47.4	17.4
	Condition	70	7.2-11.2	9.3	0.8	70	7.8-14.5	9.5	1.0	7	8.3-6.5	9.1	0.4	6	8.5-11.0	9.6	1.0
Cross	Length	—	—	—	—	29	121-152	134.7	8.2	12	125-164	143.2	15.0	32	139-213	164.8	14.6
Sound	Weight	—	—	—	—	29	14.4-33.5	21.7	4.5	12	17.3-45.7	27.9	9.9	32	24.9-102.8	44.0	13.6
	Condition	—	—	—	—	29	7.7-10.1	8.8	0.5	12	7.9-10.4	9.1	0.7	32	8.3-10.7	9.6	0.7
Icy	Length	—	—	—	—	173	93-190	138.5	18.1	1	163	163.0	0	1	146	146.0	0
Point	Weight	—	—	—	—	119	9.2-64.9	25.2	11.8	—	—	—	—	—	—	—	—
	Condition	—	—	—	—	119	6.8-11.9	9.2	0.7	—	—	—	—	—	—	—	—
Cape	Length	25	93-133	115.8	9.0	1	121	121.0	0	NS	NS	NS	NS	NS	NS	NS	NS
Edward	Weight	25	5.6-22.1	14.1	3.7	1	15.9	15.9	0	NS	NS	NS	NS	NS	NS	NS	NS
	Condition	25	6.7-9.8	8.8	0.6	1	9.0	9.0	0	NS	NS	NS	NS	NS	NS	NS	NS
Total	Length	506	77-133	103.7	8.3	648	90-190	129.7	15.8	21	113-164	138.9	15.8	40	139-213	164.9	15.0
	Weight	302	4.3-22.1	10.9	3.0	272	8.0-64.9	22.8	9.3	19	13.1-45.7	25.1	9.4	40	24.0-102.8	44.1	14.1
	Condition	302	6.5-11.3	9.1	0.7	274	4.2-14.5	9.1	0.8	19	7.8-10.4	9.1	0.6	40	8.3-11.0	9.6	0.8

Table 10.—Juvenile sockeye salmon length (mm fork), weight (g), and condition (weight/length^3) of captured in different marine habitats of the northern region of southeastern Alaska by rope trawl, June–October 1999. NS denotes no sampling.

		June				July				August				September-October			
Locality	Factor	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd
Inshore	Length	16	89-121	98.2	9.7	6	99-130	111.8	12.5	1	124	124.0	0	10	135-186	158.4	19.0
	Weight	16	6.2-16.6	8.9	2.7	6	7.6-20.4	12.9	5.1	1	19.0	19.0	0	10	24.2-60.0	40.5	13.7
	Condition	16	8.0-10.4	9.1	0.7	6	7.8-9.4	8.7	0.7	1	10.0	10.0	0	10	9.1-10.5	9.9	0.4
Upper	Length	11	92-144	104.7	16.2	1	171	171.0	0	—	—	—	—	—	—	—	—
Chatham	Weight	11	6.9-27.8	11.1	6.3	1	50.8	50.8	0	—	—	—	—	—	—	—	—
Strait	Condition	11	7.0-10.4	9.1	1.0	1	10.2	10.2	0	—	—	—	—	—	—	—	—
Icy	Length	81	94-163	129.3	14.5	29	99-182	135.6	22.7	2	99-144	121.5	31.8	2	156-169	162.5	9.2
Strait	Weight	78	7.6-37.5	21.8	6.7	29	9.1-60.5	21.3	15.5	2	7.8-32.4	20.1	17.4	2	35.9-45.5	40.7	6.8
	Condition	78	7.8-12.6	9.8	0.7	29	8.7-11.6	9.9	0.7	2	8.0-10.9	9.4	2	2	9.4-9.5	9.4	0.0
Cross	Length	1	167	167.0	0	3	119-149	133.7	15.0	—	—	—	—	21	151-209	165.0	12.4
Sound	Weight	1	46.9	46.9	0	3	14.5-31.4	23.3	8.5	—	—	—	—	21	33.5-92.8	44.3	12.6
	Condition	1	10.1	10.1	0	3	8.6-10.1	9.4	0.8	—	—	—	—	21	8.0-10.8	9.7	0.6
Icy	Length	—	—	—	—	120	111-182	149.1	12.6	—	—	—	—	—	—	—	—
Point	Weight	—	—	—	—	70	12.8-67.7	34.9	10.3	—	—	—	—	—	—	—	—
	Condition	—	—	—	—	70	8.0-13.9	10.6	1.1	—	—	—	—	—	—	—	—
Cape	Length	2	135-151	143.0	11.3	—	—	—	—	NS	NS	NS	NS	NS	NS	NS	NS
Edward	Weight	2	24.6-31.9	28.3	5.2	—	—	—	—	NS	NS	NS	NS	NS	NS	NS	NS
	Condition	2	9.3-10.0	9.6	0.5	—	—	—	—	NS	NS	NS	NS	NS	NS	NS	NS
Total	Length	111	89-167	123.0	19.2	159	99-182	145.0	17.2	3	99-144	122.0	22.5	33	135-209	162.9	14.5
	Weight	111	6.2-46.9	19.3	8.9	105	7.6-67.7	31.3	13.2	3	7.8-32.4	19.7	12.3	33	24.2-92.8	42.9	12.5
	Condition	111	7.0-12.6	9.6	0.8	105	7.8-13.9	10.3	1.1	3	8.0-10.9	9.6	1.4	33	8.0-10.8	9.7	0.5

Table 11.—Juvenile coho salmon length (mm fork), weight (g), and condition (weight/length^3) in different marine habitats of the northern region of southeastern Alaska by rope trawl, June–October 1999. NS denotes no sampling.

		June				July				August				September-October			
Locality	Factor	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd
Inshore	Length	30	83-186	135.6	20.0	23	127-247	185.0	30.0	10	180-247	210.8	25.9	—	—	—	—
	Weight	30	5.3-67.3	28.0	12.6	23	20.9-174.5	81.3	43.9	10	64.9-170.2	112.8	41.4	—	—	—	—
	Condition	30	8.8-12.6	10.4	1.0	23	9.3-30.4	12.0	4.1	10	10.7-12.6	11.6	0.7	—	—	—	—
Upper	Length	91	108-207	159.5	21.6	22	156-273	224.0	24.2	9	191-239	213.3	18.9	7	273-311	293.1	13.6
Chatham	Weight	91	14.8-100.1	49.1	20.5	22	38.1-257.3	127.0	44.1	9	82.1-167.9	117.6	35.3	7	234.7-391.5	323.3	53.4
Strait	Condition	91	9.5-13.7	11.4	0.8	22	4.6-12.6	10.9	1.5	9	10.8-12.6	11.8	0.7	7	11.5-14.0	12.7	0.9
Icy	Length	72	125-189	153.9	14.4	67	169-249	208.5	19.5	21	192-258	221.1	20.8	5	181-301	247.4	43.0
Strait	Weight	72	20.7-81.9	42.4	13.4	67	52.5-166.1	108.0	29.1	21	78.2-199.5	129.9	37.2	5	65.8-352.1	197.0	102.0
	Condition	72	9.7-13.4	11.3	0.8	67	10.0-17.0	11.7	1.0	21	10.8-13.0	11.7	0.5	5	11.1-12.9	11.9	0.7
Cross	Length	1	184	184.0	0	3	218-233	223.0	8.7	3	192-249	218.7	28.7	6	250-316	287.8	24.7
Sound	Weight	1	69.5	69.5	0	3	118.1-137.4	125.0	10.7	3	89.0-185.7	129.0	50.5	6	205.0-380.1	300.3	64.2
	Condition	1	11.2	11.2	0	3	10.9-11.5	11.3	0.4	3	11.3-12.6	12.0	0.6	6	12.0-13.1	12.5	0.5
Icy	Length	—	—	—	—	1	202	202.0	0	6	255-309	280.2	19.7	—	—	—	—
Point	Weight	—	—	—	—	1	101.3	101.3	0	6	200.5-315.6	265.2	40.0	—	—	—	—
	Condition	—	—	—	—	1	12.3	12.3	0	6	10.7-13.3	12.0	0.9	—	—	—	—
Cape	Length	—	—	—	—	1	236	236.0	0	NS	NS	NS	NS	NS	NS	NS	NS
Edward	Weight	—	—	—	—	1	167.5	167.5	0	NS	NS	NS	NS	NS	NS	NS	NS
	Condition	—	—	—	—	1	12.7	12.7	0	NS	NS	NS	NS	NS	NS	NS	NS
Total	Length	194	83-207	153.8	20.6	117	127-273	207.0	25.7	49	180-309	224.7	29.9	18	181-316	278.7	32.9
	Weight	194	5.3-100.1	43.5	18.5	117	20.9-257.3	107.2	38.1	49	64.9-315.6	140.7	60.3	18	65.8-391.5	280.5	87.2
	Condition	194	8.8-13.7	11.2	0.9	117	4.6-30.4	11.6	2.1	49	10.7-13.3	11.8	0.6	19	3.9-14.0	12.0	2.1

Table 12.—Juvenile chinook salmon length (mm fork), weight (g), and condition (weight/length^3) different marine habitats of the northern region of southeastern Alaska by rope trawl, June–October 1999. NS denotes no sampling.

		June				July				August				September-October			
Locality	Factor	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd
Inshore	Length	2	90-101	95.5	7.8	20	106-182	157.8	20.6	10	152-228	182.1	23.8	16	163-225	202.2	15.0
	Weight	2	6.2-9.8	8.0	2.5	20	11.3-70.7	45.9	16.5	10	39.7-162.9	75.4	35.8	16	49.3-137.8	100.7	22.7
	Condition	2	8.5-9.5	9.0	0.7	20	9.5-12.0	11.0	0.7	10	10.9-13.7	11.8	0.9	16	11.2-12.7	12.0	0.5
Upper Chatham Strait	Length	—	—	—	—	—	—	—	—	—	—	—	—	4	205-264	233.8	32.1
	Weight	—	—	—	—	—	—	—	—	—	—	—	—	3	99.3-261.0	192.9	83.8
	Condition	—	—	—	—	—	—	—	—	—	—	—	—	3	11.5-14.2	12.8	1.3
Icy Strait	Length	2	181-183	182.0	1.4	2	142-225	183.5	58.7	—	—	—	—	3	202-255	233.3	27.8
	Weight	2	66.1-76.4	71.2	7.3	2	36.6-168.7	102.6	93.4	—	—	—	—	3	104.6-241.3	179.9	69.4
	Condition	2	10.8-12.9	11.8	1.5	2	12.8-14.8	13.8	1.4	—	—	—	—	3	12.7-13.6	13.6	0.9
Cross Sound	Length	—	—	—	—	—	—	—	—	—	—	—	—	1	273	273.0	0
	Weight	—	—	—	—	—	—	—	—	—	—	—	—	2	105.0-250.9	178.0	103.2
	Condition	—	—	—	—	—	—	—	—	—	—	—	—	2	3.9-12.3	8.1	5.9
Icy Point	Length	—	—	—	—	—	—	—	—	1	270	270.0	0	—	—	—	—
	Weight	—	—	—	—	—	—	—	—	1	279.1	279.1	0	—	—	—	—
	Condition	—	—	—	—	—	—	—	—	1	14.2	14.2	0	—	—	—	—
Cape Edward	Length	—	—	—	—	—	—	—	—	NS	NS	NS	NS	NS	NS	NS	NS
	Weight	—	—	—	—	—	—	—	—	NS	NS	NS	NS	NS	NS	NS	NS
	Condition	—	—	—	—	—	—	—	—	NS	NS	NS	NS	NS	NS	NS	NS
Total	Length	4	90-183	138.8	50.1	22	106-225	160.2	24.6	11	152-270	190.1	34.8	24	163-273	214.3	26.7
	Weight	4	6.2-76.4	39.6	36.8	22	11.3-168.7	51.0	30.7	11	39.7-279.1	93.9	70.2	24	49.3-261.0	128.6	58.9
	Condition	4	8.5-12.9	10.4	1.9	22	9.5-14.8	11.3	1.1	11	10.9-14.2	12.0	1.1	23	11.2-14.6	12.3	0.9

Table 13.—Release and recovery information for coded-wire tagged chinook and coho salmon captured in marine waters of the northern region of southeastern Alaska by rope trawl, May—October 1999.

			Release information					Recovery information							
Species	Coded-wire tag code	Brood year	Agency*	Locality	Date	Size (mm)	Size (g)	Locality	(station code)	Date	Size (mm)	Size (g)	Age	Days since release	Distance traveled (km)
							May								
Chinook	04:47/27	1996	ADFG	Taiya Inlet, AK	06/10/98	—	9.0	Icy Strait	(ISD)	05/21/99	325	420.0	1.1	346	170
Chinook	04:47/11	1995	NSRAA	Kasnyku Bay, AK	05/27/97	—	38.3	Icy Strait	(ISD)	05/21/99	505	1575.0	1.2	724	130
							June								
Chinook	50:04/59	1997	DIPAC	Gastineau Hatch., AK	06/07/99	—	25.3	Taku Inlet	(TKI)	06/26/99	125	22.0	1.0	19	25
Coho	50:04/62	1997	DIPAC	Gastineau Hatch., AK	06/07/99	—	16.7	False Pt. Retreat	FPR)	06/26/99	127	20.0	1.0	19	45
Coho	50:04/50	1997	DIPAC	Sheep Creek, AK	06/08/99	—	15.8	False Pt. Retreat	(FPR)	06/26/99	130	21.3	1.0	18	50
Coho	50:31/03	1997	NSRAA	Kasnyku Bay, AK	06/07/99	—	17.1	False Pt. Retreat	(FPR)	06/26/99	137	25.2	1.0	19	30
Coho	03:02/73	1997	NMFS	Auke Creek, AK (wild)	05-06/99	—	—	Icy Strait	(ISD)	06/29/99	159	50.1	1.0	44	75
Coho	04:45/31	1997	ADFG	Berners R., AK (wild)	06/2-8/99	—	—	Chatham Strait	(UCD)	07/01/99	164	48.7	1.0	~26	70
Coho	04:45/31	1997	ADFG	Berners R., AK (wild)	06/2-8/99	—	—	Chatham Strait	(UCD)	07/01/99	159	43.9	1.0	~26	70
Coho	04:01/28	1997	ADFG	Chilkat R., AK (wild)	5/24-6/6/99	—	—	Chatham Strait	(UCD)	07/01/99	203	90.1	1.0	~30	150
Coho	04:49/14	1997	NSRAA	Kasnyku Bay, AK	06/07/99	—	22.0	Chatham Strait	(UCD)	07/01/99	167	54.1	1.0	24	105
Coho	No Tag	—	—	—	—	—	—	Taku Inlet	(TKI)	06/26/99	159	17.0	—	—	—
							July								
Chinook	50:04/42	1996	DIPAC	Gastineau Channel, AK	06/02/98	—	24.1	Icy Strait	(ISD)	07/22/99	362	640.0	1.1	415	165
Chinook	50:04/55	1997	DIPAC	Auke Bay, AK	06/04/99	—	26.4	L. Fav. Channel	(LFC)	07/30/99	159	48.1	1.0	58	5
Coho	04:48/58	1997	NSRAA	Kasnyku Bay, AK	06/07/99	—	19.8	False Pt. Retreat	(FPR)	07/24/99	220	120.0	1.0	47	130
Coho	04:48/58	1997	NSRAA	Kasnyku Bay, AK	06/07/99	—	19.8	Icy Strait	(ISD)	07/22/99	226	137.8	1.0	45	130
Coho	50:31/04	1997	DIPAC	Gastineau Channel, AK	06/07/99	—	17.1	Icy Strait	(ISD)	07/22/99	190	82.2	1.0	47	165
Coho	50:04/47	1997	DIPAC	Sheep Creek, AK	06/09/99	—	15.8	Taku Inlet	(TKI)	07/24/99	150	32.3	1.0	47	15
Coho	No Tag	—	—	—	—	—	—	Chatham Strait	(UCD)	07/29/99	179	69.6	—	—	—
Coho	No Tag	—	—	—	—	—	—	False Pt. Retreat	(FPR)	07/24/99	247	174.2	—	—	—

Table 13.—(Cont.)

			Release information					Recovery information						
Species	Coded-wire tag code	Brood year	Agency*	Locality	Date	Size (mm)	Size (g)	Locality (station code)	Date	Size (mm)	Size (g)	Age	Days since release	Distance traveled (km)
						August								
Coho	04:45/31	1997	ADFG	Berner's R., AK (wild)	05-06/99	—	—	Icy Strait (ISC)	08/23/99	239	163.1	1.0	99	100
Coho	50:31/01	1997	DIPAC	Gastineau Channel, AK	06/07/99	—	16.7	Icy Strait (ISC)	08/24/99	211	109.0	1.0	78	165
Coho	50:04/32	1997	DIPAC	Sheep Creek, AK	06/09/99	—	15.8	Icy Strait (ISD)	08/24/99	195	87.4	1.0	76	170
Coho	No Tag	—	—	—	—	—	—	Icy Point (IPA)	08/25/99	262	240.0	—	—	—
Coho	No Tag	—	—	—	—	—	—	Icy Point (IPB)	08/25/99	291	285.0	—	—	—
Coho	No Tag	—	—	—	—	—	—	Icy Point (IPC)	08/25/99	309	320.0	—	—	—
						September/October								
Chinook	04:01/41	1997	ADFG	Taku River, AK (wild)	04-06/99	71	3.8	L. Favorite Ch. (LFC)	09/26/99	203	106.9	1.0	149	95
Chinook	50:04/58	1997	DIPAC	Gastineau Channel, AK	06/07/99	—	24.3	L. Favorite Ch. (LFC)	09/26/99	201	99.9	1.0	110	15
Coho	No Tag	—	—	—	—	—	—	Cross Sound (CSB)	09/29/99	299	329.9	—	—	—

*ADFG = Alaska Department of Fish and Game; DIPAC = Douglas Island Pink and Chum; HFH = Hidden Falls Hatchery; NMFS = National Marine Fisheries Service; NSRAA = Northern Southeast Regional Aquaculture Association.

Table 14.—Stock-specific information on thermally-marked juvenile chum salmon captured in different marine habitats of the northern region of southeastern Alaska by rope trawl, June–October 1999. No juvenile salmon were captured in May. NS denotes no sampling.

		June				July				August				September-October			
Locality	Factor	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd
DIPAC																	
Inshore	Length	5	77-115	92.4	15.3	1	144	144.0	0.0	—	—	—	—	—	—	—	—
	Weight	5	4.3-12.6	7.3	3.7	1	25.7	25.7	0.0	—	—	—	—	—	—	—	—
	Condition	5	7.8-9.6	8.7	0.8	1	8.6	8.6	0.0	—	—	—	—	—	—	—	—
Upper	Length	8	92-119	105.9	7.4	1	148	148.0	0.0	—	—	—	—	—	—	—	—
Chatham	Weight	8	6.3-16.4	11.2	2.8	1	31.5	31.5	0.0	—	—	—	—	—	—	—	—
Strait	Condition	8	8.1-10.1	9.3	0.7	1	9.7	9.7	0.0	—	—	—	—	—	—	—	—
Icy	Length	62	84-117	100.0	7.6	4	133-148	140.8	7.8	1	145	145.0	0.0	—	—	—	—
Strait	Weight	62	5.5-13.9	9.5	2.2	4	21.4-32.2	25.8	4.9	1	28.3	28.3	0.0	—	—	—	—
	Condition	62	7.2-11.2	9.4	0.8	4	8.4-9.9	9.2	0.6	1	9.3	9.3	0.0	—	—	—	—
Cross	Length	—	—	—	—	8	123-139	131.9	5.6	1	164	164.0	0.0	2	173-181	177.0	5.7
Sound	Weight	—	—	—	—	8	14.7-24.7	20.0	3.3	1	45.7	45.7	0.0	2	45.2-53.1	49.2	5.6
	Condition	—	—	—	—	8	7.9-9.3	8.7	0.5	1	10.4	10.4	0.0	2	8.7-9.0	8.8	0.2
Icy	Length	—	—	—	—	17	117-145	130.5	8.2	—	—	—	—	—	—	—	—
Point	Weight	—	—	—	—	17	13.8-29.4	20.5	4.5	—	—	—	—	—	—	—	—
	Condition	—	—	—	—	17	8.3-9.7	9.1	0.5	—	—	—	—	—	—	—	—
Total	Length	75	77-119	100.1	8.6	31	117-148	133.2	8.6	2	145-164	154.5	13.4	2	173-181	177.0	5.7
	Weight	75	4.3-16.4	9.5	2.5	31	13.8-32.2	21.5	4.8	2	28.5-45.7	37.0	12.3	2	45.2-53.1	49.1	5.6
	Condition	75	7.2-11.2	9.3	0.8	31	7.9-9.9	9.0	0.5	2	9.3-10.4	9.8	0.8	2	8.7-9.0	8.8	0.2

Table 14.—(Cont.)

Locality	Factor	June				July				August				September-October			
		n	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd
Hidden Falls																	
Inshore	Length	2	99-103	101.0	2.8	16	99-153	129.8	14.5	—	—	—	—	—	—	—	—
	Weight	2	8-9.2	8.6	0.8	16	8.2-32.7	19.5	6.9	—	—	—	—	—	—	—	—
	Condition	2	8.2-8.4	8.3	0.1	16	8.0-9.4	8.6	0.4	—	—	—	—	—	—	—	—
Upper Chatham Strait	Length	127	89-127	107.6	8.1	1	144	144.0	0.0	—	—	—	—	—	—	—	—
	Weight	127	6.2-19.4	11.5	2.7	1	25.9	25.9	0.0	—	—	—	—	—	—	—	—
	Condition	127	6.5-11.3	9.1	0.6	1	8.7	8.7	0.0	—	—	—	—	—	—	—	—
Icy Strait	Length	2	110-111	110.5	0.7	33	117-154	137.8	8.7	—	—	—	—	—	—	—	—
	Weight	2	11.2-11.8	11.5	0.4	33	15.2-34.1	25.6	4.6	—	—	—	—	—	—	—	—
	Condition	2	8.2-8.9	8.5	0.5	33	7.8-11.9	9.7	0.8	—	—	—	—	—	—	—	—
Cross Sound	Length	—	—	—	—	15	121-152	135.7	9.3	4	150-163	155.5	5.8	3	160-184	171.7	12.0
	Weight	—	—	—	—	15	14.4-33.5	22.4	5.0	4	31.3-42.9	35.3	5.5	3	41.6-53.7	46.3	6.5
	Condition	—	—	—	—	15	7.7-10.1	8.8	0.6	4	8.9-9.9	9.3	0.4	3	8.6-10.2	9.2	0.9
Icy Point	Length	—	—	—	—	22	115-158	131.0	10.7	—	—	—	—	—	—	—	—
	Weight	—	—	—	—	22	12.4-37.6	20.8	6.1	—	—	—	—	—	—	—	—
	Condition	—	—	—	—	22	8.2-9.8	9.0	0.5	—	—	—	—	—	—	—	—
Total	Length	131	89-127	107.5	8.0	87	99-158	134.3	10.9	4	150-163	155.5	5.8	3	160-184	171.7	12.0
	Weight	131	6.2-19.4	11.5	2.7	87	8.2-37.6	22.7	6.0	4	31.3-42.9	35.3	5.5	3	41.6-53.7	46.3	6.5
	Condition	131	6.5-11.3	9.1	0.6	87	7.7-11.9	9.2	0.8	4	8.9-9.9	9.3	0.4	3	8.6-10.2	9.2	0.9

Table 14.— (Cont.)

Locality	Factor	June				July				August				September-October			
		n	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd
Unmarked																	
Cross	Length	—	—	—	—	6	123-148	135.8	8.7	7	125-155	133.1	10.2	27	139-213	163.2	14.9
Sound	Weight	—	—	—	—	6	16.2-30.2	22.1	4.8	7	17.3-30.4	21.0	4.5	27	24.9-102.8	43.4	14.6
	Condition	—	—	—	—	6	8.5-9.3	8.7	0.3	7	7.9-9.6	8.8	0.6	27	8.3-10.7	9.7	0.7
Inshore	Length	1	125	125.0	0.0	33	99-146	121.1	10.5	—	—	—	—	2	141-169	155.0	19.8
	Weight	1	17.8	17.8	0.0	33	8.9-21.7	15.4	3.7	—	—	—	—	2	24-46.8	35.4	16.1
	Condition	1	9.1	9.1	0.0	33	4.2-9.5	8.6	0.9	—	—	—	—	2	8.6-9.7	9.1	0.8
Upper	Length	64	89-121	103.3	7.3	3	131-148	138.7	8.6	—	—	—	—	—	—	—	—
Chatham	Weight	64	5.9-17.6	10.1	2.5	3	18.8-29.7	24.4	5.5	—	—	—	—	—	—	—	—
Strait	Condition	64	7.3-11.0	9.0	0.7	3	8.4-9.6	9.0	0.6	—	—	—	—	—	—	—	—
Icy Strait	Length	6	89-104	98.5	5.4	33	96-148	127.8	11.7	6	113-147	126.7	12.1	6	153-194	168.3	17.1
	Weight	6	7.2-9.9	8.9	1.0	33	8.0-33.1	20.1	5.8	6	13.1-30.2	18.9	6.2	6	30.5-77.2	47.4	17.4
	Condition	6	8.6-10.2	9.3	0.6	33	7.8-14.5	9.4	1.2	6	8.3-9.5	9.0	0.5	6	8.5-11.0	9.6	1.0
Icy Point	Length	—	—	—	—	80	105-190	139.7	20.2	—	—	—	—	—	—	—	—
	Weight	—	—	—	—	80	9.2-64.9	27.4	13.4	—	—	—	—	—	—	—	—
	Condition	—	—	—	—	80	6.8-11.9	9.3	0.8	—	—	—	—	—	—	—	—
Cape	Length	25	93-133	115.8	9.0	1	121	121.0	0.0	NS	NS	NS	NS	NS	NS	NS	NS
Edward	Weight	25	5.6-22.1	14.1	3.7	1	15.9	15.9	0.0	NS	NS	NS	NS	NS	NS	NS	NS
	Condition	25	7.0-9.8	8.8	0.6	1	9.0	9.0	0.0	NS	NS	NS	NS	NS	NS	NS	NS
Total	Length	96	89-133	106.5	9.7	156	96-190	132.9	18.0	13	113-155	130.2	11.1	35	139-213	163.6	15.3
	Weight	96	5.6-22.1	11.2	3.4	156	8.0-64.9	23.0	11.3	13	13.1-30.4	20.1	5.2	35	24.0-102.8	43.6	14.9
	Condition	96	7.0-11.0	9.0	0.7	156	4.2-14.5	9.1	0.9	13	7.9-9.6	8.9	0.5	35	8.3-11.0	9.6	0.7

Table 15.—Juvenile sockeye salmon: stock-specific numbers of thermally-marked (*n*) fish caught monthly in marine habitats of the northern region of southeastern Alaska by rope trawl, June-October, 1999, and the range, mean and standard deviation of their lengths (mm), weights (g) and Fulton's condition. NS denotes no sampling.

		June				July				August				September-October			
Locality	Factor	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd
Snettisham																	
Inshore	Length	9	89-101	93	4.1	2	121-130	125.5	6.4	—	—	—	—	1	179	179	—
	Weight	9	6.2-9.3	7.6	1.1	2	16.7-20.4	18.6	2.6	—	—	—	—	1	57.7	57.7	—
	Condition	9	8.8-10.4	9.4	0.6	2	9.3-9.4	9.4	0.1	—	—	—	—	1	10.1	10.1	—
Upper Chatham	Length	—	—	—	—	1	171	171	—	—	—	—	—	—	—	—	—
	Weight	—	—	—	—	1	50.8	50.8	—	—	—	—	—	—	—	—	—
	Condition	—	—	—	—	1	10.2	10.2	—	—	—	—	—	—	—	—	—
Icy Strait	Length	11	96-146	118.3	15.8	10	112-173	134.4	17.5	—	—	—	—	—	—	—	—
	Weight	11	8.3-31.8	17.5	7.1	10	13.9-60.3	25.9	13.5	—	—	—	—	—	—	—	—
	Condition	11	8.8-11.1	10.0	0.7	10	8.7-11.6	10.0	0.8	—	—	—	—	—	—	—	—
Icy Point	Length	—	—	—	—	1	133	133.0	—	—	—	—	—	—	—	—	—
	Weight	—	—	—	—	1	20.9	20.9	—	—	—	—	—	—	—	—	—
	Condition	—	—	—	—	1	8.9	8.9	—	—	—	—	—	—	—	—	—
Total	Length	20	89-146	106.9	17.5	14	112-173	135.6	18.1	—	—	—	—	1	179	179.0	—
	Weight	20	6.2-31.8	13.0	7.3	14	13.9-60.3	26.3	13.6	—	—	—	—	1	57.7	57.7	—
	Condition	20	8.8-11.1	9.7	0.7	14	8.7-11.6	9.8	0.7	—	—	—	—	1	10.1	10.1	—

Table 15.—(Cont.)

Locality	Factor	June n	June range	June x̄	June sd	July n	July range	July x̄	July sd	August n	August range	August x̄	August sd	September-October n	September-October range	September-October x̄	September-October sd
Sweetheart Lake*																	
Total	Length	10	123-156	137.1	9.4	1	175	175.0	—	—	—	—	—	—	—	—	—
(Icy Strait)	Weight	10	18.6-37.5	25.4	5.7	1	60.3	60.3	—	—	—	—	—	—	—	—	—
	Condition	10	8.7-10.4	9.7	0.6	1	11.3	11.3	—	—	—	—	—	—	—	—	—
Tatsumenie*																	
Total	Length	1	99	99	—	—	—	—	—	—	—	—	—	—	—	—	—
(Inshore)	Weight	1	8.4	8.4	—	—	—	—	—	—	—	—	—	—	—	—	—
	Condition	1	8.7	8.7	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmarked																	
Inshore	Length	6	91-121	106.0	11.6	4	99-115	105.0	7.7	1	124	124	—	9	135-186	156.1	18.7
	Weight	6	6.5-16.6	10.8	3.6	4	7.6-14.1	10.0	3.0	1	19.0	19.0	—	9	24.2-60.0	38.6	13.0
	Condition	6	8.0-9.9	8.9	0.7	4	7.8-9.3	8.4	0.6	1	10.0	10.0	—	9	9.1-10.5	9.9	0.4
Upper Chatham	Length	11	92-144	104.7	16.2	—	—	—	—	—	—	—	—	—	—	—	—
	Weight	11	6.9-27.8	11.1	6.3	—	—	—	—	—	—	—	—	—	—	—	—
	Condition	11	7.0-10.4	9.1	1.0	—	—	—	—	—	—	—	—	—	—	—	—
Icy Strait	Length	60	94-163	130.0	14.0	18	99-182	134.0	24.3	2	99-144	121.5	31.8	2	156-169	162.5	9.2
	Weight	60	7.6-44.8	22.2	7.1	18	9.1-60.5	26.3	15.2	2	7.8-32.4	20.1	17.4	2	35.9-45.5	40.7	6.8
	Condition	60	7.8-12.6	9.7	0.8	18	8.9-10.8	9.9	0.7	2	8.0-10.9	9.4	2.0	2	9.4-9.5	9.4	0.0
Icy Point	Length	—	—	—	—	64	111-181	147.1	13.0	—	—	—	—	—	—	—	—
	Weight	—	—	—	—	64	12.8-67.7	34.9	10.5	—	—	—	—	—	—	—	—
	Condition	—	—	—	—	64	8.0-13.9	10.6	1.1	—	—	—	—	—	—	—	—

Table 15.—(Cont.)

Locality	Factor	June n	June range	June x̄	June sd	July n	July range	July x̄	July sd	August n	August range	August x̄	August sd	September-October n	September-October range	September-October x̄	September-October sd
Unmarked																	
Cross Sound	Length	1	167	167.0	—	3	119-149	133.7	15.0	—	—	—	—	21	151-209	165.0	12.4
	Weight	1	46.9	46.9	—	3	14.5-31.4	23.3	8.5	—	—	—	—	21	33.5-92.8	44.3	12.6
	Condition	1	10.1	10.1	—	3	8.6-10.2	9.4	0.8	—	—	—	—	21	8.0-10.8	9.7	0.6
Total	Length	80	91-167	125.5	18.0	89	99-182	142.1	18.4	3	99-144	122.3	22.5	32	135-209	162.4	14.4
	Weight	80	6.5-46.9	20.3	8.7	89	7.6-67.7	31.6	12.8	3	7.8-32.4	19.7	12.3	32	24.2-92.8	42.5	12.4
	Condition	80	7.0-12.6	9.6	0.9	89	7.8-13.9	10.3	1.2	3	8.0-10.9	9.6	1.4	32	8.0-10.8	9.7	0.5

*only location

Table 16.—Numbers of juvenile chum and sockeye salmon released from principal enhancement facilities at sites in the northern region of southeastern Alaska, and represented in 1999 trawl catches, with mean ± two standard deviations of fork length (mm), weight (g) and Fulton's condition factor. Abbreviations: SW = saltwater, FW = freshwater.

Release information			Size and condition			
Site	Release dates	Total count (10^6)	Sample size	Length	Weight	Condition
Juvenile chum salmon, brood year 1998						
Gastineau Hatchery, DIPAC						
Amalga Harbor SW	Mid-May, 1999	43.1	Unavailable	—	—	—
Amalga Harbor[1] SW	June 1, 1999	7.7	62	64.2 ± 12.6	2.8 ± 1.8	10.2 ± 1.9
Boat Harbor SW	Mid-May, 1999	9.3	Unavailable	—	—	—
Gastineau Channel[1] SW	Mid-May, 1999	22.0	40	51.2 ± 7.0	1.3 ± 0.6	9.5 ± 1.9
Limestone Inlet[2] SW	Mid-May, 1999	14.5	41	48.9 ± 5.6	1.2 ± 0.4	10.4 ± 1.5
	Total released:	96.6				
Hidden Falls Hatchery, NSRAA						
Kasnyku Bay SW	Mid-May, 1999	48.9	Unavailable		1.72	
Takatz Bay SW	Mid-May, 1999	25.7	Unavailable		1.6	
	Total released:	74.6				
Total chum of both hatcheries:		171.2				
Juvenile sockeye salmon, brood year 1997						
Snettisham Hatchery, DIPAC						
Snettisham SW	Late May, 1999	2.2	Unavailable		9.3	
Snettisham SW	Early June, 1999	2.8	Unavailable		8.0	
Sweetheart Lake FW	Mid-Late	0.3	Unavailable		0.1	
Tatsumenie Lake FW	Late June, 1998	3.6	Unavailable		0.1	
	Total released:	8.9				

[1]Voucher fish measured and Fulton's condition factor derived.
[2]No voucher fish. Hatchery-estimated weight.

Table 17.--Number of potential predators of juvenile salmon examined from rope trawl collections, number of empty stomachs, percentage of predator stomachs that contained food, and number and percentage of feeding fish that ate juvenile salmon, May-October, 1999.

Predator species	Life history stage	Number examined	Number empty	% feeding	Number with salmon	% feeders w/ salmon
	Predation on juvenile salmon					
Sablefish	I	66	0	100	24	36
Spiny dogfish	A	10	0	100	1	10
Coho salmon	A	14	3	79	2	18
	No predation on juvenile salmon					
Pink salmon	A	81	5	94	0	0
Walleye pollock	A	64	7	89	0	0
Chinook salmon	I	42	2	95	0	0
Pacific sandfish	A	16	1	94	0	0
Starry flounder	A	4	1	75	0	0
Dolly Varden	A	3	0	100	0	0
Sockeye salmon	A	4	0	100	0	0
Black rockfish	A	1	1	0	0	0
Chum salmon	A	1	0	100	0	0
Pacific cod	A	1	0	100	0	0
Total		307	20		26	

I=immature; A=adult of spawning age.

Appendix 1.–Catches and life history stage of salmonids captured in marine waters of the northern region of southeastern Alaska by rope trawl, May–October 1999. NS denotes no rope trawl sampling.

			Juvenile					Immature			Adult		
Date	Haul#	Station	Pink	Chum	Sockeye	Coho	Chinook	Chinook	Chum	Sockeye	Pink	Sockeye	Coho
20 May	3001	TKI	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
20 May	3002	ABM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
20 May	3003	LFC	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
20 May	3004	FPR	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
21 May	3005	ISA	–	–	–	–	–	2	–	–	–	–	–
21 May	3006	ISB	–	–	–	–	–	–	–	–	–	–	–
21 May	3007	ISC	–	–	–	–	–	1	–	–	–	–	–
21 May	3008	ISD	–	–	–	–	–	3	–	–	–	–	–
22 May	3009	UCD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
22 May	3010	UCC	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
22 May	3011	UCB	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
18 May	3012	UCA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
18 May	3013	CSD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
24 May	3014	CSC	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
24 May	3015	CSB	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
25 May	3016	CSA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
26 June	3017	TKI	–	1	14	11	2	2	–	–	–	–	–
26 June	3018	FPR	–	4	2	14	–	–	–	–	–	–	–
27 June	3019	IPA	–	–	–	–	–	–	–	–	3	1	–
27 June	3020	IPB	–	–	–	–	–	–	–	–	–	–	–
27 June	3021	IPC	–	–	–	–	–	–	–	–	–	–	–
28 June	3022	CSA	–	–	–	–	–	–	–	–	–	–	1
28 June	3023	CSB	–	–	–	–	–	–	–	–	3	–	–
28 June	3024	CSC	–	–	–	–	–	–	–	–	2	–	–
28 June	3025	CSD	–	–	1	1	–	–	–	–	1	–	–
29 June	3026	ISA	–	–	–	–	–	–	–	–	–	–	–
29 June	3027	ISB	–	16	42	2	–	1	–	–	–	–	–
29 June	3028	ISC	8	95	36	1	2	2	–	–	–	1	–
29 June	3029	ISD	3	7	3	69	–	4	–	–	1	–	–
30 June	3030	EDA	–	25	–	–	–	–	–	–	–	–	–
30 June	3031	EDB	–	–	2	–	–	–	–	–	2	–	–
30 June	3032	EDC	–	–	–	–	–	–	–	–	–	–	–
30 June	3033	EDD	–	–	–	–	–	–	–	–	–	–	–

Appendix 1.–(Cont.)

			Juvenile					Immature			Adult		
Date	Haul#	Station	Pink	Chum	Sockeye	Coho	Chinook	Chinook	Chum	Sockeye	Pink	Sockeye	Coho
01 July	3034	UCA	–	12	–	3	–	4	–	–	2	–	–
01 July	3035	UCB	3	69	1	13	–	6	–	–	–	–	–
01 July	3036	UCC	5	17	3	15	–	–	–	–	–	–	–
01 July	3037	UCD	13	257	7	60	–	4	–	–	–	–	–
01 July	3038	LFC	–	3	–	5	–	–	–	–	–	–	–
01 July	3039	ABM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	–
24 July	3040	TKI	–	–	–	1	6	–	–	–	–	–	–
25 July	3041	FPR	268	280	5	22	–	1	–	–	4	–	–
25 July	3042	IPA	15	58	16	–	–	–	–	–	–	–	–
25 July	3043	IPB	47	104	318	1	–	–	1	–	–	–	–
25 July	3044	IPC	–	–	–	–	–	–	–	–	–	–	–
26 July	3045	CSD	–	–	1	–	–	–	–	–	–	–	–
26 July	3046	CSC	–	–	–	3	–	–	–	–	–	–	–
26 July	3047	CSB	18	22	1	–	–	–	–	–	–	–	–
26 July	3048	CSA	1	7	1	–	–	–	–	–	1	–	–
27 July	3049	ISA	–	1	–	13	–	2	–	–	21	–	–
27 July	3050	ISB	14	72	5	17	–	2	–	–	–	–	–
27 July	3051	ISC	151	164	17	15	–	–	–	–	–	–	–
27 July	3052	ISD	155	161	7	22	2	2	–	–	8	–	1
28 July	3053	EDA	1	1	–	–	–	–	–	–	–	–	–
28 July	3054	EDB	–	–	–	1	–	–	–	–	–	–	–
28 July	3055	EDC	–	–	–	–	–	–	–	–	–	–	–
28 July	3056	EDD	–	–	–	–	–	–	1	–	4	–	–
29 July	3057	UCA	–	–	–	7	–	–	–	–	2	–	–
29 July	3058	UCB	–	5	1	11	–	–	–	–	3	–	–
29 July	3059	UCC	–	–	–	2	–	–	–	–	–	–	–
29 July	3060	UCD	–	–	–	2	–	–	–	–	1	–	–
30 July	3061	LFC	–	–	1	–	14	–	–	–	–	–	–
30 July	3062	ABM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	–
20 August	3063	TKI	–	–	–	–	7	–	–	–	–	–	–

Appendix 1.–(Cont.)

Date	Haul#	Station	Juvenile					Immature			Adult		
			Pink	Chum	Sockeye	Coho	Chinook	Chinook	Chum	Sockeye	Pink	Sockeye	Coho
20 August	3064	LFC	–	–	1	–	2	–	–	–	–	–	–
20 August	3065	FPR	–	–	–	10	1	–	–	–	1	–	–
21 August	3066	UCC	–	–	–	–	–	–	–	–	–	–	–
21 August	3067	UCB	–	–	–	9	–	–	–	–	2	1	–
21 August	3068	UCA	–	–	–	–	–	–	–	–	5	–	–
21 August	3069	UCD	–	–	–	–	–	–	–	–	–	–	–
24 August	3070	ISB	–	–	–	–	–	–	–	–	–	–	–
22 August	3071	ISC	5	–	1	13	–	1	–	–	2	–	–
22 August	3072	ISD	4	4	–	3	–	–	–	–	–	–	–
22 August	3073	ISA	–	–	–	–	–	–	–	–	–	–	–
25 August	3074	CSD	24	12	–	2	–	–	–	–	–	–	1
25 August	3075	CSC	7	–	–	–	–	–	–	–	1	–	–
26 August	3076	CSB	–	–	–	1	–	–	–	–	–	–	1
26 August	3077	CSA	–	–	–	–	–	–	–	–	–	–	–
24 August	3078	ISC	2	1	1	1	–	–	–	–	–	1	–
24 August	3079	ISC	1	1	–	3	–	2	–	–	–	–	–
24 August	3080	ISD	–	–	–	–	–	–	–	–	1	–	–
24 August	3081	ISD	2	2	–	1	–	3	–	–	5	–	–
25 August	3082	IPA	2	–	–	2	–	–	–	–	–	–	–
25 August	3083	IPB	–	–	–	3	–	–	–	1	–	–	–
25 August	3084	IPC	–	–	–	1	1	–	–	–	–	–	–
25 August	3085	IPD	–	1	–	–	–	–	–	–	4	–	–
26 August	3086	ABM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
26 September	3087	TKI	2	–	–	–	1	–	–	–	–	–	1
26 September	3088	ABM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
26 September	3089	LFC	–	–	–	–	15	–	–	–	–	–	1
26 September	3090	FPR	7	2	10	–	–	–	–	–	–	–	–
27 September	3091	ISA	1	–	–	1	–	–	–	–	–	–	1
27 September	3092	ISB	1	–	–	1	–	–	–	–	–	–	–
27 September	3093	ISC	7	6	–	2	1	–	–	–	–	–	–

Appendix 1.–(Cont.)

			Juvenile					Immature			Adult		
Date	Haul#	Station	Pink	Chum	Sockeye	Coho	Chinook	Chinook	Chum	Pink Sockeye		Coho	
27 September	3094	ISD	–	–	2	1	2	–	–	–	–	–	–
28 September	3095	IPA	–	–	–	–	–	–	–	–	–	–	1
28 September	3096	IPB	–	–	–	–	–	–	–	–	–	–	–
30 September	3097	IPC	1	1	–	–	–	–	–	–	–	–	–
30 September	3098	IPD	–	–	–	–	–	–	–	–	–	–	–
29 September	3099	CSA	–	–	–	1	–	–	–	–	–	–	2
29 September	3100	CSB	1	1	–	5	–	–	–	–	–	–	–
28 September	3101	CSC	85	12	4	–	1	–	–	–	–	–	–
28 September	3102	CSD	135	19	17	–	–	–	–	–	–	–	1
01 October	3103	UCA	–	–	–	3	3	1	–	–	–	–	–
01 October	3104	UCB	–	–	–	2	–	–	–	–	–	–	–
01 October	3105	UCC	–	–	–	1	–	–	–	–	–	–	–
01 October	3106	UCD	1	–	–	1	1	–	–	–	–	–	–
Total catch			990	1,443	520	378	61	43	2	1	80	4	13

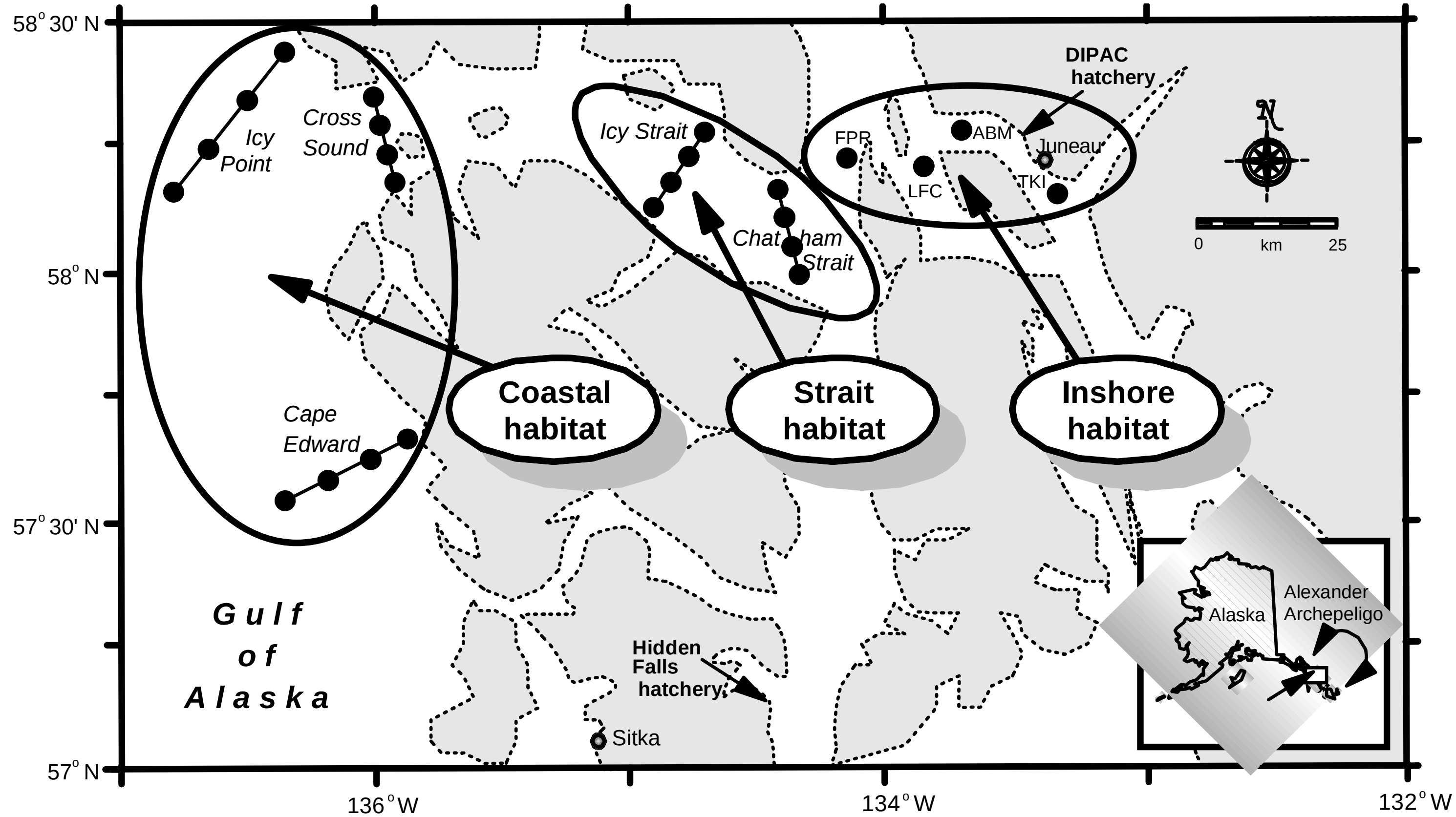

Figure 1.—Stations sampled monthly in marine waters of the northern region of southeastern Alaska, May–October 1999. Small arrows indicate two major enhancement facilities: DIPAC (Douglas Island Pink and Chum) hatchery and Hidden Falls hatchery.

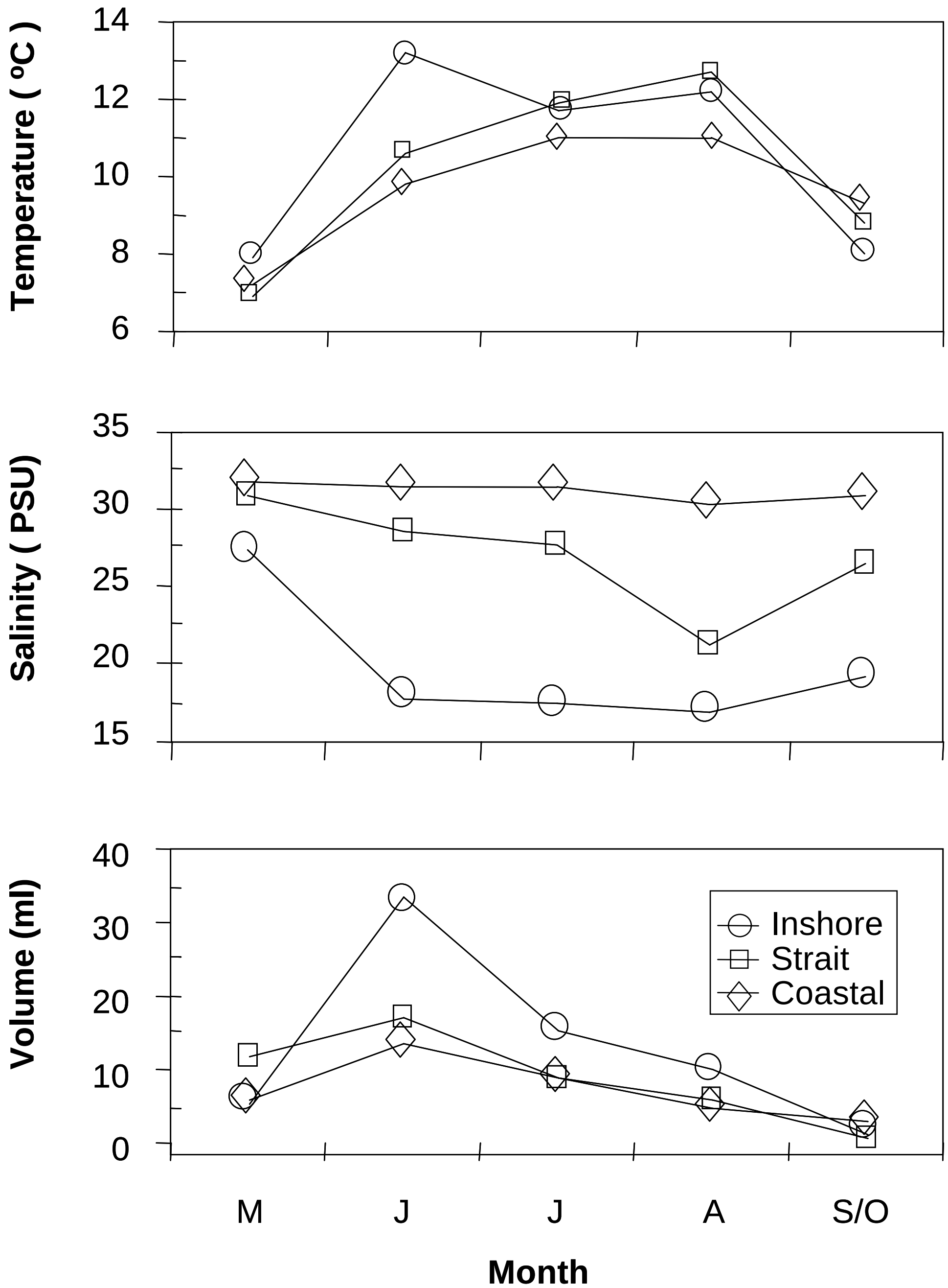

Figure 2.—Surface (2-m) temperature and salinity and 20-m zooplankton volume in inshore, strait, and coastal marine habitats of the northern region of southeastern Alaska, May–October 1999. Zooplankton volumetric density (ml/m^3) can be computed by dividing by a factor of 3.9.

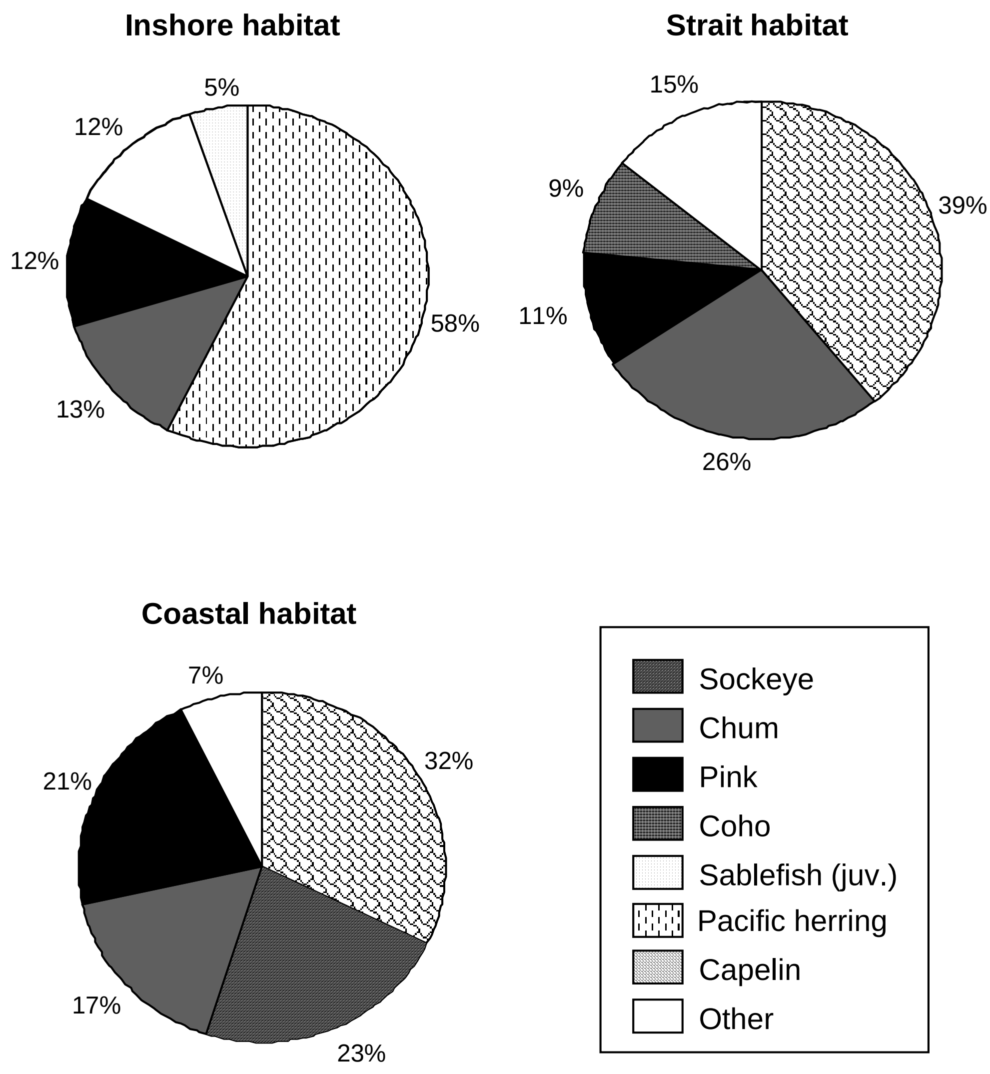

Figure 3.—Fish catch composition in inshore, strait, and coastal marine habitats of the northern region of southeastern Alaska, May–October 1999.

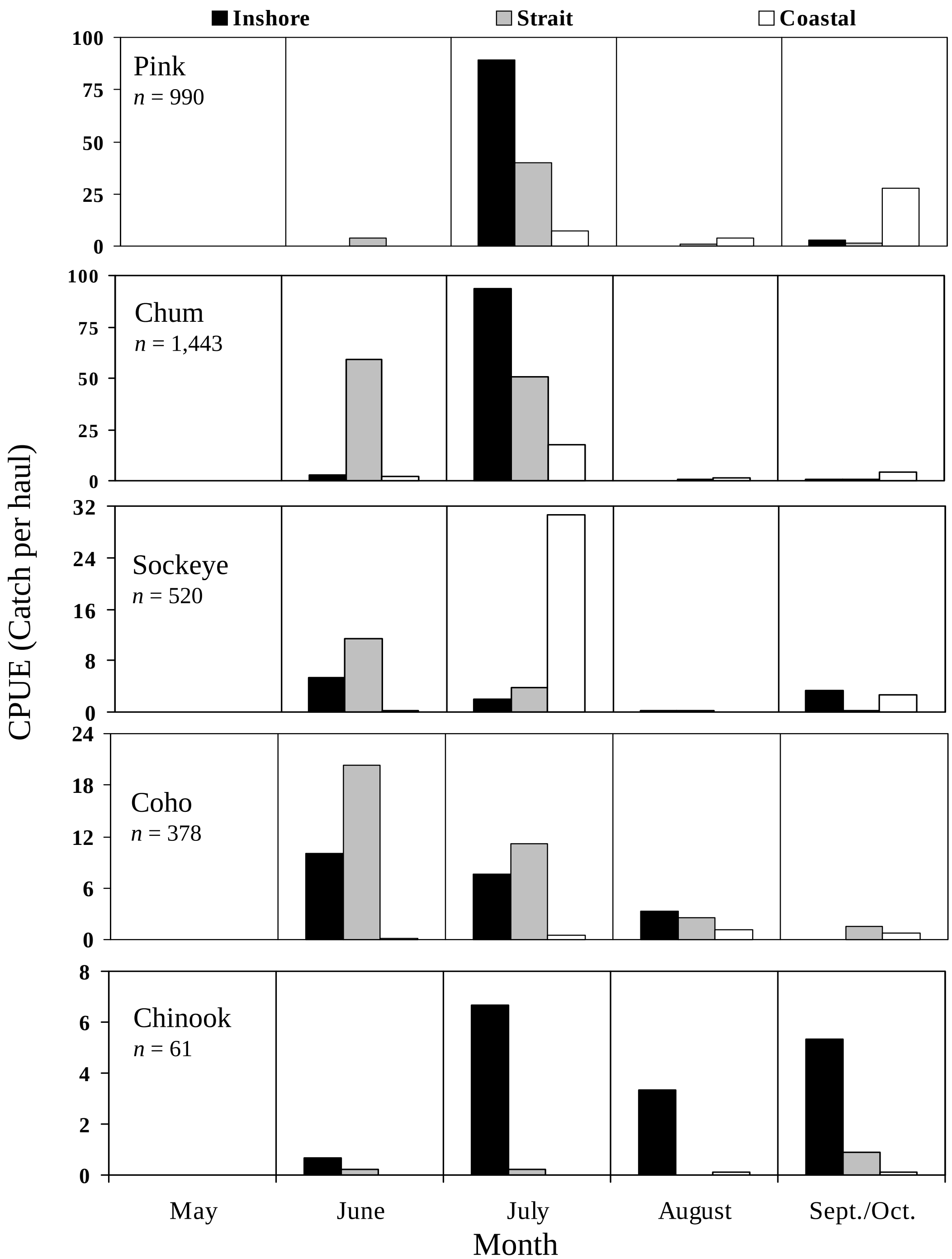

Figure 4.—Catch per rope trawl haul of juvenile salmon in inshore, strait, and coastal marine habitats of the northern region of southeastern Alaska, May–October 1999.

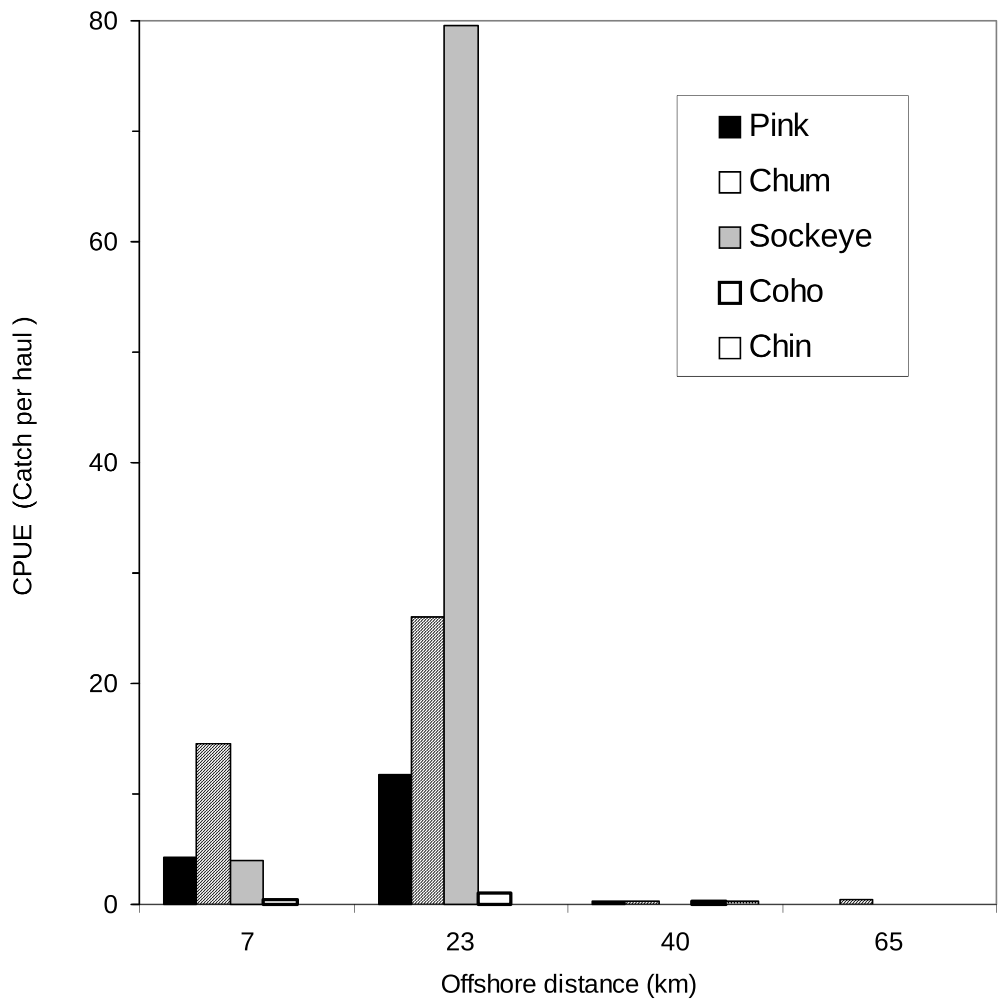

Figure 5.—Mean number of juvenile salmon captured per rope trawl haul in coastal habitat (Icy Point transect) of the northern region of southeastern Alaska, June–Sept./Oct. 1999. A total of four hauls were made at each distance offshore, with the exception of the 65 km station, where only two hauls were made (August and Sept./Oct.).

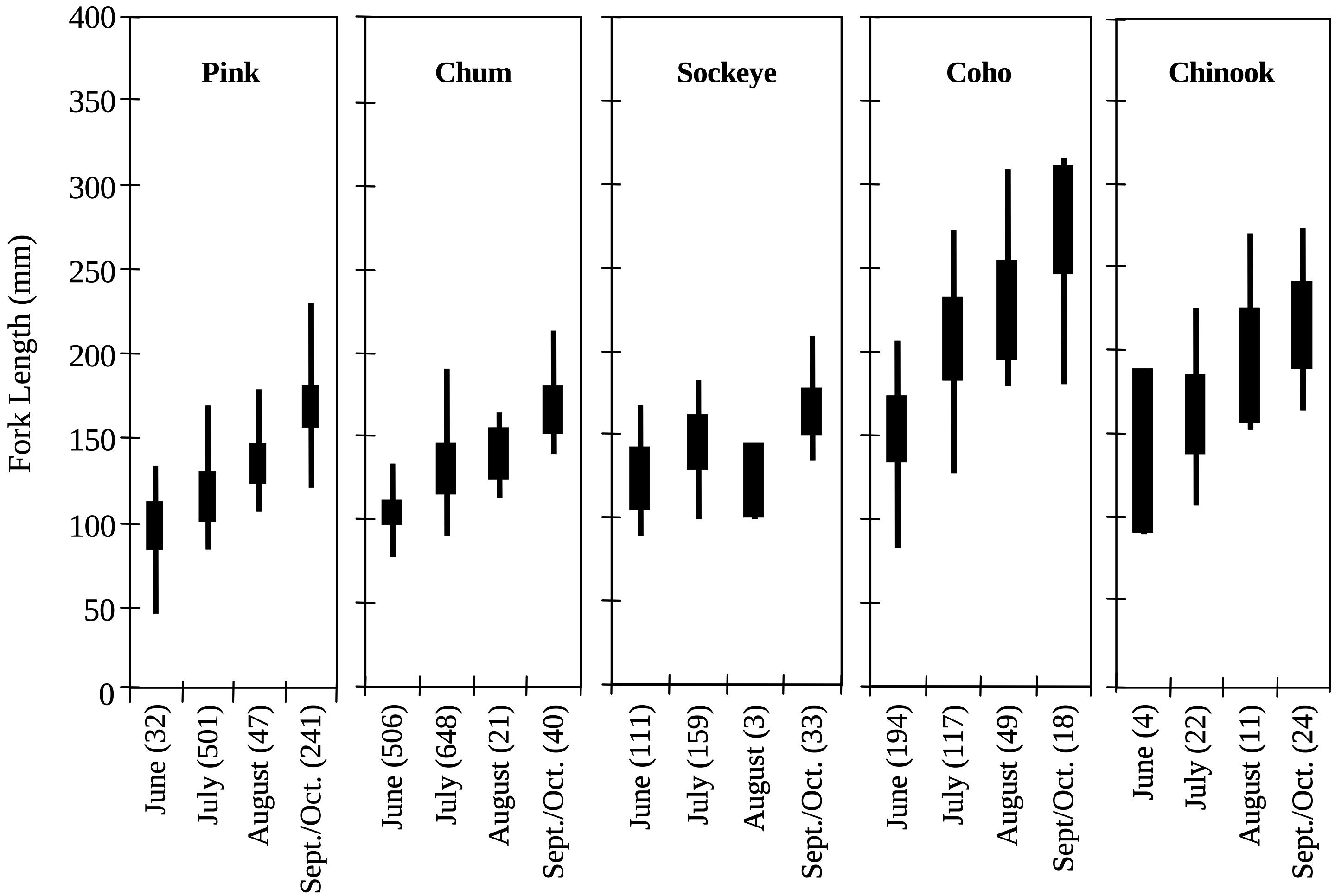

Figure 6.—Fork lengths of juvenile salmon captured in marine waters of the northern region of southeastern Alaska by rope trawl, June–October 1999. No juvenile salmon was captured in May. Length of vertical bars is the size range for each sample, and the boxes within the size range are one standard error on either side of the mean. Sample sizes are shown in parentheses.

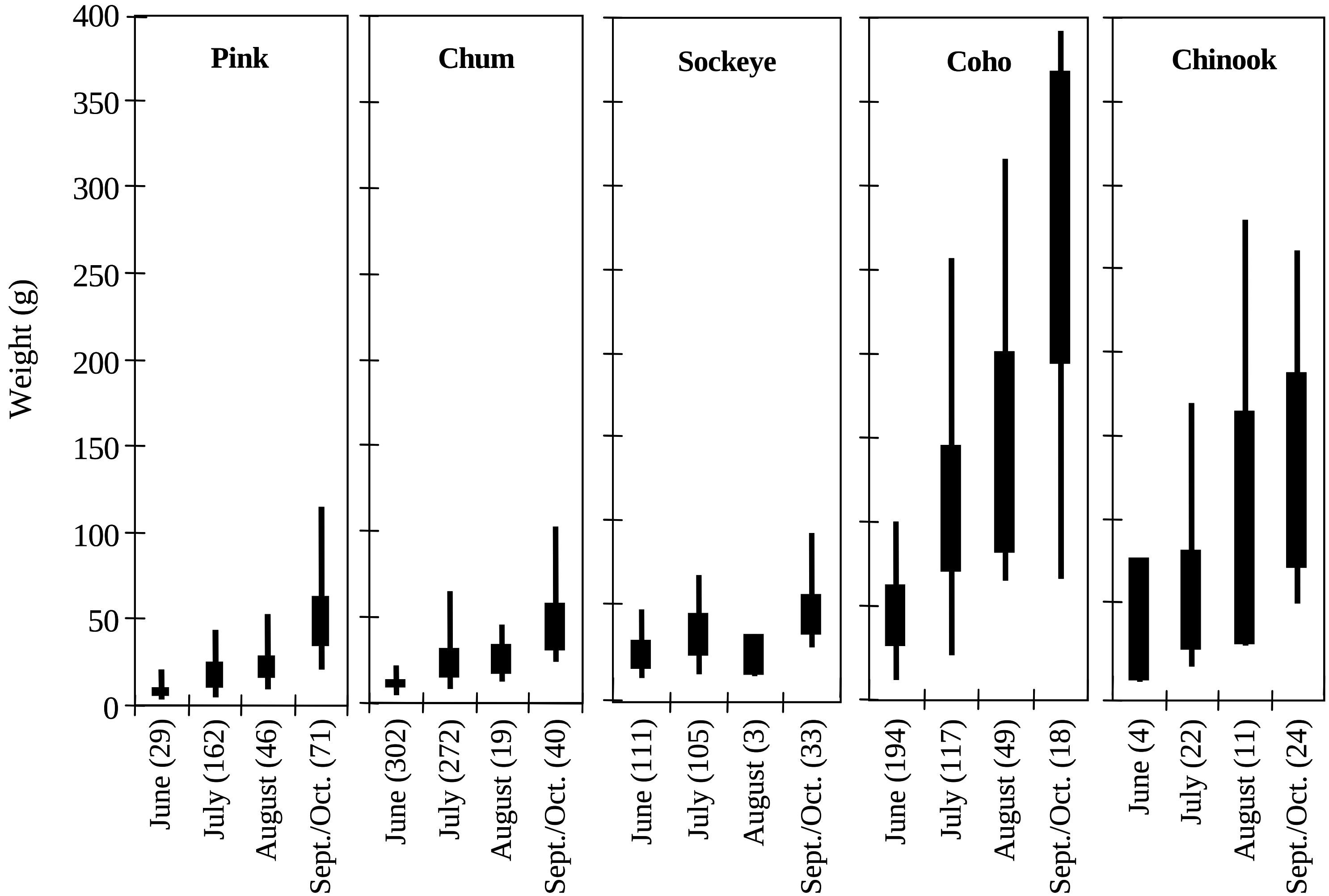

Figure 7.—Weights of juvenile salmon captured in marine waters of the northern region of southeastern Alaska by rope trawl, June–October 1999. No juvenile salmon was captured in May. Length of vertical bars is the size range for each sample, and the boxes within the size range are one standard error on either side of the mean. Sample sizes are shown in parentheses.

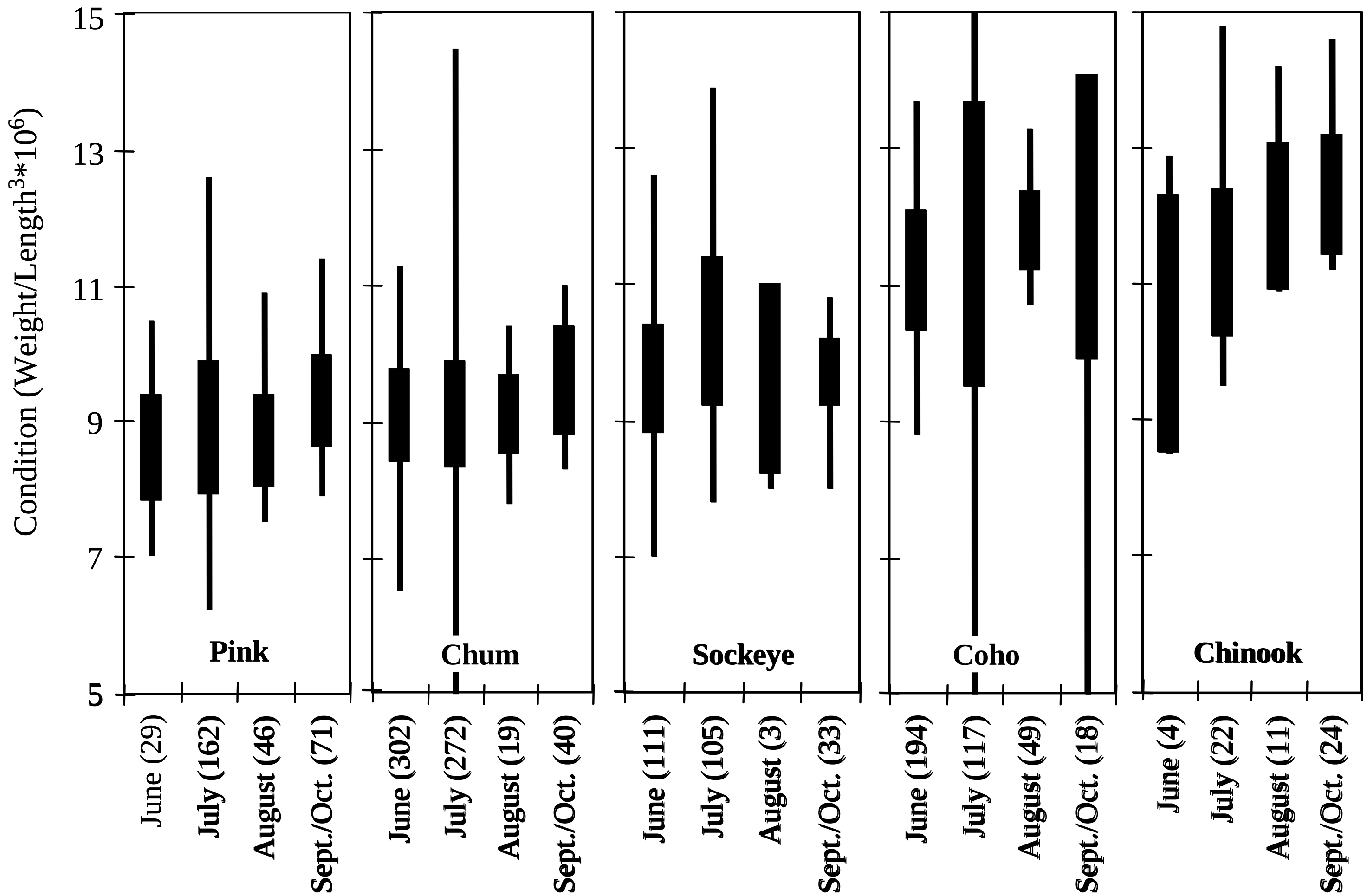

Figure 8.—Condition factors of juvenile salmon captured in marine waters of the northern region of southeastern Alaska by rope trawl, June–October 1999. No juvenile salmon was captured in May. Length of vertical bars is the size range for each sample, and the boxes within the size range are one standard error on either side of the mean. Sample sizes are shown in parentheses.

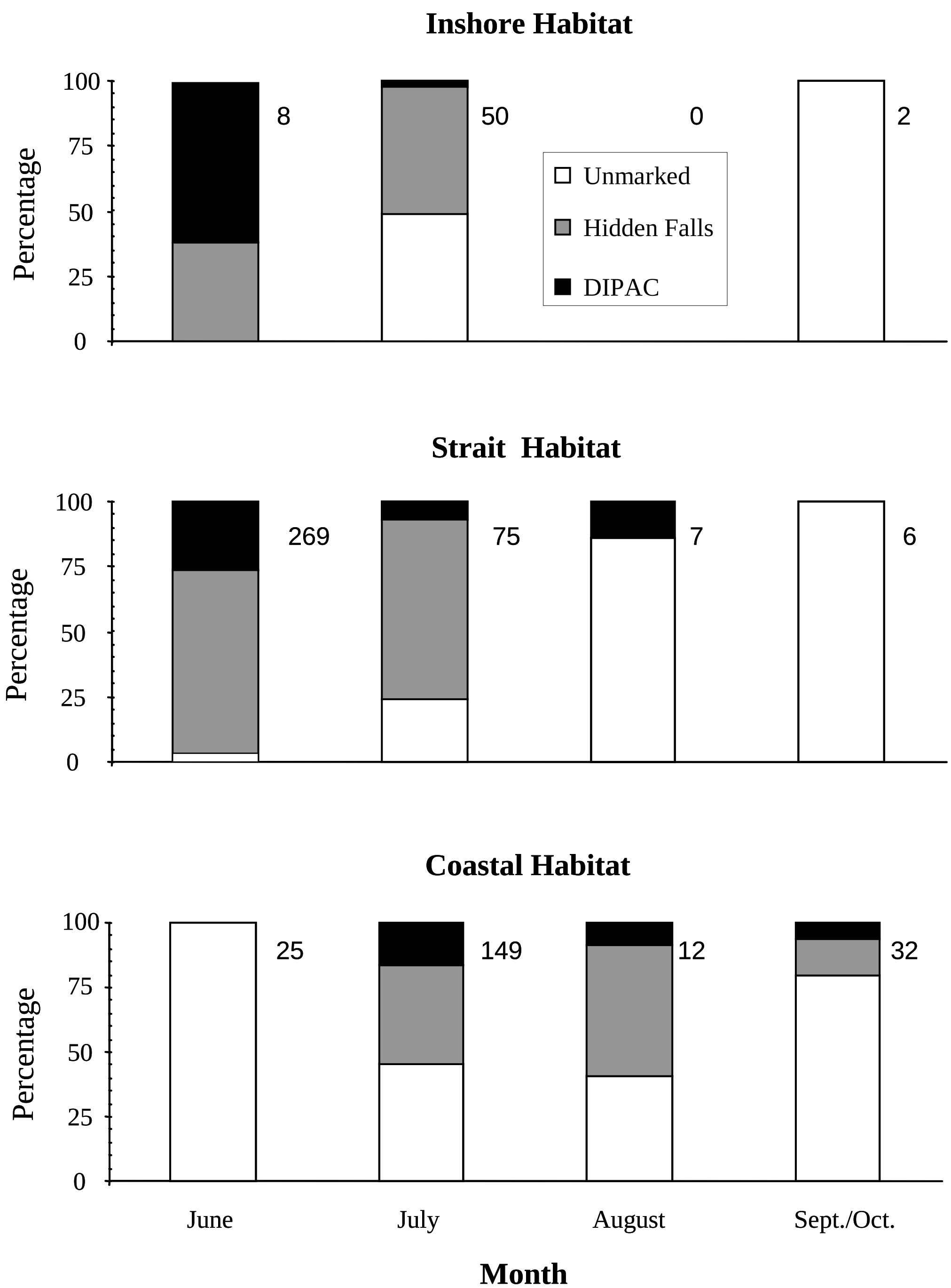

Figure 9.—Seasonal stock composition of chum salmon based on otolith thermal marks in inshore, strait, and coastal marine habitats of the northern region of southeastern Alaska, June–October 1999. Number of marks per habitat and sampling interval is indicated.

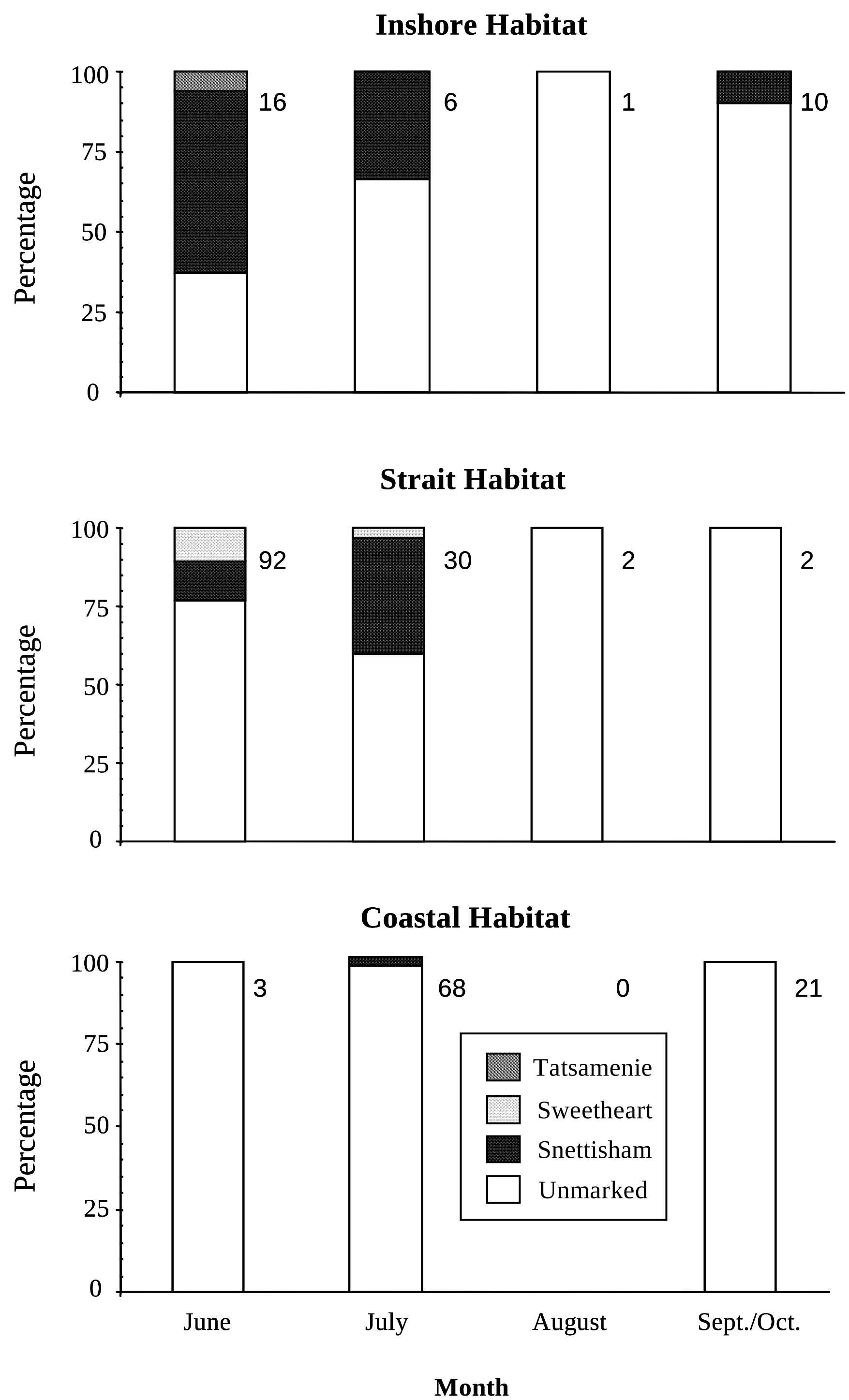

Figure 10.—Seasonal stock composition of sockeye salmon based on otolith thermal marks in inshore, strait, and coastal marine habitats of the northern region of southeastern Alaska, June–October 1999. Number of marks per habitat and sampling interval is indicated.

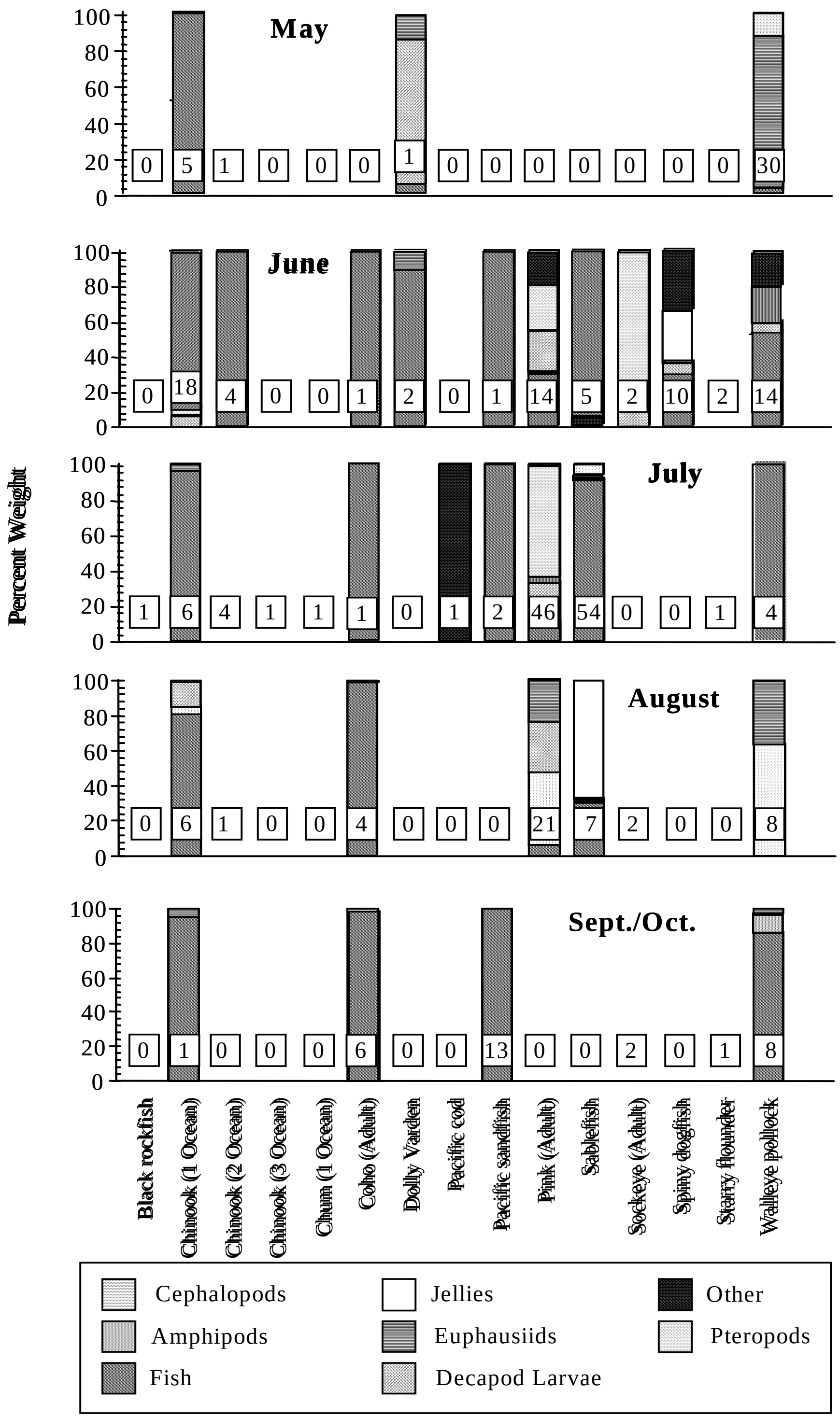

Figure 11.–Monthly gravimetric prey composition for fish species caught in surface trawl hauls in all habitats combined for the northern region of southeastern Alaska, May–October 1999. See also Table 17 for rates of predation on juvenile salmon. Number of stomachs examined per habitat and sampling interval is indicated for each species.