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Survey of Juvenile Salmon in the Marine Waters of Southeastern Alaska, May–September 2001

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Abstract

Biophysical data were collected along a primary marine migration corridor of juvenile Pacific salmon (*Oncorhynchus* spp.) in the northern region of southeastern Alaska at 13 stations in five sampling intervals (27 d total) from May to September 2001. This survey marks the fifth consecutive year of systematic monitoring, and was implemented to identify the relationships among biophysical parameters that influence the habitat use, marine growth, predation on, 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, conical and bongo nets, and a conductivity-temperature-depth profiler, respectively, usually during daylight. Surface (2-m) temperatures and salinities ranged from 7.0 to 14.1°C and 18.0 to 32.2 PSU from May to September. A total of 52,156 fish and squid, representing 24 taxa, were captured in 108 rope trawl hauls from June to September. Juvenile Pacific salmon comprised 11% of the total catch and were the most frequently occurring species: chum (*O. keta*; 78%), pink (*O. gorbuscha*; 73%), sockeye (*O. nerka*; 71%), coho (*O. kisutch*; 65%), and chinook salmon (*O. tshawtscha*; 43%). Of the 5,979 salmonids caught, > 97% were juveniles. Non-salmonid species making up > 1% of total catch included walleye pollock (*Theragra chalcogramma*), eulachon (*Thaleichthys pacificus*), and soft sculpin (*Psychrolutes sigalutes*). 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 September. 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 (mm) in June and September were: pink (93 and 203), chum (96 and 201), sockeye (119 and 178), coho (164 and 259), and chinook salmon (202 and 255). Coded-wire tags were recovered from 40 juvenile, immature, and adult salmon; all were of Alaska origin. In addition, otoliths were examined from four species of juvenile salmon: 1,157 chum, 383 sockeye, 407 coho, and 69 chinook salmon; Alaska hatchery stocks were identified by thermal marks from 30%, 12%, 11%, and 74% of these species, respectively. Onboard stomach analysis of 235 potential predators, representing ten species, indicated juvenile salmon predation by 27% of the adult spiny dogfish (*Squalus acanthias*), 14% of the adult coho salmon, and 8% of the adult Pomfret (*Brama japonica*). 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 intra- and interannual bases, 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 benefitted 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, the links between intra- and interspecific competition and carrying capacity, and the links between stock composition and biological interactions. Past research has not provided adequate time-series data to explain such links (Pearcy 1997). Since 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 over 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 have occurred in the common property fishery in the region (ADFG 2000), mostly comprised of otolith-marked fish. In addition, sockeye salmon (*O. nerka*), coho salmon (*O. kisutch*), and chinook salmon (*O. tshawytscha*) are also mass 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 northern southeastern Alaska, known as Southeast Coastal Monitoring Project (SECM), was initiated in 1997 and repeated from 1998 to 2001 (Orsi et al. 1997, 1998, 2000, 2001), 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). This document summarizes data collected by SECM scientists on biophysical parameters from May–September 2001 in southeastern Alaska.

Methods

Thirteen stations were sampled in each of five 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–September 2001 (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, some nocturnal sampling was also conducted at a pre-selected station (ISC) as part of two process studies (diel feeding periodicity and gastric evacuation of juvenile salmon) (Sturdevant et al. 2002).

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). 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 distances $\geq$ 1.5 km and $\leq$ 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.

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 University of Washington School of Oceanography Marine Chemistry Laboratory. At least one shallow haul (20-m) was made at each station and one deep haul (to 200 m or within 20 m of bottom)

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

was made at Auke Bay Monitor and the Icy Point stations (Table 2). Following previous zooplankton sampling programs in the region, a NORPAC net (50 cm, 243 µm mesh) was used or the shallow vertical hauls; following GLOBEC standards (U.S. GLOBEC 1996) a WP-2 net (57 cm, 202 µm mesh) was used for the deep vertical hauls. 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 µm and 333 µm 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 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 (ZSV, ml) and total settled volumes (TSV, ml) of each 20-m vertical haul were measured after settling the samples 24 hrs in Imhof cones. Mean ZSV 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 the NOAA ship *John N. Cobb*. The trawl was 184 m long and had a mouth opening of 24 m × 30 m (depth × width). The *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. 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 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 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 across a station for 20 min at ~1.5 m/sec (3 knots), covering approximately 1.9 km (1.0 nautical miles). 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, 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. Up to fifty juvenile salmon of each species were bagged individually, the remainder 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 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 were dissected later in the laboratory to recover CWTs, which were then decoded and verified.

Frozen individual juvenile salmon were weighed in the laboratory to the nearest gram (g). Mean lengths, weights, and Fulton condition factors (g/FL^3*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.

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 and contribution to the nearest 10% of total volume was estimated. The wet weight contribution of each prey taxon was then estimated 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 and the frequency of feeding fish.

Results and Discussion

During the 5-month (27 d) survey in 2001, data were collected from 108 rope trawl hauls, 120 CTD casts, 212 bongo net hauls, 147 conical net hauls (130 from 20-m depths and 17 from 200-m depths), and 54 surface water samples (Table 2). The sampling intervals occurred near the ends of each month. In May, oceanographic sampling was completed at all stations; four rope trawl hauls were done to test trawl operations and confirm the absence of juvenile salmon observed in previous years. After May, the strait habitat was consistently sampled monthly from June to September; the coastal habitat was only sampled in June and July due to time constraints and inclement fall weather (Table 2).

Oceanography

Sea surface (2 m) temperature and salinity data differed by month and between habitat. Overall, surface temperatures and salinities during the survey ranged from 7.0 to 14.1°C and 18.0 to 32.2 PSU from May to September (Table 3). Temperatures increased dramatically from May to June in strait and inshore habitats and from May to July in the coastal habitat. For the remainder of the season in the inshore and strait habitats, temperatures leveled off in July and

August, then declined in September (Figure 2a). Salinities in the inshore and strait habitats declined sharply from May to June, then increased gradually through September (Figure 2b). Salinities were consistently high in the coastal habitat from May to July.

A total of 54 surface water samples were taken at 13 stations over the course of the season (Tables 2 and 4). Nutrient value ranges and means were 0.1-1.5 and 0.6 µM for PO_4, 2.6-36.6 and 15.0 µM for $Si(OH)_4$, 0.0-17.9 and 4.8 µM for NO_3, 0.0-0.3 and 0.1 µM for NO_2, and 0.0-4.0 and 0.9 µM for NH_4. Chlorophyll ranged from 0.0-4.9 mg/m^3 ($\bar{x}$ = 1.4) and phaeopigment ranged from 0.0-0.8 mg/m^3 ($\bar{x}$ = 0.2; Table 4).

Plankton 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 was present only in the inshore and strait habitats. In all habitats, zooplankton volumes increased from May to June, then declined sharply in July (Figure 2c). The spatial pattern generally showed highest zooplankton volumes in the strait habitat in May and June, and the lowest in September. The peak volume for all stations and months was 48 ml ZSV during June in the strait habitat. Ambient light intensities during the sampling season ranged 0-854 W/m^2 ($\bar{x}$ = 184).

Catch composition

A total of 52,156 fish and squid, representing 24 taxa, were captured in 108 rope trawl hauls from June to September (Table 6). Juvenile Pacific salmon comprised 11% of the total catch and were the most frequently occurring species: chum (78%), pink (73%), sockeye (71%), coho (65%), and chinook (43%) salmon (Table 7). Of the 5,979 salmonids caught, > 97% were juveniles. Non-salmonid species making up > 1% of total catch included walleye pollock (*Theragra chalcogramma*), eulachon (*Thaleichthys pacificus*), and soft sculpin (*Psychrolutes sigalutes*). Juvenile salmon were the dominant species in the coastal habitat, however walleye pollock and eulachon were the dominant species in the strait habitat (Figure 3). Catches and life history stages of the salmon are listed in Appendix 1 by date, haul number, and station.

Distribution of juvenile salmon differed for the months, habitats, and species sampled; however, the patterns were consistent with observations from previous years (Orsi et al. 1997, 1998, 1999, 2000, 2001). By month, the overall catches were highest in June and July and lowest in August and September (Figure 4). By habitat, the highest catches per haul generally occurred in straits for all species of juvenile salmon. In the strait habitat, the highest catch per haul of sockeye and coho salmon occurred in June and July, while the highest catch per haul of pink and chum salmon occurred in July, and the highest catch per haul of chinook salmon occurred in September. Overall, in the coastal habitat, the highest catch per haul of juvenile salmon along the 65 km Icy Point offshore transect occurred within 40 km of shore (Figure 5).

Seasonal and diel patterns in the catches were apparent for juvenile salmon and the most abundant non-salmonids. Among the juvenile salmonids, pink, chum, sockeye, and coho salmon were captured early- to mid-season, primarily in June and July, whereas chinook salmon were captured later, primarily in September (Table 6). Walleye pollock and eulachon, the two most abundant non-salmonid species, were found mainly in the latter part of the season in August and September. Distinct differences in the diel catch patterns of these two species were observed in the strait habitat (Figure 3). From day to night, walleye pollock composition increased from 60% to 80%, consistent with the known vertical migration behavior of this species (Smith 1981), whereas eulachon increased even more dramatically, from 0% to 100%. Conversely, salmonid composition in the strait habitat declined from 25% to 1% from day to night. The highest composition of salmonids (50%) was found in the coastal habitat, which was only fished during the day.

Size and condition of juvenile salmon differed among the species and sampling intervals (Tables 8-12; Figures 6-8). Juvenile coho and chinook salmon were consistently 25–100 mm longer than sockeye, chum, and pink salmon. All 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–August–September were: pink (93–121–155–203), chum (96–123–145–201), sockeye (119–126–147–178), coho (164–190–227–259), and chinook (202–216–246–255). Mean weights (g) for each species of juvenile salmon in June–July–August–September were: pink (7.5–17.1–35.6–82.8), chum (8.5–18.4–32.1–91.6), sockeye (18.1–22.1–35.7–62.0), coho (50.4–84.9–141.8–216.6), and chinook (64.3–138.3–209.1–239.7). Condition factor values generally increased for each species of juvenile salmon from June–July–August–September were: pink (0.9–0.9–1.0–1.0), chum (0.9–0.9–1.0–1.1), sockeye (1.0–1.0–1.0–1.0), coho (1.1–1.1–1.2–1.2), and chinook (1.2–1.3–1.3–1.3); values >1 for species condition indicated healthy feeding environments.

Forty of the 44 juvenile, immature, and adult salmon lacking adipose fins contained CWTs (Table 13). Twelve CWTs were recovered from chinook salmon and 28 CWTs were recovered from coho salmon. All CWT fish were recovered in the strait habitat and originated from hatchery and wild stocks of the northern region of southeastern Alaska. Of the CWT chinook salmon, nine were juveniles (no marine winters, age 1.0); immatures included two age 1.1 fish and one age 1.2 fish. Of the CWT coho salmon, 27 were juveniles and one was a maturing adult (age 1.1). Migration rates of juvenile chinook (0.5-5.9, $\bar{x}$ = 2.3 km/d) averaged about 1 km/day faster than that of juvenile coho salmon (0.3-2.5, $\bar{x}$ = 1.4 km/d).

Stock-specific information for juvenile chum salmon was derived from the otoliths of a sub-sample of 1,157 fish, representing about 56% of those caught (Table 14). These fish were the same individuals sampled for weight and condition. Of all chum salmon otoliths examined, 353 (31%) were marked: 215 (19%) were from DIPAC and 138 (12%) were from HF. The remaining 804 (69%) chum salmon were unmarked and included both wild stocks and possibly unmarked hatchery stocks from southern release localities. In strait habitat, where sufficient numbers of chum salmon were sampled in all four time periods to examine temporal patterns, the composition of hatchery chum salmon declined from about 55% in June to 3% in September; DIPAC stock contributed most in June, whereas the HF stock contributed most in July (Figure 9).

Stock-specific information for juvenile sockeye salmon was derived from the otoliths of a sub-sample of 383 fish, representing about 83% of those caught (Table 15). These fish were the same individuals sampled for weight and condition. Of all the sockeye salmon otoliths examined, 46 (12%) were marked and originated from the DIPAC Snettisham hatchery from four release groups: early-small (13), early large (17), late small (4), and late large (12). Hatchery stock contribution of sockeye salmon was greatest in June for both habitats. As with chum salmon, numbers of sockeye salmon sufficient to examine temporal patterns were only caught in the strait habitat all four time periods. Hatchery stocks of sockeye salmon declined from 12-17% in June and July to 0-5% in August and September (Figure 10).

Stock-specific information for juvenile coho salmon was derived from the otoliths of a sub-sample of 407 fish, representing about 58% of those caught. These fish were the same individuals sampled for weight and condition. Of all the coho salmon otoliths examined, 44 (11%) were marked and originated from DIPAC hatchery and were caught only in the strait habitat. Hatchery stock contribution of coho salmon increased from 2% in June to 42% in September (Figure 11).

Stock-specific information for juvenile chinook salmon was derived from the otoliths of a sub-sample of 69 fish, representing about 73% of those caught. These fish were the same individuals sampled for weight and condition. Of all the chinook salmon otoliths examined, 51 (74%) were marked and originated from three hatcheries: HF (37), Medvejie (ME) (13), and DIPAC (1), and were caught only in the strait habitat. Hatchery stock contribution of chinook salmon ranged from 55% to 90% and showed no seasonal pattern (Figure 12).

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 13-14). The marked salmon stocks were from DIPAC, HF, and ME hatcheries; these fish were released in 2001 at the following approximate dates and size ranges: chum, April-May (1-4 g); sockeye, April-June (5-10 g); coho, May-June (15-23 g); and chinook salmon, May-July (9-59 g). For all species except coho salmon, individual hatchery stocks were larger than unmarked stocks, probably because hatchery fish were fed before release and unmarked stocks were comprised of late out migrants from many, constantly-recruiting stocks.

Stomachs of 235 potential predators of juvenile salmon were examined, representing 10 species of fish: 78 adult walleye pollock, 15 adult spiny dogfish (*Squalus acanthias*), 46 immature chinook salmon, 53 adult pink salmon, 5 adult chum salmon, 16 adult coho salmon, 1 adult black rockfish (*Sebastes melanops*), and 12 adult pomfret (*Brama japonica*) (Table 16). Overall, 84% of the stomachs contained food. Fish with relatively high rates of non-feeding (more than 20% of individuals) included adult pink and sockeye salmon and adult spiny dogfish. We observed a total of six incidences of predation on juvenile salmon. These predation events occurred in the coastal habitat in July by 8% of adult pomfret and 27% of adult spiny dogfish, and in the strait habitat in late August and September by 14% of adult coho salmon (Table 16).

On a seasonal basis, diets of three predator species, immature chinook salmon, adult coho salmon and spiny dogfish, were dominated by fish prey weight (Figure 15a). The prey biomass of all other species examined except sablefish (*Anoplopoma fimbria*) included some percentage of fish, as well. Prey fish included a variety of non-salmonid species: larvae and juveniles of Pacific herring (*Clupea pallasi*), capelin, Pacific sandlance (*Ammodytes hexapterus*), walleye pollock, cottids, eulachon, pleuronectids, myctophids, and unidentified fish larvae or remains. The dominant invertebrate prey included euphausiids, crab larvae (zoeae and megalops) amphipods (hyperiids) and pteropods for adult pink, chum and sockeye salmon; chum salmon stomachs also contained a large percent weight of unidentifiable material that did not appear to be the typical gelatinous taxa they consume. Walleye pollock consumed about equal percentages of euphausiids and fish prey overall, while pomfret and sablefish were unusual in having diets dominated by squid and pteropods (Figure 15a).

Samples of two species were captured consistently enough to allow comparison of diets across months: walleye pollock from five months (May-September, n = 9-24) and immature chinook salmon from four months (June-September, n = 4-17) (Figure 15b). Some of the walleye pollock stomachs were empty in each month (≤33%), but the chinook salmon exhibited empty stomachs in only two of four months (≤25%). The piscivorus feeding mode was consistent across months for immature chinook salmon, while adult walleye pollock consistently preyed on crustaceans, including decapod larvae, euphausiids and hyperiid amphipods, and smaller percentages of fish (Figure 15b).

In the past five years, coastal monitoring in southeastern Alaska has shown 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 2001, 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, and in 2002, stations in each habitat were 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, June, July, August, and September 2001. See Figure 1.

Habitat	Station	Latitude North	Longitude West	Distance offshore km	Distance between km	Depth m
Inshore						
		Auke Bay station				
	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	57° 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–September 2001.

		Data collection type*					
Dates (days)	Habitat	Rope trawl	CTD cast	Bongo	20-m vertical	WP-2 vertical	Chlorophyll & nutrients
19–20, 24 May (3 days)	Inshore	0	1	2	3	1	1
	Strait	4	8	24	8	0	8
	Coastal	0	4	8	4	4	4
	All May	4	13	34	15	5	13
26 June–01 July (6 days)	Inshore	0	1	2	3	1	1
	Strait	21	21	40	21	0	7
	Coastal	4	4	8	4	4	4
	All June	25	26	50	28	5	12
27 July–01 Aug. (6 days)	Inshore	0	1	2	3	1	1
	Strait	24	23	40	23	0	6
	Coastal	4	4	8	4	4	4
	All July	28	28	50	30	5	11
26–31 August (6 days)	Inshore	0	1	2	3	1	1
	Strait	24	24	34	24	0	8
	Coastal	0	0	0	0	0	0
	All August	24	25	36	27	1	9
26 Sept.–01 Oct. (6 days)	Inshore	0	1	2	3	1	1
	Strait	27	27	40	27	0	8
	Coastal	0	0	0	0	0	0
	All September	27	28	42	30	1	9
Total		108	120	212	130	17	54

*Rope trawl = 20-min hauls with NORDIC 264 surface trawl 20 × 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 collected monthly in marine waters of the northern region of southeastern Alaska, May–September 2001. Station code acronyms are listed in Table 1. NS denotes no sampling.

Habitat	Month	Temp. (°C)	Salinity (PSU)	Temp. (°C)	Salinity (PSU)	Temp. (°C)	Salinity (PSU)	Temp. (°C)	Salinity (PSU)
		Auke Bay station (ABM)							
Inshore	May	7.9	28.8	-	-	-	-	-	-
	June	13.4	18.0	-	-	-	-	-	-
	July	12.7	18.9	-	-	-	-	-	-
	August	12.4	20.2	-	-	-	-	-	-
	September	8.9	23.0	-	-	-	-	-	-
		Upper Chatham Strait transect stations (4)							
Strait		UCA		UCB		UCC		UCD	
	May	7.1	30.0	7.4	30.8	7.8	30.7	7.0	30.7
	June	11.9	26.4	12.3	26.1	12.9	26.3	10.9	28.1
	July	12.1	26.9	12.6	25.7	12.5	23.3	11.9	25.4
	August	12.2	26.4	11.8	27.0	12.4	25.6	12.5	21.1
	September	9.0	28.9	9.5	28.1	9.4	27.8	9.4	27.4
		Icy Strait transect stations (4)							
		ISA		ISB		ISC		ISD	
	May	7.2	31.2	7.2	31.3	7.0	31.1	7.1	31.0
	June	12.2	28.2	11.0	26.9	12.3	23.6	12.2	24.1
	July	10.2	29.2	11.0	29.0	12.1	25.8	12.8	22.6
	August	12.7	22.3	12.4	24.5	12.8	21.5	12.6	23.3
	September	8.8	28.5	9.0	28.1	9.1	28.3	9.2	27.9
		Icy Point transect stations (4)							
Coastal		IPA		IPB		IPC		IPD	
	May	7.1	31.9	7.4	31.9	7.8	32.1	7.6	32.2
	June	12.6	32.0	11.5	31.9	12.1	32.1	11.7	32.0
	July	13.6	31.7	13.3	31.7	13.8	32.0	14.1	32.0
	August	NS	NS	NS	NS	NS	NS	NS	NS
	September	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–September 2001. Station code acronyms are listed in Table 1. NS denotes no sampling.

Station	Date	Nutrients [μM]					Chlorophyll (mg/m^3)	Phaeopigment (mg/m^3)
		[PO_4]	[$Si(OH)_4$]	[NO_3]	[NO_2]	[NH_4]		
ABM	19 May	0.29	3.03	0.25	0.03	1.15	1.27	0.26
	26 June	0.77	7.86	0.00	0.07	0.87	2.33	0.09
	27 July	0.11	4.60	0.02	0.03	0.97	1.39	0.38
	26 August	0.07	3.62	0.00	0.02	0.27	1.10	0.04
	26 September	0.69	22.12	7.82	0.19	2.16	0.28	0.09
UCA	19 May	1.33	14.50	9.42	0.21	3.44	0.04	0.01
	29 July	0.05	15.48	0.00	0.00	0.12	0.61	0.08
	26 August	0.35	15.77	2.48	0.08	0.09	1.97	0.35
	26 September	1.19	30.08	13.62	0.27	0.39	0.93	0.39
UCB	19 May	1.12	9.55	7.06	0.19	3.31	NS	0.02
	26 June	0.06	12.37	0.06	0.01	0.15	3.10	0.18
	26 August	0.26	14.22	1.50	0.21	0.18	1.97	0.28
	26 September	1.34	32.49	15.81	0.32	0.35	0.9	0.37
UCC	19 May	1.12	7.61	6.63	0.19	3.61	0.04	0.01
	26 June	0.15	12.18	0.00	0.05	0.43	2.20	0.27
	26 August	0.14	10.54	1.00	0.04	0.46	0.50	0.06
	26 September	1.37	32.10	15.36	0.34	0.51	1.08	0.35
UCD	19 May	1.19	7.80	7.05	0.20	4.00	0.06	0.02
	26 June	0.05	11.60	0.00	0.00	0.28	2.79	0.23
	29 July	0.09	13.64	0.00	0.02	0.21	2.11	0.76
	26 August	0.19	11.71	1.28	0.05	0.47	0.74	0.11
	26 September	1.22	29.59	14.25	0.31	0.59	1.57	0.47
ISA	20 May	1.29	14.42	9.22	0.26	2.52	1.21	0.27
	28 June	0.18	4.98	0.24	0.03	0.68	4.53	0.57
	29 July	0.25	13.18	0.38	0.05	0.24	NS	NS
	27 August	0.16	10.97	0.79	0.07	0.88	0.64	0.12
	27 September	1.48	36.58	17.92	0.34	0.48	0.70	0.25
ISB	20 May	1.37	14.42	9.43	0.24	2.82	1.28	0.23
	28 June	0.15	4.12	0.45	0.07	0.57	4.90	0.57
	29 July	0.16	9.62	0.45	0.08	0.54	NS	NS
	27 August	0.14	9.63	0.42	0.12	0.68	1.63	0.12
	27 September	1.40	33.60	16.84	0.32	0.32	1.02	0.29
ISC	20 May	1.28	11.43	8.74	0.21	3.54	0.05	0.03
	28 June	0.09	2.77	0.11	0.02	0.25	4.27	0.74
	29 July	0.08	5.49	0.13	0.06	0.43	0.63	0.10

Table 4.—(Cont.)

Station	Date	Nutrients [µM]					Chlorophyll (mg/m^3)	Phaeopigment (mg/m^3)
		[PO_4]	[$Si(OH)_4$]	[NO_3]	[NO_2]	[NH_4]		
ISC	27 August	0.25	12.51	1.12	0.04	0.56	1.32	0.14
	27 September	1.45	33.69	16.42	0.32	0.50	1.09	0.33
ISD	20 May	1.26	11.24	8.65	0.22	3.63	NS	0.02
	28 June	0.09	2.58	0.02	0.02	0.11	3.83	0.76
	29 July	0.07	4.82	0.44	0.00	0.25	0.55	0.11
	27 August	0.22	11.84	1.02	0.05	0.78	1.07	0.13
	27 September	1.33	31.87	15.26	0.30	0.38	1.49	0.45
IPA	24 May	1.37	26.03	12.65	0.23	1.21	0.88	0.55
	27 June	0.72	16.25	0.36	0.05	0.14	0.92	0.10
	28 July	0.43	13.43	0.00	0.07	0.46	NS	NS
IPB	24 May	1.27	28.18	11.68	0.25	0.80	0.60	0.35
	27 June	0.52	22.20	0.30	0.07	0.06	4.75	0.51
	28 July	0.37	10.80	0.00	0.00	0.22	0.70	0.23
IPC	24 May	1.15	23.48	10.17	0.23	0.65	0.60	0.16
	27 June	0.51	15.76	0.07	0.02	0.03	1.49	0.14
	28 July	0.39	8.86	0.00	0.01	0.14	NS	NS
IPD	24 May	1.15	24.26	10.17	0.23	0.61	0.29	0.08
	27 June	0.45	10.02	0.06	0.02	0.16	0.95	0.24
	28 July	0.42	8.18	0.00	0.02	0.19	0.18	0.07

Table 5.—Zooplankton (ZSV) and total plankton (TSV) settled volumes (ml) from vertical 20-m NORPAC hauls sampled monthly in marine waters of the northern region of southeastern Alaska, May–September 2001. Station code acronyms are listed in Table 1. NS denotes no sampling. 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.

Habitat	Month	ZSV	TSV	ZSV	TSV	ZSV	TSV	ZSV	TSV
Inshore									
		Auke Bay station							
		ABM							
	May	12.0*	17.0	—	—	—	—	—	—
	June	19.0	19.0	—	—	—	—	—	—
	July	10.0*	11.0	—	—	—	—	—	—
	August	20.0	20.0	—	—	—	—	—	—
	September	5.0*	55.0	—	—	—	—	—	—
Strait									
		Upper Chatham Strait transect							
		UCA		UCB		UCC		UCD	
	May	28.0	28.0	42.0	42.0	23.0	23.0	23.0	23.0
	June	20.0	20.0	26.0	26.0	48.0	48.0	19.0	19.0
	July	2.0	2.0	4.0	4.0	4.0	4.0	6.0	6.0
	August	2.0	2.0	2.0	2.0	4.0	4.0	5.0	5.0
	September	2.0	2.0	1.0	1.0	2.0	2.0	2.0	2.0
		Icy Strait transect							
		ISA		ISB		ISC		ISD	
	May	16.0*	34.0	15.0*	45.0	18.0	18.0	23.0	23.0
	June	24.0	24.0	19.0	19.0	38.0	38.0	42.0	42.0
	July	2.0	2.0	4.0	4.0	4.0	4.0	6.0	6.0
	August	4.0	4.0	8.0	8.0	8.0	8.0	3.0	3.0
	September	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Coastal									
		Icy Point transect							
		IPA		IPB		IPC		IPD	
	May	6.0	6.0	7.0	7.0	31.0	31.0	26.0	26.0
	June	22.0	22.0	7.0	7.0	12.0	12.0	43.0	43.0
	July	13.0	13.0	7.0	7.0	7.0	7.0	8.0	8.0
	August	NS	NS	NS	NS	NS	NS	NS	NS
	September	NS	NS	NS	NS	NS	NS	NS	NS

Table 6.—Numbers of fishes and squid caught monthly with a rope trawl in marine waters of the northern region of southeastern Alaska, June–September 2001.

Common name	Scientific name	Number caught June	July	August	September	Total
Pink salmon[1]	*Oncorhynchus gorbuscha*	164	1,387	338	644	2,533
Chum salmon[1]	*O. keta*	484	1,354	128	105	2,071
Coho salmon[1]	*O. kisutch*	278	367	32	19	696
Sockeye salmon[1]	*O. nerka*	149	166	18	129	462
Chinook salmon[1]	*O. tshawtscha*	14	24	15	42	95
Chinook salmon[2]	*O. tshawtscha*	17	15	10	4	46
Sockeye salmon[2]	*O. nerka*	0	1	0	0	1
Pink salmon[3]	*O. gorbuscha*	5	51	3	0	51
Coho salmon[3]	*O. kisutch*	1	6	8	1	16
Chum salmon[3]	*O. keta*	3	0	2	0	5
Sockeye salmon[3]	*O. nerka*	2	1	0	0	3
Walleye pollock[4]	*Theragra chalcogramma*	18	3,308	9,744	27,121	40,247
Eulachon	*Thaleichthys pacificus*	0	918	3,380	308	4,606
Soft sculpin	*Psychrolutes sigalutes*	0	0	5	902	907
Squid	Gonatidae	76	29	6	9	120
Crested sculpin	*Blepsias bilobus*	4	31	57	8	100
Capelin	*Mallotus villosus*	1	0	1	57	59
Pacific herring	*Clupea pallasi*	0	5	5	15	25
Smelt	Osmeridae	0	0	0	21	21
Spiny dogfish	*Squalus acanthias*	3	12	0	0	15
Pacific sandlance	*Ammodytes hexapterus*	15	0	0	0	15
Pomfret	*Brama japonica*	0	12	0	0	12
Lingcod	*Ophiodon elongatus*	8	0	0	0	8
Sablefish	*Anoplopoma fimbria*	5	0	0	0	5
Fish larvae (unid.)	Teleostomi	5	0	0	0	5
Rockfish	*Sebastes* spp.	1	3	0	0	4
Smooth lumpsucker	*Aptocyclus ventricosus*	1	0	1	2	4
Wolf-eel	*Anarrhichthys ocellatus*	0	1	2	0	3
Pacific spiny lumpsucker	*Eumicrotremus orbis*	0	0	1	2	3
Sturgeon poacher	*Agonus acipenserinus*	0	0	0	2	2
Pacific saury	*Cololabis saira*	1	0	0	0	1
Whitespotted greenling	*Hexagrammos stelleri*	0	0	1	0	1
Total		1,253	7,692	13,764	29,391	52,156

[1]Juvenile
[2] Immature
[3] Adult
[4]An additional 56 walleye pollock were caught in four trawl hauls in May

Table 7.—Frequency of occurrence for fishes and squid sampled with a rope trawl in marine waters of the northern region of southeastern Alaska, June–September 2001. Percentage occurrence per 104 hauls shown in parentheses.

		Frequency of occurrence					
Common name	Scientific name	June	July	August	September	Total	(%)
Pink salmon[1]	*Oncorhynchus gorbuscha*	11	21	21	23	76	(73)
Chum salmon[1]	*O. keta*	20	22	19	20	81	(78)
Coho salmon[1]	*O. kisutch*	20	25	14	9	68	(65)
Sockeye salmon[1]	*O. nerka*	20	21	10	23	74	(71)
Chinook salmon[1]	*O. tshawtscha*	10	10	9	16	45	(43)
Chinook salmon[2]	*O. tshawtscha*	10	8	6	3	27	(26)
Sockeye salmon[2]	*O. nerka*	0	1	0	0	1	(1)
Pink salmon[3]	*O. gorbuscha*	4	17	3	0	24	(23)
Coho salmon[3]	*O. kisutch*	1	5	6	1	13	(12)
Chum salmon[3]	*O. keta*	3	0	1	0	4	(4)
Sockeye salmon[3]	*O. nerka*	2	1	0	0	3	(3)
Walleye pollock	*Theragra chalcogramma*	10	12	6	10	38	(37)
Eulachon	*Thaleichthys pacificus*	0	1	2	4	7	(7)
Soft sculpin	*Psychrolutes sigalutes*	0	0	4	23	27	(26)
Squid	Gonatidae	1	2	1	4	8	(8)
Crested sculpin	*Blepsias bilobus*	4	15	21	6	46	(44)
Capelin	*Mallotus villosus*	1	0	1	3	5	(5)
Pacific herring	*Clupea pallasi*	0	5	1	5	11	(10)
Smelt	Osmeridae	0	0	0	3	3	(3)
Spiny dogfish	*Squalus acanthias*	2	2	0	0	4	(4)
Pacific sandlance	*Ammodytes hexapterus*	1	0	0	0	1	(1)
Pomfret	*Brama japonica*	0	1	0	0	1	(1)
Lingcod	*Ophiodon elongatus*	3	0	0	0	3	(3)
Sablefish	*Anoplopoma fimbria*	1	0	0	0	1	(1)
Fish larvae (unid.)	Teleostomi	3	0	0	0	3	(3)
Rockfish	*Sebastes* spp.	1	2	0	0	3	(3)
Smooth lumpsucker	*Aptocyclus ventricosus*	1	0	1	2	4	(4)
Wolf-eel	*Anarrhichthys ocellatus*	0	1	2	0	3	(3)
Pacific spiny lumpsucker	*Eumicrotremus orbis*	0	0	1	2	3	(3)
Sturgeon poacher	*Agonus acipenserinus*	0	0	0	2	2	(2)
Pacific saury	*Cololabis saira*	1	0	0	0	1	(1)
Whitespotted greenling	*Hexagrammos stelleri*	0	0	1	0	1	(1)

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

Table 8.—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–September 2001. NS denotes no sampling.

		June				July				August				September			
Locality	Factor	*n*	range	$\bar{x}$	sd	*n*	range	$\bar{x}$	sd	*n*	range	$\bar{x}$	sd	*n*	range	$\bar{x}$	sd
Upper	Length	93	65-111	93.3	10.3	646	85-151	118.8	11.2	64	123-186	161.7	13.2	285	140-245	202.5	12.6
Chatham	Weight	93	2.1-12.3	7.5	2.4	180	6.9-34.3	17.1	5.3	64	17.1-63.9	42.4	10.4	47	54.6-127.9	86.7	15.1
Strait	Condition	93	0.8-1.0	0.9	0.0	180	0.8-1.9	0.9	0.1	64	0.9-1.1	1.0	0.1	47	0.9-1.2	1.0	0.1
Icy	Length	70	77-117	92.9	8.0	680	97-163	124.2	8.9	274	96-205	153.3	17.0	359	143-239	202.9	13.0
Strait	Weight	47	4.2-11.5	7.4	2.1	295	9.3-42.0	18.4	4.6	161	6.9-86.1	32.9	11.7	162	27.1-157.9	81.6	18.9
	Condition	47	0.5-1.2	0.9	0.1	295	0.6-2.0	0.9	0.1	161	0.5-1.2	1.0	0.1	162	0.9-1.2	1.0	0.1
Icy	Length	—	—	—	—	83	91-156	109.5	13.1	NS				NS			
Point	Weight	—	—	—	—	83	6.2-35.7	12.8	6.0	NS				NS			
	Condition	—	—	—	—	83	0.8-1.7	0.9	0.1	NS				NS			
Total	Length	163	65-117	93.1	9.4	1409	85-163	120.9	10.9	338	96-205	154.9	16.7	644	140-245	202.7	12.8
	Weight	140	2.1-12.3	7.5	2.3	558	6.2-42.0	17.1	5.4	225	6.9-86.1	35.6	12.1	209	27.1-157.9	82.8	18.2
	Condition	140	0.5-1.2	0.9	0.1	558	0.6-2.0	0.9	0.1	225	0.5-1.2	1.0	0.1	209	0.9-1.2	1.0	0.1

Table 9.—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–September 2001. NS denotes no sampling.

		June				July				August				September			
Locality	Factor	*n*	range	$\bar{x}$	sd	*n*	range	$\bar{x}$	sd	*n*	range	$\bar{x}$	sd	*n*	range	$\bar{x}$	sd
Upper	Length	87	70-117	95.0	9.4	535	88-171	120.6	12.1	13	135-197	166.9	18.4	37	178-240	207.8	15.6
Chatham	Weight	87	2.8-15.8	8.4	2.6	195	6.6-48.3	17.4	5.8	11	23.8-74.4	48.1	16.8	37	56.6-159.0	97.1	25.5
Strait	Condition	87	0.7-1.0	0.9	0.1	195	0.7-1.3	0.9	0.1	11	0.9-1.2	1.0	0.1	37	1.0-1.2	1.1	0.1
Icy	Length	378	63-121	95.9	9.6	730	82-171	124.1	12.2	115	93-194	142.1	17.4	68	143-232	197.8	17.2
Strait	Weight	289	2.2-15.3	8.4	2.6	354	4.8-53.9	19.1	5.6	106	7.0-81.5	30.5	12.5	31	24.5-136.0	84.9	23.9
	Condition	289	0.3-1.8	0.9	0.1	354	0.7-1.5	0.9	0.1	106	0.8-1.1	0.9	0.1	31	0.3-3.5	1.1	0.5
Icy	Length	10	95-136	112.4	14.3	87	100-145	123.2	10.4	NS				NS			
Point	Weight	10	6.7-24.0	13.3	6.4	87	7.8-30.2	17.6	4.8	NS				NS			
	Condition	10	0.8-1.0	0.9	0.1	87	0.5-1.1	0.9	0.1	NS				NS			
Total	Length	475	63-136	96.1	10.0	1352	82-171	122.7	12.2	128	93-197	144.6	19.0	105	143-240	201.3	17.3
	Weight	386	2.2-24.0	8.5	2.8	636	4.8-53.9	18.4	5.6	117	7.0-81.5	32.1	13.9	68	24.5-159.0	91.6	25.3
	Condition	386	0.3-1.8	0.9	0.1	636	0.5-1.5	0.9	0.1	117	0.8-1.2	1.0	0.1	68	0.3-3.5	1.1	0.3

Table 10.—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–September 2001.NS denotes no sampling.

		June				July				August				September			
Locality	Factor	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd
Upper	Length	19	70-161	116.7	23.8	41	82-163	121.4	18.4	5	155-205	174.2	18.8	64	137-252	180.8	24.3
Chatham	Weight	19	3.4-45.3	18.4	11.1	41	5.7-47.1	20.2	9.6	5	15.6-93.1	52.4	27.9	64	25.0-158.8	66.5	28.4
Strait	Condition	19	0.9-1.1	1.0	0.1	41	0.1-3.1	1.1	0.5	5	0.3-1.2	0.9	0.3	64	0.9-1.2	1.1	0.1
Icy	Length	121	79-179	119.2	22.3	115	82-182	125.8	18.9	13	95-165	136.9	19.2	65	111-234	174.8	25.4
Strait	Weight	116	4.8-57.5	18.6	11.2	81	5.7-62.1	21.1	10.7	13	7.7-48.6	29.3	12.3	28	22.7-107.8	51.9	20.8
	Condition	116	0.8-1.2	1.0	0.1	81	0.8-1.2	1.0	0.1	13	0.9-1.2	1.1	0.1	28	0.7-1.1	1.0	0.1
Icy	Length	9	107-119	113.4	4.6	7	103-192	159.3	32.2	NS				NS			
Point	Weight	9	11.2-14.6	13.0	1.3	7	8.7-73.2	45.5	24.9	NS				NS			
	Condition	9	0.8-1.0	0.9	0.0	7	0.8-1.1	1.0	0.1	NS				NS			
Total	Length	149	70-179	118.6	21.8	163	82-192	126.2	20.6	18	95-205	147.3	25.2	129	111-252	177.8	24.9
	Weight	144	3.4-57.5	18.2	10.9	129	5.7-73.2	22.1	12.7	18	7.7-93.1	35.7	20.1	92	22.7-158.8	62.0	27.0
	Condition	144	0.8-1.2	1.0	0.1	129	0.1-3.1	1.0	0.3	18	0.3-1.2	1.0	0.2	92	0.7-1.2	1.0	0.1

Table 11.—Length (mm fork), weight (g), and condition [(weight/length^3)*(10^5)] of juvenile coho salmon captured in different marine habitats of the northern region of southeastern Alaska by rope trawl, June–September 2001. NS denotes no sampling.

		June				July				August				September			
Locality	Factor	*n*	range	$\bar{x}$	sd	*n*	range	$\bar{x}$	sd	*n*	range	$\bar{x}$	sd	*n*	range	$\bar{x}$	sd
Upper Chatham Strait	Length	36	126-201	162.4	16.4	114	133-240	180.3	22.6	14	203-298	238.4	30.8	11	230-284	263.6	14.8
	Weight	35	22.1-93.5	52.4	27.9	68	35.3-172.1	78.6	31.6	14	91.1-360.4	167.2	76.2	9	173.1-269.2	223.7	31.1
	Condition	35	1.0-1.3	1.1	0.1	68	0.5-1.3	1.1	0.1	14	1.0-1.4	1.2	0.1	9	1.1-1.3	1.2	0.0
Icy Strait	Length	232	104-236	164.1	21.0	243	137-258	193.6	22.4	18	192.274	218.1	20.2	8	226-270	252.0	15.2
	Weight	163	11.1-143.3	50.6	19.9	143	28.6-194.7	86.1	33.1	13	77.4-165.8	114.5	26.5	3	161.1-231.1	195.2	35.0
	Condition	163	0.8-1.3	1.1	0.1	143	0.9-1.4	1.1	0.1	13	1.0-1.3	1.2	0.1	3	1.1-1.2	1.1	0.0
Icy Point	Length	—	—	—	—	6	201-237	219.3	15.2	NS				NS			
	Weight	—	—	—	—	6	90.4-165.9	128.1	30.8	NS				NS			
	Condition	—	—	—	—	6	1.1-1.3	1.2	0.1	NS				NS			
Total	Length	268	104-236	163.9	20.4	363	133-258	189.8	23.5	32	192-298	227.0	27.0	19	226-284	258.7	15.7
	Weight	198	11.1-143.3	50.4	19.3	217	28.6-194.7	84.9	33.4	27	77.4-360.4	141.8	62.8	12	161.1-269.2	216.6	33.0
	Condition	198	0.8-1.3	1.1	0.1	217	0.5-1.4	1.1	0.1	27	1.0-1.4	1.2	0.1	12	1.1-1.3	1.2	0.0

Table 12.—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–September 2001. NS denotes no sampling.

		June				July				August				September			
Locality	Factor	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd
Upper	Length	6	121-247	191.3	41.1	13	163-241	216.0	20.7	6	207-269	232.8	21.6	16	197-313	260.9	28.5
Chatham	Weight	6	20.1-202.2	96.4	59.6	13	51.9-198.9	140.9	37.7	6	118.1-267.8	168.2	54.3	15	103.5-389.4	246.9	76.6
Strait	Condition	6	1.1-1.3	1.2	0.1	13	1.2-1.5	1.4	0.1	6	1.2-1.4	1.3	0.1	15	1.2-1.5	1.3	0.1
Icy	Length	8	185-281	209.3	31.8	11	153-232	215.0	21.8	9	225-302	254.1	21.4	26	186-286	251.7	23.7
Strait	Weight	8	70.5-282.3	124.4	69.0	11	44.0-175.0	135.1	36.5	7	192.5-375.6	244.2	61.0	6	73.5-306.6	221.9	89.7
	Condition	8	1.1-1.4	1.3	0.1	11	1.1-1.4	1.3	0.1	7	1.3-1.5	1.4	0.1	6	1.1-1.5	1.3	0.1
Icy	Length	—	—	—	—	—	—	—	—	NS				NS			
Point	Weight	—	—	—	—	—	—	—	—	NS				NS			
	Condition	—	—	—	—	—	—	—	—	NS				NS			
Total	Length	14	121-281	201.6	35.8	24	153-241	215.5	20.7	15	207-302	245.6	23.3	42	186-313	255.2	25.7
	Weight	14	20.1-282.3	112.4	64.3	24	44.0-198.9	138.3	36.5	13	118.1-375.6	209.1	68.2	21	73.5-389.4	239.7	79.1
	Condition	14	1.1-1.4	1.2	0.1	24	1.1-1.5	1.3	0.1	13	1.2-1.5	1.3	0.1	21	1.1-1.5	1.3	0.1

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, June—September 2001. Station code position coordinates are shown in Table 1.

			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)
							June								
Chinook	04:48/19	1999	NSRAA	Kasnyku Bay, AK	06/05/01	–	40.5	Icy Strait	(ISD)	06/28/01	201	105.5	1.0	23	135
Chinook	04:48/19	1999	NSRAA	Kasnyku Bay, AK	06/05/01	–	40.5	Icy Strait	(ISC)	06/30/01	186	79.0	1.0	25	130
Chinook	04:01/62	1998	DIPAC	Fish Creek, AK	06/09/00	–	26.1	Chatham Strait	(UCC)	07/01/01	325	660.0	1.1	387	55
Coho	04:01/04/04/02	1998	ADFG	Berners River, AK	05/15/01	–	–	Icy Strait	(ISC)	06/28/01	161	49.5	1.0	44	105
Coho	04:46/27	1999	ADFG	Berners River, AK	05/15/01	–	–	Icy Strait	(ISC)	06/29/01	172	59.3	1.0	45	105
Coho	04:46/59	1998	ADFG	Berners River, AK	05/15/01	—	–	Icy Strait	(ISC)	06/30/01	181	68.9	1.0	46	105
Coho	04:03/96	1999	ADFG	Chilkat River, AK	05/03/01	86	6.2	Icy Strait	(ISC)	06/30/01	151	38.1	1.0	58	105
Coho	04:50/06	1998	BURR	Burro Creek, AK	06/13/00	110	12.6	Icy Strait	(ISB)	07/01/01	185	73.0	3.0**	383	170
Coho	04:04/54	1999	ADFG	Taku River, AK	04/25/00	85	–	Chatham Strait	(UCD)	07/01/01	181	67.9	2.0**	432	130
Coho	04:04/56	1999	ADFG	Taku River, AK	05/25/00	85	–	Chatham Strait	(UCD)	07/01/01	153	39.9	2.0**	402	130
							July								
Chinook	04:48/19	1999	NSRAA	Hidden Falls, AK	06/05/01	–	40.5	Chatham Strait	(UCA)	07/29/01	223	155.2	1.0	54	100
Chinook	04:48/19	1999	NSRAA	Hidden Falls, AK	06/05/01	–	40.5	Chatham Strait	(UCA)	07/29/01	241	198.9	1.0	54	100
Chinook	50:04/57	1997	DIPAC	Gastineau Channel, AK	06/07/99	–	25.3	Icy Strait	(ISB)	07/29/01	562	2,600.0	1.2	783	85
Chinook	04:38/63	1998	NSRAA	Kasnyku Bay, AK	05/24/00	–	37.1	Icy Strait	(ISC)	07/30/01	432	1300.0	1.1	432	130
Chinook	04:28/18	1999	NSRAA	Bear Cove, AK	05/21/01	–	36.5	Icy Strait	(ISC)	07/31/01	385	166.3	1.0	71	175
Chinook	No tag	–	–	–	–	–	–	Chatham Strait	(UCD)	07/27/01	222	134.8	–	–	–
Coho	04:01/68	1999	ADFG	Auke Creek, AK	06/01//01	111	13.0	Chatham St.	(UCD)	07/27/01	179	55.8	1.0	56	50
Coho	04:03/90	1999	DIPAC	Gastineau Channel, AK	06/14/01	–	22.4	Chatham Strait	(UCD)	07/27/01	175	55.5	1.0	43	45
Coho	04:03/90	1999	DIPAC	Gastineau Channel, AK	06/14/01	–	22.4	Chatham Strait	(UCD)	07/27/01	194	72.7	1.0	43	45
Coho	04:03/90	1999	DIPAC	Gastineau Channel, AK	06/14/01	–	22.4	Icy Strait	(ISC)	07/31/01	188	76.9	1.0	46	85
Coho	04:03/91	1999	DIPAC	Gastineau Channel, AK	06/14/01	–	21.8	Chatham Strait	(UCD)	07/27/01	188	78.9	1.0	43	45
Coho	04:03/91	1999	DIPAC	Gastineau Channel, AK	06/14/01	–	21.8	Chatham Strait	(UCD)	07/27/01	173	50.7	1.0	43	45
Coho	04:03/91	1999	DIPAC	Gastineau Channel, AK	06/14/01	–	21.8	Chatham Strait	(UCD)	07/27/01	181	59.8	1.0	43	45
Coho	04:03/91	1999	DIPAC	Gastineau Channel, AK	06/14/01	–	21.8	Icy Strait	(ISC)	07/30/01	181	63.7	1.0	46	85
Coho	04:03/91	1999	DIPAC	Gastineau Channel, AK	06/14/01	–	21.8	Chatham Strait	(UCC)	08/01/01	194	84.6	1.0	48	45
Coho	04:03/92	1999	DIPAC	Sheep Creek, AK	06/14/01	–	15.9	Chatham Strait	(UCD)	07/27/01	162	44.8	1.0	43	70
Coho	04:03/92	1999	DIPAC	Sheep Creek, AK	06/14/01	–	15.9	Chatham Strait	(UCC)	07/27/01	171	30.6	1.0	43	70
Coho	04:40/21	1998	ADFG	Berners River, AK	05/30/01	—	–	Chatham Strait	(UCD)	07/27/01	175	50.3	1.0	58	75
Coho	04:40/21	1998	ADFG	Berners River, AK	05/30/01	—	–	Chatham Strait	(UCD)	07/27/01	175	61.3	1.0	58	75

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)
							July								
Coho	04:40/21	1998	ADFG	Berners River, AK	05/30/01	—	–	Chatham Strait	(UCD)	07/27/01	179	43.0	1.0	58	75
Coho	04:03/98	1999	DIPAC	Chilkat River, AK	05/23/01	86	6.2	Icy Strait	(ISA)	07/29/01	195	86.5	1.0	67	170
Coho	04:19/05	1998	NSRAA	Kasnyku Bay, AK	06/02/00	–	20.5	Icy Strait	(ISC)	07/30/01	163	51.5	2.0**	432	130
Coho	50:31/20	1998	DIPAC	Gastineau Channel, AK	06/12/00	–	21.4	Icy Strait	(ISC)	07/31/01	605	3,450.0	1.1	414	85
Coho	04:03/89	1999	DIPAC	Gastineau Channel, AK	06/14/01	–	20.9	Icy Strait	(ISC)	07/31/01	183	70.6	1.0	47	85
Coho	No tag	–	–	–	–	–	–	Chatham Strait	(UCB)	08/01/01	528	1,950.0	–	–	–
							August								
Coho	04:03/90	1999	DIPAC	Gastineau Channel, AK	06/14/01	–	21.8	Icy Strait	(ISA)	08/29/01	207	94.1	1.0	76	90
							September								
Chinook	04:03/93	1999	DIPAC	Gastineau Channel, AK	06/12/01	–	18.3	Icy Strait	(ISB)	09/27/01	238	188.9	1.0	107	85
Chinook	04:03/93	1999	DIPAC	Gastineau Channel, AK	06/12/01	–	18.3	Chatham Strait	(UCA)	10/01/01	247	195.9	1.0	111	55
Chinook	04:48/19	1999	NSRAA	Kasnyku Bay, AK	06/05/01	–	40.5	Icy Strait	(ISC)	09/29/01	270	290.0	1.0	116	130
Chinook	04:48/19	1999	NSRAA	Kasnyku Bay, AK	06/05/01	–	40.5	Icy Strait	(ISC)	09/29/01	264	250.0	1.0	116	130
Chinook	No tag	–	–	–	–	–	–	Icy Strait	(ISB)	09/27/01	442	1,260.0	–	–	–
Chinook	No tag	–	–	–	–	–	–	Icy Strait	(ISD)	09/30/01	268	243.6	–	–	–
Coho	04:03/92	1999	DIPAC	Sheep Creek, AK	06/14/01	–	15.9	Chatham Strait	(UCB)	10/01/01	230	125.9	1.0	109	5
Coho	04:03/91	1999	DIPAC	Gastineau Channel, AK	06/14/01	—	21.8	Chatham Strait	(UCB)	10/01/01	271	213.2	1.0	109	55

*ADFG = Alaska Department of Fish and Game; BURR = Burro Creek; DIPAC = Douglas Island Pink and Chum; NSRA = Northern Southeast Regional Aquaculture Association.

**Based on the size of capture, these fish probably spent an extra winter in freshwater rather than migrating to sea; therefore the days since release include a substantial amount of time in freshwater and are not indicative of the actual number of days at sea.

Table 14.—Stock-specific information on juvenile chum salmon captured in different marine habitats of the northern region of southeastern Alaska by rope trawl, June–September 2001. NS denotes no sampling. Numbers (*n*), ranges, means, and standard deviations (sd) are shown for fork length (mm), weight (g) and Fulton's condition factor (g/FL^3*10^5).

		June				July				August				September			
Locality	Factor	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd
DIPAC																	
Upper	Length	50	71-113	96.6	8.5	9	108-142	127.2	10.6	—	—	—	—	—	—	—	—
Chatham	Weight	50	2.8-14.9	8.7	2.4	9	12.8-28.4	20.6	4.9	—	—	—	—	—	—	—	—
Strait	Condition	50	0.7-1.0	0.9	0.1	9	0.9-1.0	1.0	0.0	—	—	—	—	—	—	—	—
Icy	Length	132	75-119	99.0	8.3	16	114-157	135.1	14.9	4	118-190	144.5	32.0	—	—	—	—
Strait	Weight	132	4.2-15.3	9.2	2.3	16	14.4-37.6	24.6	7.8	4	14.6-72.1	34.1	26.3	—	—	—	—
	Condition	132	0.7-1.8	0.9	0.1	16	0.9-1.1	1.0	0.1	4	0.9-1.1	1.0	0.1	—	—	—	—
Icy	Length	—	—	—	—	4	117-130	121.8	5.7	NS				NS			
Point	Weight	—	—	—	—	4	12.7-21.8	16.5	3.8	NS				NS			
	Condition	—	—	—	—	4	0.8-1.0	0.9	0.1	NS				NS			
Total	Length	182	71-119	98.3	8.4	29	108-157	130.8	13.5	4	118-190	144.5	32.0	—	—	—	—
	Weight	182	2.8-15.3	9.1	2.3	29	12.7-37.6	22.2	7.0	4	14.6-72.1	34.1	26.3	—	—	—	—
	Condition	182	0.7-1.8	0.9	0.1	29	0.8-1.1	1.0	0.1	4	0.9-1.1	1.0	0.1	—	—	—	—
Hidden Falls																	
Upper	Length	—	—	—	—	35	101-155	122.7	13.0	—	—	—	—	1	239	239.0	0.0
Chatham	Weight	—	—	—	—	35	9.2-32.7	17.9	6.0	—	—	—	—	1	155.8	155.8	0.0
Strait	Condition	—	—	—	—	35	0.8-1.1	0.9	0.1	—	—	—	—	1	1.1	1.1	0.0
Icy	Length	—	—	—	—	87	104-156	127.0	9.9	6	158-194	172.5	13.4	1	191	191.0	0.0
Strait	Weight	—	—	—	—	87	10.4-33.6	19.4	4.6	6	39.5-81.5	53.6	16.7	1	75.6	75.6	0.0
	Condition	—	—	—	—	87	0.8-1.5	0.9	0.1	6	0.9-1.1	1.0	0.1	1	1.1	1.1	0.0

Table 14.—(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 *n*	September range	September x̄	September sd
Icy Point	Length	—	—	—	—	8	115-145	134.0	10.3	NS				NS			
	Weight	—	—	—	—	8	12.5-30.2	22.8	5.9	NS				NS			
	Condition	—	—	—	—	8	0.8-1.0	0.9	0.1	NS				NS			
Total	Length	—	—	—	—	130	1.1-156	126.3	11.1	6	158-194	172.5	13.4	2	191-239	215.0	33.9
	Weight	—	—	—	—	130	9.2-33.6	19.2	5.2	6	39.5-81.5	53.6	16.7	2	75.6-155.8	115.7	56.8
	Condition	—	—	—	—	130	0.8-1.5	0.9	0.1	6	0.9-1.1	1.0	0.1	2	1.1	1.1	0.0
Unmarked																	
Upper Chatham Strait	Length	37	70-117	92.7	10.2	151	91-171	120.4	12.4	11	135-197	165.7	19.2	36	178-240	206.9	14.9
	Weight	37	3.2-15.8	8.0	2.8	151	6.6-48.3	17.0	5.8	11	23.8-74.4	48.1	16.8	36	56.6-159.0	95.5	23.8
	Condition	37	0.8-1.0	1.0	0.1	151	0.7-1.3	0.9	0.1	11	0.9-1.2	1.0	0.1	36	1.0-1.2	1.1	0.1
Icy Strait	Length	107	63-117	92.3	10.1	251	85-171	124.3	12.1	96	93-182	140.6	15.8	30	143-232	197.8	18.0
	Weight	107	2.2-14.4	7.4	2.6	251	4.8-53.9	18.6	5.6	96	7.0-62.9	28.9	10.0	30	24.5-136.0	85.2	24.2
	Condition	107	0.3-1.1	0.9	0.1	251	0.7-1.2	0.9	0.1	96	0.8-1.1	1.0	0.1	30	0.3-3.5	1.1	0.5
Icy Point	Length	10	95-136	112.4	14.2	75	100-144	122.1	10.0	NS				NS			
	Weight	10	6.7-24.0	13.3	6.4	75	7.8-28.3	17.1	4.4	NS				NS			
	Condition	10	0.8-1.0	0.9	0.1	75	0.5-1.1	0.9	0.1	NS				NS			
Total	Length	154	63-136	93.7	11.5	477	85-171	122.7	12.0	107	93-197	143.1	17.8	66	143-240	202.8	16.9
	Weight	154	2.2-24.0	7.9	3.3	477	4.8-53.9	17.9	5.5	107	7.0-74.4	30.9	12.3	66	24.5-159.0	90.8	24.4
	Condition	154	0.3-1.1	0.9	0.1	477	0.5-1.3	0.9	0.1	107	0.8-1.2	1.0	0.1	66	0.3-3.5	1.1	0.3

Table 15.—Stock-specific information on juvenile sockeye salmon captured in different marine habitats of the northern region of southeastern Alaska by rope trawl, June–September 2001. NS denotes no sampling. Numbers (*n*), ranges, means, and standard deviations (sd) are shown for fork length (mm), weight (g) and Fulton's condition factor ($g/FL^3 * 10^5$).

		June				July				August				September			
Locality	Factor	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd
Snettisham																	
Upper	Length	3	102-118	111.7	8.5	8	95-163	130.6	20.2	—	—	—	—	5	193-236	210.0	17.3
Chatham	Weight	3	11.6-16.2	14.4	2.5	8	19.3-31.8	26.0	5.0	—	—	—	—	5	80.6-152.2	104.4	28.5
Strait	Condition	3	1.0-1.1	1.0	0.1	8	0.7-3.1	1.3	0.7	—	—	—	—	5	1.0-1.2	1.1	0.1
Icy	Length	20	88-140	116.7	11.7	7	131-182	143.1	17.4	—	—	—	—	—	—	—	—
Strait	Weight	20	6.1-27.7	16.5	4.8	7	21.8-62.1	30.3	14.2	—	—	—	—	—	—	—	—
	Condition	20	0.9-1.1	1.0	0.1	7	0.9-1.0	1.0	0.0	—	—	—	—	—	—	—	—
Icy	Length	3	109-117	113.7	4.2	—	—	—	—	NS				NS			
Point	Weight	3	12.7-13.4	13.1	0.4	—	—	—	—	NS				NS			
	Condition	3	0.8-1.0	0.9	0.1	—	—	—	—	NS				NS			
Total	Length	26	88-140	115.7	10.7	15	95-182	136.5	19.4	—	—	—	—	5	193-236	210.0	17.3
	Weight	26	6.1-27.7	15.8	4.4	15	19.3-62.1	28.0	10.2	—	—	—	—	5	80.6-152.2	104.4	28.5
	Condition	26	0.8-1.1	1.0	0.1	15	0.7-3.1	1.2	0.6	—	—	—	—	5	1.0-1.2	1.1	0.1
Unmarked																	
Upper	Length	16	70-161	117.6	25.8	33	82-163	119.5	17.6	5	155-205	174.2	18.8	59	137-252	178.4	23.2
Chatham	Weight	16	3.4-45.3	19.1	11.9	33	5.7-47.1	18.8	10.0	5	15.6-93.1	52.4	27.9	59	25.0-158.8	63.2	26.1
Strait	Condition	16	0.9-1.1	1.0	0.1	33	0.1-2.1	1.1	0.4	5	0.3-1.2	0.9	0.3	59	0.9-1.2	1.1	0.1
Icy	Length	96	79-179	119.2	23.9	74	82-175	123.5	18.4	13	95-165	136.9	19.2	28	131-216	170.4	21.5
Strait	Weight	96	4.8-57.5	19.0	12.1	74	5.7-59.5	20.2	10.0	13	7.7-48.6	29.3	12.3	28	22.7-107.8	51.9	20.8
	Condition	96	0.8-1.2	1.0	0.1	74	0.8-1.2	1.0	0.1	13	0.9-1.2	1.1	0.1	28	0.7-1.1	1.0	0.1

Table 15.—(Cont.)

		June				July				August				September			
Localit	Factor	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd	*n*	range	x̄	sd
Icy	Length	6	107-119	113.3	5.1	7	103-192	159.3	32.2	NS				NS			
Point	Weight	6	11.2-14.6	12.9	1.6	7	8.7-73.2	45.5	24.9	NS				NS			
	Condition	6	0.9	0.9	0.0	7	0.8-1.1	1.0	0.1	NS				NS			
Total	Length	118	70-179	118.7	23.5	114	82-192	124.5	21.1	18	95-205	147.3	25.2	87	131-252	175.8	22.9
	Weight	118	3.4-57.5	18.7	11.8	114	5.7-73.2	21.3	12.8	18	7.7-93.1	35.7	20.1	87	22.7-158.8	59.6	25.0
	Condition	118	0.8-1.2	1.0	0.1	114	0.1-2.1	1.0	0.2	18	0.3-1.2	1.0	0.2	87	0.7-1.2	1.0	0.1

Table 16.--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-August 2001.

Predator species	Life history stage	Number examined	Number empty	Percent feeding	Number with salmon	Percent feeders w/ salmon
	Predation on juvenile salmon					
Pomfret	A	12	0	100	1	8
Coho salmon	A	16	2	88	2	14
Spiny dogfish	A	15	4	73	3	27
	No predation on juvenile salmon					
Walleye pollock	J-A	78	13	83	0	0
Pink salmon	A	53	13	76	0	0
Chinook salmon	I	46	2	96	0	0
Chum salmon	A	5	1	80	0	0
Sablefish	A	5	1	80	0	0
Sockeye salmon	A	4	1	75	0	0
Black rockfish	A	1	1	0	0	0
Total		235	38		6	

J=juvenile, 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, June–September 2001. Nocturnal sampling was conducted at 2200 and 0400 hours at the ISC station for Haul#s: 5027, 5034, 5053, 5060, 5077, 5087, 5102, and 5110.

			Juvenile					Immature	Adult		
Date	Haul#	Station	Pink	Chum	Sockeye	Coho	Chinook	Chinook	Pink	Chum	Coho
26 June	5015	UCD	1	—	—	5	2	—	—	—	—
26 June	5016	UCC	25	22	3	—	2	—	—	—	—
26 June	5017	UCB	—	6	2	1	—	—	—	—	—
26 June	5018	UCA	4	—	2	13	—	—	—	—	—
27 June	5019	IPD	—	—	—	—	—	—	—	—	—
27 June	5020	IPC	—	—	—	—	—	—	—	1	—
27 June	5021	IPB	—	1	—	—	—	—	—	—	—
27 June	5022	IPA	—	9	9	—	—	1	2	—	—
28 June	5023	ISD	7	23	2	7	1	—	—	—	—
28 June	5024	ISC	19	34	4	6	—	—	—	—	—
28 June	5025	ISB	21	41	2	8	1	1	1	—	—
28 June	5026	ISA	—	29	1	2	1	1	—	—	1
29 June	5027	ISC	1	7	7	28	—	—	—	—	—
29 June	5028	ISC	9	81	9	31	—	1	—	—	—
29 June	5029	ISC	—	16	—	3	—	—	—	—	—
29 June	5030	ISC	13	23	2	5	—	—	1	—	1
30 June	5031	ISC	—	8	5	21	2	2	1	—	—
30 June	5032	ISC	—	9	10	29	1	2	—	—	—
30 June	5033	ISC	1	41	39	20	1	3	—	—	—
30 June	5034	ISC	—	5	10	15	—	3	—	—	—
01 July	5035	ISA	—	29	5	21	—	—	—	—	—
01 July	5036	ISB	—	30	22	17	—	—	—	—	—
01 July	5037	ISD	—	10	3	29	1	—	—	—	1
01 July	5038	UCC	63	60	10	5	2	1	—	—	—
01 July	5039	UCD	—	—	2	12	—	2	—	—	—

Appendix 1.—(Cont.)

Date	Haul#	Station	Juvenile					Immature	Adult		
			Pink	Chum	Sockeye	Coho	Chinook	Chinook	Pink	Chum	Coho
27 July	5041	UCD	136	119	26	78	4	2	—	—	—
27 July	5042	UCC	215	154	6	12	—	1	1	—	—
27 July	5043	UCB	244	252	4	4	—	—	1	—	—
28 July	5045	IPD	—	—	—	—	—	—	—	—	—
28 July	5046	IPC	14	15	—	—	—	—	—	—	—
28 July	5047	IPB	21	50	6	3	—	—	1	—	—
28 July	5048	IPA	48	22	2	3	—	—	1	—	—
29 July	5044	UCA	—	3	—	1	7	—	—	—	—
29 July	5049	ISA	24	72	8	15	—	—	2	—	—
29 July	5050	ISB	14	15	2	17	—	1	2	—	—
29 July	5051	ISC	36	80	5	12	—	—	13	—	—
29 July	5052	ISD	10	6	5	16	—	1	4	—	2
30 July	5053	ISC	—	—	—	12	2	3	—	—	—
30 July	5054	ISC	5	42	2	29	2	—	—	—	—
30 July	5055	ISC	75	61	1	15	—	—	—	—	—
30 July	5056	ISC	8	9	1	47	—	—	1	—	—
30 July	5999	ISC	209	182	16	25	—	—	1	—	—
31 July	5057	ISC	5	4	2	16	1	—	4	—	—
31 July	5058	ISC	118	124	33	7	—	—	—	—	—
31 July	5059	ISC	4	19	8	20	4	1	—	—	1
31 July	5060	ISC	—	—	—	3	1	5	11	—	—
31 July	5061	ISD	63	45	4	5	1	—	1	—	—
31 July	5062	ISB	110	72	30	8	—	—	—	—	—
31 July	5063	ISA	—	—	—	—	—	—	—	—	—
01 August	5064	UCA	5	1	—	4	—	—	2	—	1
01 August	5065	UCB	—	—	1	5	1	—	3	—	1
01 August	5066	UCC	—	—	2	6	1	1	2	—	—

Appendix 1.—(Cont.)

Date	Haul#	Station	Juvenile					Immature	Adult		
			Pink	Chum	Sockeye	Coho	Chinook	Chinook	Pink	Chum	Coho
01 August	5067	UCD	23	7	2	4	—	—	—	—	—
26 August	5069	UCD	3	—	—	—	3	—	—	—	—
26 August	5070	UCC	42	2	2	2	2	—	—	—	—
26 August	5071	UCB	1	1	—	4	—	—	1	—	1
26 August	5072	UCA	1	—	—	—	—	2	1	—	1
27 August	5073	ISA	2	1	—	3	—	—	—	—	—
27 August	5074	ISB	17	17	—	1	—	—	—	—	—
27 August	5075	ISC	9	4	1	1	2	—	—	—	—
27 August	5076	ISD	23	23	2	1	—	1	—	—	—
28 August	5077	ISC	—	—	—	—	—	2	1	—	—
28 August	5078	ISC	2	1	—	—	—	—	—	—	—
28 August	5079	ISC	—	2	—	—	—	—	—	—	—
28 August	5080	ISC	1	14	—	1	1	—	—	—	1
29 August	5081	ISA	2	1	—	4	—	—	—	—	—
29 August	5082	ISB	2	—	—	1	1	—	—	—	—
29 August	5083	ISD	24	13	1	1	2	—	—	—	—
30 August	5084	ISC	4	—	—	—	—	—	—	—	—
30 August	5085	ISC	14	4	1	—	1	—	—	—	1
30 August	5086	ISC	87	26	5	2	2	—	—	—	—
30 August	5087	ISC	63	3	3	1	—	2	—	2	—
31 August	5088	UCA	1	1	—	8	—	1	—	—	3
31 August	5089	UCB	—	2	1	—	1	2	—	—	1
31 August	5090	UCC	11	4	1	—	—	—	—	—	—
31 August	5091	UCD	5	3	1	—	—	—	—	—	—
31 August	5092	ISD	24	6	—	2	—	—	—	—	—
26 September	5094	UCD	2	1	2	—	1	—	—	—	—
26 September	5095	UCC	1	—	2	—	—	—	—	—	—

Appendix 1.—(Cont.)

			Juvenile					Immature	Adult		
Date	Haul#	Station	Pink	Chum	Sockeye	Coho	Chinook	Chinook	Pink	Chum	Coho
26 September	5096	UCB	1	—	—	—	—	—	—	—	—
26 September	5097	UCA	6	—	1	1	—	—	—	—	—
27 September	5098	ISA	12	1	1	2	3	—	—	—	—
27 September	5099	ISB	4	1	4	1	1	1	—	—	—
27 September	5100	ISC	4	1	3	—	—	—	—	—	—
27 September	5101	ISD	4	2	6	—	—	—	—	—	—
28 September	5102	ISC	6	—	2	1	1	—	—	—	—
28 September	5103	ISC	9	1	4	—	8	—	—	—	—
28 September	5104	ISC	24	3	3	—	1	—	—	—	—
28 September	5105	ISC	3	2	1	—	1	—	—	—	—
28 September	5106	ISD	4	2	2	—	1	—	—	—	—
29 September	5107	ISC	—	6	1	—	—	—	—	—	—
29 September	5108	ISC	—	1	—	—	1	—	—	—	—
29 September	5109	ISC	38	4	2	—	2	2	—	—	—
29 September	5110	ISC	79	6	9	1	3	—	—	—	—
29 September	5111	ISA	28	2	—	—	—	—	—	—	—
29 September	5112	ISB	—	—	2	—	—	—	—	—	—
30 September	5113	ISD	19	5	5	—	1	—	—	—	—
30 September	5114	ISC	16	4	6	—	—	—	—	—	—
30 September	5115	ISD	32	4	4	—	2	—	—	—	—
30 September	5116	ISC	77	23	10	3	1	—	—	—	—
01 October	5117	UCA	70	18	20	4	8	—	—	—	—
01 October	5118	UCB	200	18	37	5	7	—	—	—	—
01 October	5119	UCC	5	—	2	—	—	1	—	—	—
01 October	5120	UCD	—	—	—	1	—	—	—	—	1

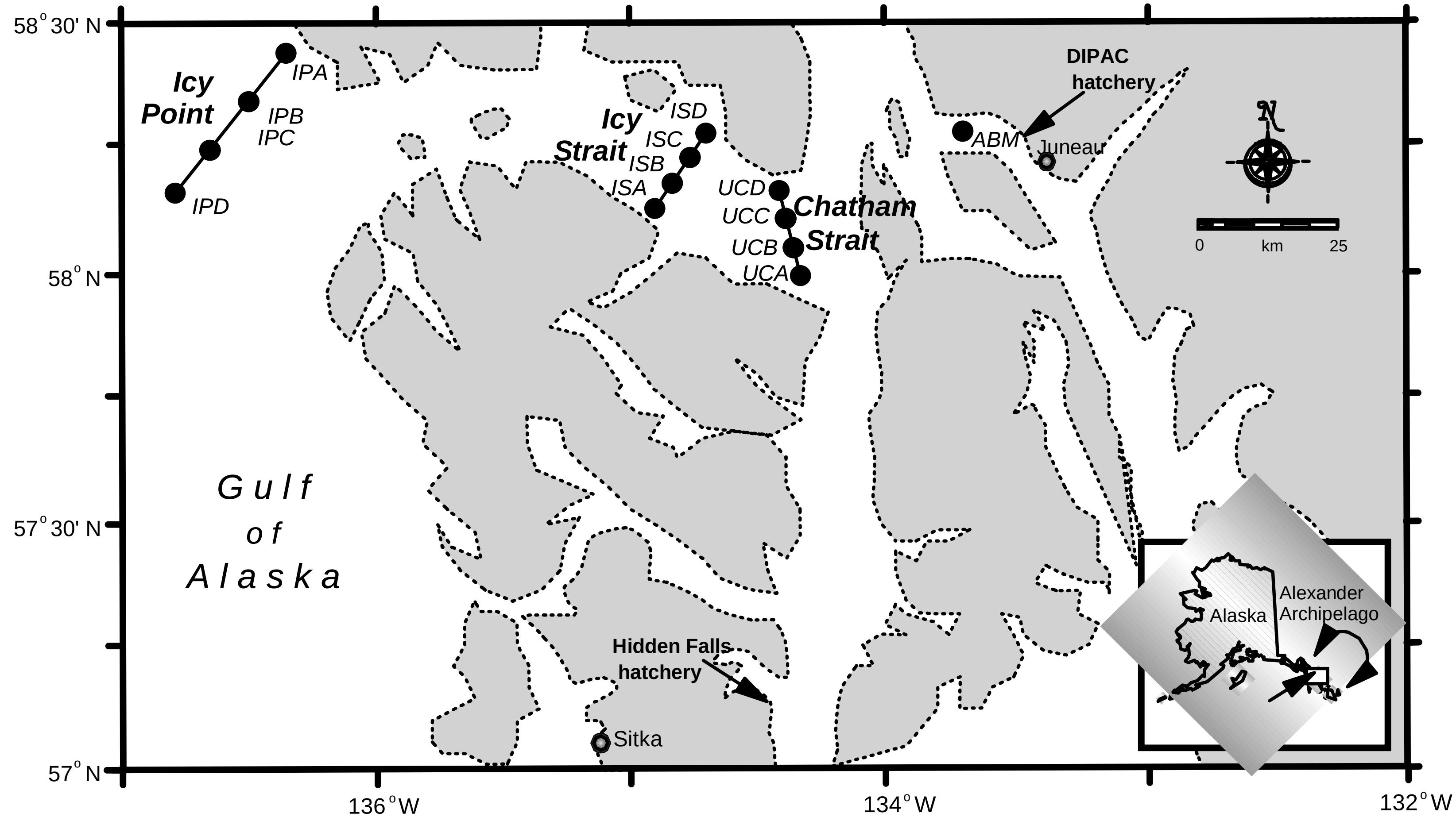

Figure 1.—Stations sampled monthly in marine waters of the northern region of southeastern Alaska, May–September 2001. Small arrows indicate two major enhancement facilities: DIPAC (Douglas Island Pink and Chum) hatchery and Hidden Falls hatchery.

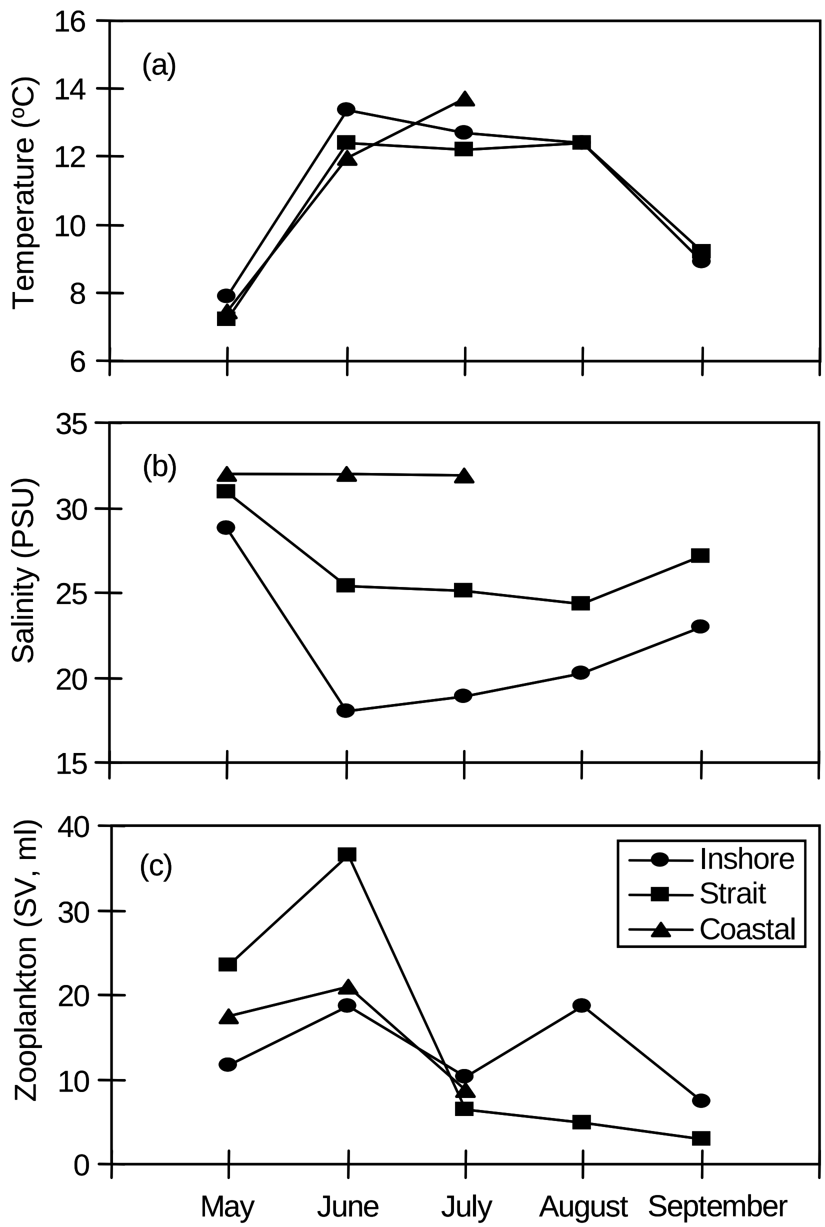

Figure 2.—Surface (2-m) temperature (a) and salinity (b) and 20-m zooplankton volume (c) in inshore, strait, and coastal marine habitats of the northern region of southeastern Alaska, May–September 2001. Zooplankton volumetric density (ml/m^3) can be computed by dividing by a factor of 3.9.

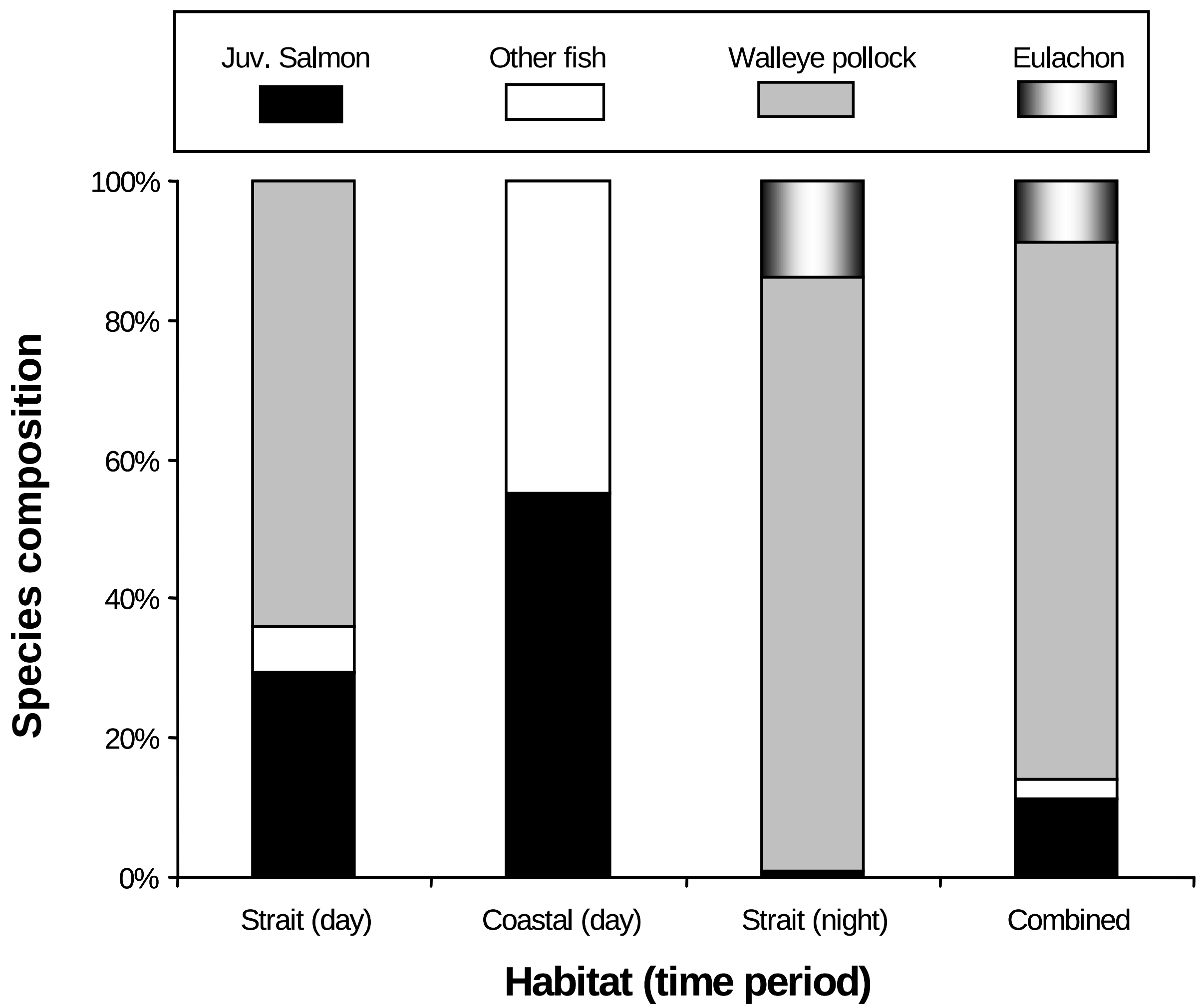

Figure 3.—Fish composition from rope trawl catches in strait and coastal marine habitats of the northern region of southeastern Alaska, June–September 2001. The four different compositions represent fish sampled in the strait habitat during day, the coastal habitat during day, the strait habitat at night, and both habitats and time periods combined.

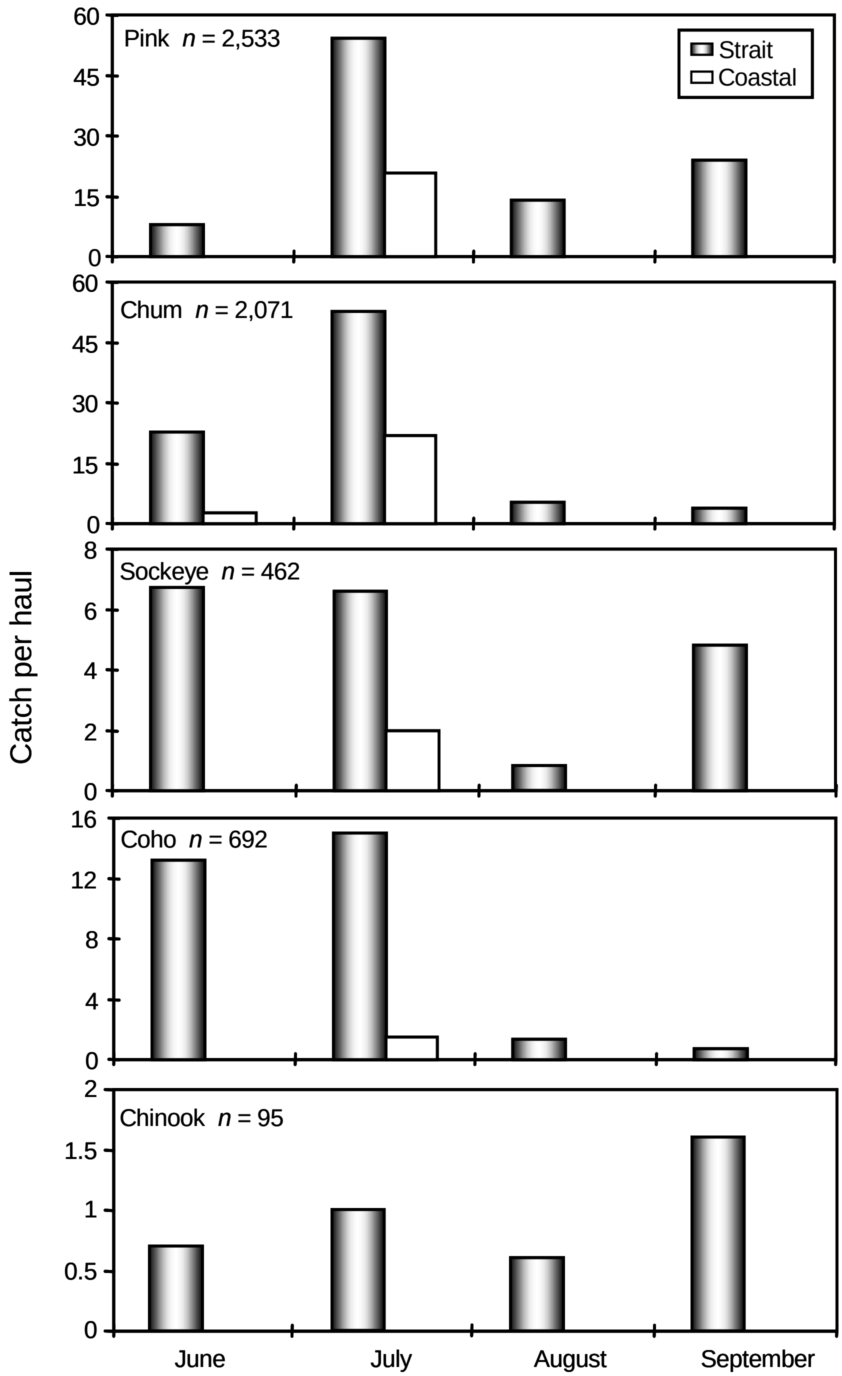

Figure 4.—Catch per rope trawl haul of juvenile salmon in strait (June–September) and coastal (June–July) marine habitats of the northern region of southeastern Alaska, 2001. No sampling was done in the coastal habitat in August and September.

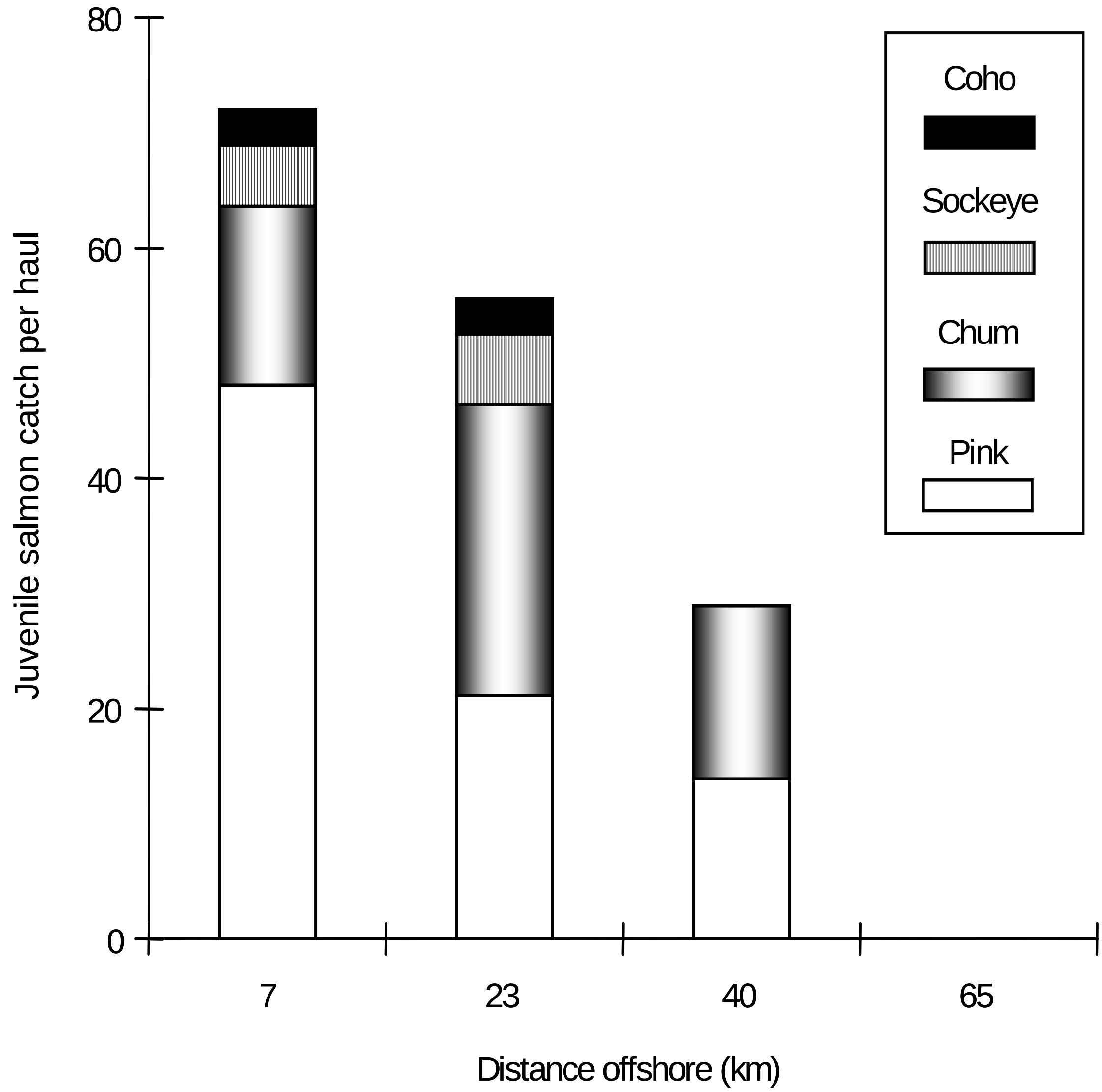

Figure 5.—Mean number of juvenile salmon captured per 8 rope trawl hauls in coastal habitat (Icy Point transect) of the northern region of southeastern Alaska, June and July, 2001. Four hauls were fished each month, for each distance offshore.

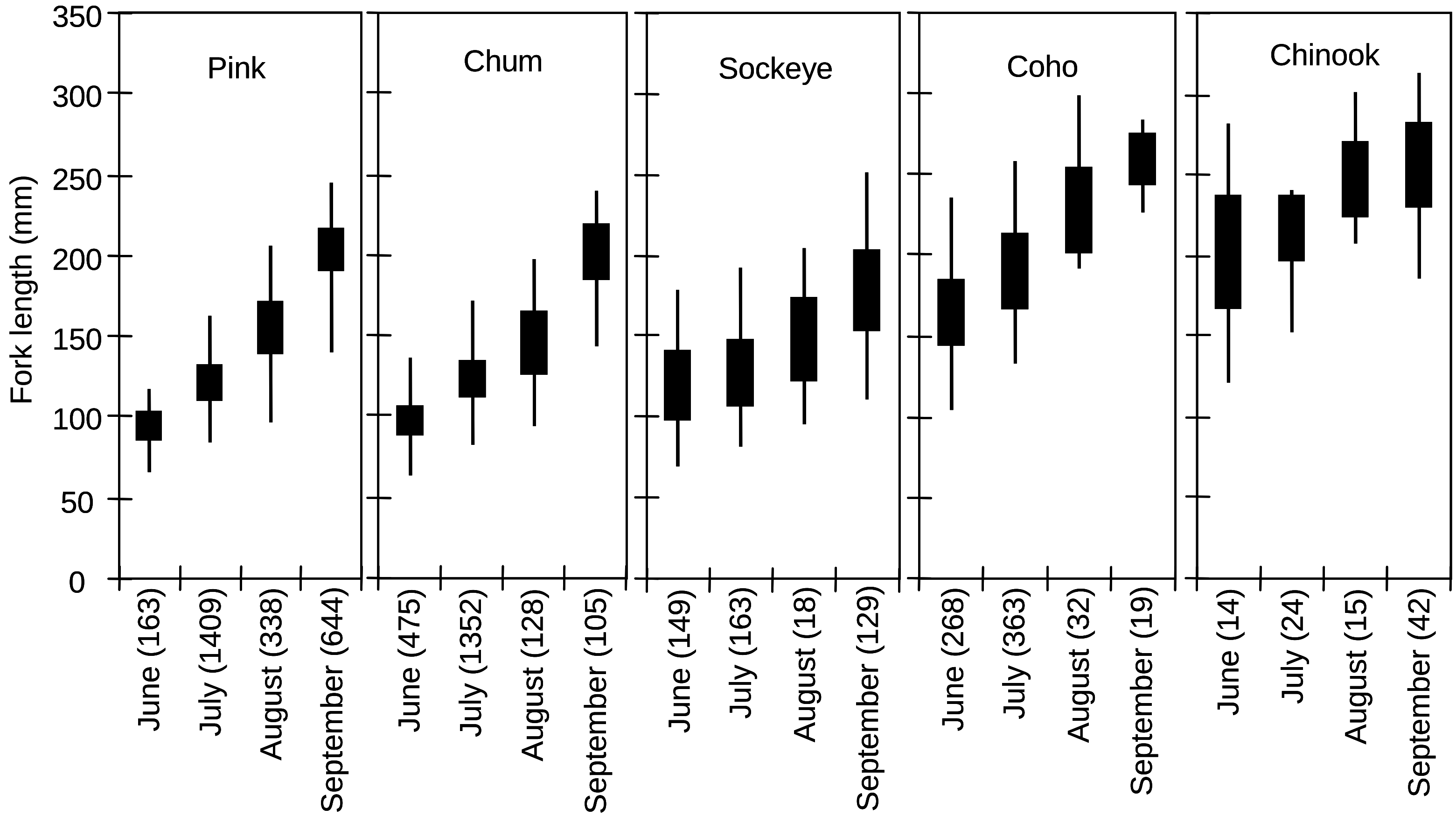

Figure 6.—Fork lengths of juvenile salmon captured in marine waters of the northern region of southeastern Alaska by rope trawl, June–September 2001. Length of vertical bars is the size range for each sample, and the boxes within the size range are one standard error on either side of the mean. Sample sizes are shown in parentheses.

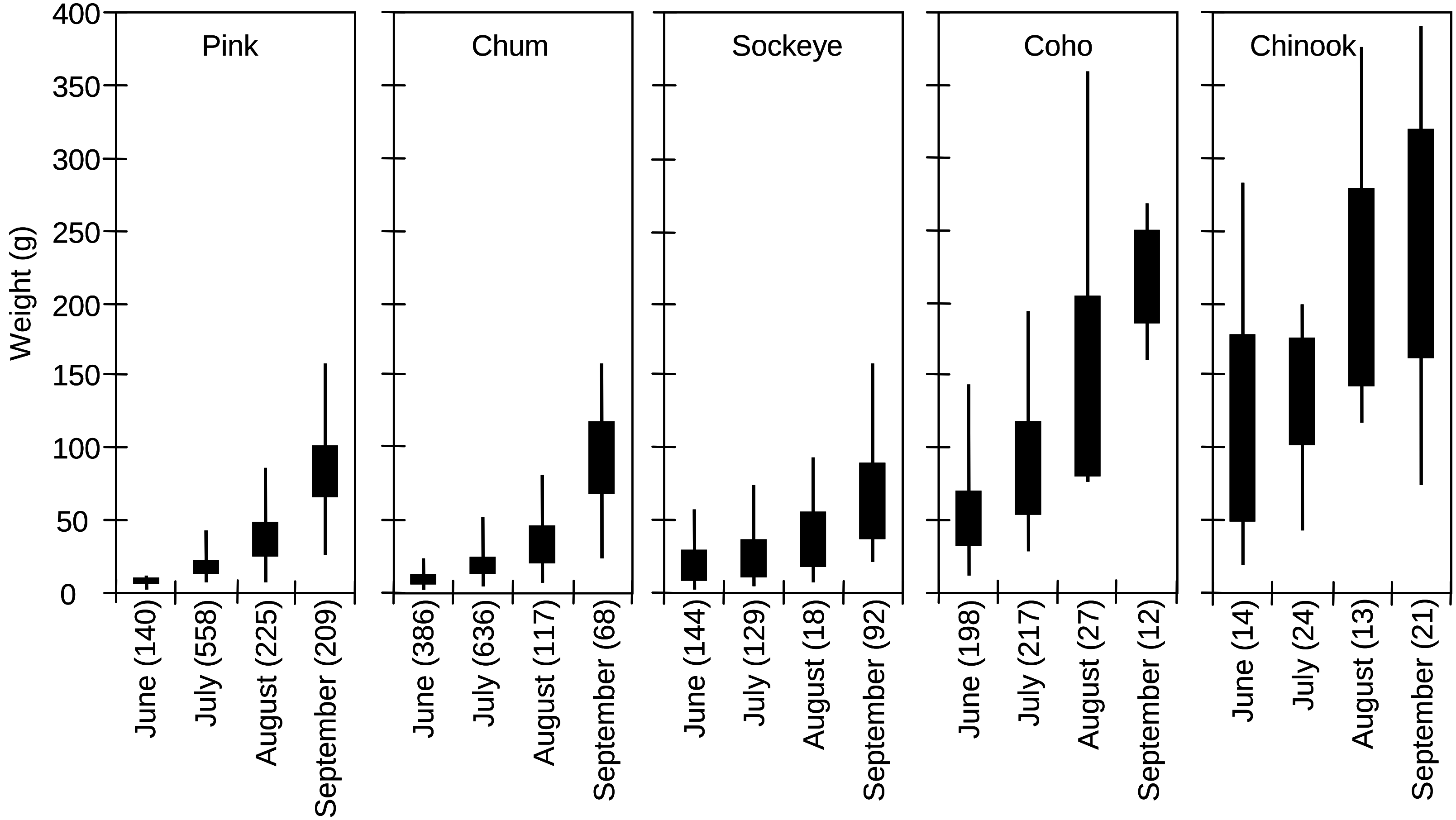

Figure 7.—Weights of juvenile salmon captured in marine waters of the northern region of southeastern Alaska by rope trawl, June–September 2001. Length of vertical bars is the size range for each sample, and the boxes within the size range are one standard error on either side of the mean. Sample sizes are shown in parentheses.

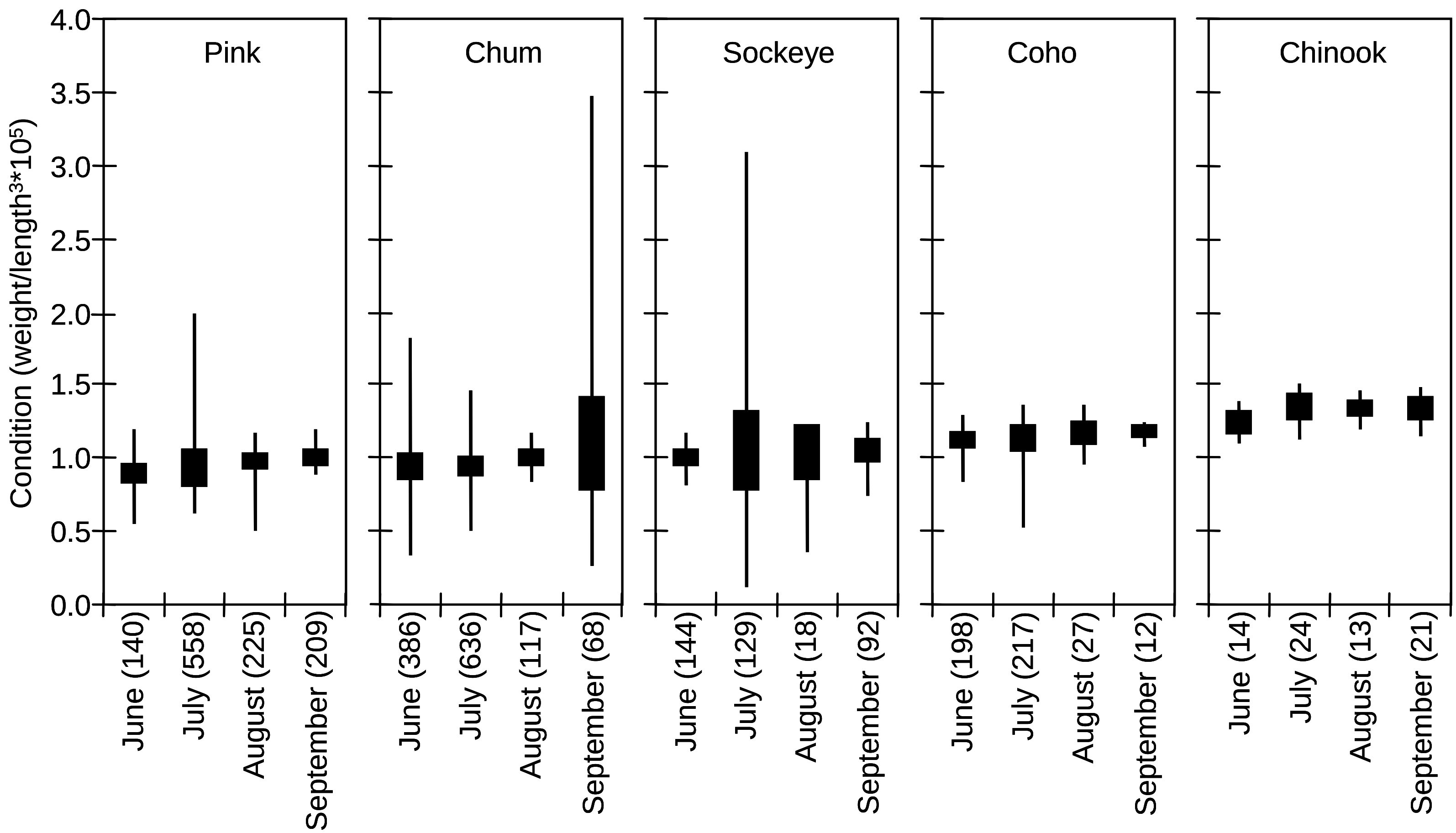

Figure 8.—Condition factors of juvenile salmon captured in marine waters of the northern region of southeastern Alaska by rope trawl, June–September 2001. Length of vertical bars is the size range for each sample, and the boxes within the size range are one standard error on either side of the mean. Sample sizes are shown in parentheses.

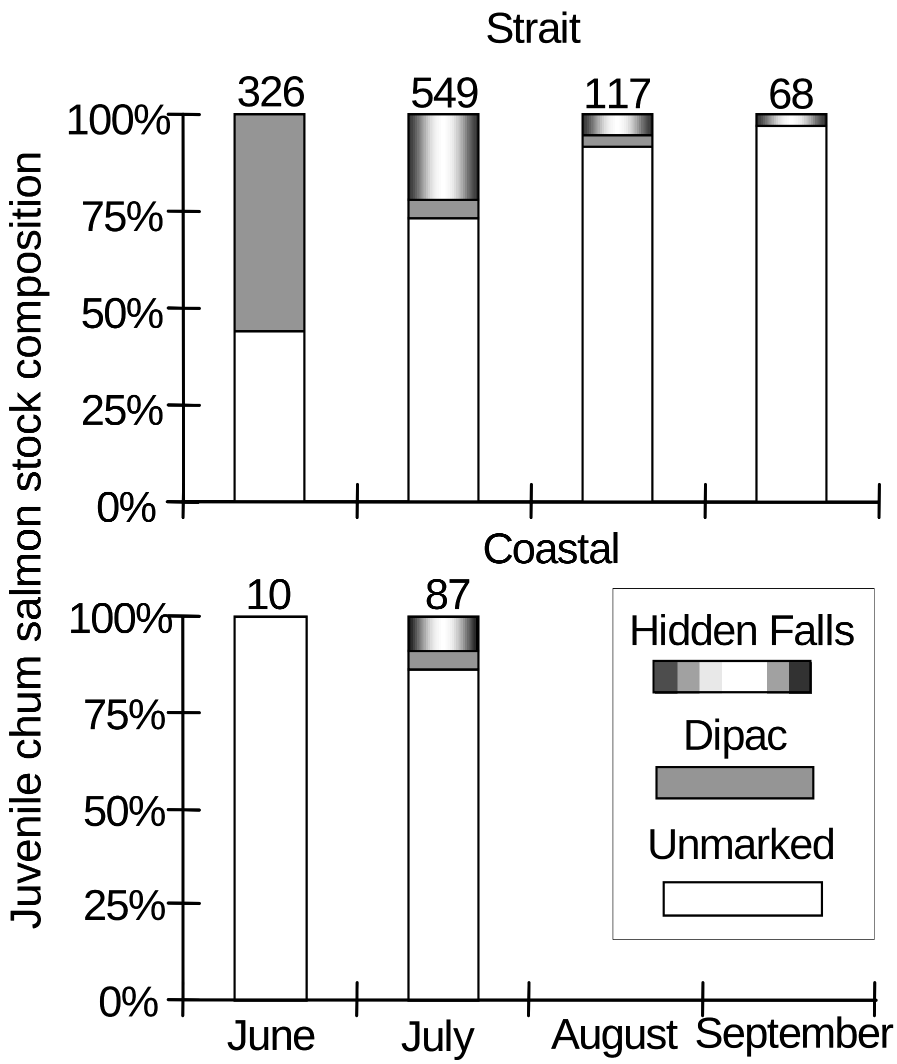

Figure 9.—Monthly stock composition of juvenile chum salmon based on otolith thermal marks in strait and coastal marine habitats of the northern region of southeastern Alaska, June–September 2001. Number of salmon sampled per month and habitat is indicated above each bar.

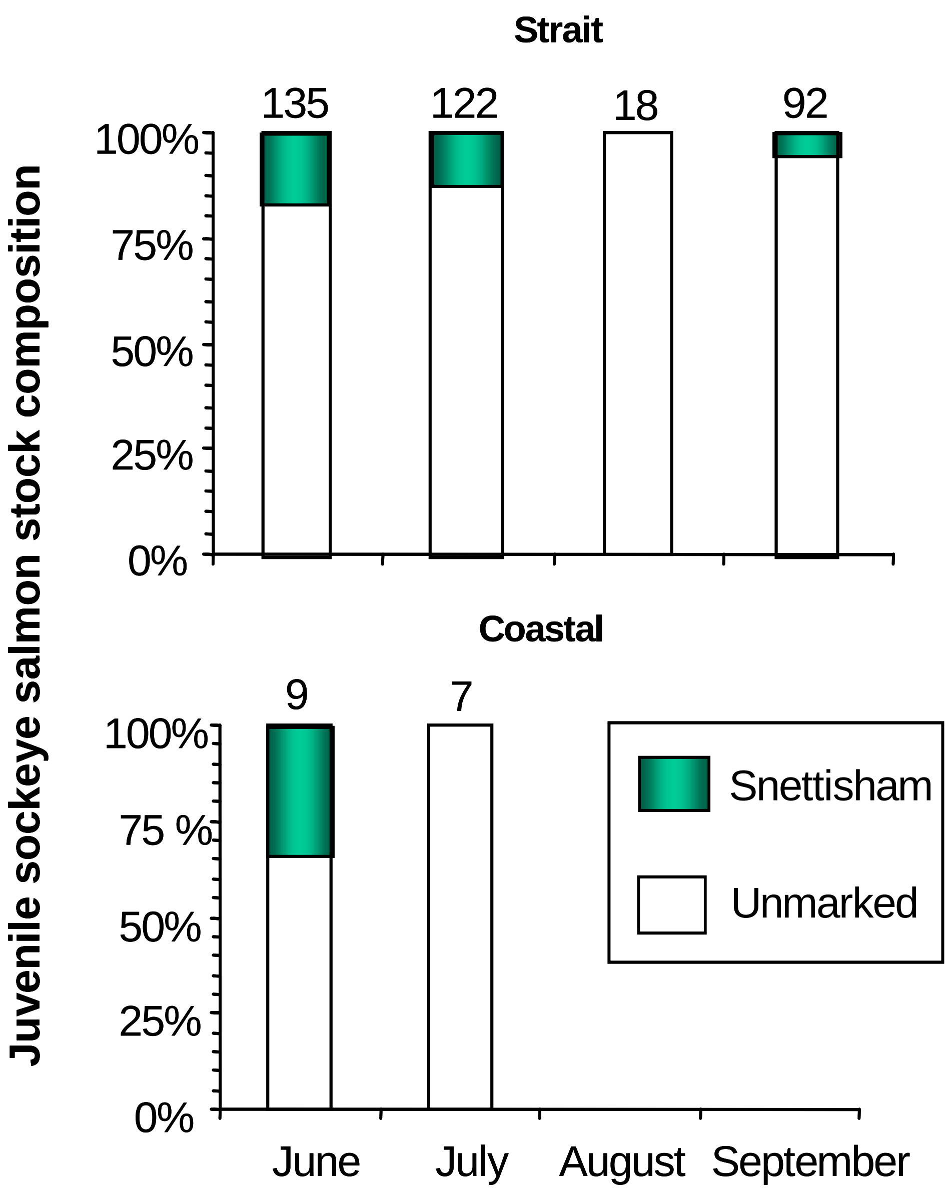

Figure 10.—Seasonal stock composition of sockeye salmon based on otolith thermal marks in strait and coastal marine habitats of the northern region of southeastern Alaska, June–September 2001. Number of salmon sampled per month and habitat is indicated above each bar.

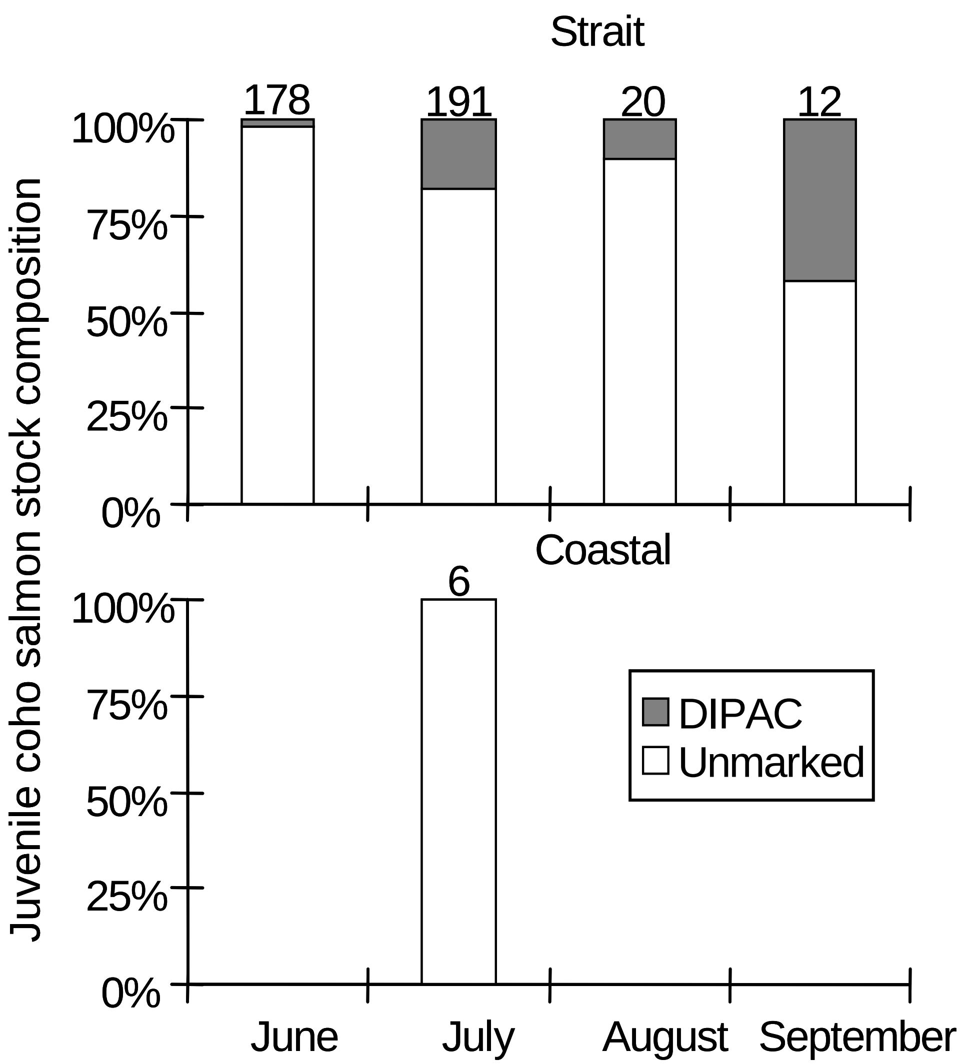

Figure 11.—Seasonal stock composition of coho salmon based on otolith thermal marks in strait and coastal marine habitats of the northern region of southeastern Alaska, June–September 2001. Number of salmon sampled per month and habitat is indicated above each bar.

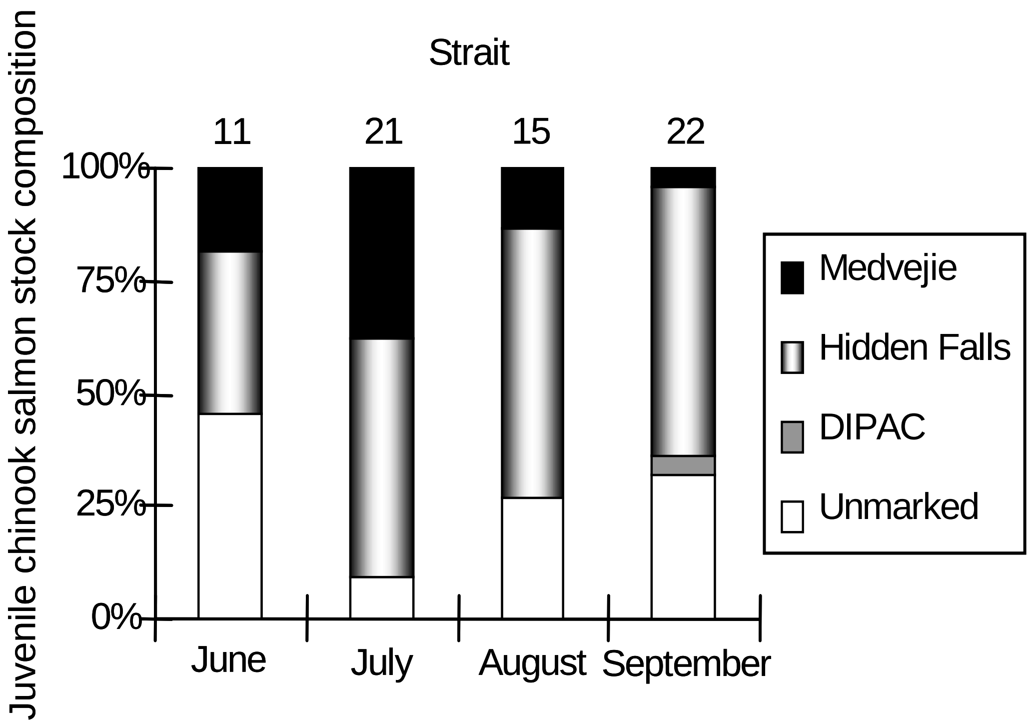

Figure 12.—Seasonal stock composition of chinook salmon based on otolith thermal marks in the strait marine habitat of the northern region of southeastern Alaska, June–September 2001. Number of salmon sampled per month is indicated above each bar.

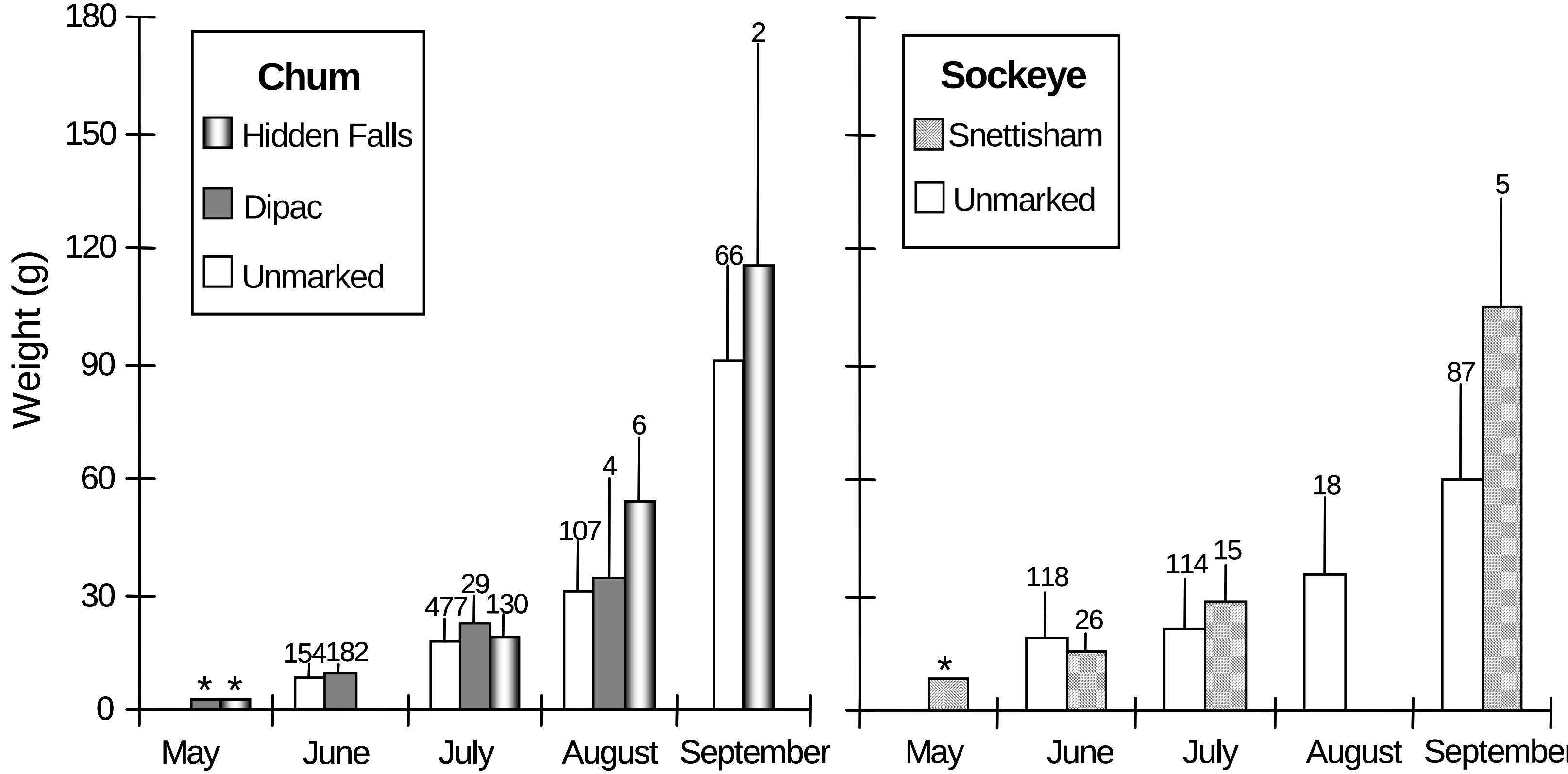

Figure 13.—Stock-specific growth trajectories of juvenile chum and sockeye salmon captured in marine waters of the northern region of southeastern Alaska by rope trawl, June–September 2001. Size of marked fish at the time of hatchery release are indicated by an asterisk above the bars in May. The sample sizes and the standard deviations are indicated above each bar.

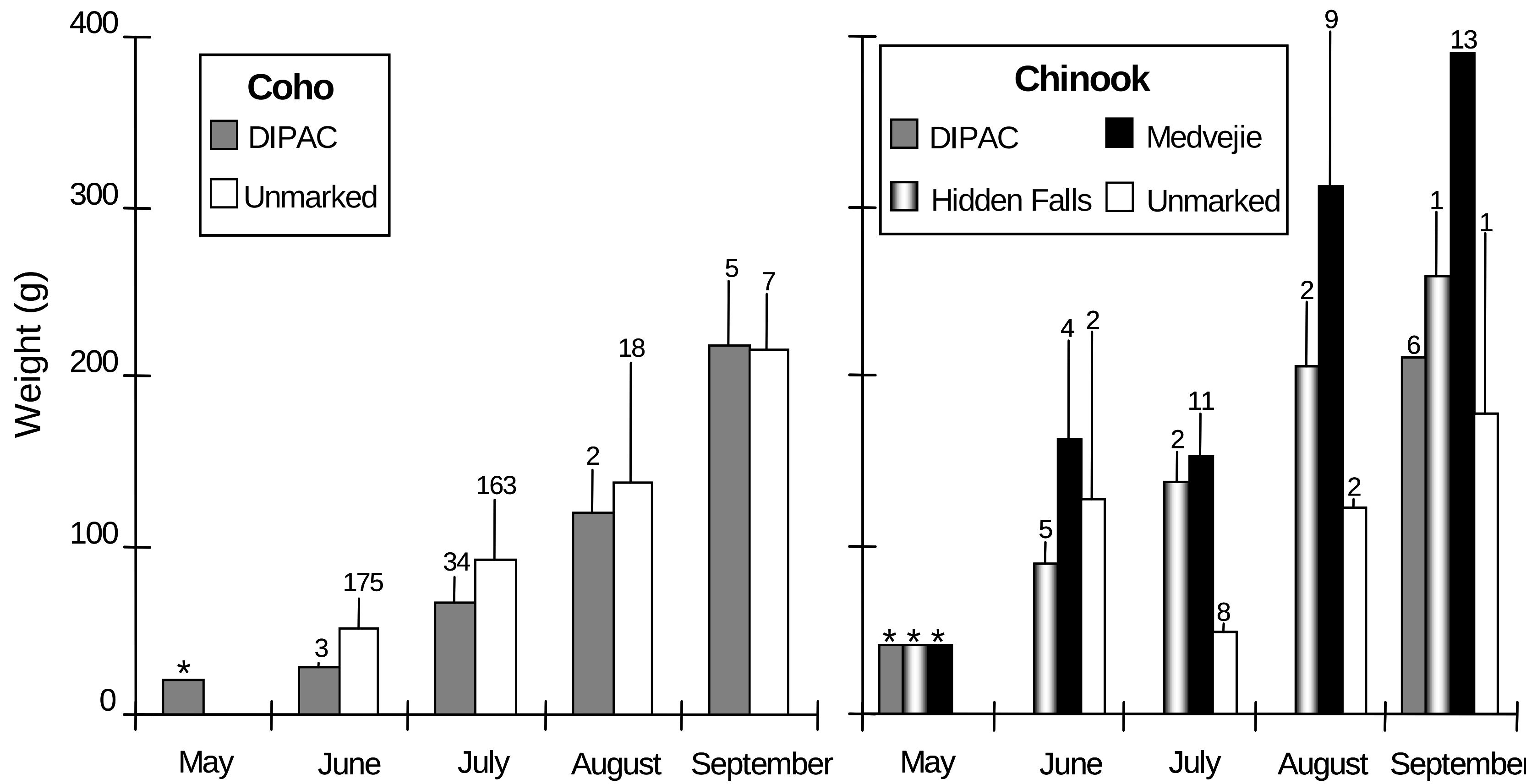

Figure 14.—Stock-specific growth trajectories of juvenile coho and chinook salmon captured in marine waters of the northern region of southeastern Alaska by rope trawl, June–September 2001. Size of marked fish at the time of hatchery release are indicated y an asterisk above the bars in May. The sample sizes and the standard deviations are indicated above each bar.

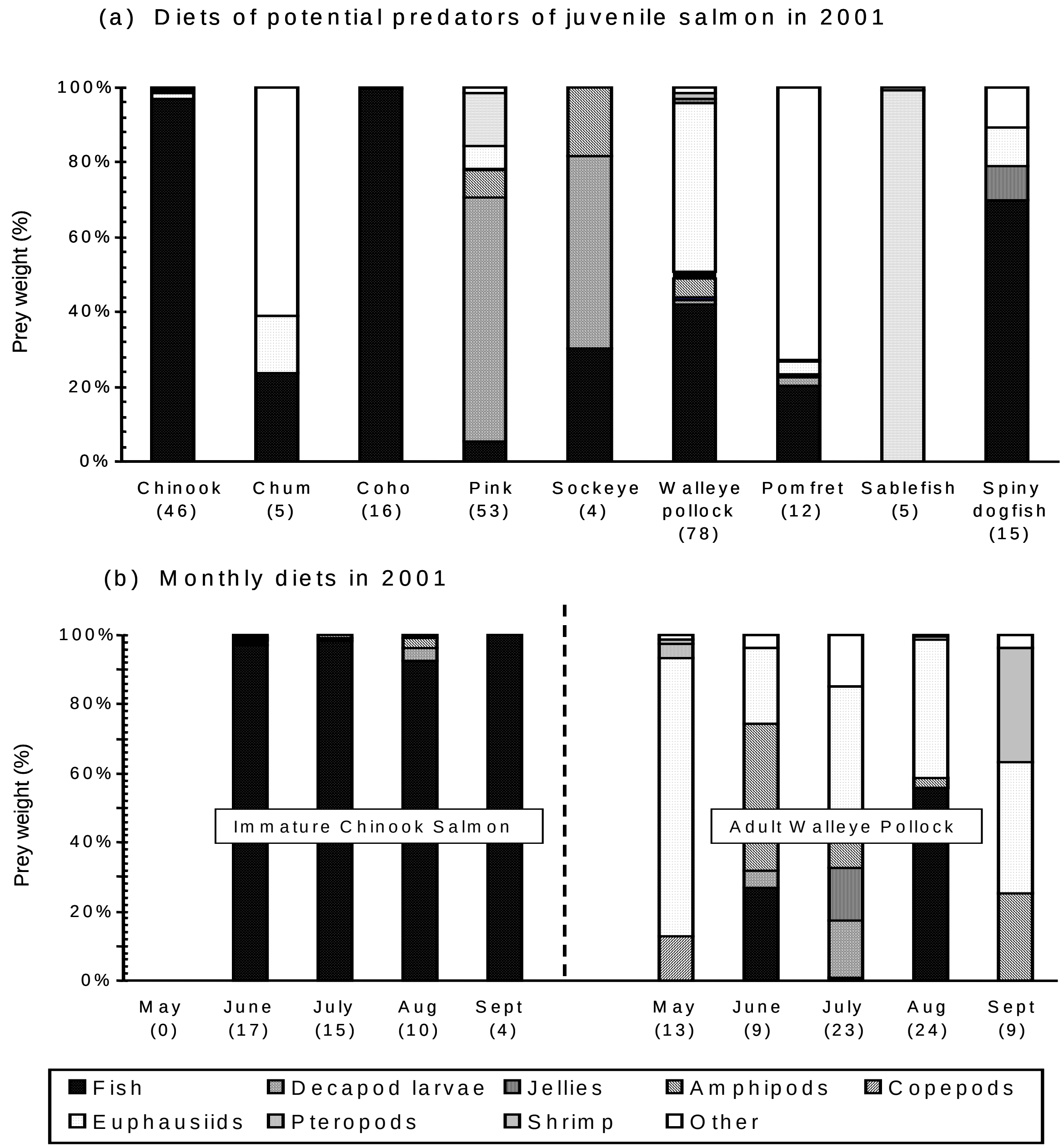

Figure 15.—(a) Prey composition of fish species caught in surface trawl hauls in all habitats and sampling intervals combined for the northern region of southeastern Alaska, May-September 2001. All species except chinook salmon (immature) were adults. See also Table 16 for rates of predation on juvenile salmon. (b) Monthly prey composition for two common species. Jellies refers to ctenophores, cnidarians, salps and oikopleurans. Other is miscellaneous unidentified material or taxa that occurred in small proportions. The numbers of fish examined are shown in parentheses.