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Survey of Juvenile Salmon in the Marine Waters of Southeastern Alaska, May–August 2002

by

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Survey of Juvenile Salmon in the Marine Waters of Southeastern Alaska, May–August 2002

Abstract

Biophysical data were collected along a primary marine migration corridor of juvenile Pacific salmon (*Oncorhynchus* spp.) in the northern region of southeastern Alaska. Data were collected at 13 stations in four sampling intervals (25 d total) from May to August 2002. This survey marks the sixth consecutive year of systematic monitoring, and was implemented to identify the relationships among biophysical parameters that influence the habitat use, marine growth, predation, stock interactions, year-class strength, and ocean carrying capacity of juvenile salmon. Habitats were classified as inshore (Auke Bay), strait (four stations each in Chatham Strait and Icy Strait), and coastal (four stations off Icy Point), and were sampled from the National Oceanic and Atmospheric Administration ship *John N. Cobb*. At each station, fish, zooplankton, surface water samples, and physical profile data were collected using a surface rope trawl (fish), conical and bongo nets (zooplankton), and a conductivity-temperature-depth profiler (physical profile), usually during daylight. Surface (2-m) temperatures and salinities ranged from 6.1 to 13.9°C and 17.4 to 32.2 PSU from May to August. A total of 8,665 fish and squid, representing 21 taxa, were captured in 75 rope trawl hauls from June to August. Juvenile salmon comprised 61% of the total catch and occurred frequently in the trawl hauls, with coho (*O. kisutch*) occurring in 65% of the trawls, pink (*O. gorbuscha*) in 57%, chum (*O. keta*) in 55%, sockeye (*O. nerka*) in 47%, and chinook salmon (*O. tshawytscha*) in 21%. Of the 5,336 salmonids caught, more that 98% were juveniles. Walleye pollock (*Theragra chalcogramma*) and crested sculpin (*Blepsias bilobus*) were the only non-salmonid species that comprised more than 1% of the total catch. Temporal and spatial differences were observed in the catch rates, size, condition, and stock of origin of juvenile salmon species, and in predation rates on them. Catches of juvenile chum, pink, sockeye, and coho salmon were generally highest in July, whereas catches of juvenile chinook salmon were highest in June. By habitat type, juvenile salmon catches were highest in straits. In the coastal habitat, catches were highest within 40 km of shore. Size of juvenile salmon increased steadily throughout the season; mean fork lengths in June and August were respectively: 86 and 143 mm for pink, 96 and 145 mm for chum, 121 and 139 mm for sockeye, 153 and 235 mm for coho, and 201 and 235 mm for chinook salmon. Coded-wire tags were recovered from 20 juvenile and immature salmon; most were from hatchery and wild stocks of southeastern Alaska origin; however, juvenile chinook and coho salmon from the Columbia River Basin were also recovered. In addition, otoliths were examined from four species of juvenile salmon: 1,525 from chum, 248 from sockeye, 363 from coho, and 18 from chinook salmon. Alaska hatchery stocks were identified by thermal marks from 44% of the chum, 17% of the sockeye, 5% of the coho, and 61% of the chinook salmon. Onboard stomach analysis of 135 potential predators, representing nine species, indicated five predation instances on juvenile salmon in August, including both of the age 1+ sablefish (*Anoplopoma fimbria*) and 3 of 12 (25%) adult coho salmon. Our results 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 an intra- and interannual basis, will enable researchers to understand how growth, abundance, and ecological interactions affect year-class strength and ocean carrying capacity for salmon.

Introduction

Studies of the early marine ecology of Pacific salmon (*Oncorhynchus* spp.) in Alaska require adequate time series of biophysical data to relate climate fluctuations to the distribution, abundance, and production of salmon. 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 production of Pacific salmon and shifts in climate conditions has renewed interest in processes governing salmon year-class strength (Beamish 1995). In particular, climate variation has been associated with ocean production of salmon during El Niño and La Niña events, such as the recent warming trends that benefited many wild and hatchery stocks of Alaskan salmon (Wertheimer et al. 2001). However, research is lacking in areas such as the links between salmon production and climate variability, between intra- and interspecific competition and carrying capacity, and between stock composition and biological interactions. Past research has not provided adequate time-series data to explain such links (Pearcy 1997). Because the numbers of Alaskan salmonids produced in the region have increased over the last few decades (Wertheimer et al. 2001), mixing between stocks with different life history characteristics has also increased. The consequences of such changes on the growth, survival, distribution, and migratory rates of salmonids remain unknown.

To adequately identify mechanisms linking salmon production to climate change, synoptic data on stock-specific life history characteristics of salmon and on ocean conditions must be collected in a time series. 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, mass-marking with thermally induced otolith marks (Hagen and Munk 1994) has provided technological advances. The high incidence of these marking programs in southeastern Alaska (Courtney et al. 2000) offers an opportunity to examine growth, survival, and migratory rates of specific stocks during the current record production of hatchery chum salmon (*O. keta*) and wild pink salmon (*O. gorbuscha*) in the region. For example, two private non-profit enhancement facilities in the northern region of southeastern Alaska have produced more than 100 million otolith-marked juvenile chum salmon annually in recent years. Consequently, since the mid-1990s, average annual commercial harvests of about 14 million adult chum salmon mostly comprised of otolith-marked fish, have occurred in the common property fishery in the region (ADFG 2000). In addition, sockeye salmon (*O. nerka*), coho salmon (*O. kisutch*), and chinook salmon (*O. tshawytscha*) are otolith marked by some enhancement facilities. 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.

This coastal monitoring study in the northern region of southeastern Alaska, known as the Southeast Coastal Monitoring Project (SECM), was initiated in 1997 and repeated from 1998 to 2002 (Orsi et al. 1997, 1998, 2000, 2001, 2002) to develop our understanding of the relationships between annual time series of biophysical data and stock-specific information. Data collections from prior years have been reported in several documents (Murphy and Orsi 1999; Murphy et al.

1999; Orsi et al. 1999, 2001, 2002). This document summarizes biophysical data collected by SECM scientists from May to August 2002 in southeastern Alaska.

Methods

Thirteen stations were sampled in each of four time intervals, 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 to August 2002 (Table 1). Stations were located along the primary seaward migration corridor used by juvenile salmon that originate in this region. This corridor extends 250 km from inshore waters within the Alexander Archipelago along Chatham Strait, Icy Strait, and off Icy Point into the Gulf of Alaska (Figure 1). At each station, the physical environment, zooplankton, and fish were typically sampled during daylight, between 0700 and 2000 hours; however, nocturnal sampling (0400) was conducted at one station in July.

The selection of the 13 core 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. The inshore station (Auke Bay Monitor, ABM) and the four Icy Strait stations were selected initially because historical data exist for them (Bruce et al. 1977; Jaenicke and Celewycz 1994; Landingham et al. 1998; Orsi et al. 1997, 1998, 1999, 2000, 2001, 2002). The Chatham Strait stations were selected to intercept juvenile otolith-marked salmon entering Icy Strait from both the south (i.e., Hidden Falls Hatchery (HF) operated by Northern Southeast Alaska Regional Aquaculture Association (NSRAA)) and from the north (i.e., Douglas Island Pink and Chum Hatchery (DIPAC) facilities) (Figure 1). The Icy Point stations were selected to monitor conditions in the coastal habitat of the Gulf of Alaska. Vessel and sampling gear constraints limited operations to shoreline distances between 1.5 km and 65 km, and to bottom depths greater than 75 m, which precluded trawling at the Auke Bay Monitor station (Table 1). Sea conditions of waves less than 2.5 m and winds less than 12.5 m/sec were usually necessary to operate the sampling gear safely, which particularly influenced sampling opportunities in coastal waters.

Oceanographic sampling

Oceanographic data were collected at each station before or immediately after each trawl haul and consisted of one conductivity-temperature-depth profiler (CTD) cast, one or more vertical plankton hauls with conical nets, and one double oblique plankton haul with a bongo net system. 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 collected at 1-minute intervals with an onboard thermosalinograph (Sea-Bird SBE 21). Surface water samples were taken at each station for later nutrient and chlorophyll analysis contracted to the Marine Chemistry Laboratory at the University of Washington School of Oceanography. At least one shallow vertical haul (20 m) was made at each station with a 50-cm, 243-μm mesh NORPAC net. At least one deep vertical haul (to 200 m or within 20 m of bottom) was made at most

1 Reference to trade names does not imply endorsement by the Auke Bay Laboratory, National Marine Fisheries Service, NOAA Fisheries.

stations with a 57-cm, 202-μm mesh WP2 net (Table 2). In addition, a double oblique bongo haul was taken at all stations, except the Upper Chatham Strait stations, to a depth of 200 m or within 20 m of the bottom using a 60-cm diameter frame with 505-μm and 333-μm mesh nets. A Bendix bathykymograph was used with the oblique bongo hauls to record the maximum sampling depths. General Oceanics model 2031 or Roshiga flow meters were placed inside the bongo and deep conical nets for calculation of filtered water volumes. To quantify ambient light levels that could influence zooplankton vertical migration, light intensities (W/m^2) were recorded at each station with a Li-Cor Model 189 radiometer.

Zooplankton samples were preserved in a 5% formalin-seawater solution. In the laboratory, zooplankton settled volumes (SV, ml) and total settled volumes (TSV, ml) of each 20-m vertical haul were measured after settling the samples over a 24 hour period in Imhof cones. Mean SV were determined for pooled stations by habitat and month. Displacement volumes (DV, ml) were measured for zooplankton bongo net samples (333-µm mesh) collected in Icy Strait. Samples were brought to a constant volume (500-ml) by adding water, and then were sieved through 243-µm mesh to separate the zooplankton from the liquid. The volume of decanted liquid was measured, and then subtracted from the sample starting volume to yield zooplankton DV. Detailed species composition was determined microscopically only for Icy Strait and Auke Bay Monitor 333-µm samples.

Fish sampling

Fish sampling was accomplished with a Nordic 264 rope trawl modified to fish the surface water directly astern of the NOAA ship *John N. Cobb*. The trawl was 184 m long and had a mouth opening of 24 m by 30 m (depth by width). The *John N. Cobb* is a 29-m research vessel with a main engine of 325 horsepower and a cruising speed of 10 knots. A pair of 3-m foam-filled Lite trawl doors, each weighing 544 kg (91 kg submerged), was used to spread the trawl open. 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 m to 60 m (Orsi et al., unpubl. cruise report 1996). 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 length of the rope trawl. A 6.1-m long, 0.8-cm knotless liner was sewn into the cod end. 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. 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 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 across a station for 20 min at about 1.5 m/sec (3 knots), covering approximately 1.9 km (1.0 nautical mile). 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. Trawling effort in the strait habitat was increased to ensure that sufficient samples of marked juvenile salmon were obtained for comparison among previous years. In particular, replicate trawls were conducted in Icy Strait when weather and time allowed, with minimal accompanying oceanographic sampling.

After each trawl haul, the fish were anesthetized with tricaine methanesulfonate (MS-222), identified, enumerated, measured, labeled, bagged, and frozen. 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 subsampled due to processing time constraints. Up to 50 juvenile salmon of each species were bagged individually; the remainder were bagged in bulk. All fish were frozen immediately after measurement. During times of extended processing, fish were chilled with ice packs to minimize tissue decomposition and gastric activity. All chinook and coho salmon were examined for missing adipose fins indicating the possible presence of implanted CWTs; those with adipose fins intact were again screened through a detector in the laboratory. The snouts of these fish were dissected later in the laboratory to recover CWTs, which were then decoded and verified to determine origin.

Frozen individual juvenile salmon were weighed in the laboratory to the nearest gram (g). Mean lengths, weights, and Fulton condition factors ($g/FL^3 \cdot 10^5$; Cone 1989) were computed for each species by habitat and sampling interval. To identify stock of origin of juvenile chum, sockeye, coho, and chinook salmon, sagittal otoliths were extracted from the crania and preserved in 95% ethyl alcohol. Laboratory processing of otoliths for thermal marks was contracted to DIPAC. 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). Ambiguous otolith thermal marks were verified by personnel at the Alaska Department of Fish and Game otolith laboratory. Stock composition and growth trajectories of thermally marked fish were then determined for each month and habitat.

Whole body energy content (WBEC) was determined by bomb calorimetry in the laboratory for juvenile coho salmon caught in the strait habitat. After removing the stomach contents, individual juvenile coho were dried at 55°C to a constant weight in an oven. Fish were homogenized in a micro-mill to yield a uniform powder, from which 0.50 ± 0.02mg pellet subsamples were formed. Pellets were combusted in a Parr micro-bomb calorimeter following standard methods (Parr Instrument Co. 1994), and WBEC values were expressed in energy units of calories/g dry weight.

Potential predators of juvenile salmon from each haul were identified, measured, and weighed onboard the vessel. Their stomachs were then excised, weighed, and classified by percent fullness. Stomach contents were removed, empty stomachs weighed, and total content weight determined by subtraction. General prey composition was determined by estimating contribution of taxa to the nearest 10% of total volume. The wet-weight contribution of each prey taxon to the diets was then calculated by multiplying its percent volume by the total content weight. Fish prey was identified to species, if possible, and lengths were 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 and the frequency of feeding fish.

Results and Discussion

During the 4-month (25-d) survey in 2002, data were collected from 75 rope trawl hauls, 96 CTD casts, 92 bongo net hauls, 143 conical net hauls (103 from 20-m depths and 40 from 200-m depths), and 52 surface water samples (Table 2). The sampling intervals occurred near the ends of each month. In May, only oceanographic sampling was completed at all stations; no trawling occurred due to the absence of juvenile salmon observed in previous years. After May, the strait and coastal habitats were consistently sampled monthly from June to August (Table 2).

Oceanography

Sea surface (2 m) temperature and salinity data followed similar seasonal patterns but differed between habitats. Overall, surface temperatures and salinities during the survey ranged from 6.1 to 13.9°C and from 17.4 to 32.2 PSU from May to August (Table 3). In general, inshore habitat was warmest and least saline, while coastal habitat was coldest and most saline. In strait and inshore habitats, temperatures increased dramatically from May to July and declined from July to August (Figure 2a). In the coastal habitat, temperatures increased from May to August. Salinities in the inshore and strait habitats declined sharply from May to June, then decreased gradually to August and increased slightly to September (Figure 2b). Salinities were consistently high in the coastal habitat from May to August.

A total of 52 surface water samples were taken at 13 stations over the course of the season (Tables 2 and 4). Nutrient concentration ranges and means were 0.1–2.5 and 0.6 μM for PO_4, 2.2–27.5 and 12.0 μM for $Si(OH)_4$, 0.0–8.5 and 1.6 μM for NO_3, 0.0–0.4 and 0.1 μM for NO_2, and 0.2–3.0 and 0.6 μM for NH_4. Chlorophyll ranged from 0.2 to 8.9 mg/m^3 with a mean of 2.3 mg/m^3, and phaeopigment ranged from 0.0 to 0.4 mg/m^3 with a mean of 0.1 mg/m^3 (Table 4).

Plankton settled volumes were highly variable among habitats, but seasonal patterns were evident from the 20-m NORPAC hauls (Table 5; Figure 2c). Qualitative, visual examination of samples indicated a wide diversity of zooplankton taxa and phytoplankton present. Zooplankton SV decreased dramatically from May to June, and increased slightly in August in inshore and coastal habitats (Figure 2c). Zooplankton SV were consistently high in the strait habitat in May and June, then declined dramatically in July, and dropped slightly lower in August. Phytoplankton was present in the inshore habitat each month from May to August, in the strait habitat in June and July, and in the coastal habitat in May and July. The spatial pattern generally showed highest zooplankton volumes in the strait habitat in May and June, and the lowest in September. The peak volume among all stations and months was 48 ml ZSV during June in the strait habitat. Ambient light intensities during the sampling season ranged from 0 to 959 W/m^2, with a mean of 188 W/m^2.

Zooplankton seasonal displacement volumes (DVs) varied dramatically only in the inshore habitat (Table 6; Figure 3). The DVs in the inshore habitat were similarly high in May and August (> 1.6 ml/m^3), with a dramatic decline to summer minima (approximately 0.5 m/ml^3) in June and July. The DVs in strait habitat were similar in all four months, with values similar to the inshore habitat minima. The DVs in the coastal habitat were the lowest of all habitats (0.1-0.3 ml/m^3) from May to August.

Catch composition

A total of 8,665 fish and squid, representing 21 taxa, were captured in 75 rope trawl hauls from June to August (Table 7). Of the 5,336 salmonids caught, more than 98% were juveniles. Juvenile salmon comprised 61% of the total catch. Juvenile salmon were generally the most frequently occurring species, with coho occurring in 65% of the hauls, pink in 57%, chum in

55%, sockeye in 47%, and chinook salmon in 1% (Table 8). Non-salmonid species making up more than 1% of total catch included walleye pollock (*Theragra chalcogramma*) and crested sculpin (*Blepsias bilobus*); these species occurred in 33% and 48% of the trawl hauls.

Seasonal catches differed by habitat for juvenile salmon and for the most abundant non-salmonids. Juvenile salmon comprised 75-95% of the catch in the strait and coastal habitats in July and August, while in June, walleye pollock was the dominant species in the strait habitat and Pacific sandfish (*Trichodon trichodon*) was the dominant species in the coastal habitat (Figure 4). Catches and life history stages of the salmon are listed by date, haul number, and station in Appendix 1.

Distribution of juvenile salmon differed for the months, habitats, and species sampled; however, the patterns were generally consistent with observations from previous years (Orsi et al. 1997, 1998, 1999, 2000, 2001, 2002). By month, the overall catches were highest in July in both the strait and coastal habitats (Figure 5). By habitat, the highest catches per haul for all species of juvenile salmon generally occurred in the strait habitat each month. Overall, the highest average catches (>50 fish/haul) were for pink and chum salmon in the strait habitat; however, pink salmon catches were also high (>60 fish/haul) at the IPB station in the coastal habitat in June and July (Figures 5 and 6). Offshore distribution of juvenile salmon in the coastal habitat in June and July indicated that the highest catches per haul occurred within 40 km of shore, particularly within the 23-km distance from shore (Figure 6).

Size and condition of juvenile salmon differed among the species and sampling intervals (Tables 9–13; Figures 7–9). Juvenile coho and chinook salmon were consistently 25 to 100 mm longer than sockeye, chum, and pink salmon. Most species increased in both length and weight in successive intervals, indicating growth despite the influx of additional stocks with varied times of saltwater entry. Mean FLs (mm) for each species of juvenile salmon in June, July, and August were: 86.1, 114.8, and 142.6 mm for pink; 95.7, 124.2, and 144.9 mm for chum; 121.7, 148.8, and 139.1 mm for sockeye; 153.4, 211.9, and 235.1 mm for coho; and 201.8, 247.1, and 235.0 mm for chinook salmon. Mean weights (g) for each species of juvenile salmon in June, July, and August were: 5.9, 16.7, and 31.6 g for pink; 8.0, 20.0, and 30.5 g for chum; 17.8, 35.4, and 30.6 g for sockeye; 44.7, 113.5, and 162.9 g for coho; and 113.4, 206.9, and 183.1 g for chinook salmon. Juvenile sockeye salmon decreased in size from July to August. This may in part be due to smaller, zero-check (no freshwater winter) fish migrating into the marine environment later in the summer than their one-check cohorts. Mean condition factor values for each sepecies of juvenile salmon in June, July, and August were: 0.8, 0.9, and 0.9 for pink; 0.9, 0.9, and 1.0 for chum; 0.9, 1.0, and 1.0 for sockeye; 1.2, 1.2, and 1.2 for coho; and 1.3, 1.3, and 1.3 for chinook salmon. Condition factor values greater than 1.0 for species condition indicated healthy feeding environments.

Twenty of the 27 juvenile and immature salmon lacking adipose fins contained CWTs (Table 14). Four CWTs were recovered from chinook salmon and 16 CWTs were recovered from coho salmon. Most CWT fish were juveniles recovered in the strait habitat during July that originated from hatchery and wild stocks indigenous to the northern region of southeastern Alaska. Of the CWT chinook salmon, one was a juvenile (no marine winters, age 1.0) and three were immature (one marine winter, age 0.1 or 1.1). The one juvenile chinook salmon was from the Columbia River Basin, and one of the three immature chinook salmon was from British Columbia. Of the CWT coho salmon, all were juveniles and one was from the Columbia River Basin. For chinook salmon, migration rates were 12.1 km/d for the one juvenile, and ranged from 0.1 to 1.7 km/d (average 1.7 km/d) for immatures. For juvenile coho salmon, migration rates ranged from 0.7 to18.0 km/d (average 3.5 km/d).

For juvenile chum, salmon stock-specific information was derived from the otoliths of a subsample of 957 fish, representing 48% of those caught (Table 15). These fish were the same individuals sampled for weight and condition. Of all chum salmon otoliths examined, 427 (44%) were marked: 395 (41%) were from HF and 31 (3%) were from DIPAC. The remaining 531 (56%) chum salmon were unmarked and included both wild stocks and possibly unmarked hatchery stocks from southern release localities. Temporal occurrence of hatchery stocks of chum salmon from June to August indicated that their composition was highest in July in both strait (greater than 60%) and coastal (less than 40%) habitats (Figure 10). In the remainder of the time periods and habitats, hatchery composition was less than 25% in each habitat, with the exception of the coastal habitat in June where no samples were obtained.

For juvenile sockeye salmon, stock-specific information was derived from the otoliths of a subsample of 248 fish, representing 93% of those caught (Table 16). These fish were the same individuals sampled for weight and condition. Of all the sockeye salmon otoliths examined, 41 (17%) were marked and originated from four stock groups: Snettisham (37), Tahltan (2), Tatsumenie (1), and Sweetheart (1). Marked stock contribution of sockeye salmon was highest in the strait habitat and declined over time from 25% in June to 15% in August (Figure 11). In the coastal habitat, only 5% of the fish were found to be marked in July, no marks were detected in August, and no samples were obtained in June.

For juvenile coho salmon, stock-specific information was derived from the otoliths of a subsample of 363 fish, representing 95% of those caught (Table 17). These fish were the same individuals sampled for weight and condition. Of all the coho salmon otoliths examined, 17 (5%) were marked and originated from DIPAC hatchery (49%) and Port Armstrong (1%). In the strait habitat, hatchery stock contribution of coho salmon increased from 0% in June to 20% in August (Figure 12). In the coastal habitat, only 10% of the fish were found to be marked in July, no marks were detected in August, and no samples were obtained in June.

For juvenile chinook salmon, stock-specific information was derived from the otoliths of a subsample of 18 fish, representing 86% of those caught (Table 18). These fish were the same individuals sampled for weight and condition. Of all the chinook salmon otoliths examined, 11 (61%) were marked and originated from two hatcheries: HF (8) and Medvejie (ME) (3); HF fish were found only in the strait habitat and ME fish were found primarily in the coastal habitat. Hatchery stock contribution of chinook salmon ranged from 25% to 100% and no samples were obtained in the coastal habitat in June (Figure 13).

Monthly samples of thermally marked juvenile chum, sockeye, coho, and chinook salmon were used to examine stock-specific growth trajectories. Weights of juvenile salmon from marked stocks were compared with weights of juvenile salmon from unmarked stocks (Figures 14 and 15). The marked salmon stocks were from DIPAC, HF, ME, and Snettisham hatcheries; these fish were released in 2002 at the following approximate dates and size ranges: chum in April–May (1–4 g); sockeye in April–June (5–10 g); coho in May–June (15–23 g); and chinook salmon in May–July (9–59 g). For all species except sockeye salmon, individual hatchery stocks were generally smaller than unmarked stocks in each time period.

Whole body energy content was determined for 84 juvenile coho salmon in strait habitats in June, July, and September (Table 11). These fish represented 23% of the seasonal catch. Average WBEC for juvenile coho salmon caught in Icy Strait decreased from 5002.7 to 4829.2

cal/g from June to August, while WBEC for juvenile coho salmon caught in Upper Chatham Strait increased from 4871.8 to 5156.2 cal/g from June to August, after a decline in July. Seasonal patterns in condition factor values (wt/$L^3 \cdot 10^5$) generally mimicked the WBEC patterns (Figure 16).

Stomachs of 135 potential predators of juvenile salmon were examined, representing nine species of fish: 56 immature walleye pollock, 31 immature chinook salmon, 20 adult pink salmon, 16 adult coho salmon, 6 adult chum salmon, 2 adult spiny dogfish (*Squalus acanthias*), 2 juvenile sablefish (*Anoplopoma fimbria*), 1 immature sockeye salmon, and 1 Pacific sandfish (Table 19). Overall, 79.3% of the stomachs contained food. Low rates of feeding were observed only among species infrequently caught: the spiny dogfish, immature sockeye salmon, and Pacific sandfish. We observed a total of five incidences of predation on juvenile salmon (Table 19).

On an annual basis, diets of three predator species: immature chinook salmon, adult coho salmon, and sablefish, were dominated by fish prey weight (Figure 17a); pink salmon were the only other species whose diet included some fish. The principal fish prey were unidentified larvae or well-digested older fish remains, but walleye pollock, wolf-eels (*Anarrhichthys ocellatus*), and Pacific herring (*Clupea pallasi*) were occasionally identified. Juvenile salmon occurred in the diets of two adult coho salmon and two sablefish captured in a single trawl haul at Icy Point (IPA), and one adult coho captured in Upper Chatham Strait (UCA) in August. All of the identified salmon prey were pink salmon, ranging in length from 115 to 147 mm; these prey salmon constituted roughly one-third of the body length of the sablefish predators and one-fifth of the length of the coho salmon predators.

Invertebrate prey composition differed among the predator species. Chinook salmon ate euphausiids and cephalopods in addition to fish; chum salmon ate almost exclusively oikopleurans; pink salmon ate mostly fish, crab larvae, amphipods, and pteropods; and walleye pollock ate principally copepods and euphausiids. One spiny dogfish stomach contained cnidarian and ctenophore remains (Figure 17a).

Samples of chinook and pink salmon, and walleye pollock were sufficient to compare seasonal diets (Figure 17b). Rates of empty stomachs were generally low (> 22%), except for the August chinook (80%) and pink (67%) salmon (Table 20). Diets varied across months for all three species, although some overlap occurred between months. Piscivory occurred only in June and July for chinook salmon, principally in June for pinks, and only in August for pollock (Figure 17b).

In the past six years, coastal monitoring in southeastern Alaska has shown both similar and contrasting patterns with respect to the temporal and spatial occurrence of biophysical data from prior years. A common annual pattern of seasonality existed in surface temperatures and salinity levels which increased progressively westward from inshore to coastal habitats. In 2002, surface temperatures were neither warmer nor colder than in prior years. In contrast, warmer El Niño conditions of 1997-1998 were cooler than La Niña conditions of 1999, indicating lower temperatures and lower zooplankton volumes, which may have led to the lower growth observed for juvenile salmon in 1999 compared to 1997-98 (Orsi et al. 2000). The coastal monitoring of stations in the northern region of southeastern Alaska is currently ongoing; in 2003, stations in each habitat were planned to be sampled monthly from May to August. Long-term ecological monitoring of key juvenile salmon stocks, including ocean sampling programs that operate 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.

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Table 1.—Localities and coordinates of stations sampling in the marine waters of the northern region of southeastern Alaska using the NOAA ship *John N. Cobb*, May–August 2002. Station positions are shown in Figure 1.

Station	Latitude North	Longitude West	Distance offshore km	Distance between km	Depth m
			Inshore		
			Auke Bay		
ABM	58°22.00'	134°40.00'	1.5	—	60
			Strait		
			Upper Chatham Strait transect		
UCA	58°04.57'	135°00.08'	3.2	—	400
UCB	58°06.22'	135°00.91'	6.4	3.2	100
UCC	58°07.95'	135°01.69'	6.4	3.2	100
UCD	58°09.64'	135°02.52'	3.2	3.2	200
			Icy Strait transect		
ISA	58°13.25'	135°31.76'	3.2	—	128
ISB	58°14.22'	135°29.26'	6.4	3.2	200
ISC	58°15.28'	135°26.65'	6.4	3.2	200
ISD	58°16.38'	135°23.98'	3.2	3.2	234
			Coastal		
			Icy Point transect		
IPA	58°20.12'	137°07.16'	6.9	—	160
IPB	58°12.71'	137°16.96'	23.4	16.8	130
IPC	58°05.28'	137°26.75'	40.2	16.8	150
IPD	58°53.50'	137°42.60'	65.0	24.8	1,300

Table 2.—Numbers and types of data collected at different habitat types sampled monthly in marine waters of the northern region of southeastern Alaska, May–August 2002.

		Data collection type[1]					
Dates (days)	Habitat	Rope trawl	CTD cast	Bongo	20-m vertical	WP-2 vertical	Chlorophyll & nutrients
21-24 May (4 days)	Inshore	0	1	4	3	1	1
	Strait	0	8	12	8	8	8
	Coastal	0	4	16	4	4	4
	All May	0	13	32	15	13	13
22-27 June (6 days)	Inshore	0	1	2	3	1	1
	Strait	17	20	8	20	4	8
	Coastal	4	4	8	4	4	4
	All June	21	25	18	27	9	13
23-30 July (8 days)	Inshore	0	1	2	3	1	1
	Strait	20	21	14	20	4	8
	Coastal	8	8	8	8	4	4
	All July	28	30	24	31	9	13
23-29 August (7 days)	Inshore	0	1	2	3	1	1
	Strait	20	20	8	20	4	8
	Coastal	6	7	8	7	4	4
	All August	26	28	18	30	9	13
Total		75	96	92	103	40	52

[1]Rope trawl = 20-min hauls with NORDIC 264 surface trawl 18 m deep by 24 m wide; CTD casts = to 200 m or within 10 m of the bottom; Bongo tow = 60-cm diameter frame, 505- and 333-µm meshes, double oblique haul to 200 m or within 20 m of the bottom; 20-m vertical = 50-cm diameter frame, 243-µm conical net towed vertically from 20 m; WP-2 vertical = 57-cm diameter frame, 202-µm conical net towed vertically from 200 m or within 20 m of the bottom.

Table 3.—Surface (2-m) temperature and salinity data collected monthly in marine waters of the northern region of southeastern Alaska, May–August 2002. Station code acronyms are listed in Table 1 and shown in Figure 1.

Month	Temp (°C)	Salinity (PSU)	Temp (°C)	Salinity (PSU)	Temp (°C)	Salinity (PSU)	Temp (°C)	Salinity (PSU)
Inshore								
Auke Bay								
	ABM							
May	10.8	27.6	–	–	–	–	–	–
June	12.2	19.4	–	–	–	–	–	–
July	13.0	17.4	–	–	–	–	–	–
August	10.4	17.7	–	–	–	–	–	–
Strait								
Upper Chatham Strait transect								
	UCA		UCB		UCC		UCD	
May	7.9	30.5	7.5	30.9	7.1	31.0	6.6	31.3
June	10.7	29.4	11.6	27.6	10.8	26.6	11.3	26.1
July	11.0	28.0	11.1	27.9	12.1	26.9	11.3	26.6
August	10.4	27.6	10.2	29.2	10.1	29.0	11.1	27.6
Icy Strait transect								
	ISA		ISB		ISC		ISD	
May	7.0	31.7	6.1	31.8	6.9	31.5	6.4	31.5
June	9.1	30.5	9.8	29.2	11.8	25.0	12.0	25.1
July	10.2	28.2	11.1	27.2	12.3	24.9	12.8	23.9
August	9.7	28.5	10.8	26.2	10.9	25.9	10.9	26.1
Coastal								
Icy Point transect								
	IPA		IPB		IPC		IPD	
May	7.6	31.5	8.0	32.0	8.3	32.2	8.4	32.2
June	10.8	31.7	11.9	31.4	11.7	31.8	11.5	31.9
July	10.1	31.1	12.4	31.6	13.8	31.9	13.9	31.9
August	13.5	31.5	13.0	31.6	13.8	31.7	13.8	31.5

Table 4.—Nutrient and chlorophyll concentrations from 250-ml surface water samples in marine waters of the northern region of southeastern Alaska, May–August 2002. Station code acronyms are listed in Table 1.

		Nutrients [µM]						
Station	Date	[PO_4]	[$Si(OH)_4$]	[NO_3]	[NO_2]	[NH_4]	Chlorophyll (mg/m^3)	Phaeopigment (mg/m^3)
ABM	May	0.13	2.17	0.13	0.07	0.19	1.19	0.08
	June	0.05	5.58	0.04	0.00	0.51	2.39	0.26
	July	0.00	4.52	0.00	0.00	0.68	1.20	0.32
	August	0.11	8.09	0.00	0.06	0.88	4.66	0.12
UCA	May	0.39	3.84	0.22	0.04	0.70	1.10	0.02
	June	0.21	5.06	0.00	0.02	0.58	1.25	0.07
	July	0.25	11.35	0.01	0.03	0.15	3.11	0.15
	August	0.96	25.56	6.03	0.31	0.60	1.09	0.15
UCB	May	0.36	3.00	0.19	0.04	0.34	4.83	0.00
	June	0.15	4.91	0.00	0.01	0.40	2.06	0.03
	July	0.34	9.84	0.00	0.16	0.41	2.71	0.30
	August	1.06	27.04	7.67	0.40	0.77	1.29	0.18
UCC	May	0.31	2.17	0.16	0.02	0.30	5.23	0.00
	June	0.12	4.84	0.00	0.01	0.28	0.75	0.03
	July	0.29	6.70	0.00	0.03	0.45	1.27	0.25
	August	1.08	27.52	7.73	0.31	1.16	1.26	0.20
UCD	May	0.85	12.35	5.14	0.09	0.94	6.95	0.00
	June	0.09	6.27	0.00	0.01	0.36	2.50	0.00
	July	2.47	9.68	0.07	0.06	0.85	2.43	0.30
	August	0.72	21.36	3.20	0.40	0.90	2.57	0.18
ISA	May	0.69	6.43	1.24	0.10	0.67	3.41	0.07
	June	0.59	20.25	3.30	0.11	1.22	6.43	0.00
	July	0.59	15.06	2.65	0.14	0.63	3.70	0.38
	August	0.84	24.15	4.12	0.23	0.53	1.58	0.18
ISB	May	0.92	18.04	8.44	0.15	0.72	7.84	0.11
	June	0.27	12.33	0.00	0.07	0.18	8.86	0.00
	July	0.33	8.90	0.35	0.04	0.51	2.43	0.25
	August	0.83	24.14	4.11	0.25	0.56	1.34	0.14
ISC	May	0.66	17.30	5.61	0.14	0.32	8.10	0.06
	June	0.15	4.43	0.00	0.04	3.03	2.61	0.11
	July	0.24	6.06	0.00	0.02	0.25	2.07	0.33
	August	0.77	23.40	3.63	0.24	0.51	1.82	0.05

Table 4.—(Cont.)

		Nutrients [μM]						
Station	Date	[PO_4]	[$Si(OH)_4$]	[NO_3]	[NO_2]	[NH_4]	Chlorophyll (mg/m^3)	Phaeopigment (mg/m^3)
ISD	May	0.26	3.02	0.01	0.04	0.33	5.19	0.00
	June	0.20	3.78	0.00	0.01	0.23	2.17	0.02
	July	0.24	4.64	0.00	0.01	0.29	1.53	0.32
	August	0.78	22.66	3.29	0.24	0.30	2.64	0.13
IPA	May	0.74	15.30	1.89	0.07	0.76	0.33	0.06
	June	0.35	10.37	0.00	0.04	0.37	0.96	0.22
	July	1.08	24.86	8.49	0.27	0.57	0.87	0.05
	August	0.53	12.73	0.00	0.03	0.90	0.86	0.19
IPB	May	0.58	5.04	0.50	0.05	0.49	0.95	0.38
	June	0.46	11.35	0.00	0.02	0.18	0.41	0.05
	July	0.69	15.12	1.00	0.09	1.29	1.08	0.09
	August	1.36	12.72	0.00	0.11	0.96	1.20	0.14
IPC	May	0.76	18.61	1.42	0.08	0.89	0.36	0.06
	June	0.41	10.49	0.00	0.04	0.21	0.19	0.04
	July	0.82	9.68	0.71	0.06	0.83	0.49	0.02
	August	0.58	7.89	0.00	0.06	0.54	0.72	0.13
IPD	May	0.79	18.52	2.06	0.09	0.65	0.62	0.02
	June	0.44	11.62	0.08	0.05	0.89	0.25	0.03
	July	0.56	10.87	0.74	0.06	0.61	0.53	0.01
	August	0.51	11.26	0.00	0.03	0.73	0.28	0.04

Table 5.— Mean zooplankton settled volumes (SV, ml) and total plankton settled volumes (TSV, ml) from vertical 20-m NORPAC hauls sampled monthly in marine waters of the northern region of southeastern Alaska, May–August 2002. Station code acronyms are listed in Table 1. Asterisk denotes that separation of zooplankton was not distinct but was estimated. Volumetric density (ml/m^3) can be computed by dividing by a factor of 3.9 m^3 water volume filtered.

Month	*n*	SV	TSV	*n*	SV	TSV	*n*	SV	TSV	*n*	SV	TSV
						Inshore						
						Auke Bay						
	ABM											
May	3	25.3*	36.0		–	–		–	–		–	–
June	3	13.0*	17.7		–	–		–	–		–	–
July	3	10.7*	18.7		–	–		–	–		–	–
August	3	15.0*	63.3		–	–		–	–		–	–
						Strait						
						Upper Chatham Strait transect						
	UCA			UCB			UCC			UCD		
May	1	29.0*	65.0	1	32.0*	65.0	1	24.0*	80.0	1	15.0*	47.0
June	2	13.5*	16.0	2	17.5*	24.5	2	12.5*	28.5	2	19.5*	32.0
July	2	2.5	2.5	2	1.5	1.5	2	2.0	2.0	2	1.0	1.0
August	2	0.4	0.4	2	0.3	0.3	2	0.3	0.3	2	0.5	0.5
						Icy Strait transect						
	ISA			ISB			ISC			ISD		
May	1	20.0*	37.0	1	22.0*	55.0	1	20.0*	85.0	1	20.0*	95.0
June	3	15.3*	15.7	3	21.7*	28.3	3	44.3*	71.7	3	27.0*	47.0
July	3	5.3	5.3	3	7.7	7.7	4	9.0	9.0	2	4.0	4.0
August	3	4.3	4.3	3	4.3	4.3	3	5.0	5.0	3	5.0	5.0
						Coastal						
						Icy Point transect						
	IPA			IPB			IPC			IPD		
May	1	11.0*	16.0	1	60.0	60.0	1	15.0*	25.0	1	15.0*	24.0
June	1	13.0	13.0	1	6.0	6.0	1	8.0	8.0	1	7.0	7.0
July	2	3.5	3.5	2	5.0	5.0	2	11.0*	13.0	2	16.5	16.5
August	2	14.0	14.0	2	10.0	10.0	2	5.5	5.5	1	38.0	38.0

Table 6.—Zooplankton displacement volumes (DV, ml/m^3) from oblique bongo (333-µm mesh) hauls sampled monthly in marine waters of the northern region of southeastern Alaska, May–August 2002. Station code acronyms are listed in Table 1.

Month	DV	depth	DV	depth	DV	depth	DV	depth
Inshore								
Auke Bay								
	ABM							
May	1.72	40	—	—	—	—	—	—
June	0.47	45	—	—	—	—	—	—
July	0.42	45	—	—	—	—	—	—
August	1.49	40	—	—	—	—	—	—
Strait								
Icy Strait transect								
	ISA		ISB		ISC		ISD	
May	0.90	60	0.86	190	0.47	195	0.49	200
June	0.61	80	0.82	150	0.55	190	0.86	195
July	0.58	50	0.73	210	0.13	230	0.36	190
August	0.67	80	0.59	185	0.47	220	0.49	225
Coastal								
Icy Point transect								
	IPA		IPB		IPC		IPD	
May	0.29	170	0.29	115	0.18	100	0.09	200
June	0.25	125	0.32	120	0.09	110	0.16	210
July	0.52	140	0.15	100	0.05	125	0.09	190
August	0.18	120	0.08	120	0.09	125	0.12	210

Table 7.—Numbers of fish and squid caught monthly with a rope trawl in marine waters of the northern region of southeastern Alaska, June-August 2002.

Common name	Scientific name	Number caught			
		June	July	August	Total
	Salmonids				
Pink salmon[1]	*Oncorhynchus gorbuscha*	21	1691	878	2,590
Chum salmon[1]	*O. keta*	76	1,748	175	1,999
Coho salmon[1]	*O. kisutch*	50	274	60	384
Sockeye salmon[1]	*O. nerka*	18	177	73	268
Chinook salmon[1]	*O. tshawytscha*	8	7	6	21
Chinook salmon[2]	*O. tshawytscha*	17	9	5	31
Sockeye salmon[2]	*O. nerka*	0	1	0	1
Pink salmon[3]	*O. gorbuscha*	3	14	3	20
Coho salmon[3]	*O. kisutch*	1	3	12	16
Chum salmon[3]	*O. keta*	4	1	1	6
Total					**5,336**
	Non-salmonids				
Walleye pollock	*Theragra chalcogramma*	3,091	7	4	3,102
Crested sculpin	*Blepsias bilobus*	5	62	40	107
Squid	Gonatidae	1	33	21	55
Capelin	*Mallotus villosus*	0	0	25	25
Pacific spiny lumpsucker	*Eumicrotremus orbis*	2	6	3	11
Pacific sandlance	*Ammodytes hexapterus*	5	0	0	5
Wolf-eel	*Anarrhichthys ocellatus*	2	2	0	4
Fish larvae (unid.)	Teleostomi	4	0	0	4
Black rockfish	*Sebastes melanops*	0	0	3	3
Salmon shark	*Lamna ditropis*	0	2	1	3
Prowfish	*Zaprora silenus*	2	0	0	2
Sablefish	*Anoplopoma fimbria*	0	0	2	2
Spiny dogfish	*Squalus acanthias*	1	1	0	2
Soft sculpin	*Psychrolutes sigalutes*	1	0	0	1
Pacific sandfish	*Trichodon trichodon*	1	0	0	1
Smooth lumpsucker	*Aptocyclus ventricosus*	0	0	1	1
Bigmouth sculpin	*Hemitripterus bolini*	1	0	0	1
Total					**3,329**
Total fish and squid		**3,314**	**4,038**	**1,313**	**8,665**

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

Table 8.—Frequency of occurrence for fishes and squid sampled with a rope trawl in marine waters of the northern region of southeastern Alaska, June–August 2002. The percentage occurrence of fish per 75 total hauls is shown in parentheses.

Common name	Scientific name	Frequency of occurrence June	July	August	Total	(%)
		Salmonids				
Pink salmon[1]	*Oncorhynchus gorbuscha*	3	22	18	43	(57)
Chum salmon[1]	*O. keta*	8	21	12	41	(55)
Coho salmon[1]	*O. kisutch*	5	24	20	49	(65)
Sockeye salmon[1]	*O. nerka*	5	18	12	35	(47)
Chinook salmon[1]	*O. tshawytscha*	5	6	5	16	(21)
Chinook salmon[2]	*O. tshawytscha*	10	8	5	23	(31)
Sockeye salmon[2]	*O. nerka*	0	1	0	1	(1)
Pink salmon[3]	*O. gorbuscha*	3	11	3	17	(23)
Coho salmon[3]	*O. kisutch*	1	3	9	13	(17)
Chum salmon[3]	*O. keta*	2	1	1	4	(5)
		Non-salmonids				
Walleye pollock	*Theragra chalcogramma*	15	7	3	25	(33)
Crested sculpin	*Blepsias bilobus*	4	18	14	36	(48)
Squid	Gonatidae	1	2	3	6	(8)
Capelin	*Mallotus villosus*	0	0	1	1	(1)
Pacific spiny lumpsucker	*Eumicrotremus orbis*	2	4	3	9	(12)
Pacific sandlance	*Ammodytes hexapterus*	1	0	0	1	(1)
Wolf-eel	*Anarrhichthys ocellatus*	2	2	0	4	(5)
Fish larvae (unid.)	Teleostomi	1	0	0	1	(1)
Black rockfish	*Sebastes melanops*	0	0	1	1	(1)
Salmon shark	*Lamna ditropis*	0	2	1	3	(4)
Prowfish	*Zaprora silenus*	2	0	0	2	(3)
Sablefish	*Anoplopoma fimbria*	0	0	1	1	(1)
Spiny dogfish	*Squalus acanthias*	1	1	0	2	(3)
Soft sculpin	*Psychrolutes sigalutes*	1	0	0	1	(1)
Pacific sandfish	*Trichodon trichodon*	1	0	0	1	(1)
Smooth lumpsucker	*Aptocyclus ventricosus*	0	0	1	1	(1)
Bigmouth sculpin	*Hemitripterus bolini*	1	0	0	1	(1)

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

Table 9.—Length (mm, fork), weight (g), and condition [(weight/length^3)·(10^5)] of juvenile pink salmon captured in different marine habitats of the northern region of southeastern Alaska by rope trawl, June–August 2002.

		June				July				August			
Locality	Factor	*n*	range	mean	sd	*n*	range	mean	sd	*n*	range	mean	sd
Upper Chatham Strait	Length	3	96-104	100.3	4.0	281	91-184	123.4		17	112-195	169.2	23.6
	Weight	3	7.4-9.7	8.5	1.2	143	6.2-63.8	20.2	9.6	17	13.0-74.4	49.8	18.9
	Condition	3	0.7-1.1	0.9	0.2	143	0.6-1.4	0.9	0.1	17	0.9-1.1	1.0	0.1
Icy Strait	Length	17	70-116	83.5	10.4	1061	85-171	111.5	10.8	850	106-211	142.5	15.5
	Weight	14	2.4-13.3	5.3	2.5	289	6.2-43.6	13.9	5.3	285	10.5-94.5	32.2	13.5
	Condition	14	0.7-0.9	0.8	0.1	289	0.7-1.0	0.9	0.1	285	0.8-1.1	0.9	0.1
Icy Point	Length	—	—	—	—	239	79-200	119.7	21.5	62	103-189	136.3	15.4
	Weight	—	—	—	—	140	5.2-83.4	18.6	11.2	62	10.3-77.4	23.9	11.5
	Condition	—	—	—	—	140	07-1.1	0.9	0.1	62	0.8-1.2	0.9	0.1
Total	Length	20	70-116	86.1	11.5	1581	79-200	114.8	15.1	929	103-211	142.6	16.1
	Weight	17	2.4-13.3	5.9	2.6	572	5.2-83.4	16.7	8.7	364	10.3-94.5	31.6	14.4
	Condition	17	0.7-1.1	0.8	0.1	572	0.6-1.4	0.9	0.1	364	0.8-1.2	0.9	0.1

Table 10.—Length (mm, fork), weight (g), and condition [(weight/ length^3)·(10^5)] of juvenile chum salmon captured in different marine habitats of the northern region of southeastern Alaska by rope trawl, June–August 2002.

		June				July				August			
Locality	Factor	*n*	range	mean	sd	*n*	range	mean	sd	*n*	range	mean	sd
Upper Chatham Strait	Length	27	81-121	100.2	9.8	370	88-186	127.1	15.8	1	129	129.0	0.0
	Weight	27	4.5-15.1	9.4	3.1	207	6.7-66.8	22.3	9.7	1	18.7	18.7	0.0
	Condition	27	0.8-1.0	0.9	0.1	207	0.6-1.5	1.0	0.1	1	0.9	0.9	0.0
Icy Strait	Length	50	75-114	93.2	10.2	861	91-160	122.0	11.1	166	88-227	144.6	20.3
	Weight	47	3.2-14.3	7.1	2.5	366	7.1-37.6	18.3	4.9	165	6.6-119.0	30.4	14.3
	Condition	47	0.8-1.0	0.9	0.1	366	0.8-1.1	0.9	0.1	165	0.8-1.2	1.0	0.1
Icy Point	Length	—	—	—	—	110	97-196	131.4	16.1	9	123-175	150.8	14.9
	Weight	—	—	—	—	109	7.9-76.3	21.2	10.1	9	15.8-51.1	33.1	10.6
	Condition	—	—	—	—	109	0.7-1.0	0.9	0.1	9	0.9-1.0	0.9	0.1
Total	Length	77	75-121	95.7	10.5	1341	88-196	124.2	13.4	176	88-227	144.9	20.0
	Weight	74	3.2-15.1	8.0	2.9	682	6.7-76.3	20.0	7.8	175	6.6-119.0	30.5	14.1
	Condition	74	0.8-1.0	0.9	0.1	682	0.6-1.5	0.9	0.1	175	0.8-1.2	1.0	0.1

Table 11.—Length (mm, fork), weight (g), and condition [(weight/ length^3)·(10^5)] of juvenile sockeye salmon captured in different marine habitats of the northern region of southeastern Alaska by rope trawl, June–August 2002.

		June				July				August			
Locality	Factor	*n*	range	mean	sd	*n*	range	mean	sd	*n*	range	mean	sd
Upper Chatham Strait	Length	9	93-130	115.4	13.0	102	95-189	159.0	18.4	1	180	180.0	0.0
	Weight	9	6.6-23.3	15.1	5.5	92	8.2-69.2	42.0	13.7	1	60.1	60.1	0.0
	Condition	9	0.8-1.1	0.9	0.1	92	0.8-1.2	1.0	0.1	1	1.0	1.0	0.0
Icy Strait	Length	9	101-157	128.0	17.5	47	79-189	124.4	23.3	67	90-201	138.1	29.8
	Weight	9	9.1-38.2	20.4	9.0	44	5.2-66.7	21.3	14.8	66	6.8-81.69	30.0	19.7
	Condition	9	0.9-1.0	0.9	0.0	44	0.4-1.1	1.0	0.1	66	0.8-1.2	1.0	0.1
Icy Point	Length	—	—	—	—	28	112-187	152.6	18.6	5	125-188	144.8	25.6
	Weight	—	—	—	—	27	12.2-64.1	35.9	14.0	5	18.0-68.5	32.2	20.8
	Condition	—	—	—	—	27	0.8-1.1	1.0	0.1	5	0.5-2.1	1.1	0.6
Total	Length	18	93-157	121.7	16.3	177	79-189	148.8	24.8	73	90-201	139.1	29.7
	Weight	18	6.6-38.2	17.8	7.7	163	5.2-69.2	35.4	16.5	72	6.8-81.6	30.6	19.8
	Condition	18	0.8-1.1	0.9	0.1	163	0.4-1.2	1.0	0.1	72	0.5-2.1	1.0	0.2

Table 12.—Length (mm, fork), weight (g), condition [(weight/ length^3)·(10^5)], and whole body energy content (WBEC) of juvenile coho salmon captured in different marine habitats of the northern region of southeastern Alaska by rope trawl, June–August 2002.

		June				July				August			
Locality	Factor	*n*	range	mean	sd	*n*	range	mean	sd	*n*	range	mean	sd
Upper Chatham Strait	Length	32	120-210	152.1	21.5	120	160-245	208.2	16.8	11	191-281	249.2	27.4
	Weight	32	17.9-120.8	44.6	22.1	118	47.1-168.0	108.0	27.0	11	81.5-276.1	184.1	57.5
	Condition	32	0.7-1.3	1.2	0.1	118	1.0-1.4	1.2	0.1	11	1.0-1.2	1.2	0.1
	WBEC	10	4871.7-5014.8	4871.8	41.2	27	4634.2-5076.7	4894.0	127.5	5	4781.2-5870.9	5156.2	505.2
Icy Strait	Length	18	111-182	155.8	18.0	138	177-251	212.0	16.0	39	167-286	222.1	26.4
	Weight	18	14.4-66.3	45.0	15.1	138	61.6-192.1	112.6	27.1	39	48.0-241.0	132.6	47.6
	Condition	18	1.0-1.3	1.1	0.1	138	1.0-2.3	1.2	0.1	39	1.0-3.3	1.2	0.4
	WBEC	10	4853.7-5237.9	5002.7	118.5	28	4537.9-5166.4	4878.2	140.7	4	4801.6-4865.3	4829.2	31.3
Icy Point	Length	—	—	—	—	14	201-299	241.9	29.1	10	229-307	270.1	24.2
	Weight	—	—	—	—	14	85.7-308.8	169.1	64.2	10	157.7-364.8	257.8	62.6
	Condition	—	—	—	—	14	1.0-1.2	1.1	0.1	10	1.2-1.4	1.3	0.1
Total	Length	50	111-210	153.4	20.2	272	160-299	211.9	18.6	60	167-307	235.1	31.9
	Weight	50	14.4-120.8	44.7	19.7	270	47.1-308.8	113.5	32.6	60	48.0-364.8	162.9	69.5
	Condition	50	0.7-1.3	1.2	0.1	270	1.0-2.3	1.2	0.1	60	1.0-3.3	1.2	0.3
	WBEC	20	4853.7-5237.9	4979.9	89.5	55	4537.9-5166.4	4885.2	132.3	9	4781.2-5870.9	5010.8	397.1

Table 13.—Length (mm, fork), weight (g), and condition [(weight/ length^3)·(10^5)] of juvenile chinook salmon captured in different marine habitats of the northern region of southeastern Alaska by rope trawl, June–August 2002.

		June				July				August			
Locality	Factor	*n*	range	mean	sd	*n*	range	mean	sd	*n*	range	mean	sd
Upper Chatham Strait	Length	5	152-233	187.2	30.4	2	208-252	230.0	31.1	1	236	236	0.0
	Weight	4	40.8-93.5	67.9	21.6	2	119.0-215.3	167.2	68.1	1	166.7	166.7	0.0
	Condition	4	1.2-1.3	1.2	0.1	2	1.3-1.4	1.3	0.0	1	1.3	1.3	0.0
Icy Strait	Length	1	195	195.0	0.0	1	227	227.0	0.0	5	151-282	234.8	50.5
	Weight	1	104.6	104.6	0.0	1	162.4	162.4	0.0	5	31.4-291.8	186.4	99.2
	Condition	1	1.4	1.4	0.0	1	1.4	1.4	0.0	5	0.9-1.4	1.2	0.2
Icy Point	Length	2	193-290	241.5	68.6	4	215-310	260.8	40.5	—	—	—	—
	Weight	2	90.4-327.6	209.0	167.7	4	131.9-381.3	237.8	104.7	—	—	—	—
	Condition	2	1.3-1.3	1.3	0.1	4	1.1-1.4	1.3	0.1	—	—	—	—
Total	Length	8	152-290	201.8	42.5	7	208-310	247.1	35.6	6	151-282	235.0	45.1
	Weight	7	40.8-327.6	113.4	96.8	7	119.0-381.3	206.9	88.0	6	31.4-291.8	183.1	89.1
	Condition	7	1.2-1.4	1.3	0.1	7	1.1-1.4	1.3	0.1	6	0.9-1.4	1.3	0.2

Table 14.—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, June–August 2002. Station codes and coordinates are shown in Table 1.

		Release information						Recovery information							
Species	Coded-wire tag code	Brood year	Agency[1]	Locality	Date	(mm)	(g)	Locality	Station code	Date	(mm)	(g)	Age	Days since release	Distance traveled (km)
June															
Chinook	04:01/56	1999	DIPAC	Fish Creek, AK	06/13/01	—	—	Chatham Strait	UCD	06/25/02	377	690.0	1.1	377	55
Chinook	No tag	—	—	—	—	—	—	Chatham Strait	UCB	06/25/02	378	745.0	—	—	—
Chinook	No tag	—	—	—	—	—	—	Chatham Strait	UCB	06/25/02	352	597.0	—	—	—
July															
Chinook	18:31/31	2000	CDFO	Wannock River, B.C.	06/28/01	—	3.5	Chatham Strait	UCC	07/23/02	344	560.0	0.1	390	700
Chinook	63:06/92	2000	WDFW	Lewis River, WA	03/20/02	—	53.7	Icy Point	IPA	07/30/02	310	381.3	1.0	132	1600
Chinook	No tag	—	—	—	—	—	—	Icy Point	IPA	07/29/02	215	132.1	—	—	—
Coho	04:04/76	2000	ADFG	Berners River, AK	05/25/02	105	—	Chatham Strait	UCA	07/23/02	217	121.6	1.0	60[2]	40
Coho	04:04/76	2000	ADFG	Berners River, AK	05/25/02	105	—	Icy Strait	ISC	07/26/02	245	172.9	1.0	60[2]	80
Coho	04:04/76	2000	ADFG	Berners River, AK	05/25/02	105	—	Icy Strait	ISA	07/24/02	204	95.9	1.0	60[2]	70
Coho	04:05/52	2000	ADFG	Chilkat River, AK	05/19/02	86	6.4	Chatham Strait	UCA	07/23/02	201	89.1	1.0	—	—
Coho	04:05/73	2000	DIPAC	Sheep Creek, AK	05/21/02	—	12.3	Icy Strait	ISA	07/24/02	177	61.7	1.0	64	70
Coho	04:05/77	2000	DIPAC	Sheep Creek, AK	05/21/02	—	12.3	Icy Strait	ISA	07/24/02	212	107.2	1.0	64	70
Coho	04:32/08	2000	ADFG	Berners River, AK	06/10/02	105	—	Icy Strait	ISD	07/24/02	207	102.9	1.0	44[3]	80
Coho	04:48/32	2000	NSRAA	Kasnyku Bay, AK	06/05/02	—	22.1	Icy Strait	ISD	07/24/02	219	124.0	1.0	49	130
Coho	04:48/33	2000	NSRAA	Kasnyku Bay, AK	06/01/02	—	20.5	Chatham Strait	UCC	07/23/02	203	105.0	1.0	—	—
Coho	04:48/33	2000	NSRAA	Kasnyku Bay, AK	06/01/02	—	20.5	Chatham Strait	UCC	07/23/02	227	140.9	1.0	52	100
Coho	04:48/33	2000	NSRAA	Kasnyku Bay, AK	06/01/02	—	20.5	Icy Strait	ISC	07/24/02	236	154.8	1.0	53	130
Coho	04:48/51	2000	NSRAA	Kasnyku Bay, AK	06/05/02	—	22.4	Icy Strait	ISD	07/26/02	187	70.4	1.0	51	130
Coho	63:10/90	2000	WDFW	NF Toutle River, WA	5/02/02[4]	140	29.1	Icy Point	IPB	07/30/02	237	149.7	1.0	89	1600
Coho	No tag	—	—	—	—	—	—	Icy Point	IPB	07/30/02	225	138.2	—	—	—
Coho	No tag	—	—	—	—	—	—	Icy Point	IPB	07/30/02	264	222.6	—	—	—
Coho	No tag	—	—	—	—	—	—	Icy Point	IPB	07/30/02	275	257.0	—	—	—
August															
Chinook	04:01/57	1999	DIPAC	Auke Bay, AK	06/13/01	—	24.0	Icy Strait	ISD	08/28/02	392	750.0	1.1	410	45
Chinook	No tag	—	—	—	—	—	—	Chatham Strait	UCC	08/29/02	236	166.7	—	—	—

Table 14.—(Cont.)

		Release information						Recovery information							
Species	Coded-wire tag code	Brood year	Agency	Locality	Date	(mm)	(g)	Locality	Station code	Date	(mm)	(g)	Age	Days since release	Distance traveled (km)
Coho	04:03/99	1999	ADFG	Chickamin River, AK	10/19/01	81[5]	5.2	Icy Point	IPA	08/26/02	259	246.5	2.0	100	350
Coho	04:05/57	2000	DIPAC	Gastineau Ch., AK	06/17/02	—	19.1	Icy Strait	ISC	08/24/02	180	193.2	1.0	71	100
Coho	04:06/66	2000	SSRAA	Burnett Inlet, AK	05/28/02	137	25.9	Icy Point	IPB	08/26/02	277	270.4	1.0	91	65

[1]ADFG = Alaska Department of Fish and Game; CDFO = Canadian Department of Fisheries and Oceans; DIPAC = Douglas Island Pink and Chum; NSRAA = Northern Southeast Regional Aquaculture Association; SSRAA = Southern Southeast Regional Aquaculture Association; WDFW = Washington Department of Fish and Wildlife.

[2] Released from 14 May to 06 June 2002.

[3] Released from 06 June to 13 June 2002.

[4] Released from 29 April to 06 May 2002.

[5] Size data and release date are for fry, smolt released in 2002.

Table 15.—Stock-specific information on juvenile chum salmon captured in different marine habitats of the northern region of southeastern Alaska by rope trawl, June–August 2002. Numbers (*n*), ranges, means, and standard deviations (sd) are shown for fork length (mm), weight (g), and Fulton's condition factor ($g/FL^3 \cdot 10^5$).

		June				July				August			
Locality	Factor	*n*	range	mean	sd	*n*	range	mean	sd	*n*	range	mean	sd
DIPAC													
Upper	Length	1	81	81.0	0.0	5	111-147	130.6	12.8	—	—	—	—
Chatham	Weight	1	4.5	4.5	0.0	5	12.6-27.1	21.5	5.4	—	—	—	—
Strait	Condition	1	0.9	0.9	0.0	5	0.9-1.0	1.0	0.1	—	—	—	—
Icy	Length	3	89-93	91.0	2.0	10	99-138	123.4	13.6	5	122-147	134.8	11.3
Strait	Weight	3	5.9-7.1	6.4	0.6	10	9.5-24.2	18.6	5.5	5	16.2-30.2	23.0	6.4
	Condition	3	0.8-0.9	0.8	0.1	10	0.9-1.1	1.0	0.1	5	0.8-1.0	0.9	0.1
Icy	Length	—	—	—	—	5	119-139	127.4	7.3	2	148-150	149.0	1.4
Point	Weight	—	—	—	—	5	14.1-19.8	17.1	2.1	2	28.7-31.0	29.9	1.6
	Condition	—	—	—	—	5	0.7-0.9	0.8	0.1	2	0.9-1.0	0.9	0.1
Total	Length	4	81-93	88.5	5.3	20	99-147	126.2	11.9	7	122-150	138.9	11.6
	Weight	4	4.5-7.1	5.9	1.1	20	9.5-27.1	18.9	4.9	7	16.2-31.0	24.9	6.3
	Condition	4	0.8-0.9	0.8	0.0	20	0.7-1.1	0.9	0.1	7	0.8-1.0	0.9	0.1
Hidden Falls													
Upper	Length	—	—	—	—	115	95-153	128.4	10.7	—	—	—	—
Chatham	Weight	—	—	—	—	115	7.2-35.4	20.7	5.4	—	—	—	—
Strait	Condition	—	—	—	—	115	0.6-1.2	1.0	0.1	—	—	—	—
Icy	Length	2	97-111	104.0	9.9	220	105-149	126.5	9.0	14	119-151	138.4	11.4
Strait	Weight	2	7.9-11.3	9.6	2.4	220	9.4-31.4	18.8	4.4	14	15.1-33.7	25.5	6.5
	Condition	2	0.8-0.9	0.9	0.0	220	0.8-1.1	0.9	0.1	14	0.8-1.0	0.9	0.1

Table 15.—(Cont.)

Locality	Factor	June				July				August			
		n	range	mean	sd	*n*	range	mean	sd	*n*	range	mean	sd
Icy Point	Length	—	—	—	—	43	109-149	128.7	9.2	—	—	—	—
	Weight	—	—	—	—	43	9.9-30.2	18.9	4.5	—	—	—	—
	Condition	—	—	—	—	43	0.7-1.0	0.9	0.1	—	—	—	—
Total	Length	2	97-111	104.0	9.9	378	95-153	127.3	9.6	14	119-151	138.4	11.4
	Weight	2	7.9-11.3	9.6	2.4	378	7.2-35.4	19.4	4.8	14	15.1-33.7	25.5	6.5
	Condition	2	0.8-0.9	0.9	0.0	378	0.6-1.2	0.9	0.1	14	0.8-1.0	0.9	0.1
Unmarked													
Upper Chatham Strait	Length	32	88-121	102.3	9.8	86	93-186	131.1	22.6	1	129	129.0	0.0
	Weight	32	5.8-15.1	10.1	3.2	86	6.7-66.8	24.3	13.3	1	18.7	18.7	0.0
	Condition	32	0.8-1.0	0.9	0.1	86	0.8-1.1	1.0	0.1	1	0.9	0.9	0.0
Icy Strait	Length	64	75-114	93.6	9.9	136	91-158	121.8	12.7	144	88-227	145.1	21.0
	Weight	64	3.2-14.3	7.2	2.3	136	7.1-37.6	17.5	5.6	144	6.6-119.0	30.9	14.8
	Condition	64	0.8-1.0	0.9	0.1	136	0.8-1.1	0.9	0.1	144	0.8-1.2	1.0	0.1
Icy Point	Length	—	—	—	—	61	97-196	133.9	19.8	7	123-175	151.3	17.1
	Weight	—	—	—	—	61	7.9-76.3	23.2	12.7	7	15.8-51.1	34.0	12.0
	Condition	—	—	—	—	61	0.8-1.0	0.9	0.1	7	0.9-1.0	0.9	0.1
Total	Length	96	75-121	96.5	10.6	283	91-196	127.2	18.5	152	88-227	145.3	20.8
	Weight	96	3.2-15.1	8.2	3.0	283	6.7-76.3	20.8	10.6	152	6.6-119.0	31.0	14.7
	Condition	96	0.8-1.0	0.9	0.1	283	0.8-1.1	0.9	0.1	152	0.8-1.2	1.0	0.1

Table 16.—Stock-specific information on juvenile sockeye salmon captured in different marine habitats of the northern region of southeastern Alaska by rope trawl, June–August 2002. Numbers (*n*), ranges, means, and standard deviations (sd) are shown for fork length (mm), weight (g), and Fulton's condition factor ($g/FL^3 \cdot 10^5$).

		June				July				August			
Locality	Factor	*n*	range	mean	sd	*n*	range	mean	sd	*n*	range	mean	sd
Snettisham													
Upper	Length	3	114-130	120.7	8.3	22	111-175	153.1	15.5	—	—	—	—
Chatham	Weight	3	15.2-23.3	18.0	4.6	22	12.3-61.2	39.7	11.6	—	—	—	—
Strait	Condition	3	0.9-1.1	1.0	0.1	22	0.9-1.2	1.1	0.1	—	—	—	—
Icy	Length	1	129	129.0	0.0	5	125-157	140.0	12.4	5	115-201	163.6	32.5
Strait	Weight	1	20.4	20.4	0.0	5	20.8-43.4	29.2	8.9	5	14.6-81.6	49.0	25.4
	Condition	1	1.0	1.0	0.0	5	1.0-1.1	1.0	0.1	5	1.0-1.1	1.0	0.0
Icy	Length	—	—	—	—	1	140	140.0	0.0	—	—	—	—
Point	Weight	—	—	—	—	1	26.9	26.9	0.0	—	—	—	—
	Condition	—	—	—	—	1	1.0	1.0	0.0	—	—	—	—
Total	Length	4	114-130	122.8	8.0	28	111-175	150.3	15.5	5	115-201	163.6	32.5
	Weight	4	15.2-23.3	18.6	3.9	28	12.3-61.2	37.4	11.7	5	14.6-81.6	49.0	25.4
	Condition	4	0.9-1.1	1.0	0.1	28	0.9-1.2	1.1	0.1	5	1.0-1.1	1.0	0.0
Tahltan													
Upper	Length	—	—	—	—	1	163	163.0	0.0	—	—	—	—
Chatham	Weight	—	—	—	—	1	46	46.0	0.0	—	—	—	—
Strait	Condition	—	—	—	—	1	1.1	1.1	0.0	—	—	—	—
Icy	Length	—	—	—	—	—	—	—	—	1	179	179	0.0
Strait	Weight	—	—	—	—	—	—	—	—	1	56.3	56.3	0.0
	Condition	—	—	—	—	—	—	—	—	1	1.0	1.0	0.0

Table 16.—(Cont.)

Locality	Factor	June				July				August			
		n	range	mean	sd	*n*	range	mean	sd	*n*	range	mean	sd
Total	Length	—	—	—	—	1	163	163.0	0.0	1	179	179	0.0
	Weight	—	—	—	—	1	46	46.0	0.0	1	56.3	56.3	0.0
	Condition	—	—	—	—	1	1.1	1.1	0.0	1	1.0	1.0	0.0
Tatsumenie													
Total (Icy Strait)	Length	—	—	—	—	1	129	129.0	0.0	—	—	—	—
	Weight	—	—	—	—	1	20.5	20.5	0.0	—	—	—	—
	Condition	—	—	—	—	1	1.0	1.0	0.0	—	—	—	—
Sweetheart Lake													
Total (U. Chatham Strait)	Length	1	180	180.0	0.0	—	—	—	—	—	—	—	—
	Weight	1	60.1	60.1	0.0	—	—	—	—	—	—	—	—
	Condition	1	1.0	1.0	0.0	—	—	—	—	—	—	—	—
Unmarked													
Upper Chatham Strait	Length	6	93-127	112.8	14.8	68	95-189	160.7	19.9	—	—	—	—
	Weight	6	6.6-19.0	13.7	5.6	68	8.2-69.2	42.9	14.4	—	—	—	—
	Condition	6	0.8-1.0	0.9	0.1	68	0.8-1.1	1.0	0.1	—	—	—	—
Icy Strait	Length	8	101-157	127.9	18.7	37	79-189	122.9	24.6	57	90-199	135.1	28.6
	Weight	8	9.1-38.2	20.4	9.6	37	5.2-66.7	20.6	15.5	57	6.8-75.4	27.6	18.3
	Condition	8	0.9-1.0	0.9	0.0	37	0.4-1.1	1.0	0.1	57	0.8-1.2	1.0	0.1
Icy Point	Length	—	—	—	—	26	112-187	152.9	19.1	5	125-188	144.8	25.6
	Weight	—	—	—	—	26	12.2-64.1	36.3	14.2	5	18.0-68.5	32.2	20.8
	Condition	—	—	—	—	26	0.8-1.1	1.0	0.1	5	0.5-2.1	1.1	0.6
Total	Length	14	93-157	121.4	18.2	131	79-189	148.5	26.6	62	90-199	135.9	28.3
	Weight	14	6.6-38.2	17.5	8.6	131	5.2-69.2	35.3	17.4	62	6.8-75.4	28.0	18.4
	Condition	14	0.8-1.0	0.9	0.0	131	0.4-1.1	1.0	0.1	62	0.5-2.1	1.0	0.2

Table 17.—Stock-specific information on juvenile coho salmon captured in different marine habitats of the northern region of southeastern Alaska by rope trawl, June–August 2002. Numbers (*n*), ranges, means, and standard deviations (sd) are shown for fork length (mm), weight (g), and Fulton's condition factor ($g/FL^3 \cdot 10^5$).

		June				July				August			
Locality	Factor	*n*	range	mean	sd	*n*	range	mean	sd	*n*	range	mean	sd
DIPAC													
Upper	Length	—	—	—	—	2	175-195	185.0	14.1	—	—	—	—
Chatham	Weight	—	—	—	—	2	54.5-90.7	72.6	25.6	—	—	—	—
Strait	Condition	—	—	—	—	2	1.0-1.2	1.1	0.2	—	—	—	—
Icy	Length	—	—	—	—	4	181-187	184.3	2.5	9	184-215	201.4	10.0
Strait	Weight	—	—	—	—	4	65.7-70.1	67.7	1.9	9	64.8-126.0	92.8	19.2
	Condition	—	—	—	—	4	1.1	1.1	0.0	9	1.0-1.3	1.1	0.1
Total	Length	—	—	—	—	6	175-195	184.5	6.6	9	184-215	201.4	10.0
	Weight	—	—	—	—	6	54.5-90.7	69.3	11.8	9	64.8-126.0	92.8	19.2
	Condition	—	—	—	—	6	1.0-1.2	1.1	0.1	9	1.0-1.3	1.1	0.1
Port Armstrong													
Icy	Length	—	—	—	—	1	251	251.0	0.0	—	—	—	—
Strait	Weight	—	—	—	—	1	192.1	192.1	0.0	—	—	—	—
	Condition	—	—	—	—	1	1.2	1.2	0.0	—	—	—	—
Icy	Length	—	—	—	—	1	225	225.0	0.0	—	—	—	—
Point	Weight	—	—	—	—	1	138.2	138.2	0.0	—	—	—	—
	Condition	—	—	—	—	1	1.2	1.2	0.0	—	—	—	—
Total	Length	—	—	—	—	2	225-251	238.0	18.4	—	—	—	—
	Weight	—	—	—	—	2	138.2-192.1	165.2	38.1	—	—	—	—
	Condition	—	—	—	—	2	1.2	1.2	0.0	—	—	—	—

Table 17.—(Cont.)

Locality	Factor	June *n*	June range	June mean	June sd	July *n*	July range	July mean	July sd	August *n*	August range	August mean	August sd
Unmarked													
Upper	Length	31	120-210	151.5	21.6	112	160-245	208.6	16.7	11	191-281	249.2	27.4
Chatham	Weight	31	17.9-120.8	44.0	22.2	112	47.1-168.0	108.4	27.0	11	81.5-276.1	184.1	57.5
Strait	Condition	31	0.7-1.3	1.2	0.1	112	1.0-1.4	1.2	0.1	11	1.0-1.2	1.2	0.1
Icy	Length	18	111-182	155.8	18.0	125	179-250	212.6	14.6	29	167-286	229.9	25.5
Strait	Weight	18	14.4-66.3	45.0	15.1	125	61.6-180.0	113.4	24.7	29	48.0-241.0	142.9	47.2
	Condition	18	1.0-1.3	1.1	0.1	125	1.0-2.3	1.2	0.1	29	1.0-1.3	1.1	0.1
Icy	Length	—	—	—	—	12	201-299	243.8	31.1	8	229-307	270.6	26.9
Point	Weight	—	—	—	—	12	85.7-308.8	173.3	68.8	8	157.7-364.8	257.7	70.7
	Condition	—	—	—	—	12	1.0-1.2	1.1	0.1	8	1.2-1.4	1.3	0.1
Total	Length	49	111-210	153.1	20.3	249	160-299	212.3	18.2	48	167-307	241.1	29.9
	Weight	49	14.4-120.8	44.3	19.7	249	47.1-308.8	114.1	32.0	48	48.0-364.8	171.5	67.7
	Condition	49	0.7-1.3	1.2	0.1	249	1.0-2.3	1.2	0.1	48	1.0-1.4	1.2	0.1

Table 18.—Stock-specific information on juvenile chinook salmon captured in different marine habitats of the northern region of southeastern Alaska by rope trawl, June–August 2002. Numbers (*n*), ranges, means, and standard deviations (sd) are shown for fork length (mm), weight (g), and Fulton's condition factor ($g/FL^3 \cdot 10^5$).

		June				July				August			
Locality	Factor	*n*	range	mean	sd	*n*	range	mean	sd	*n*	range	mean	sd
Hidden Falls													
Upper	Length	3	152-197	177.0	22.9	1	208	208.0	0.0	—	—	—	—
Chatham	Weight	3	40.8-93.5	68.4	26.4	1	119.0	119.0	0.0	—	—	—	—
Strait	Condition	3	1.2	1.2	0.0	1	1.3	1.3	0.0	—	—	—	—
Icy	Length	—	—	—	—	1	227	227.0	0.0	3	229-282	256.0	26.5
Strait	Weight	—	—	—	—	1	162.4	162.4	0.0	3	155.1-291.8	224.5	68.4
	Condition	—	—	—	—	1	1.4	1.4	0.0	3	1.3	1.3	0.0
Total	Length	3	152-197	177.0	22.9	2	208-227	217.5	13.4	3	229-282	256.0	26.5
	Weight	3	40.8-93.5	68.4	26.4	2	119.0-162.4	140.7	30.7	3	155.1-291.8	224.5	68.4
	Condition	3	1.2	1.2	0.0	2	1.3-1.4	1.4	0.1	3	1.3	1.3	0.0
Medvejie													
Upper	Length	—	—	—	—	1	252	252.0	0.0	—	—	—	—
Chatham	Weight	—	—	—	—	1	215.3	215.3	0.0	—	—	—	—
Strait	Condition	—	—	—	—	1	1.4	1.4	0.0	—	—	—	—
Icy	Length	1	193	193.0	0.0	1	273	273.0	0.0	—	—	—	—
Point	Weight	1	90.4	90.4	0.0	1	232.9	232.9	0.0	—	—	—	—
	Condition	1	1.3	1.3	0.0	1	1.1	1.1	0.0	—	—	—	—
Total	Length	1	193	193.0	0.0	2	252-273	262.5	14.9	—	—	—	—
	Weight	1	90.4	90.4	0.0	2	215.3-232.9	224.1	12.5	—	—	—	—
	Condition	1	1.3	1.3	0.0	2	1.1-1.4	1.3	0.1	—	—	—	—

Table 18.—(Cont.)

Locality	Factor	June				July				August			
		n	range	mean	sd	*n*	range	mean	sd	*n*	range	mean	sd
Unmarked													
Upper	Length	—	—	—	—	—	—	—	—	1	236	236.0	0.0
Chatham	Weight	—	—	—	—	—	—	—	—	1	166.7	166.7	0.0
Strait	Condition	—	—	—	—	—	—	—	—	1	1.3	1.3	0.0
Icy	Length	1	195	195.0	0.0	—	—	—	—	2	151-255	203.0	73.5
Strait	Weight	1	104.6	104.6	0.0	—	—	—	—	2	31.4-227.3	129.4	138.5
	Condition	1	1.4	1.4	0.0	—	—	—	—	2	0.9-1.4	1.1	0.3
Icy	Length	1	290	290.0	0.0	2	215-310	262.5	67.2	—	—	—	—
Point	Weight	1	327.6	327.6	0.0	2	131.9-381.3	256.6	176.4	—	—	—	—
	Condition	1	1.3	1.3	0.0	2	1.3	1.3	0.0	—	—	—	—
Total	Length	2	195-290	242.5	67.2	2	215-310	262.5	67.2	3	151-255	214.0	55.4
	Weight	2	104.6-327.6	216.1	157.7	2	131.9-381.3	256.6	176.4	3	31.4-227.3	141.8	100.3
	Condition	2	1.3-1.4	1.4	0.1	2	1.3	1.3	0.0	3	0.9-1.4	1.2	0.2

Table 19.—Number of potential predators of juvenile salmon examined, number of empty stomachs, percentage of predator stomachs that contained food, and number and percentage of feeding fish that ate juvenile salmon, in different marine habitats of the northern region of southeastern Alaska by rope trawl, June–August 2002. Abbreviations: A = adult, I =immature, J = juvenile.

Predator species	Life history stage	Number examined	Number empty	Percent feeding	Number with salmon	Percent feeders with salmon
	Predation on juvenile salmon					
Coho salmon	A	16	3	81.3	3	23.0
Sablefish	J	2	0	100.0	2	100.0
	No predation on juvenile salmon					
Chinook salmon	I	31	8	74.2	0	0
Chum salmon	A	6	2	66.7	0	0
Pink salmon	A	20	5	75.0	0	0
Sockeye salmon	I	1	1	0	0	0
Pacific sandfish	A	1	1	0	0	0
Spiny dogfish	A	2	1	50.0	0	0
Walleye pollock	J	56	7	87.5	0	0
Total		135	28	79.3	5	4.6

Table 20.—Length (mm, fork), weight (g), and stomach percent fullness of nine species of potential predators of juvenile salmon captured in different marine habitats of the northern region of southeastern Alaska by rope trawl, June–August 2002. Asterisks denote fish pooled across months due to small sample sizes.

		June				July				August			
Species	Factor	*n*	range	mean	sd	*n*	range	mean	sd	*n*	range	mean	sd
Chinook	Length	17	272-556	355.3	69.1	9	344-650	454.2	129.5	5	392-530	448.4	51.0
salmon	Weight	17	230-2050	627.9	422.2	9	370-3700	1142.2	1146.9	5	750-1850	1188.0	405.2
	Fullness	17	0-100	66.8	33.0	9	0-110	49.4	38.9	5	0-110	22.0	49.2
Pink	Length	3	465-530	505.0	35.0	14	418-542	492.8	30.3	3	405-495	450.0	45.0
salmon	Weight	3	1100-1800	1506.7	363.5	14	820-2050	1388.6	319.5	3	600-1550	1048.3	477.2
	Fullness	3	10-75	45.0	32.8	14	0-110	57.9	34.2	3	0-75	25.0	43.3
Chum*	Length	6	625-775	685.7	61.2	—	—	—	—	—	—	—	—
salmon	Weight	6	2600-7500	4197	1819.9	—	—	—	—	—	—	—	—
	Fullness	6	0-100	45.8	40.1	—	—	—	—	—	—	—	—
Coho*	Length	16	385-717	617.1	85.6	—	—	—	—	—	—	—	—
salmon	Weight	16	750-4950	2997	1039.8	—	—	—	—	—	—	—	—
	Fullness	16	0-110	66.3	46.8	—	—	—	—	—	—	—	—
Sockeye*	Length	1	335	335.0	0.0	—	—	—	—	—	—	—	—
salmon	Weight	1	450	450.0	0.0	—	—	—	—	—	—	—	—
	Fullness	1	0	0.0	0.0	—	—	—	—	—	—	—	—
Walleye	Length	44	235-587	331.8	112.6	5	350-605	494.6	93.0	4	280-530	385.0	109.6
pollock	Weight	43	80-1100	363.2	314.9	5	220-1250	782.0	373.5	4	150-1050	525.0	382.6
	Fullness	47	0-110	53.6	29.3	5	0-110	61.0	48.8	4	10-100	48.8	45.9

Table 20.—(Cont.)

Species	Factor	June				July				August			
		n	range	mean	sd	*n*	range	mean	sd	*n*	range	mean	sd
Spiny*	Length	2	740-770	755.0	21.2	—	—	—	—	—	—	—	—
dogfish	Weight	2	2500-2600	2550.0	70.7	—	—	—	—	—	—	—	—
	Fullness	2	0-75	37.5	53.0	—	—	—	—	—	—	—	—
Pacific*	Length	1	234	234.0	0.0	—	—	—	—	—	—	—	—
sandfish	Weight	1	160	160.0	0.0	—	—	—	—	—	—	—	—
	Fullness	1	0	0.0	0.0	—	—	—	—	—	—	—	—
Sablefish	Length	2	338-394	366.0	39.6	—	—	—	—	—	—	—	—
	Weight	2	510-580	545.0	49.5	—	—	—	—	—	—	—	—
	Fullness	2	110	110.0	0.0	—	—	—	—	—	—	—	—

Appendix 1.—Catches and life history stage of salmonids captured in marine waters of the northern region of southeastern Alaska by rope trawl, June–August 2002. Nocturnal sampling was conducted at 0400 hours at the ISC station for Haul# 6048.

			Juvenile					Immature		Adult		
Date	Haul#	Station	Pink	Chum	Sockeye	Coho	Chinook	Sockeye	Chinook	Pink	Chum	Coho
22 June	6015	UCD	—	—	—	2	—	—	—	—	—	—
22 June	6016	UCC	—	2	—	—	—	—	2	—	—	—
22 June	6017	UCB	—	4	—	—	—	—	—	—	—	—
22 June	6018	UCA	—	—	—	—	—	—	—	—	—	—
23 June	6019	IPD	—	—	—	—	—	—	—	—	—	—
23 June	6020	IPC	—	—	—	—	—	—	—	—	—	—
23 June	6021	IPB	—	—	—	—	—	—	1	1	—	—
23 June	6022	IPA	—	—	—	—	2	—	—	—	—	—
24 June	6023	ISA	—	—	—	—	—	—	2	1	—	—
24 June	6024	ISB	—	—	—	—	—	—	—	—	—	—
24 June	6025	ISC	—	—	—	—	—	—	—	—	—	—
24 June	6026	ISD	—	—	—	—	—	—	—	—	—	—
25 June	6027	UCD	3	17	8	30	3	—	5	—	—	—
25 June	6028	UCC	—	—	1	—	1	—	—	—	—	—
25 June	6029	UCB	—	3	—	—	—	—	2	—	—	—
25 June	6030	UCA	—	—	—	—	1	—	1	—	—	—
26 June	6031	ISA	—	—	—	—	—	—	—	—	—	—
26 June	6032	ISB	—	1	1	1	—	—	1	—	2	—
26 June	6033	ISC	—	9	6	—	—	—	1	—	—	—
26 June	6034	ISD	4	9	2	15	—	—	1	1	—	1
27 June	6035	ISD	14	31	—	2	1	—	—	—	2	—
27 June	6036	ISC	—	—	—	—	—	—	—	—	—	—
27 June	6037	ISB	—	—	—	—	—	—	—	—	—	—
27 June	6038	ISA	—	—	—	—	—	—	1	—	—	—
25 July	6040	UCA	7	16	6	36	—	—	1	2	—	—
23 July	6041	UCB	4	27	5	4	1	—	—	—	—	—

Appendix 1.—(Cont.)

			Juvenile					Immature		Adult		
Date	Haul#	Station	Pink	Chum	Sockeye	Coho	Chinook	Sockeye	Chinook	Pink	Chum	Coho
23 July	6042	UCC	65	153	5	1	—	—	1	1	—	—
24 July	6043	ISA	10	105	4	34	—	—	—	1	—	—
24 July	6044	ISB	198	174	6	3	—	—	—	—	—	—
24 July	6045	ISC	84	163	2	11	—	—	—	—	1	—
24 July	6046	ISD	351	252	9	30	—	—	—	—	—	—
25 July	6047	UCD	51	33	34	18	—	—	—	1	—	—
26 July	6048	ISC	11	30	2	8	—	—	1	—	—	1
26 July	6049	ISA	30	16	—	1	—	—	—	—	—	—
26 July	6050	ISB	31	43	4	8	—	—	2	2	—	—
26 July	6051	ISC	449	459	18	5	—	—	—	—	—	—
26 July	6052	ISD	7	28	2	12	1	—	1	—	—	1
27 July	6053	UCA	—	—	—	8	—	—	—	—	—	—
27 July	6054	UCB	3	—	—	7	—	—	1	1	—	—
27 July	6055	UCC	4	30	8	27	—	—	1	—	—	—
27 July	6056	UCD	147	110	44	20	1	1	—	—	—	—
28 July	6057	ISA	—	—	—	2	—	—	—	1	—	—
28 July	6058	ISB	—	—	—	6	—	—	—	—	—	—
28 July	6059	ISC	—	—	—	19	—	—	—	1	—	—
29 July	6060	IPA	1	4	6	1	1	—	1	—	—	—
29 July	6061	IPB	149	34	10	1	1	—	—	2	—	—
29 July	6062	IPC	1	1	—	—	—	—	—	—	1	—
29 July	6063	IPD	—	—	—	—	—	—	—	1	—	—
30 July	6064	IPA	4	15	—	—	2	—	—	—	—	—
30 July	6065	IPB	43	31	11	11	—	—	—	—	—	—
30 July	6066	IPC	41	24	1	—	—	—	—	—	—	—
30 July	6067	IPD	—	—	—	1	—	—	—	1	—	—
23 August	6070	UCD	1	—	—	5	—	—	1	—	—	1
23 August	6071	UCC	3	—	1	1	—	—	—	—	—	—

Appendix 1.—(Cont.)

			Juvenile					Immature		Adult		
Date	Haul#	Station	Pink	Chum	Sockeye	Coho	Chinook	Sockeye	Chinook	Pink	Chum	Coho
23 August	6072	UCB	—	—	—	1	—	—	—	—	—	—
23 August	6073	UCA	—	—	—	3	—	—	—	—	—	—
24 August	6074	ISA	—	—	—	1	—	—	—	1	—	—
24 August	6075	ISB	7	—	1	10	2	—	—	—	—	1
24 August	6076	ISC	46	7	1	3	—	—	—	—	—	—
24 August	6077	ISD	2	2	—	4	—	—	—	—	—	—
25 August	6078	IPA	40	3	1	1	—	—	—	—	—	2
25 August	6079	IPB	—	—	—	2	—	—	—	—	—	—
25 August	6080	IPC	—	—	—	3	—	—	—	—	—	—
25 August	6081	IPD	—	—	—	—	—	—	—	—	—	—
26 August	6082	IPA	22	6	4	3	—	—	—	—	—	—
26 August	6083	IPB	—	—	—	1	—	—	—	—	—	—
27 August	6085	ISA	10	4	—	—	—	—	—	—	1	—
27 August	6086	ISB	10	3	4	—	—	—	—	—	—	1
27 August	6087	ISC	383	94	35	8	—	—	1	—	2	—
27 August	6088	ISD	61	5	3	2	1	—	—	1	—	—
28 August	6089	ISA	3	—	2	1	—	—	1	—	—	—
28 August	6090	ISB	19	2	2	4	1	—	—	1	2	—
28 August	6091	ISC	27	12	14	4	1	—	—	—	1	—
28 August	6092	ISD	231	36	5	2	—	—	1	—	—	—
29 August	6093	UCA	—	—	—	—	—	—	—	—	1	—
29 August	6094	UCB	4	—	—	1	—	—	—	—	—	—
29 August	6095	UCC	4	—	—	—	1	—	—	—	1	—
29 August	6096	UCD	5	1	—	—	—	—	—	—	—	—

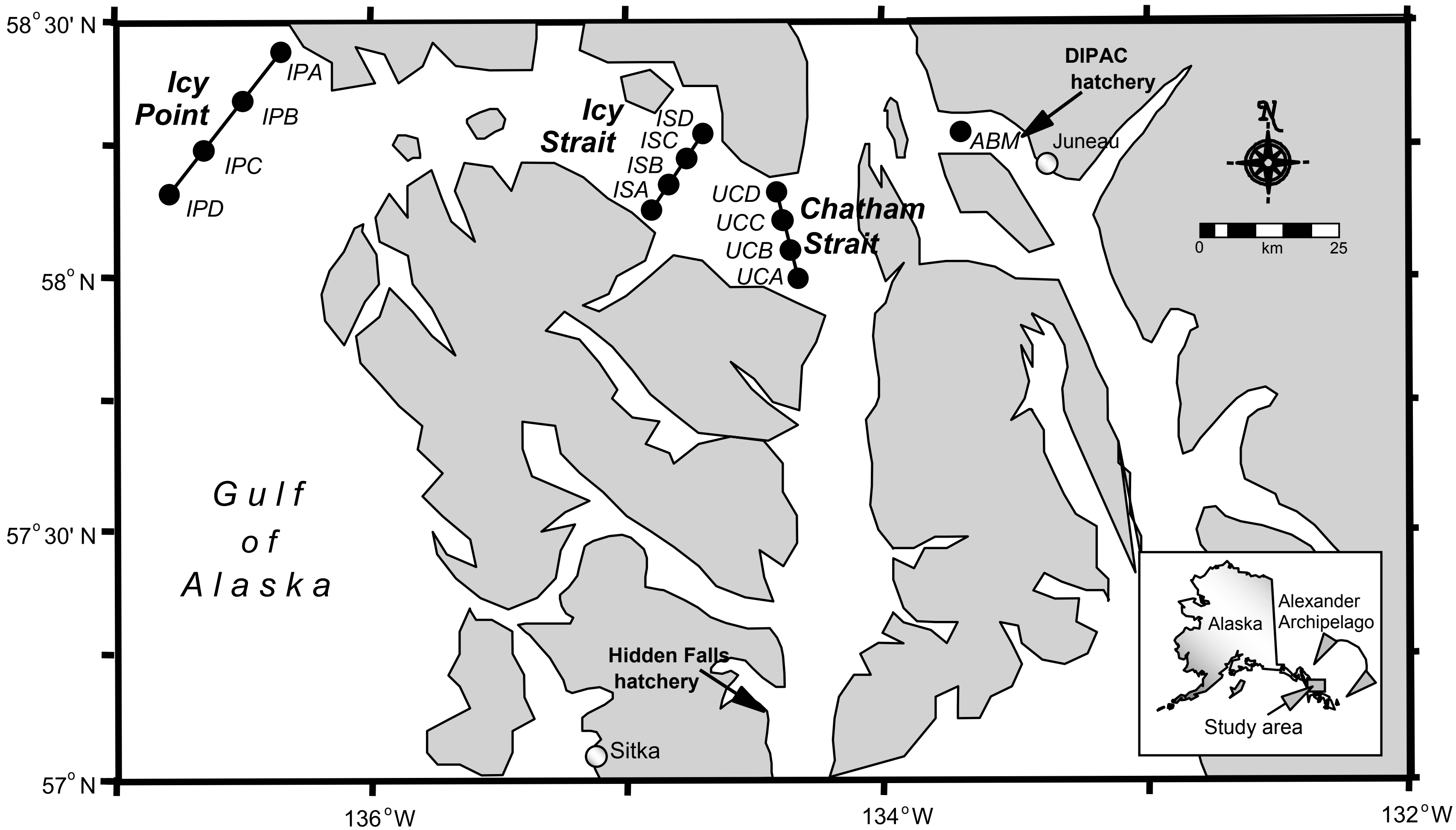

Figure 1.—Stations sampled monthly in marine waters of the northern region of southeastern Alaska, May–August 2002. Small arrows indicate two major enhancement facilities: DIPAC (Douglas Island Pink and Chum) hatchery and Hidden Falls hatchery.

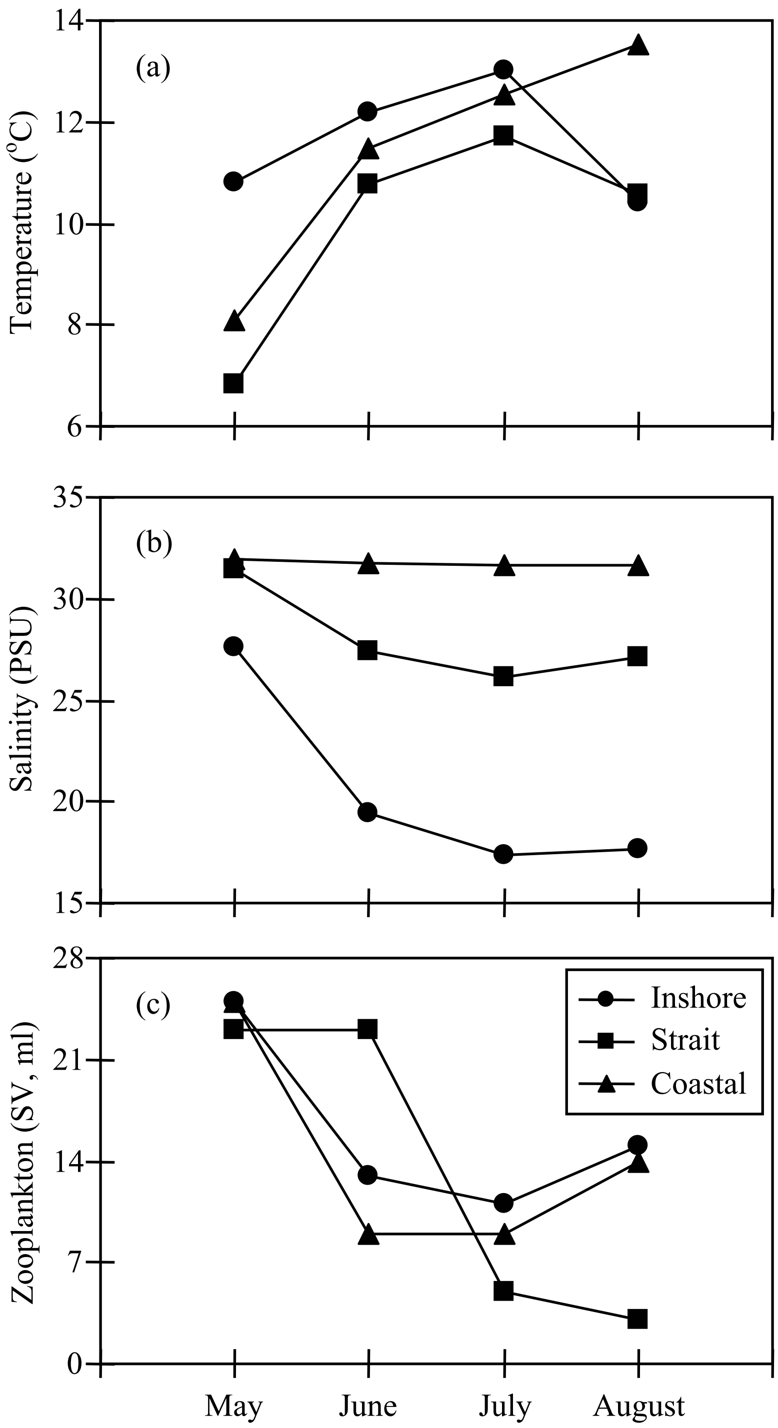

Figure 2.—Surface (2-m) temperature (a) and salinity (b) and 20-m zooplankton volume (c) in inshore, strait, and coastal marine habitats of the northern region of southeastern Alaska, May–August 2002. Zooplankton volumetric density (ml/m^3) can be computed by dividing by a factor of 3.9 m^3 water volume filtered.

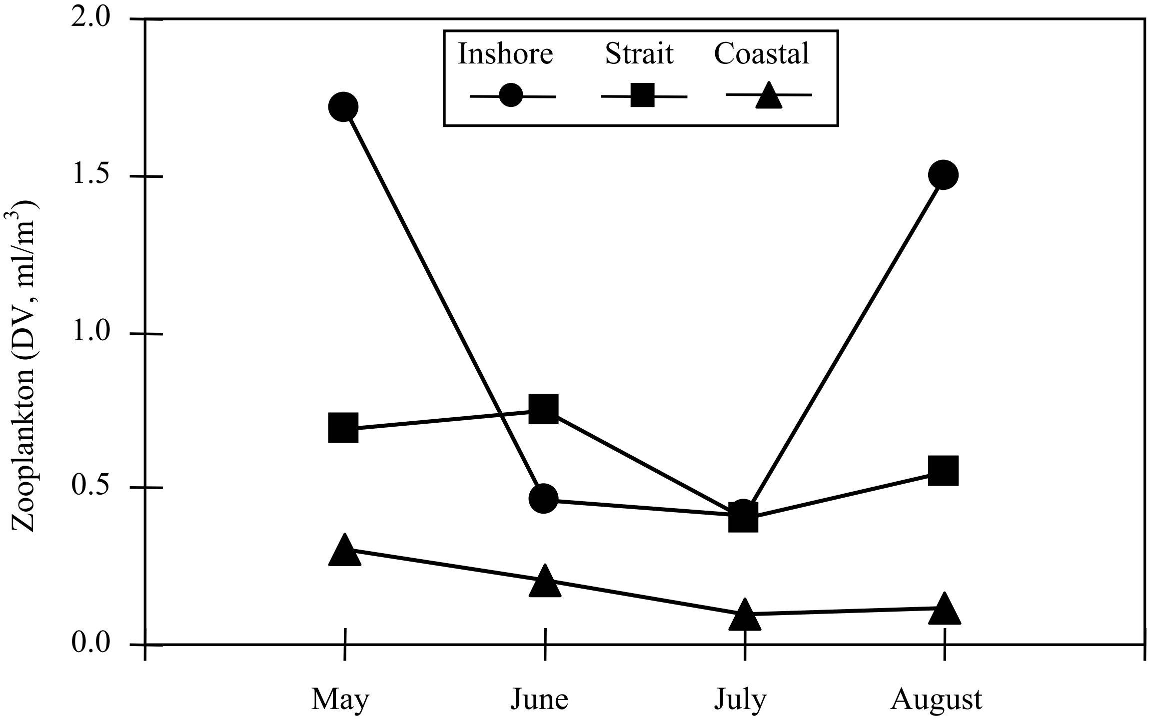

Figure 3.—Zooplankton displacement volume (ml/m3) from oblique bongo 333-µm hauls in inshore, strait, and coastal marine habitats of the northern region of southeastern Alaska, May–August 2002. The inshore habitat is represented by single monthly samples taken at an average depth of 42.5 m. The strait and coastal habitats are represented by four samples per month taken at average depths of 165.6 and 142.5 m. See Table 6 for sample depths and other details.

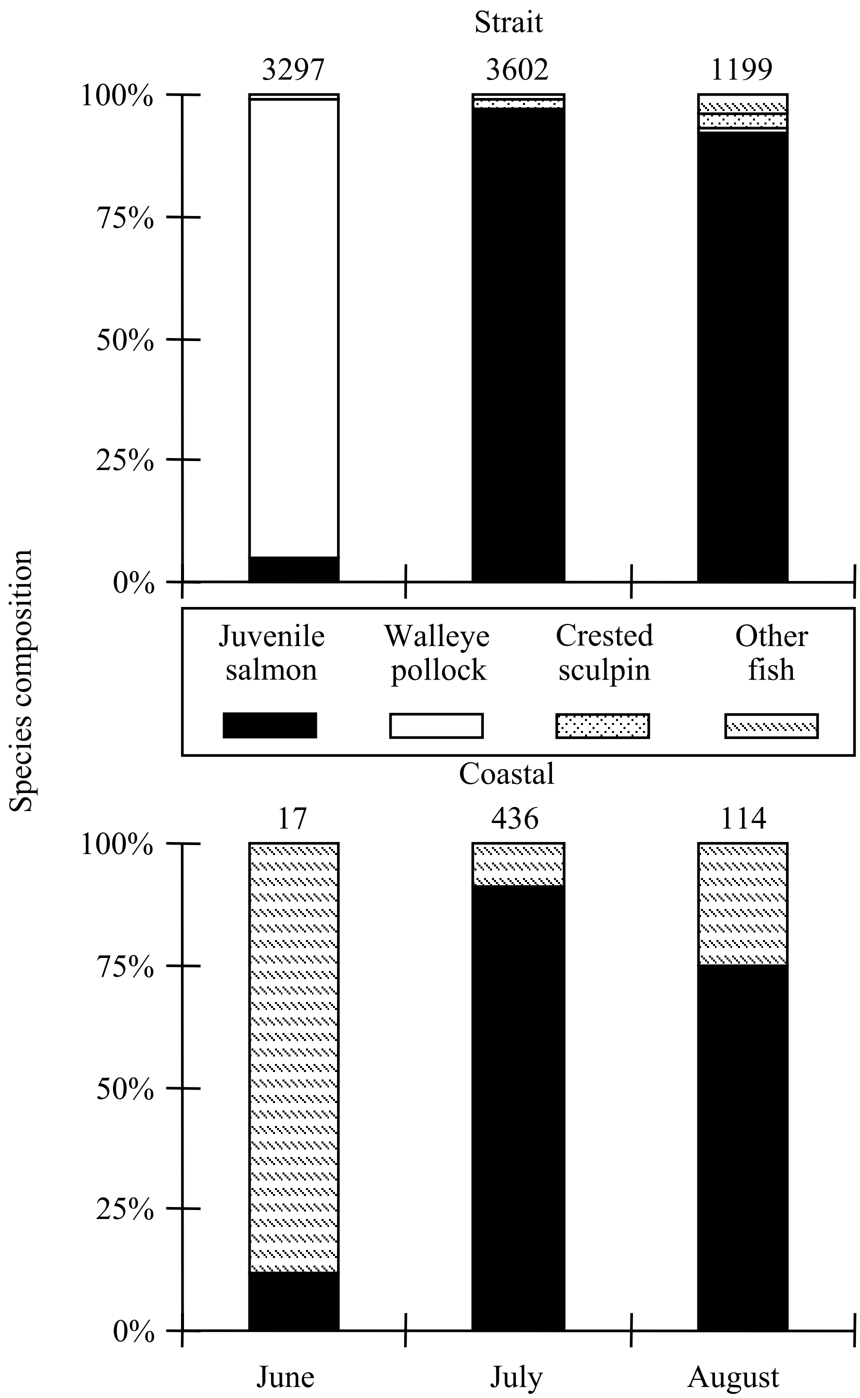

Figure 4.—Fish composition from rope trawl catches in strait and coastal marine habitats of the northern region of southeastern Alaska, June–August 2002. Number of fish is indicated above each bar.

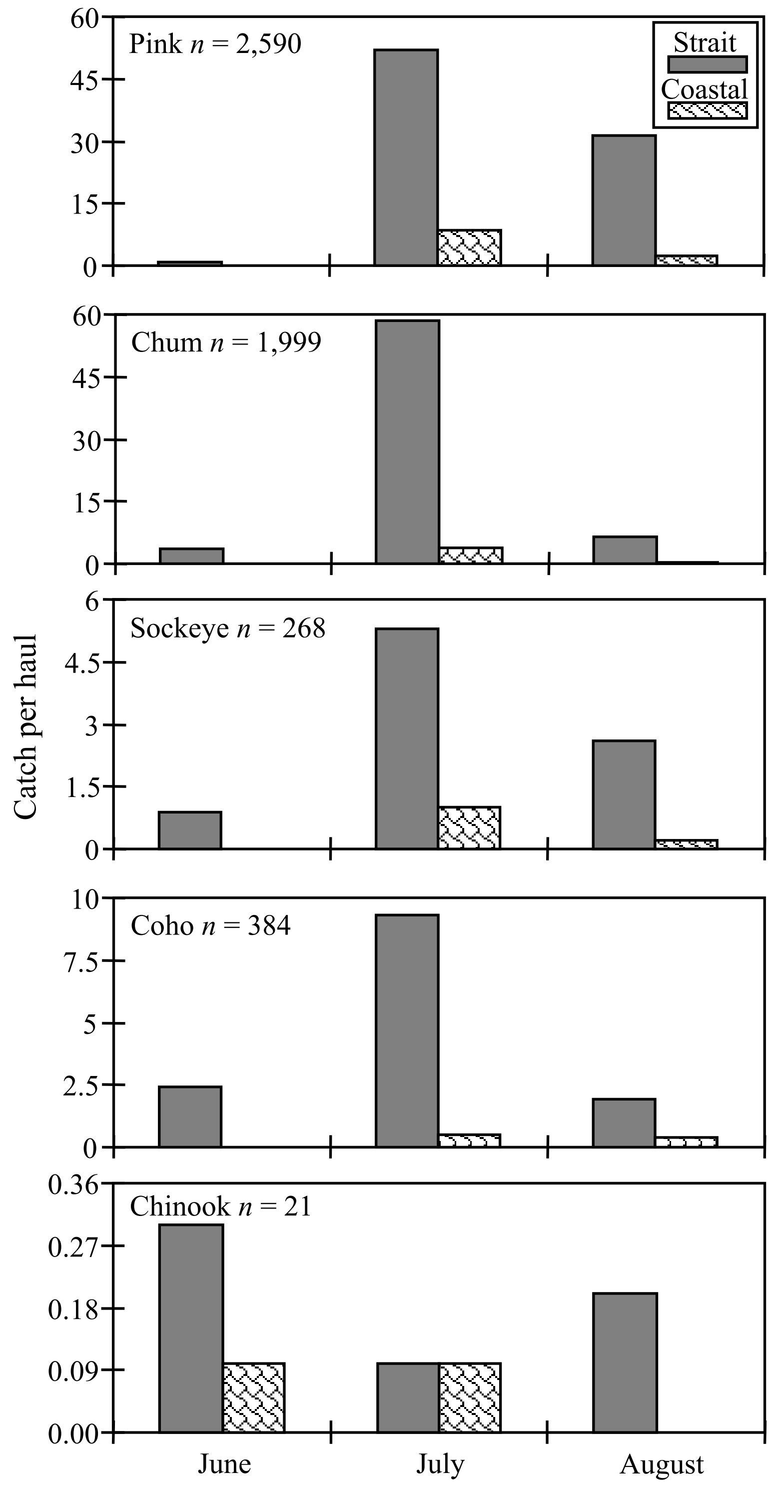

Figure 5.—Catch per rope trawl haul of juvenile salmon in strait and coastal marine habitats of the northern region of southeastern Alaska, June–August, 2002.

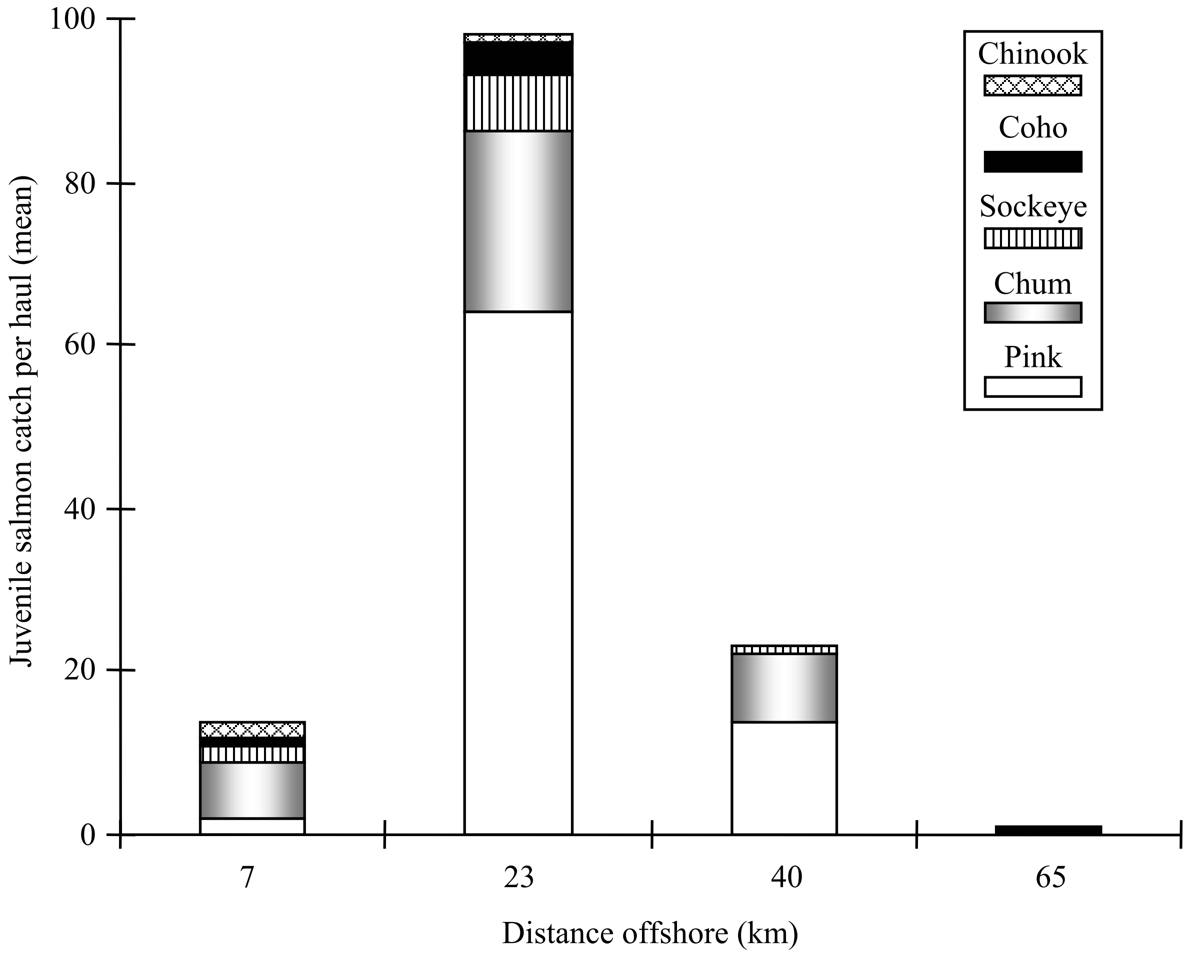

Figure 6.—Mean number of juvenile salmon captured per 12 rope trawl hauls in the coastal marine habitat (Icy Point transect) of the northern region of southeastern Alaska, June and July, 2002. Four hauls were fished in June (one at each station) and eight hauls were fished in July (two at each station).

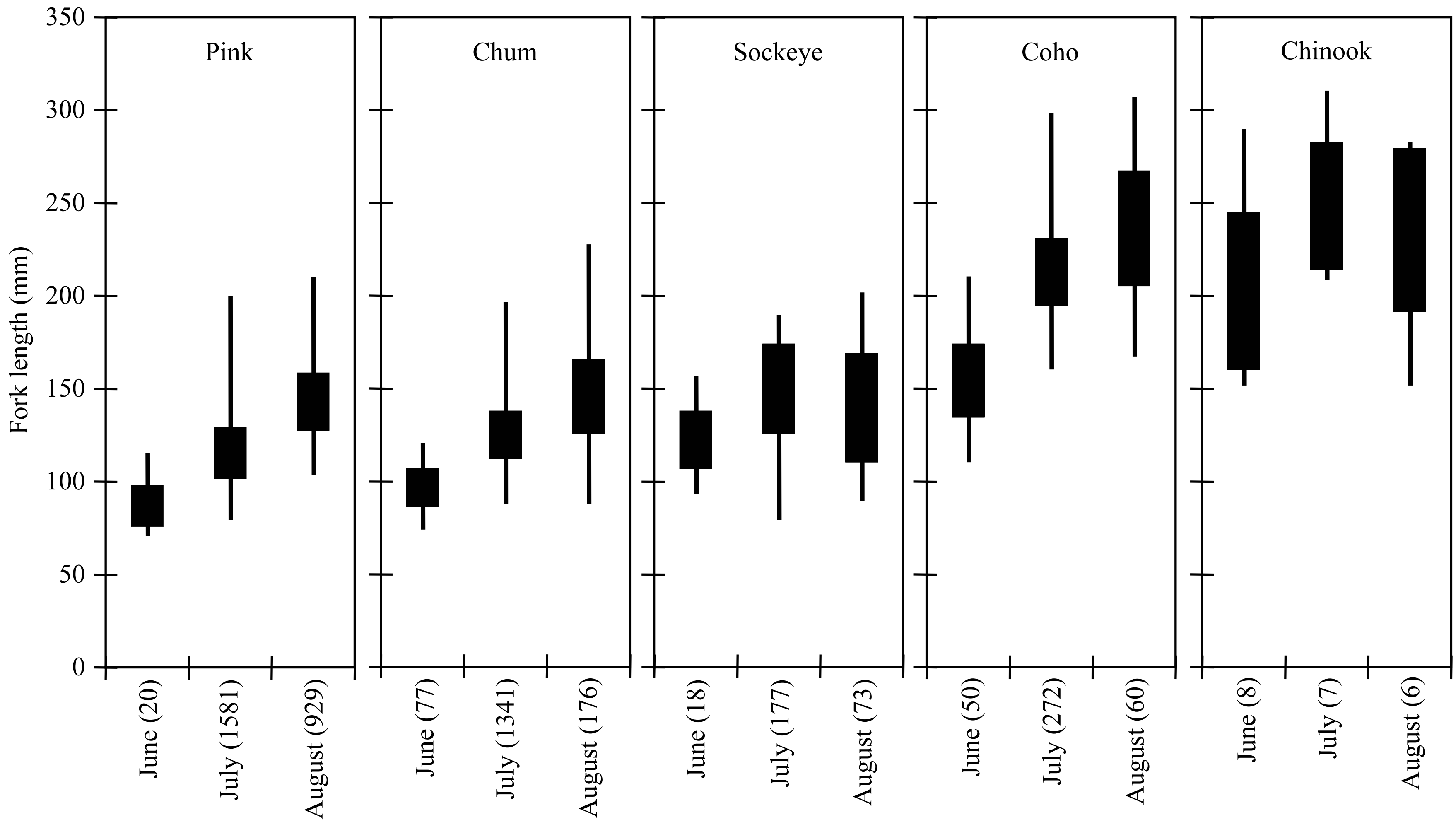

Figure 7.—Fork lengths of juvenile salmon captured in marine waters of the northern region of southeastern Alaska by rope trawl, June–August 2002. Length of vertical bars is the size range for each sample, and the boxes within the size range are one standard deviation on either side of the mean. Sample sizes are shown in parentheses.

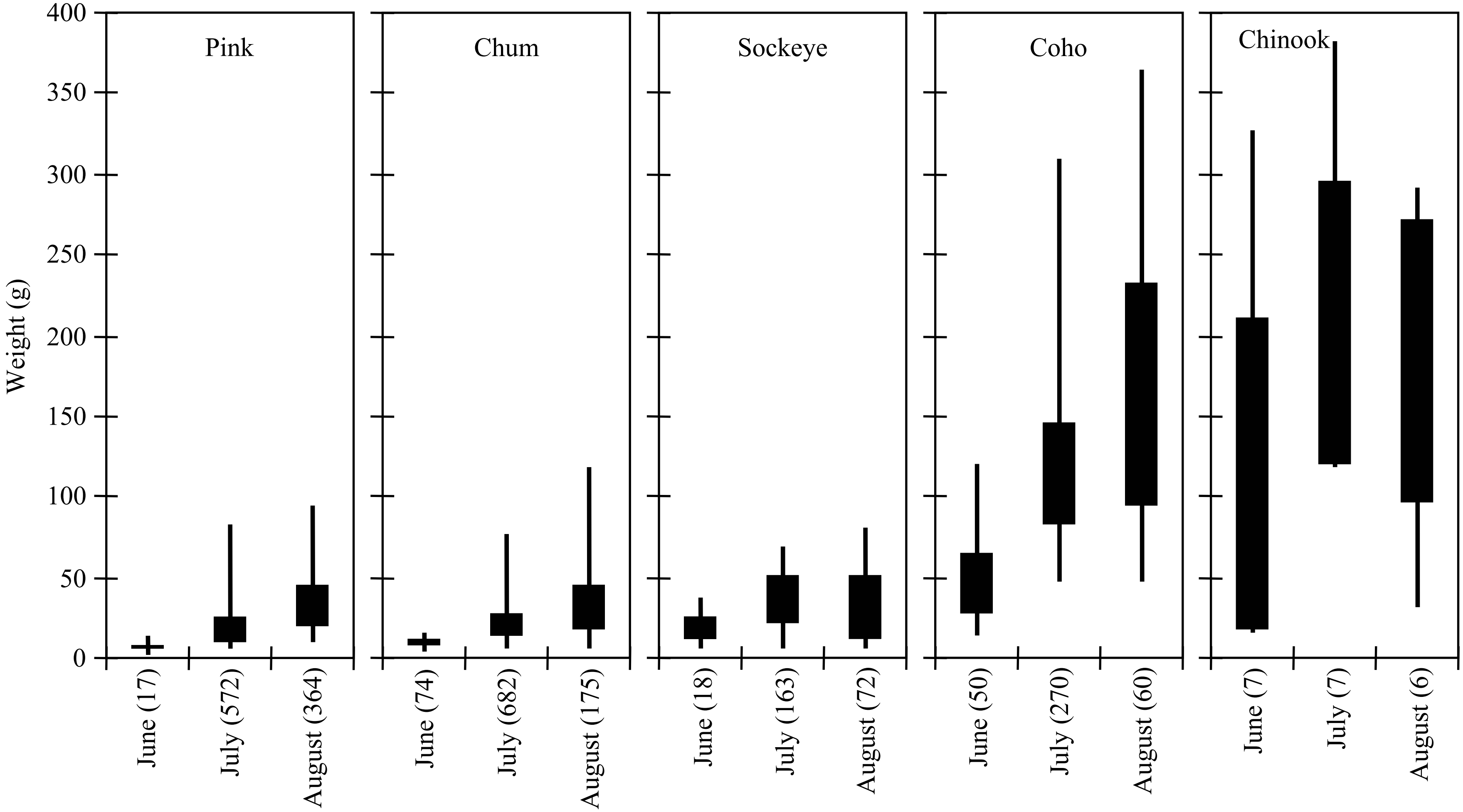

Figure 8.—Weights of juvenile salmon captured in marine waters of the northern region of southeastern Alaska by rope trawl, June–August 2002. Length of vertical bars is the size range for each sample, and the bars within the size range are one standard deviation on either side of the mean. Sample sizes are shown in parentheses.

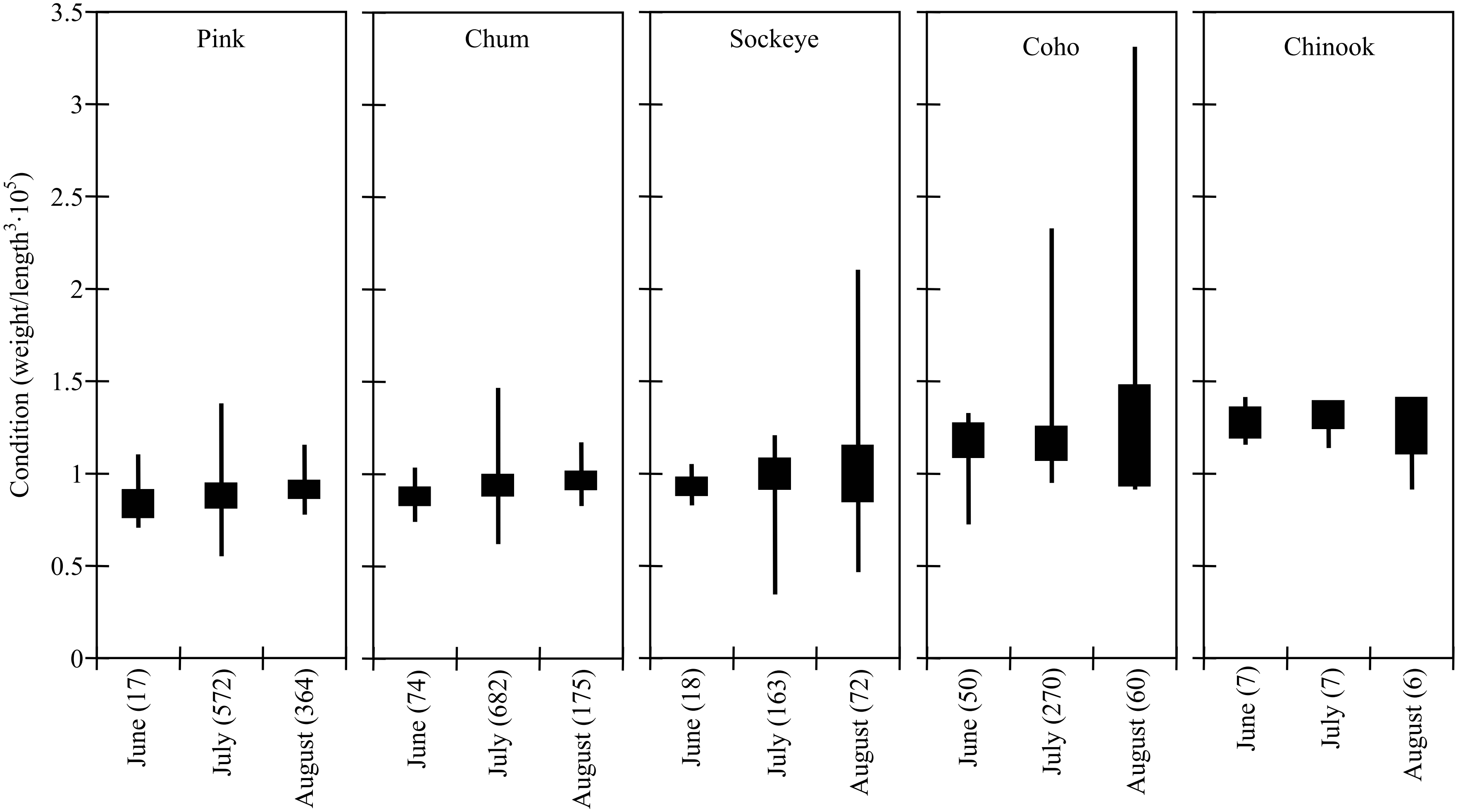

Figure 9.—Condition factors of juvenile salmon captured in marine waters of the northern region of southeastern Alaska by rope trawl, June–August 2002. Length of vertical bars is the size range for each sample, and the boxes within the size range are one standard deviation on either side of the mean. Sample sizes are shown in parentheses.

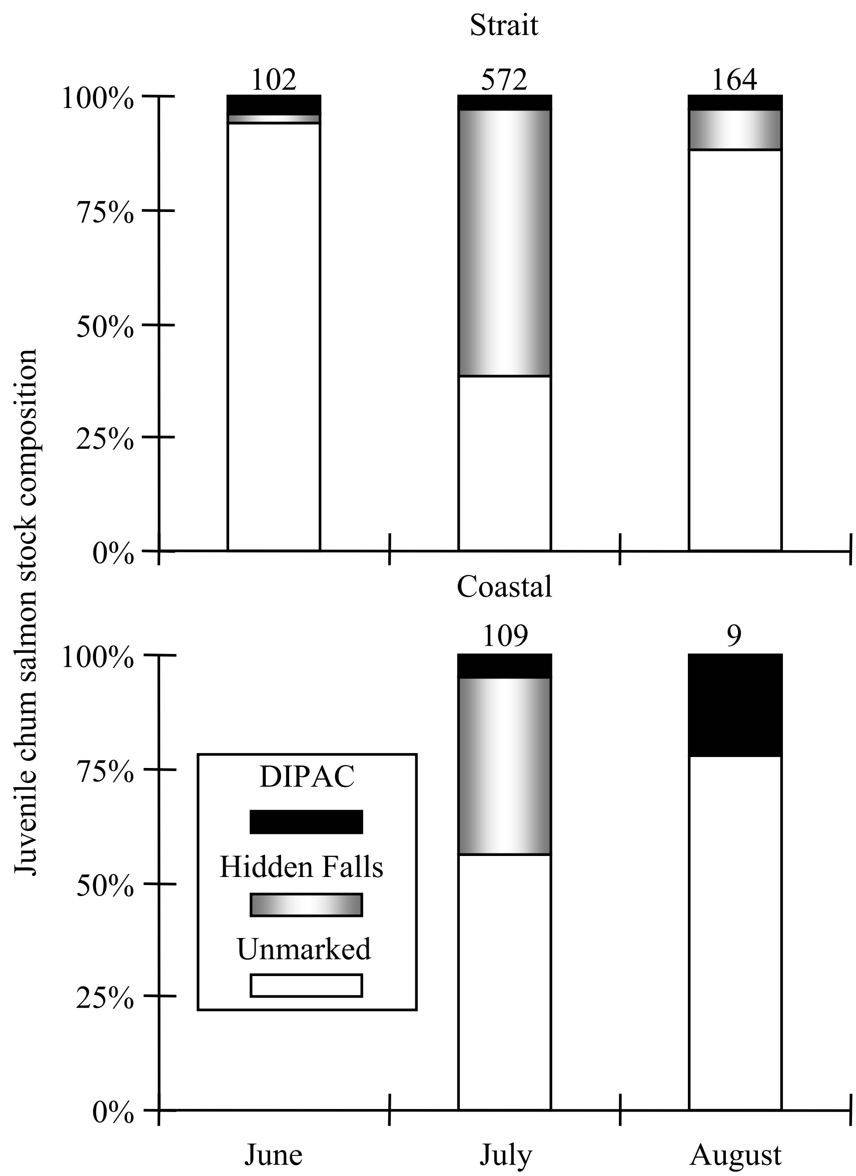

Figure 10.—Monthly stock composition of juvenile chum salmon based on otolith thermal marks in strait and coastal marine habitats of the northern region of southeastern Alaska, June–August 2002. Number of salmon sampled per month and habitat is indicated above each bar.

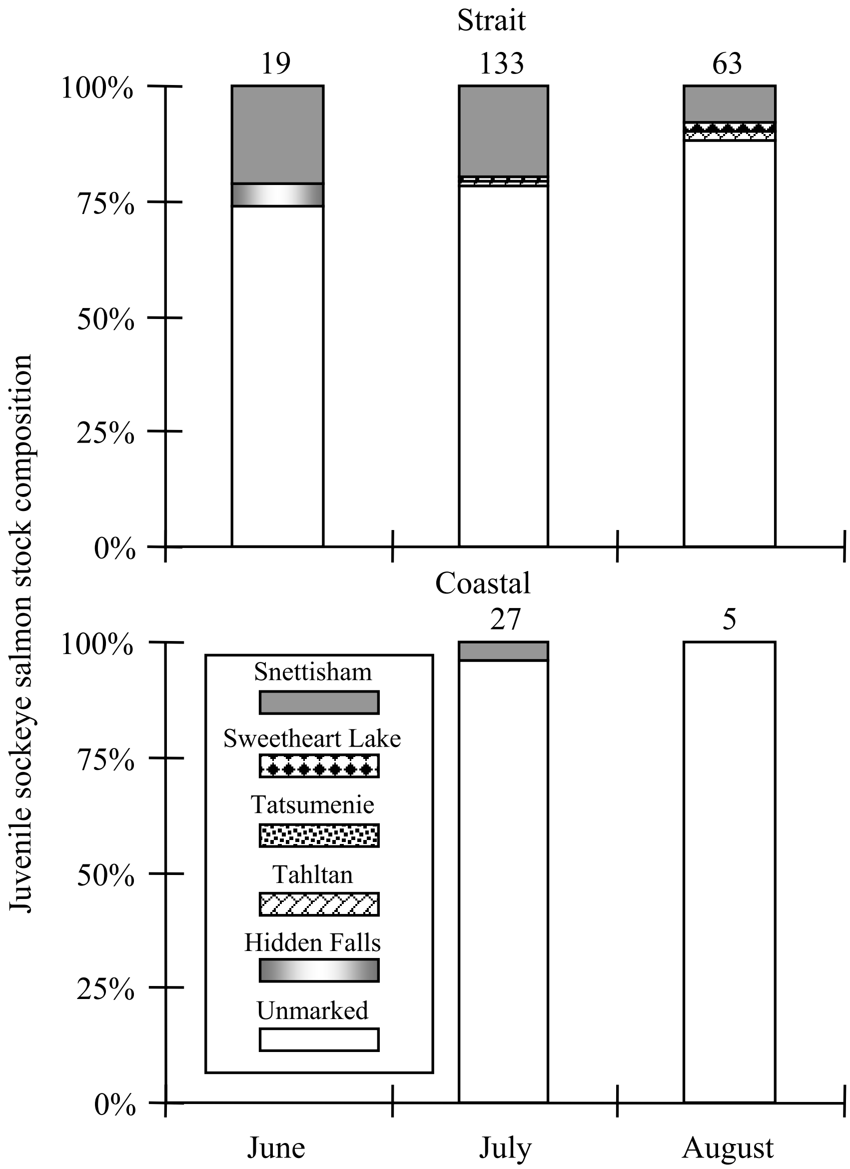

Figure 11.—Monthly stock composition of sockeye salmon based on otolith thermal marks in strait and coastal marine habitats of the northern region of southeastern Alaska, June–August 2002. Number of salmon sampled per month and habitat is indicated above each bar.

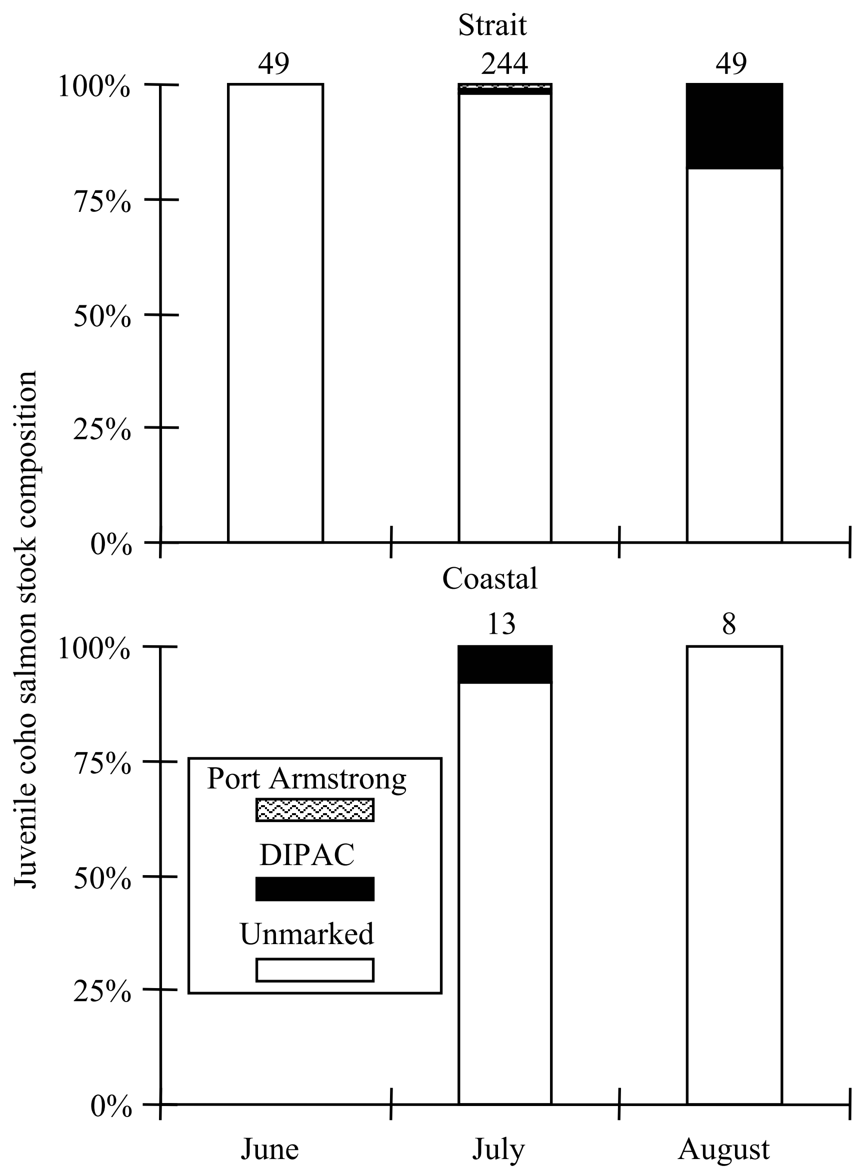

Figure 12.—Monthly stock composition of juvenile coho salmon based on otolith thermal marks in strait and coastal marine habitats of the northern region of southeastern Alaska, June–August 2002. Number of salmon per month and habitat is indicated above each bar.

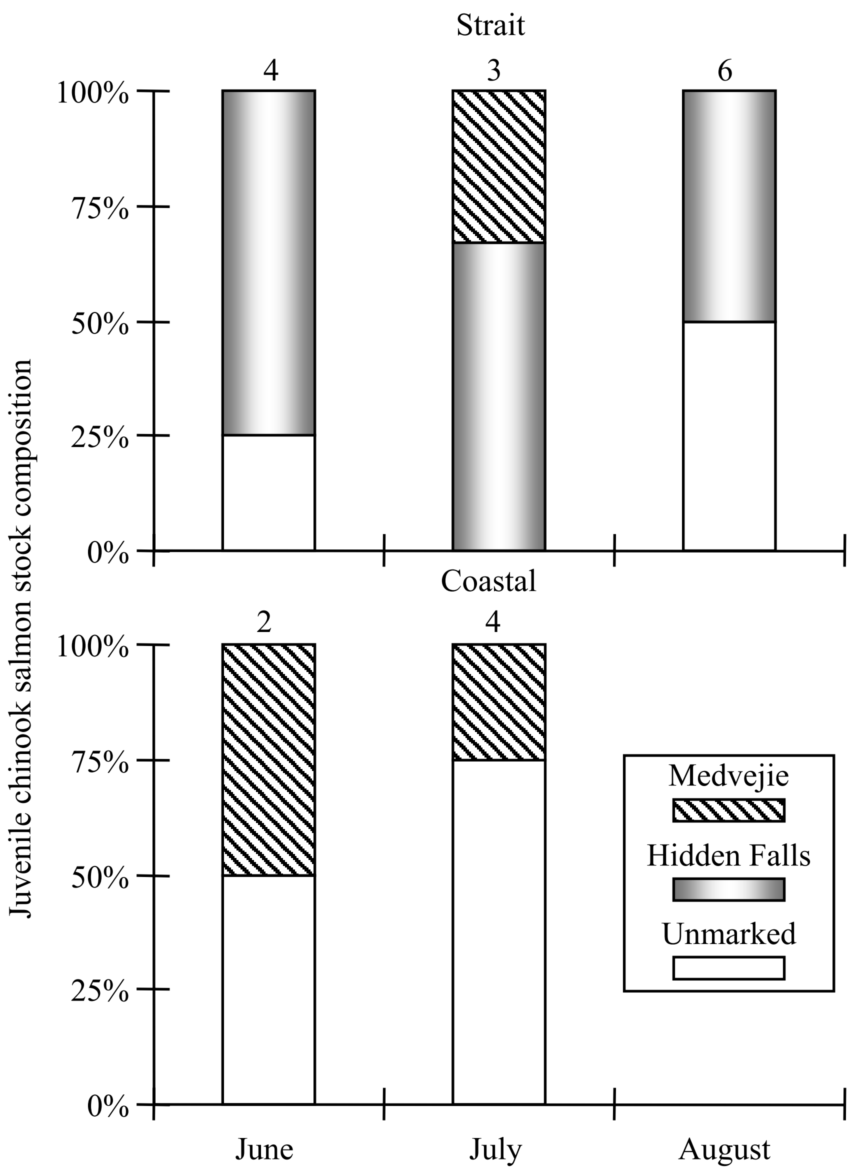

Figure 13.—Monthly stock composition of chinook salmon based on thermal marks in the strait and coastal marine habitats of the northern region of southeastern Alaska, June–August 2002. Number of salmon per month and habitat is indicated above each bar.

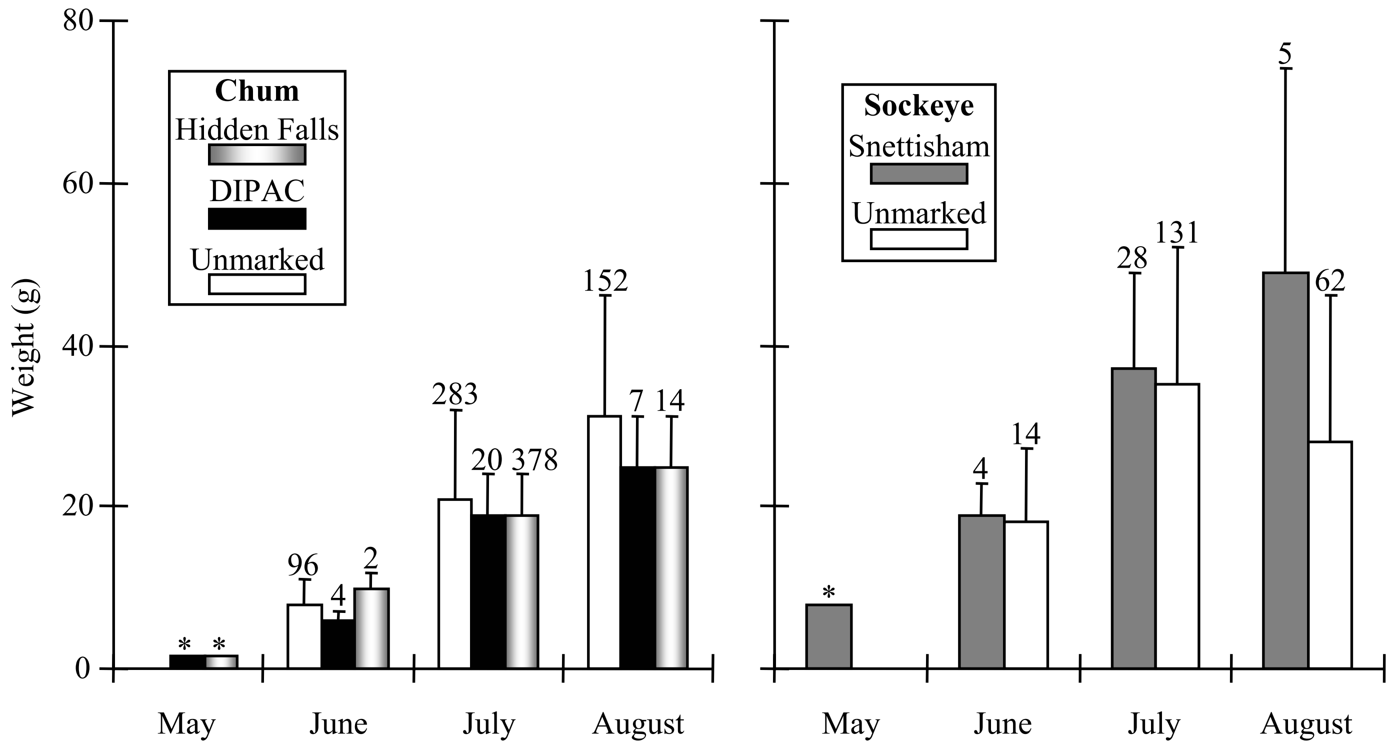

Figure 14.—Stock-specific growth trajectories of juvenile chum and sockeye salmon captured in marine waters of the northern region of southeastern Alaska by rope trawl, June–August 2002. Size of marked fish at the time of hatchery release is indicated by an asterisk above the bars in May. The sample sizes and the standard deviation are indicated above each bar.

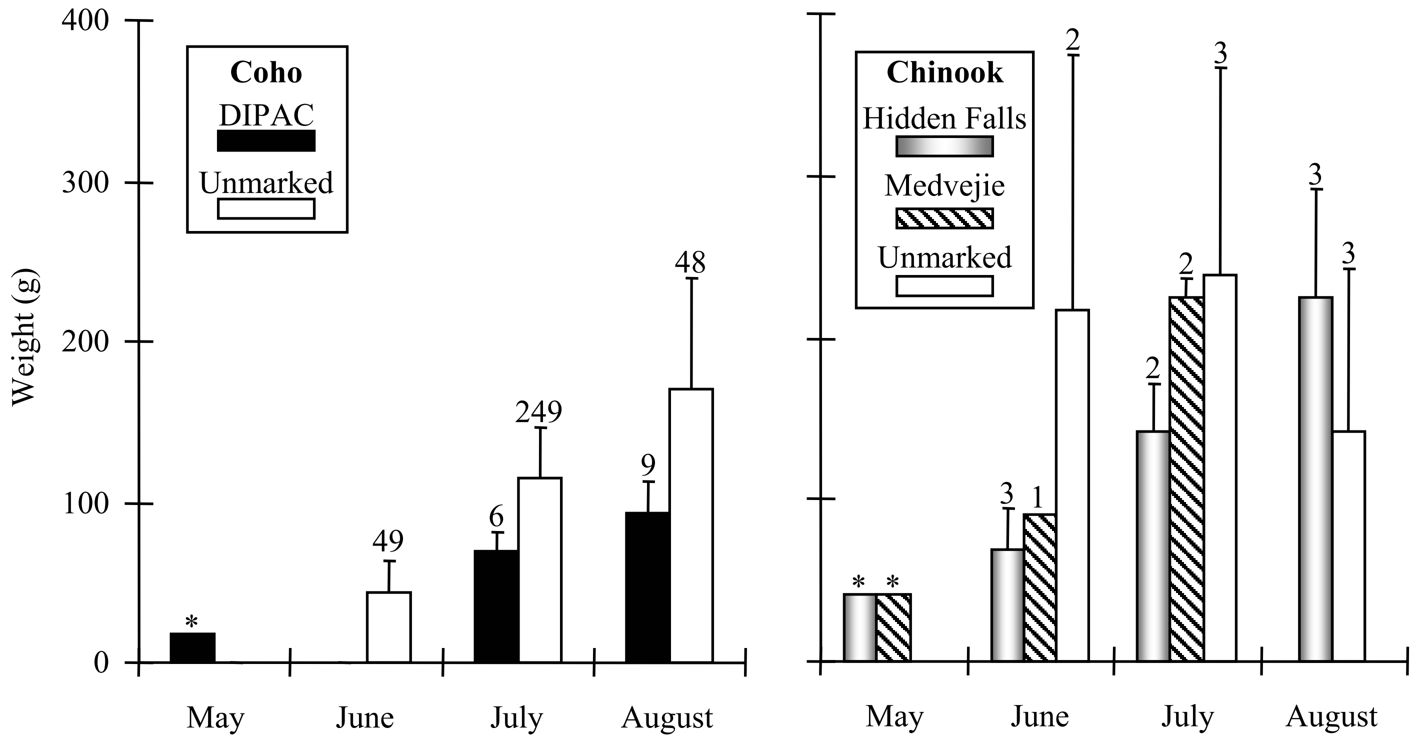

Figure 15.—Stock-specific growth trajectories of juvenile coho and chinook salmon captured in marine waters of the northern region of southeastern Alaska by rope trawl, June–August 2002. Size of marked fish at the time of hatchery release is indicated by an asterisk above the bars in May. The sample sizes and the standard deviation are indicated above each bar.

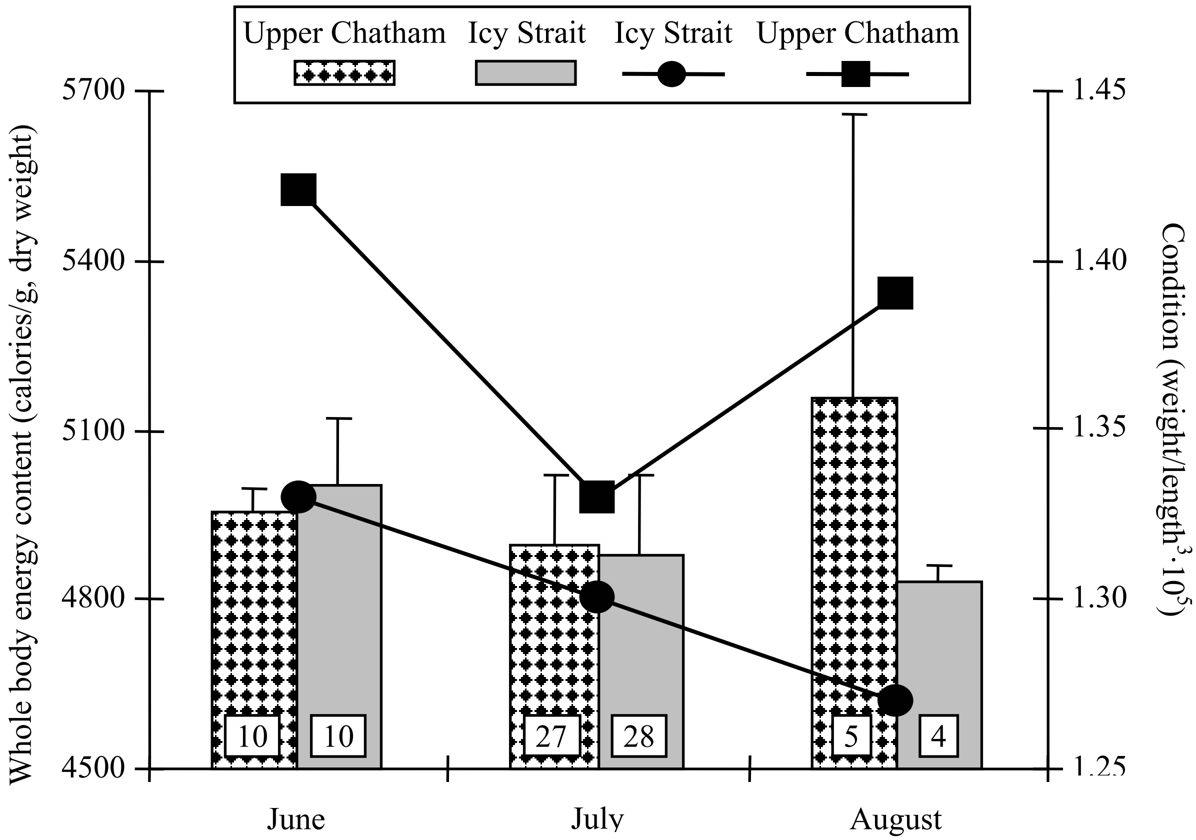

Figure 16.—Whole body energy content (calories/g, dry weight) with standard deviation and condition factors (weight/length^3·10^5) of juvenile coho salmon captured in the strait marine habitat of the northern region of southeastern Alaska, May–August 2002. The number of fish is indicated at the bottom of each bar.

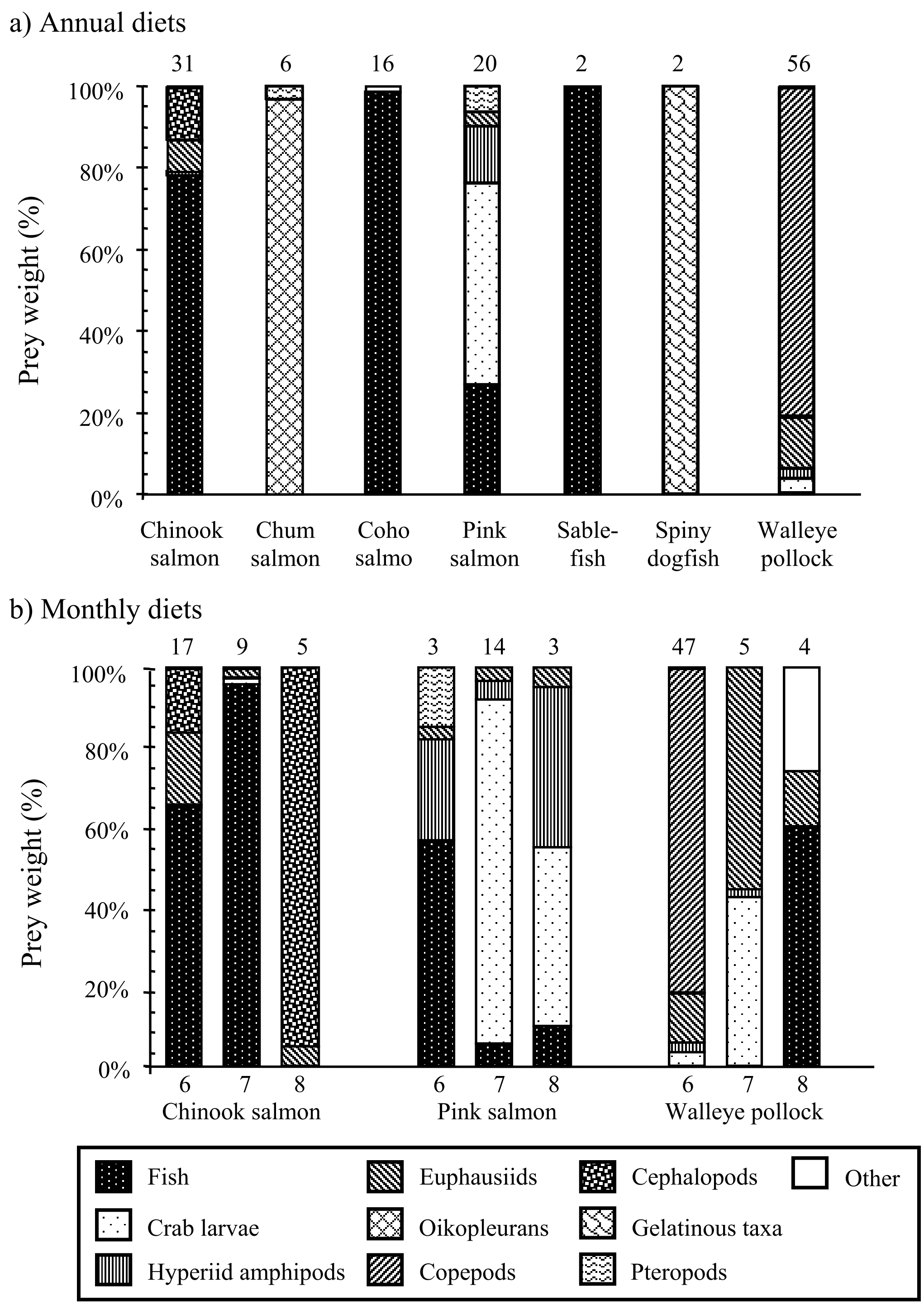

Figure 17.—Prey composition of potential predator species caught in surface trawl hauls in marine habitats of the northern region of southeastern Alaska, June–August 2002, pooled a) annually and b) monthly (where sufficient specimens). See also Table 19 for rates of predation on juvenile salmon. The numbers of fish examined are shown above the bars.