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Annual Survey of Juvenile Salmon, Ecologically-Related Species, and Environmental Factors in the Marine Waters of Southeastern Alaska, May–August 2009

by

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ABSTRACT

Juvenile Pacific salmon (*Oncorhynchus* spp.), ecologically-related species, and associated biophysical data were collected from the marine waters of the northern and southern regions of southeastern Alaska in 2009. This annual survey marks 13 consecutive years of systematically monitoring how juvenile salmon interact in marine ecosystems, and was implemented to identify the relationships among biophysical parameters that influence habitat use, marine growth, predation, stock interactions, and year-class strength of juvenile salmon. This report also contrasts the 2009 findings with selected biophysical parameters from the prior 12 sampling years. Up to 17 stations were sampled in epipelagic waters over four time periods (20 sampling days) from May to August. Typically, at each station, fish, zooplankton, surface water samples, and physical profile data were collected during daylight using a surface rope trawl, conical and bongo nets, a water sampler, and a conductivity-temperature-depth profiler. Surface (3-m) temperatures and salinities ranged from approximately 8 to 15 ºC and 19 to 31 PSU from May to August. Nearly 11,000 fish, representing 12 taxa, were captured in 60 rope trawl hauls in July and August in the two regions. No trawling was conducted in June, in contrast to all other years. Juvenile salmon comprised about 97% of the total fish catch. Juvenile pink (*O. gorbuscha*), chum (*O. keta*), sockeye (*O. nerka*), and coho salmon (*O. kisutch*) occurred in 56-98% of the trawls, while juvenile Chinook salmon (*O. tshawytscha*) occurred in < 13% of the hauls. All juvenile salmon species occurred more frequently in northern region trawls than in southern region trawls in July. In the northern region, catch rates of juvenile pink, chum, and coho salmon were higher in July than in August, whereas catches of sockeye salmon were higher in August. Coded-wire tags were recovered from 18 juvenile coho salmon from hatchery and wild stocks originating in southeastern Alaska. Alaska enhanced stocks were also identified by thermal otolith marks from 47% of the chum and 18% of the sockeye salmon examined. Onboard stomach analysis of 108 potential predators, representing seven species, did not provide evidence of predation on juvenile salmon. Biophysical measures from 2009 differed from prior years, in many respects. Integrated (20-m) temperature anomalies were all positive and salinity anomalies were negative; in particular, the May temperature anomaly was the 2nd highest on record. Anomalies of zooplankton total density were positive each month, a trend which has persisted for four years. In addition, size anomalies for juvenile salmon were positive, a shift from the previous two years. Condition residual anomalies were unusually high for juvenile salmon species in August. These data, in conjunction with basin-scale biophysical parameters, are currently being used to forecast pink salmon harvest in southeastern Alaska. Long-term monitoring of key stocks of juvenile salmon, on seasonal and interannual time scales, will enable researchers to understand how growth, abundance, and ecological interactions affect year-class strength of salmon and to better understand their roles in North Pacific marine ecosystems.

INTRODUCTION

The Southeast Coastal Monitoring (SECM) project, a coastal monitoring study focused in the northern region of southeastern Alaska (SEAK), was initiated in 1997 to annually study the early marine ecology of Pacific salmon (*Oncorhynchus* spp.) and associated epipelagic ichthyofauna and to better understand effects of environmental change on salmon production. Salmon are a keystone species that constitute an important ecological link between marine and terrestrial habitats, and therefore play a significant, yet poorly understood, role in marine ecosystems. Fluctuations in the survival of this important living marine resource have broad ecological and socio-economic implications for coastal localities throughout the Pacific Rim.

Evidence for relationships between production of Pacific salmon and shifts in climate conditions has renewed interest in processes governing salmon year-class strength (Downton and Miller 1998; Beauchamp et al. 2007; Farley et al. 2007; Taylor 2007). In particular, climate variables such as temperature have been associated with ocean production and survival of salmon; for example, warming trends benefited many wild and hatchery stocks of Alaskan salmon or enhanced their food supplies (Wertheimer et al. 2001; Beauchamp et al. 2007). Biophysical attributes of climate and habitat, such as temperature, salinity, and mixed layer depth (MLD), influence primary and secondary production (Bathen 1972; Kara et al. 2000; Alexander et al. 2001) and therefore may influence the trophic links leading to variable growth and survival of salmon (Mann and Lazier 1991; Francis et al. 1998; Brodeur et al. 2007). However, research is lacking on the links between salmon production and climate variability, intra- and interspecific competition and carrying capacity, and stock composition and biological interactions. In addition, past research has not provided adequate time-series data to explain these links (Pearcy 1997; Beamish et al. 2008). Because regional salmon production has increased over the last few decades, understanding the consequences of these population changes and potential interactions on the growth, distribution, migratory rates, and survival of all salmon stock groups is important.

One goal of the SECM project is to identify mechanisms linking salmon production to climate change using a time series of synoptic data on salmon, their stock-specific life history characteristics, and the ocean conditions they experience. The SECM project obtains stock information from coded-wire tags (CWT; Jefferts et al. 1963) and otolith thermal marks (Hagen and Munk 1994; Courtney et al. 2000) from five Pacific salmon species, including chum (*O. keta*), pink (*O. gorbuscha*), sockeye (*O. nerka*), coho (*O. kisutch*), and Chinook (*O. tshawytscha*). Portions of wild and hatchery salmon stocks are tagged or marked prior to ocean entry by enhancement facilities or state and federal agencies in southeastern Alaska, Canada, and the Pacific Northwest. Catches of these marked fish by the SECM project in the northern, southern, and coastal regions of SEAK have provided information on habitat use, migration rates, and timing (e.g., Orsi et al. 2004, 2007a, b); in addition, interceptions in the regional common property fisheries have documented substantial contributions of enhanced fish to commercial harvests (ADFG, 2008). Therefore, examining the early marine ecology of these marked stocks provides an opportunity to study stock-specific abundance, distribution, migration, and species interactions of juvenile salmon that will later recruit to fisheries.

The extent of interactions between hatchery and wild salmon stocks in marine ecosystems is also important to examine with regard to carrying capacity. For example, increased hatchery production of juvenile chum salmon has coincided with declines of some wild chum salmon stocks, suggesting the potential for stock interactions in the marine environment (Seeb et al. 2004; Reese et al. 2009). In SEAK, however, SECM and other studies have shown that growth is not food limited and that stocks interact extensively with little negative impact (Bailey et al., 1975; Orsi et al. 2004; Sturdevant et al. 2002, 2004, 2008; Sturdevant et al. in review). Zooplankton prey fields are more likely to be cropped by the more abundant vertically-migrating planktivores, including walleye pollock (*Theragra chalcogramma*) and Pacific herring (*Clupea pallasi*) (Orsi et al. 2004; Sigler and Csepp 2007), than by juvenile salmon. Companion studies in Icy Strait have also suggested that food quantity may be more important to growth and survival of juvenile salmon con-specifics than food type (Weitkamp and Sturdevant 2008) and that predation events can affect salmon year-class strength (Sturdevant et al. 2009). Seasonal and interannual changes in planktivorous jellyfish abundance have been reported by SECM in past years (Orsi et al. 2009; SECM unpublished data). Monitoring their abundance is important because of their potential competition with salmon and forage fish (Purcell and Sturdevant 2001), and their association with environmental change (Brodeur et al. 2008; Cieciel et al. 2009). Similarly, regional differences in composition, abundance, and timing of zooplankton taxa with different life history strategies are important to document because of their dependence on environmental conditions which vary seasonally and interannually (Coyle and Paul 1990; Paul et al. 1990; Park et al. 2004). These findings stress the importance of comparing ecological processes between different areas producing salmon and consistently examining the entire epipelagic community in the context of trophic interactions.

In 2009, the SECM project was supported by the small NOAA research vessels RV *Quest* and RV *Sashin* and by a larger charter vessel, FV *Chellissa.* In addition to sampling in the northern region, sampling in the southern region was reinstated after a year lapse (Orsi et al. 2006, 2007a, 2008) to support forecasting of adult pink salmon returns from juvenile abundance and to explore the concordance of harvests between regions in conjunction with local biophysical parameters.

This document summarizes catches of juvenile salmon, ecologically-related species, and associated biophysical data collected by SECM scientists in 2009, and contrasts key parameters from 2009 with the entire 13-yr time series.

METHODS

Up to 17 stations were sampled in SEAK during four time periods from May to August 2009 (Table 1). Sampling was conducted in both the northern and southern portions of the region, within the Alexander Archipelago. The northern region corridor extends 250 km from inshore waters along Chatham and Icy Straits into the Gulf of Alaska (GOA), whereas the southern region corridor extends 175 km from middle Clarence Strait through Dixon Entrance into the GOA (Figure 1). At each station, the physical environment, zooplankton, and fish were typically sampled during daylight hours. Oceanographic sampling in May and June was accomplished with the RV *Quest* (7 m) and the RV *Sashin* (11 m). Typically, annual trawling is conducted monthly beginning in June, but in 2009, funding for a sampling platform was not administered in time. In July and August, sampling included trawling and was accomplished with the chartered commercial fishing vessel FV *Chellissa* (28 m), a trawler with a single main engine producing 1,200 HP. Also in July, sampling with the *Chellissa* was calibrated to the previously-used Alaska Department of Fish and Game (ADFG) RV *Medeia* (33 m), a trawler with twin main engines producing 1,250 HP. The calibration was done to standardize *Chellissa* catches to the long-term dataset based on the first 12 years of SECM monitoring from the NOAA ship *John N. Cobb*, which was decommissioned in 2008, and which had previously been calibrated to the RV *Medeia* (Wertheimer et al. 2008, 2009). This report summarizes catches only from the *Chellissa*.

Sampling in the northern region of SEAK was conducted in the vicinity of Icy Strait (Table 1; Figure 1). The selection of these stations was determined by 1) the presence of historical time series of biophysical data in the region, 2) the intent to sample primary seaward migration corridors used by juvenile salmon, and 3) the operational constraints of the vessel. The inshore station and the four Icy Strait stations were selected initially based on existing historical data (e.g., Bruce et al. 1977; Jaenicke and Celewycz 1994; Orsi et al. 1997). The four Chatham Strait stations were selected to intercept wild and hatchery juvenile salmon entering Icy Strait from both the north and the south. The northern hatchery stocks typically originate from the Douglas Island Pink and Chum Hatchery (DIPAC) facilities, whereas the southern hatchery stocks typically originate from the Hidden Falls Hatchery (HF; Northern Southeast Alaska Regional Aquaculture Association [NSRAA]) (Figure 1).

Sampling in the southern region of SEAK was conducted in the vicinity of Clarence Strait (Table 1; Figure 1). Unlike the northern corridor, which is oriented westward, the southern corridor is oriented southward. Like the northern region, several salmon enhancement facilities operate in this region (Figure 1). Of these, the largest is the Neets Bay (NB) facility operated by the Southern Southeast Alaska Regional Aquaculture Association (SSRAA); NB is a major producer of chum salmon in the region near Ketchikan.

Historically, sampling operations were constrained to 1.5-65 km off shore and bottom depths > 75 m, sea conditions < 2.5 m, and winds < 12.5 m/sec. Shallow bottom depth precluded trawling at the Auke Bay station. In 2009, most sample stations were 3.2 or 6.4 km from shore.

Oceanographic sampling

Oceanographic data were collected at each station immediately before or after each trawl haul. These data generally consisted of one conductivity-temperature-depth profiler (CTD) cast, one Secchi reading for water clarity, one surface water sample for chlorophyll and nutrients, one ambient light reading, one or more vertical plankton tows with conical nets, and at certain stations, one double oblique plankton tows with a bongo net system.

The CTD data were collected with a Sea-Bird[1] SBE 19 plus Seacat profiler to 200 m or within 10 m of the bottom. The CTD data profiles were used to determine 3-m sea surface temperature (SST, °C) and salinity (PSU), average 20-m integrated water column SST and salinity, and mixed layer depth (MLD, m). The average 20-m integrated water column data was used to characterize the upper water column that typically brackets seasonal pycnoclines and MLD. The MLD is the depth where temperature was ≥ 0.2°C colder than the water at 5 m, and established the active mixing layer (Kara et al. 2000).

Additional physical data included water clarity (Secchi depth), nutrients and chlorophyll, and ambient light. Secchi depths were measured during CTD deployment as the disappearance depth (m). Nutrient and chlorophyll samples were taken from surface waters monthly. To quantify ambient light levels, light intensities (W/m^2) were recorded with a Li-Cor Model LI-250A light meter.

Zooplankton was sampled monthly at all stations with several net types. At least one shallow vertical haul (20 m) was made with a 50-cm, 243-µm mesh Norpac net. One deep

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

vertical haul (≤ 200 m or within 10 m of bottom) was made at ABM with a 57-cm, 202-µm mesh WP-2 net. One double oblique bongo haul was made at stations along the Icy Strait and Lower Clarence Strait transects and at ABM (≤ 200 m or within 20 m of bottom) using a 60-cm diameter tandem frame with 505-µm and 333-µm mesh nets. A VEMCO ML-08-TDR time-depth recorder was used with the bongo hauls to record the maximum sampling depth of each haul. General Oceanics model 2031 or Rigosha flow meters were placed inside the bongo and deep conical nets for calculation of filtered water volumes.

Zooplankton samples were immediately preserved in a 5% formalin-seawater solution. In the laboratory, settled volumes (SV, ml), total settled volumes (TSV, ml), displacement volumes (DV, ml), standing stock (DV/m^3), and density (number/m^3) were determined for various samples (Omori and Ikeda, 1984). For Norpac samples, SV and TSV were measured after a 24-hr period in Imhof cones. Mean SVs were determined for pooled stations by habitat and month. For bongo samples (333-µm and 505-µm mesh), DVs were measured and standing stock was calculated using DV and filtered water volumes. Detailed zooplankton species composition from the 333-µm samples was determined microscopically from subsamples obtained using a Folsom splitter. Densities were then estimated using the subsample counts, split fractions, and filtered water volumes. Percent total composition was summarized across species by major taxa, including small calanoid copepods (≤ 2.5 mm total length, TL), large calanoid copepods (> 2.5 mm TL), euphausiids (principally larval and juvenile stages), oikopleurans (Larvacea), decapod larvae, amphipods, chaetognaths, and combined minor taxa.

Fish sampling

Fish sampling was accomplished with a Nordic 264 rope trawl modified to fish the surface water directly astern of the trawl vessel. The trawl was 184 m long and had a mouth opening of approximately 24 m wide by 30 m deep. Recent gear trials with this trawl indicated the actual fishing dimensions of the trawl to be 31 m deep (head rope to foot rope) by 21 m wide (wingtip to wingtip) (Wertheimer et al. 2009). A pair of 3-m foam-filled Lite trawl doors, each weighing 544 kg (91 kg submerged), was used to spread the trawl open. 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 mesh 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 between the head rope and the 162.6-cm mesh to reduce loss of small fish. To keep the trawl head rope fishing at the surface, two clusters of three A-4 Polyform buoys (inflated to 0.75 m diameter and encased in knotted mesh bags) were clipped on the opposing corner wingtips of the head rope and one A-3 Polyform float (inflated to 0.5 m diameter) was clipped into a mesh kite pocket in the center of the head rope. The trawl was fished with about 150 m of 1.6-cm wire main warp attached to each door, a 9.1 m length of 1.6-cm wire trailing off the top and bottom of each trawl door (back strap), and each back strap connected with a “G” hook and flat link to a 70.1-m wire swiveled bridle. The head and foot rope bridles were 1.0-cm and 1.3-cm wire.

For each haul, the trawl 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. Hauls were usually fished downwind and with the prevailing current and seas. Replicate hauls were made in the straits to ensure that sufficient samples of marked juvenile salmon were obtained for interannual comparisons.

After each trawl haul, the fish were separated from the jellyfish, anaesthetized with tricaine methanesulfonate (MS-222), identified, enumerated, measured, labeled, bagged, and frozen. Jellyfish were identified to genus, counted, and volumetrically measured to the nearest 0.1 liter (L). After the catch was sorted, all fish and squid were typically measured to the nearest mm fork length (FL) or mantle length with a Limnoterra FMB IV electronic measuring board (Chaput et al. 1992). In instances of very large fish catches, all fish were counted, but only a subsample of each species (≤ 100) was measured for length, bagged individually, and immediately frozen. Excess fish were enumerated and discarded. 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 that could indicate the presence of implanted CWTs; those with adipose fins intact were again screened with a magnetic detector in the laboratory. The snouts of these tagged fish were dissected in the laboratory to recover the CWTs, which were then decoded and verified to determine fish origin.

Potential predators of juvenile salmon from each haul were identified, measured (FL, mm), weighed (g), and stomach contents were examined onboard the vessel. Stomachs were excised, weighed (0.1 g), and visually classified by percent fullness (0, 10, 25, 50, 75, 100%). Stomach content weight was determined by subtracting the empty stomach weight from the full stomach weight. General prey composition was determined by estimating the contribution of major 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 total volume by the total content weight. Whenever possible, fish prey were identified to species and FL were measured. Overall diets were summarized by percent weight of major prey taxa and the frequency of feeding fish.

After each cruise, frozen individual juvenile salmon were weighed (0.1 g) in the laboratory. Mean lengths, weights, Fulton condition factor ($g/mm^3 \cdot 10^5$; Cone 1989), and residuals from a length-weight linear regression (condition residuals, CR) were computed for each species by habitat and sampling month. To determine stock of origin, sagittal otoliths were extracted from the crania and preserved in 95% ethyl alcohol, then later mounted on slides, ground down to the primordia, and examined for potential thermal marks (Secor et al. 1992). Ambiguous thermal marks were verified by personnel at the ADFG otolith laboratory. Stock composition and growth trajectories of thermally marked fish were then determined for each month and habitat.

In order to compare the biophysical conditions observed in 2009 to the prior 12-yr time series, a set of key parameters was examined. These parameters included: average 20-m integrated temperature and salinity, MLD, zooplankton density, and the CPUE, size-at-time (length on July 24), and CRs for the principal juvenile salmon species (pink, chum, sockeye, and coho). Graphical plots were used to compare annual means of these values from the core SECM sampling area in Icy Strait and to portray anomalies as deviations from the long-term grand means.

RESULTS AND DISCUSSION

In 2009, monitoring of northern strait stations was completed monthly from May to August, while southern strait stations were sampled only in July. In June, funding for a sampling platform was not administered in time to conduct trawling. During the four monthly surveys (22-d total), data were collected from 60 rope trawl hauls, 80 CTD casts, 47 bongo net samples, 81 Norpac net samples, 4 WP-2 net samples, 44 surface water samples, 80 Secchi readings, and 79 ambient light measures (Table 2, Appendix 1). The sampling periods occurred near the ends of each month. Rope trawling and associated fish collections were completed in Icy and Chatham Straits in July and August and in Clarence Strait in July. No sampling was scheduled at Icy Point.

Oceanography

Overall, surface (3-m) water temperatures ranged from 8.2 to 14.8ºC from May to August (Table 3; Appendix 1). Mean surface (3-m) temperatures followed similar patterns of seasonal increase among strait and inshore habitats from May to July, and then declined in August (Figure 2a). Monthly mean temperatures differed by up to 2ºC among habitats. By comparison, the monthly average 20-m integrated temperatures were colder than the 3-m values, but showed a more moderate seasonal increase and late summer decline.

Surface (3-m) salinities ranged from 18.8 to 30.8 PSU from May to August (Table 3; Appendix 1). Surface salinities followed similar patterns of seasonal decrease among strait and inshore habitats from May to July, and then increased in August (Figure 2b); salinities were considerably lower in inshore than in strait habitat. By comparison, the monthly average 20-m integrated salinities were higher than the 3-m values, but showed a more moderate seasonal decline and late summer increase.

Mixed layer depths ranged from 6 to 15 m (Appendix 1). Seasonally by habitat, in late summer, mean MLD was deepest in the northern strait and was shallowest in the northern inshore habitat (Figure 3b). Thus, our 3-m temperature and salinity measures as well as Secchi depths typically represented the most active segment of the water column, while trawling depth encompassed these waters and the more stable waters below the MLD.

Other physical data also showed seasonal and spatial differences. Secchi depths ranged from 1 to 10 m and averaged 5 m (Appendix 1). Water clarity was highest in the southern region and lowest in the inshore habitat, and was generally lower in spring than in summer (Figure 3a). Ambient light measurements ranged from 35 to 917 W/m^2, with a mean of 296 W/m^2. Light intensity was greatest in June and July (Appendix 1). Nutrient, chlorophyll, and phaeopigment patterns from water samples varied among habitats and months (Tables 2 and 4). Nutrient concentrations (range and mean) were 0.0–1.4 and 0.2 µM for PO_4, 1.4–20.7 and 6.4 µM for $Si(OH)_4$, 0.0–9.2 and 1.1 µM for NO_3, 0.0–0.3 and 0.1 µM for NO_2, and 0.2–2.3 and 0.7 µM for NH_4. Chlorophyll concentration ranged from 0.4 to 4.5 µg/L, with a mean of 1.7 µg/L, and the phaeopigment concentration ranged from 0.1 to 2.9 µg/L, with a mean of 0.5 µg/L (Table 4). Overall, chlorophyll concentration was highest in June (Figure 4a).

Zooplankton SVs ranged from approximately 3 to 65 ml and averaged 18 ml overall (Table 5). Seasonal patterns were similar in inshore and strait habitats. In both habitats, peaks in SV occurred in May, were followed by similarly low values in June and July, and then increased slightly in August (Figure 4b). The July SVs in the strait habitat were greater in the southern than in the northern region. Qualitative, visual examination of samples indicated a wide diversity of mesozooplankton taxa and phytoplankton present.

Zooplankton standing stock varied from 0.1 to 1.2 ml/m^3 across stations, months, and bongo net mesh sizes (Table 6). Seasonal patterns in mean values differed between inshore and strait habitats. In general, zooplankton standing stock was lower in inshore habitat than in strait habitat. The seasonal peak in inshore habitat occurred in May, whereas the seasonal peak in strait habitat occurred in June (Figure 5). Standing stock of organisms from the smaller, 333-µm mesh net (Figure 5a) was greater than in the larger 505-µm mesh net (Figure 5b). The July standing stock in the strait habitat was greater in the northern than in the southern region.

Abundance of seasonal, daytime prey fields present for planktivorous juvenile salmon and ecologically-related ichthyofauna was represented by zooplankton in 333-μm bongo samples from the northern and southern regions. In Icy Strait, mean zooplankton density declined over the season, and ranged from a high of approximately 3,400 organisms/m^3 in June to a low of approximately 1,000 organisms/m^3 in August; in Lower Clarence Strait, mean zooplankton density in July was less than half that for the same month in Icy Strait (Figure 6a). Zooplankton taxa were dominated by small (44-69%) and large (16-40%) calanoid copepods throughout the season. Small calanoids were consistently abundant in each month, while large calanoids were more than three times as abundant in May and June as in later summer. Other zooplankton taxa were seasonally present and contributed ≤ 22% of total densities in the northern strait, and ≤ 34% in the southern strait. Larvaceans, amphipods, and euphausiids were the only other taxa that contributed > 5% total density at any time (Figure 6b). Along with calanoids, these taxa are seasonally prominent in diets of juvenile salmon and other planktivores (Landingham et al. 1998; Sturdevant et al. 2002; Orsi et al. 2004).

Large and small calanoid taxa were remarkably consistent among the four sampling months (data not shown). From May to August, small calanoids were predominantly *Pseudocalanus* spp. (92-96%) while large calanoids were predominantly *Metridia* spp. (77-87%). The remaining small copepods included *Acartia*, *Centropages*, *Microcalanus*, and *Oithona* (a cyclopoid); other large calanoid species included *Neocalanus plumchrus/flemingeri* (seasonally decreasing) and *Calanus marshallae* (seasonally increasing). The July calanoids in the strait habitat were more diverse in the northern than in the southern region.

Catch composition

The trawls sampled a total of five large jellyfish species: *Aurelia labiata*, *Aequorea* sp., *Cyanea capillata*, *Chrysaora melanaster*, and *Staurophora mertensii* (Table 7). The monthly mean volume of jellyfish per haul ranged from 0.0 to 16.0 L. Overall, jellyfish biomass increased monthly in the northern region from July to August, but some genera (*Aequorea* and *Staurophora*) declined (Figure 7). In July, more *Cyanea* and *Chrysaora* were found in the southern region than in the northern region. Few other monthly or regional comparisons were possible in the absence of June trawling.

A total of 10,622 fish, representing 12 taxa, were captured in 60 rope trawl hauls in July and August in the two regions (Table 8). Juvenile salmon comprised about 97% of the total fish catch (Figure 8). Juvenile pink, chum, sockeye, and coho salmon occurred in 56-98% of the trawls, while juvenile Chinook salmon occurred in < 13% of the hauls (Table 9). All juvenile salmon species occurred more frequently in northern than in southern region in July. In the northern region, catches of juvenile pink, chum, and coho were higher in July than in August, whereas catches of sockeye salmon were higher in August (Figure 9).

Size and condition of juvenile salmon differed among the species and sampling periods (Tables 10–14, Figures 10–13). Most species increased in both length and weight in successive time periods, indicating growth despite the influx of additional stocks with varied times of saltwater entry. Mean FLs of juvenile salmon in July and August were: 125.2 and 151.9 mm for pink; 133.8 and 150.4 mm for chum; 136.2 and 146.6 mm for sockeye; 207.8 and 221.2 mm for coho; and 226.6 (July only) for Chinook salmon (Tables 10–14, Figure 10). Mean weights of juvenile salmon in July and August were: 20.0 and 35.5 g for pink; 25.1 and 39.0 g for chum; 27.2 and 38.1 g for sockeye; 106.9 and 132.5 g for coho; and 149.6 g (July only) for Chinook salmon (Tables 10–14, Figure 11). Juvenile coho and Chinook salmon were consistently 50-75 mm longer and 50-100 g heavier than pink, chum, and sockeye salmon in a given time period.

Mean Fulton's condition factor values for juvenile salmon in July and August were: 0.9 and 0.9 for pink; 1.0 and 1.1 for chum; 1.0 and 1.1 for sockeye; 1.2 and 1.2 for coho; and 1.3 for Chinook salmon (July only; Figure 12). Condition residuals were positive for pink, chum, sockeye, and coho salmon in July and August in both regions, suggesting that marine conditions were good in 2009 compared to the previous years (Figure 13). Conversely, the few Chinook salmon captured indicated average or below average condition residuals.

Stock-specific information was obtained from CWT recoveries. Twelve of the 18 juvenile coho salmon lacking adipose fins contained CWTs (Table 15). None of the juvenile or immature Chinook salmon captured lacked adipose fins. All tagged coho were from hatchery and wild stocks originating in SEAK and were recovered only in the northern region. Migration rates of juvenile coho salmon ranged 0.5-2.0 km/day and averaged 1.6 km/day. Five of the six adipose-clipped, untagged juvenile coho salmon were caught in the southern region; this suggests an influx of fish from Pacific Northwest hatcheries, which are mandated to adipose-clip all releases.

Stock-specific information was also obtained from recoveries of otolith-marked hatchery chum and sockeye salmon. Releases of these species from SEAK enhancement facilities are commonly mass-marked and not tagged with CWTs. A total of 513 otolith-marked salmon originating in SEAK were recovered in both regions (Tables 16-17; Figures 14-16).

For juvenile chum salmon, stock-specific information was derived from the otoliths of a subsample of 910 fish, representing 17% of those caught (Tables 8, 9, and 16; Figure 14). These fish were the same individuals sampled for weight and condition (Table 11). Of all chum salmon otoliths examined, 425 (47%) were marked from hatcheries in SEAK: 198 (22%) were from DIPAC, 160 (18%) were from SSRAA, 66 (7%) were from NSRAA, and 1 (< 1%) was from AKI. The remaining 485 (53%) of chum salmon examined were unmarked and probably included both wild and unmarked hatchery stocks. Hatchery composition declined from 56 to 30% from July to August. This decline is consistent with the pattern observed for previous years in which the decline usually began in June. Catches of hatchery chum salmon also indicated a pattern of northward movement by southern region stocks (Table 16).

For juvenile sockeye salmon, stock-specific information was derived from the otoliths of a subsample of 492 fish, representing 84% of those caught (Tables 8, 9, and 17; Figure 15). These fish were the same individuals sampled for weight and condition (Table 12). Of all the sockeye salmon otoliths examined, 90 (18%) were marked and originated from six stock groups: 80 from Speel Arm, Alaska (16%), three from Tatsamenie Lake/Taku River, British Columbia (<1%), two from McDonald Lake, Alaska (< 1%), one from Trapper Lake/Taku River, British Columbia (<1%), one from Tahltan Lake/Stikine River, British Columbia (<1%), and one from Tuya/Stikine River, British Columbia (<1%). The remaining 404 (82%) of sockeye salmon examined were unmarked and presumably from wild stocks. All but one stock group were recovered in the northern region. The one stock group recovered in the southern region was from McDonald Lake (Table 17).

Stock-specific sizes of otolith-marked juvenile chum and sockeye salmon increased monthly for all stock groups. Average weights of these fish were used to plot monthly growth trajectories (Figure 16). Both of these salmon species were released or migrated to sea in 2009 at the following approximate dates and size ranges: chum salmon in April–May (1–4 g) and sockeye salmon in April–June (5–10 g). Weights approximately doubled for both species from July to August.

Stomachs of seven species of potential predators of juvenile salmon were analyzed onboard, but no incidents of predation were observed (Tables 18 and 19, Figure 17). The 108 potential predators included five salmon species (97%), two walleye pollock (*Theragra* *chalcogramma*; 2%), and one spiny dogfish (*Squalus acanthius*; 1%). Adult pink salmon were the most common in both regions; the next most common species included adult chum salmon in the northern region and immature Chinook salmon in southern region (Table 18). The percentage of empty stomachs was low except for the Chinook salmon in the southern region (Table 19). Diet composition varied considerably among the species. Identifiable fish prey were prominent only for Chinook salmon, and included lanternfish (Myctophidae) and larval osmerids and cottids; unidentifiable fish prey were consumed by the pollock and spiny dogfish (Figure 17). Prominent invertebrate prey included crab larvae (northern region), amphipods (southern region) and gelatinous taxa (other than Larvacea) for the chum salmon.

Long-term trends

Our research in SEAK over the past 13 years indicates seasonal patterns of habitat use and species- and stock-dependent migration for juvenile salmon, as well as annual trends in associated biophysical factors. Biophysical measures from 2009 in Icy Strait were compared to the 12-yr time series to identify anomalies (Figures 18-27). Among the physical factors, anomalies were high for average 20-m integrated temperatures and were low for salinities (Figures 18, 19, and 21). Anomalies of MLD varied and alternated direction monthly (Figures 20 and 21). Among the biological factors, positive anomalies were observed for zooplankton density each month, a trend which has persisted for four years (Figure 22 and 23). Compared to previous years, juvenile salmon CPUEs were average (Figure 24 and 25) but individuals were large in July (size-at-time; Figure 26) and condition residuals were high in August (Figure 27). These data are used in conjunction with basin-scale biophysical parameters to develop forecast models for pink salmon harvest in SEAK (Wertheimer et al. 2010). Long-term monitoring of key stocks of juvenile salmon, on seasonal and interannual time scales, will enable researchers to understand how growth, abundance, and ecological interactions affect year-class strength of salmon and to better understand their role in North Pacific marine ecosystems.

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Table 1.—Localities and coordinates of stations sampled in the marine waters of southeastern Alaska, May–August 2009. Transect and station positions are shown in Figure 1.

Station	Latitude north	Longitude west	Distance: Offshore (km)	Distance: Between adjacent station (km)	Bottom depth (m)
Northern region					
Auke Bay Monitor					
ABM	58°22.00'	134°40.00'	1.5	—	60
Upper Chatham Strait transect					
UCA	58°04.57'	135°00.08'	3.2	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	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
Icy Point transect					
IPA	58°20.12'	137°07.16'	6.9	16.8	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
Southern region					
Middle Clarence Strait transect					
MCA	55°23.05'	131°55.49'	3.2	3.2	346
MCB	55°24.26'	131°58.23'	6.4	3.2	439
MCC	55°25.06'	132°01.19'	6.4	3.2	412
MCD	55°25.79'	132°03.93'	3.2	3.2	461

Table 1.—cont.

Station	Latitude north	Longitude west	Distance: Offshore (km)	Distance: Between adjacent station (km)	Bottom depth (m)
		Lower Clarence Strait transect			
LCA	55°07.53'	131°48.09'	3.2	3.2	413
LCB	55°07.32'	131°51.09'	6.4	3.2	459
LCC	55°07.14'	131°56.79'	6.4	3.2	466
LCD	55°06.93'	131°56.79'	3.2	3.2	315

Table 2.—Numbers and types of data collected using two laboratory vessels and one charter vessel in different habitats sampled monthly in the marine waters of the northern and southern regions of southeastern Alaska, May–August 2009.

			Data collection type[1]					
Dates (days)	Vessel	Habitat	Rope trawl	CTD cast	Oblique bongo	20-m vertical	WP-2 vertical	Chlorophyll & nutrients
			Northern region					
29 May,	R/V *Quest*	Inshore	0	2	2	3	1	1
02-03 June	R/V *Sashin*	Strait	0	8	8	8	0	8
(3 days)		Coastal	0	0	0	0	0	0
01 July	R/V *Sashin*	Inshore	0	1	2	3	1	1
(1 day)		Strait	0	8	8	8	0	8
		Coastal	0	0	0	0	0	0
26-31 July	F/V *Chellissa*	Inshore	0	1	2	3	1	1
(6 days)		Strait	28	28	8	22	0	8
		Coastal	0	0	0	0	0	0
17-24 August	F/V *Chellissa*	Inshore	0	1	1	3	1	1
(8 days)		Strait	16	16	8	16	0	8
		Coastal	0	0	0	0	0	0
			Southern region					
21-24 June (4 days)	F/V *Chellissa*	Strait	16	15	8	15	0	8

[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; oblique bongo = 60-cm diameter frame, 505- and 333-µm meshes, towed double obliquely down to and up from a depth of 200 m or within 20 m of the bottom; 20-m vertical = 50-cm diameter frame, 243-µm conical net (Norpac) towed vertically from 20 m; WP-2 vertical = 57-cm diameter frame, 202-µm conical net towed vertically from 200 m or within 10 m of the bottom; chlorophyll and nutrients are from surface seawater samples.

Table 3.—Surface (3-m, mean) temperature (°C) and salinity (PSU) data collected monthly at stations in the marine waters of the northern and southern regions of southeastern Alaska, May–August 2009. Station code acronyms are listed in Table 1.

Month	*n*	Temp (°C)	Salinity (PSU)	*n*	Temp (°C)	Salinity (PSU)	*n*	Temp (°C)	Salinity (PSU)	*n*	Temp (°C)	Salinity (PSU)
Northern region												
Auke Bay Monitor												
	ABM											
May	2	9.5	24.0									
June	1	11.6	20.4									
July	1	14.8	18.8									
August	1	12.2	20.7									
Upper Chatham Strait transect												
	UCA			UCB			UCC			UCD		
May	1	8.8	29.6	1	8.2	29.9	1	8.5	29.3	1	12.7	27.5
June	1	11.1	26.7	1	10.6	27.6	1	11.0	26.9	1	10.3	27.1
July	3	14.1	22.4	3	13.8	23.2	3	14.0	23.1	3	14.2	21.7
August	2	11.8	23.6	2	12.1	21.8	2	11.8	24.7	2	12.1	22.4
Icy Strait transect												
	ISA			ISB			ISC			ISD		
May	1	8.9	30.8	1	8.9	30.6	1	9.0	30.3	1	9.0	29.9
June	1	12.2	25.9	1	12.2	25.4	1	12.1	25.3	1	11.7	26.1
July	4	11.2	28.8	4	11.8	28.5	4	12.9	25.7	4	13.3	23.7
August	2	9.8	30.0	2	10.9	29.2	2	11.2	28.3	2	10.4	29.6

Table 3.—cont.

Month	*n*	Temp (°C)	Salinity (PSU)	*n*	Temp (°C)	Salinity (PSU)	*n*	Temp (°C)	Salinity (PSU)	*n*	Temp (°C)	Salinity (PSU)
Southern region												
Middle Clarence Strait transect												
	MCA			MCB			MCC			MCD		
July	2	13.4	25.2	2	13.3	24.2	2	12.1	26.3	2	10.7	28.8
Lower Clarence Strait transect												
	LCA			LCB			LCC			LCD		
July	2	13.0	26.1	2	12.8	26.3	2	13.4	26.3	1	10.9	29.1

Table 4.—Nutrient (µM) and chlorophyll (µg/L) concentrations from 200-ml surface water samples collected monthly at stations in the marine waters of the northern and southern regions of southeastern Alaska, May–August 2009. Station code acronyms are listed in Table 1.

		Nutrients [µM]						
Station	Date	[PO_4]	[$Si(OH)_4$]	[NO_3]	[NO_2]	[NH_4]	Chlorophyll (µg/L)	Phaeopigment (µg/L)
				Northern region				
ABM	2 June	1.36	20.68	1.57	0.06	2.31	1.86	0.40
	1 July	0.03	2.87	0.14	0.02	1.10	3.49	1.44
	31 July	0.02	8.88	0.02	0.01	1.12	0.53	0.13
	17 August	0.44	4.62	0.17	0.05	0.76	2.02	0.12
UCA	3 June	0.04	3.83	0.17	0.02	0.50	1.74	0.49
	1 July	0.00	1.53	0.00	0.00	0.29	2.26	0.96
	29 July	0.00	4.38	0.13	0.01	0.25	0.99	0.28
	20 August	0.41	8.51	2.68	0.11	0.74	1.40	0.30
UCB	3 June	0.05	3.83	0.12	0.02	0.17	1.96	0.63
	1 July	0.00	1.37	0.00	0.00	0.44	1.68	0.62
	29 July	0.03	4.05	0.12	0.02	0.59	0.71	0.43
	20 August	0.26	6.24	1.89	0.11	1.73	1.68	0.20
UCC	3 June	0.07	4.64	0.13	0.01	0.21	1.61	0.66
	1 July	0.00	1.37	0.00	0.00	0.40	4.49	2.85
	29 July	0.00	5.44	0.10	0.09	0.34	0.83	0.22
	20 August	0.11	6.88	0.82	0.04	0.46	1.46	0.07
UCD	3 June	0.33	4.48	0.22	0.02	0.21	1.91	0.51
	1 July	1.30	1.45	0.00	0.01	0.64	3.80	2.26
	29 July	0.00	4.62	0.10	0.04	0.35	1.07	0.33
	20 August	0.06	7.04	0.41	0.03	0.80	1.73	0.22
ISA	3 June	0.16	4.69	0.18	0.03	0.21	4.41	1.21
	1 July	0.40	3.68	0.11	0.02	0.70	1.68	0.51
	26 July	0.65	17.30	6.59	0.27	0.78	2.03	0.43
	18 August	0.53	20.21	9.22	0.17	0.65	2.52	0.57
ISB	3 June	0.08	5.02	0.15	0.03	0.45	2.81	0.78
	1 July	0.00	2.69	0.04	0.01	0.28	1.25	0.63
	26 July	0.07	15.97	6.10	0.17	0.78	1.60	0.37
	18 August	0.52	9.26	2.89	0.09	1.07	1.29	0.30
ISC	3 June	0.10	4.18	0.14	0.09	0.56	1.66	0.44
	1 July	0.01	1.86	0.03	0.00	0.62	2.48	0.83
	26 July	0.14	4.42	0.58	0.05	0.30	0.53	0.24
	18 August	0.48	6.21	1.23	0.05	0.89	0.88	0.33

Table 4.—cont.

Station	Date	Nutrients [μM]					Chlorophyll (μg/L)	Phaeopigment (μg/L)
		$[PO_4]$	$[Si(OH)_4]$	$[NO_3]$	$[NO_2]$	$[NH_4]$		
ISD	3 June	0.07	3.02	0.12	0.06	0.60	1.19	0.28
	1 July	0.39	4.67	0.12	0.03	1.82	1.74	0.38
	26 July	0.52	4.58	0.35	0.03	0.44	1.01	0.34
	18 August	0.03	5.88	1.83	0.06	1.81	0.89	0.54
				Southern region				
LCA	22 July	0.12	7.91	0.40	0.07	0.76	0.58	0.12
LCB	22 July	0.03	7.06	0.32	0.05	0.19	0.44	0.10
LCC	22 July	0.29	9.07	1.58	0.08	0.34	1.28	0.34
LCD	22 July	0.28	8.90	1.85	0.09	0.36	1.42	0.43
MCA	21 July	0.06	3.28	0.18	0.05	0.79	0.83	0.15
MCB	21 July	0.13	3.03	0.02	0.01	1.51	0.69	0.07
MCC	21 July	0.43	5.77	0.16	0.03	0.71	0.63	0.15
MCD	24 July	0.69	14.09	4.76	0.21	0.64	4.04	1.00

Table 5.— Mean zooplankton settled volumes (ZSV, ml) and total plankton settled volumes (TSV, ml) from vertical 20-m Norpac hauls collected monthly at stations in the marine waters of the northern and southern regions of southeastern Alaska, May–August 2009. Station code acronyms are listed in Table 1. Volume differences between SV and TSV are caused by presence of slub in the sample. Standing stock (ml/m^3) can be computed by dividing by the water volume filtered, a constant factor of 3.9 m^3 for these samples.

Month	*n*	ZSV	TSV	*n*	ZSV	TSV	*n*	ZSV	TSV	*n*	ZSV	TSV
Northern region												
Auke Bay Monitor												
	ABM											
May	3	34.7	44.0									
June	3	13.0	15.0									
July	3	12.3	12.3									
August	3	20.3	23.7									
Upper Chatham Strait transect												
	UCA			UCB			UCC			UCD		
May	1	30.5	38.0	1	51.5	103.0	1	50.0	99.0	1	53.5	107.0
June	1	10.0	10.0	1	17.0	17.0	1	8.0	8.0	1	9.0	9.0
July	2	5.4	6.5	3	5.4	6.2	3	5.8	6.5	2	3.4	5.8
August	2	7.5	7.5	2	7.3	7.3	2	5.4	8.3	2	7.5	7.5
Icy Strait transect												
	ISA			ISB			ISC			ISD		
May	1	31.0	48.0	1	21.0	32.0	1	65.0	100.0	1	44.5	69.5
June	1	24.0	24.0	1	20.0	20.0	1	8.0	8.0	1	8.0	8.0
July	3	5.7	11.3	3	6.5	10.5	3	8.7	17.3	3	5.5	11.0
August	2	6.8	12.5	2	4.1	6.8	2	19.5	19.5	2	3.8	6.0
Southern region												
Middle Clarence Strait transect												
	MCA			MCB			MCC			MCD		
July	2	22.5	38.0	2	27.0	47.0	2	19.3	38.8	1	15.0	30.0
Lower Clarence Strait transect												
	LCA			LCB			LCC			LCD		
July	2	12.3	24.5	2	17.5	35.0	2	14.5	29.0	2	8.8	17.5

Table 6.—Zooplankton displacement volumes (DV, ml), standing stock (DV/m^3), and total density (number/m^3, 333-µm mesh only) from double oblique bongo (333- and 505-µm mesh) hauls collected monthly at the Icy Strait stations in the marine waters of the northern and southern regions of southeastern Alaska, May–August 2009. Standing stock (ml/m^3) is computed using flow meter readings to determine water volume filtered. Station code acronyms are listed in Table 1.

Month	Depth (m)	DV	DV/m^3	Total density	Depth (m)	DV	DV/m^3	Total density	Depth (m)	DV	DV/m^3	Total density	Depth (m)	DV	DV/m^3	Total density
333-µm mesh																
Northern region																
	ISA				ISB				ISC				ISD			
May	60	60	0.8	3,946.3	120	115	0.9	2,016.1	238	175	0.8	1,930.0	235	115	0.5	2,344.7
June	95	100	0.9	4,776.0	120	135	0.9	4,212.7	193	230	1.0	3,040.3	199	255	1.1	1,804.3
July	96	60	0.5	1,582.4	127	100	0.4	1,469.5	185	150	0.6	1,559.6	217	245	0.9	2,109.6
August	52	25	0.2	126.7	123	140	0.5	1,435.9	172	170	0.5	1,213.5	187	180	0.5	1,278.3
Southern region																
	LCA				LCB				LCC				LCD			
July	188	75	0.3	1,371.8	166	65	0.2	569.7	192	50	0.2	453.5	186	45	0.2	538.8
505-µm mesh																
Northern region																
	ISA				ISB				ISC				ISD			
May	60	45	0.6	—	120	50	0.3	—	238	155	0.8	—	235	105	0.7	—
June	95	70	0.6	—	120	120	0.8	—	193	185	0.7	—	199	310	1.2	—
July	96	35	0.3	—	127	70	0.3	—	185	115	0.5	—	217	215	0.8	—
August	52	10	0.1	—	123	100	0.4	—	172	135	0.4	—	187	150	0.5	—

Table 6.—cont.

Month	Depth (m)	DV	DV/m^3	Total density	Depth (m)	DV	DV/m^3	Total density	Depth (m)	DV	DV/m^3	Total density	Depth (m)	DV	DV/m^3	Total density
Southern region																
	LCA				LCB				LCC				LCD			
July	188	50	0.2	—	166	50	0.2	—	192	35	0.2	—	186	45	0.2	—

Table 7.—Mean volume (L) of jellyfish captured in rope trawl hauls in the marine waters of the northern and southern regions of southeastern Alaska, July-August 2009. No trawling was conducted in June in either region or in August in the southern region.

Genus	Volume (L) July	Volume (L) August
Northern region		
Aequorea sp.	4.1	1.6
Aurelia sp.	2.5	6.1
Cyanea sp.	1.0	1.5
Staurophora sp.	0.2	—
Chrysaora sp.	0.1	0.3
Total	7.8	9.5
Southern region		
Aequorea sp.	3.5	
Aurelia sp.	0.2	
Cyanea sp.	16.0	
Chrysaora sp.	0.6	
Total	20.3	

Table 8.—Numbers of fish captured in rope trawl hauls in the marine waters of the northern (*n*=44) and southern (*n*=16) regions of southeastern Alaska, July–August 2009. No trawling was conducted in June in either region or in August in the southern region.

		Northern region		Southern region
Common name	Scientific name	July	August	July
Salmonids				
Chum salmon[1]	*Oncorhynchus keta*	3,216	913	1,275
Pink salmon[1]	*O. gorbuscha*	1,731	712	1,163
Coho salmon[1]	*O. kisutch*	531	95	122
Sockeye salmon[1]	*O. nerka*	157	296	132
Pink salmon[3]	*O. gorbuscha*	52	14	15
Chum salmon[3]	*O. keta*	3	5	2
Chinook salmon[2]	*O. tshawytscha*	3	1	6
Chinook salmon[1]	*O. tshawytscha*	1	—	2
Coho salmon[3]	*O. kisutch*	1	—	1
Sockeye salmon[3]	*O. nerka*	—	—	1
Salmonid subtotals		5,695	2,036	2,719
Non-salmonids				
Crested sculpin	*Blepsias bilobus*	90	23	1
Pacific herring	*Clupea pallasi*	1	7	8
Spiny lumpsucker	*Eumicrotremus orbis*	7	—	—
Smooth lumpsucker	*Aptocyclus ventricosus*	4	2	—
Walleye pollock[3]	*Theragra chalcogramma*	2	1	—
Squid	Gonatidae	1		—
Spiny dogfish	*Squalus acanthias*	—	1	—
Walleye pollock[4]	*T. chalcogramma*	—	—	24
Non-salmonid subtotals		105	34	33
Grand total fish and squid		5,800	2,070	2,752

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

Table 9.—Frequency of occurrence of fish species captured in rope trawl hauls in the marine waters of the northern (*n*=44) and southern (*n*=16) regions of southeastern Alaska by rope trawl, July–August 2009. The percent frequency of occurrence is shown in parentheses. No trawling was conducted in June in either region or in August in the southern region.

		Northern region			Southern region	
Common name	Scientific name	July	August	(%)	July	(%)
	Salmonids					
Chum salmon[1]	*Oncorhynchus keta*	27	15	(95)	12	(75)
Pink salmon[1]	*O. gorbuscha*	27	16	(98)	12	(75)
Coho salmon[1]	*O. kisutch*	28	15	(98)	15	(94)
Sockeye salmon[1]	*O. nerka*	23	15	(86)	12	(75)
Pink salmon[3]	*O. gorbuscha*	20	9	(66)	9	(56)
Chum salmon[3]	*O. keta*	3	4	(16)	2	(13)
Chinook salmon[2]	*O. tshawytscha*	3	1	(9)	5	(31)
Chinook salmon[1]	*O. tshawytscha*	1	0	(2)	2	(13)
Coho salmon[3]	*O. kisutch*	1	0	(2)	1	(6)
Sockeye salmon[3]	*O. nerka*	0	0	(0)	1	(6)
	Non-salmonids					
Crested sculpin	*Blepsias bilobus*	24	12	(82)	1	(6)
Pacific herring	*Clupea pallasi*	1	3	(9)	2	(13)
Spiny lumpsucker	*Eumicrotremus orbis*	6	0	(14)	0	(0)
Smooth lumpsucker	*Aptocyclus ventricosus*	3	2	(11)	0	(0)
Walleye pollock[3]	*Theragra chalcogramma*	2	1	(7)	0	(0)
Squid	Gonatidae	1	0	(2)	0	(0)
Spiny dogfish	*Squalus acanthias*	0	1	(2)	0	(0)
Walleye pollock[4]	*T. chalcogramma*	0	0	(0)	8	(50)

[1]Juvenile, [2]Immature, [3]Adult, and [4]Larvae

Table 10.—Length (mm, fork), weight (g), Fulton's condition [$(g/mm^3)\cdot(10^5)$], and condition residuals from length-weight regression analysis of juvenile pink salmon captured in the strait habitat of the northern and southern regions of southeastern Alaska by rope trawl, July–August 2009. No trawling was conducted in June in either region or in August in the southern region.

		July				August			
Locality	Factor	*n*	Range	mean	se	*n*	range	mean	se
Upper	Length	369	95-170	127.9	0.6	477	103-257	149.9	0.7
Chatham	Weight	156	8.5-45.2	20.6	0.5	476	11.0-90.7	34.4	0.5
Strait	Condition	156	0.8-1.2	0.9	0.0	476	0.2-2.0	1.0	0.0
	Residual	156	-0.18-0.19	0.01	0.01	476	-2.01-0.75	0.05	0.01
Icy	Length	1246	91-181	127.3	0.3	262	102-197	155.7	1.0
Strait	Weight	448	5.2-54.2	20.2	0.3	235	10.3-84.0	37.9	0.8
	Condition	448	0.7-1.2	0.9	0.0	235	0.4-1.2	1.0	0.0
	Residual	448	-0.26-0.25	-0.02	0.00	235	-0.93-0.21	0.01	0.01
Middle	Length	949	91-163	121.5	0.4				
Clarence	Weight	370	8.6-42.3	19.7	0.3				
Strait	Condition	370	0.8-1.3	1.0	0.0				
	Residual	370	-0.13-0.37	0.10	0.00				
Lower	Length	17	89-165	125.4	4.5				
Clarence	Weight	17	6.2-42.8	19.5	2.2				
Strait	Condition	17	0.8-1.1	0.9	0.0				
	Residual	17	-0.15-0.13	0.02	0.02				
Total	Length	2581	89-181	125.2	0.2	739	102-257	151.9	0.6
	Weight	991	5.2-54.2	20.0	0.2	711	10.3-90.7	35.5	0.4
	Condition	991	0.7-1.3	0.9	0.0	711	0.2-2.0	1.0	0.0
	Residual	991	-0.26-0.37	0.03	0.00	711	-2.00-0.75	0.04	0.00

Table 11.— Length (mm, fork), weight (g), Fulton's condition [(g/mm^3)·(10^5)], and condition residuals from length-weight regression analysis of juvenile chum salmon captured in the marine habitat of the northern and southern regions of southeastern Alaska by rope trawl, July–August 2009. No trawling was conducted in June in either region or in August in the southern region.

		July				August			
Locality	Factor	*n*	Range	mean	se	*n*	range	mean	Se
Upper	Length	791	85-202	134.0	0.5	598	89-207	145.3	0.7
Chatham	Weight	448	5.1-92.1	23.9	0.4	503	10.4-81.1	35.8	0.6
Strait	Condition	448	0.8-1.4	0.0	0.0	503	0.5-3.1	0.1	0.0
	Residual	448	-0.20-0.32	0.01	0.00	503	-0.82-1.17	0.09	0.01
Icy	Length	1716	97-180	134.2	0.3	353	109-199	158.9	0.9
Strait	Weight	627	7.9-52.8	24.9	0.3	299	10.9-82.0	44.6	0.8
	Condition	627	0.8-1.3	0.0	0.0	299	0.9-1.4	0.1	0.0
	Residual	627	-0.32-0.23	-0.01	0.00	299	-0.17-0.28	0.06	0.00
Middle	Length	803	93-187	132.5	0.6				
Clarence	Weight	378	7.9-55.4	26.7	0.5				
Strait	Condition	378	0.8-1.4	0.1	0.0				
	Residual	378	-0.32-0.37	0.10	0.00				
Lower	Length	12	108-170	135.3	6.6				
Clarence	Weight	12	11.4-50.4	25.4	3.9				
Strait	Condition	12	0.9-1.1	0.0	0.0				
	Residual	12	-0.15-0.08	-0.03	0.02				
Total	Length	3322	85-202	133.8	0.2	951	89-207	150.4	0.6
	Weight	1465	5.1-92.1	25.1	0.2	802	10.4-82.0	39.0	0.5
	Condition	1465	0.8-1.4	1.0	0.0	802	0.5-3.1	1.1	0.0
	Residual	1465	-0.32-0.36	0.02	0.00	802	-0.81-1.16	0.08	0.00

Table 12.— Length (mm, fork), weight (g), Fulton's condition [$(g/mm^3)\cdot(10^5)$], and condition residuals from length-weight regression analysis of juvenile sockeye salmon captured in the marine habitat of the northern and southern regions of southeastern Alaska by rope trawl, July–August 2009. No trawling was conducted in June in either region or in august in the southern region.

		July				August			
Locality	Factor	*n*	Range	mean	se	*n*	range	mean	se
Upper	Length	56	67-166	137.6	1.9	232	85-193	141.8	1.3
Chatham	Weight	56	2.6-42.2	27.7	0.9	231	8.7-85.9	34.8	0.9
Strait	Condition	56	0.9-1.2	1.0	0.0	231	0.7-1.7	1.2	0.0
	Residual	56	-0.13-0.13	0.01	0.01	231	-0.42-0.48	0.11	0.01
Icy	Length	101	83-202	137.2	1.8	69	101-233	162.8	2.6
Strait	Weight	101	5.5-97.4	27.9	1.4	64	12-147.4	49.9	2.7
	Condition	101	0.3-2.8	1.0	0.0	64	1.0-1.4	1.1	0.0
	Residual	101	-1.25-1.00	-0.01	0.02	64	-0.08-0.23	0.05	0.01
Middle	Length	113	111-172	133.7	1.0				
Clarence	Weight	113	14.8-51.4	25.8	0.6				
Strait	Condition	113	0.9-1.3	1.1	0.0				
	Residual	113	-0.22-0.24	0.03	0.01				
Lower	Length	16	121-190	142.6	5.1				
Clarence	Weight	16	16.8-73.7	30.2	4.0				
Strait	Condition	16	0.9-1.1	1.0	0.0				
	Residual	16	-0.17-0.04	-0.07	0.01				
Total	Length	286	67-202	136.2	0.9	301	85-233	146.6	1.2
	Weight	286	2.6-97.4	27.2	0.6	295	8.7-147.4	38.1	1.0
	Condition	286	0.3-2.8	1.0	0.0	295	0.7-1.7	1.1	0.0
	Residual	286	-1.25-1.00	0.01	0.01	295	-0.42-0.48	0.10	0.01

Table 13.— Length (mm, fork), weight (g), Fulton's condition [(g/mm^3)·(10^5)], and condition residuals from length-weight regression analysis of juvenile coho salmon captured in the marine habitat of the northern and southern regions of southeastern Alaska by rope trawl, July–August 2009. No trawling was conducted in June in either region or in August in the southern region.

		July				August			
Locality	Factor	*n*	Range	mean	se	*n*	range	mean	se
Upper	Length	213	155-259	207.6	1.4	48	182-266	216.2	3.0
Chatham	Weight	184	35.6-196.1	106.5	2.4	48	75.2-271.5	124.4	6.1
Strait	Condition	184	0.7-2.6	1.2	0.0	48	1.1-1.6	1.2	0.0
	Residual	184	-0.54-0.80	0.00	0.01	48	-0.13-0.25	0.02	0.01
Icy	Length	317	167-264	208.8	1.0	48	157-265	226.2	3.0
Strait	Weight	284	51.7-207.8	107.4	1.6	44	39.2-218.6	141.3	5.6
	Condition	284	1.0-1.6	1.2	0.0	44	1.1-1.4	1.2	0.0
	Residual	284	-0.25-0.30	0.00	0.00	44	-0.13-0.15	0.03	0.01
Middle	Length	38	175-250	205.5	2.7				
Clarence	Weight	38	61.3-188.1	103.4	4.1				
Strait	Condition	38	1.1-1.4	1.2	0.0				
	Residual	38	-0.15-0.15	0.01	0.01				
Lower	Length	79	183-241	205.7	1.3				
Clarence	Weight	79	76.9-172.0	107.3	2.1				
Strait	Condition	79	1.1-1.5	1.2	0.0				
	Residual	79	-0.14-0.24	0.05	0.01				
Total	Length	647	155-264	207.8	0.7	96	157-266	221.2	2.2
	Weight	585	35.6-207.8	106.9	1.1	92	39.2-271.5	132.5	4.2
	Condition	585	0.7-2.6	1.2	0.0	92	1.1-1.6	1.2	0.0
	Residual	585	-0.53-0.80	0.00	0.00	92	-0.12-0.25	0.02	0.01

Table 14.— Length (mm, fork), weight (g), Fulton's condition [(g/mm^3)·(10^5)], and condition residuals from length-weight regression analysis of juvenile Chinook salmon captured in the marine habitat of the northern and southern regions of southeastern Alaska by rope trawl, July–August 2009. No trawling was conducted in June in either region or in August in the southern region.

		July				August			
Locality	Factor	*n*	Range	mean	se	*n*	range	mean	se
Upper	Length	—	—	—	—	—	—	—	—
Chatham	Weight	—	—	—	—	—	—	—	—
Strait	Condition	—	—	—	—	—	—	—	—
	Residual	—	—	—	—	—	—	—	—
Icy	Length	1	229	229.0	—	—	—	—	—
Strait	Weight	1	143.1	143.1	—	—	—	—	—
	Condition	1	1.2	1.2	—	—	—	—	—
	Residual	1	-0.12	-0.11	—	—	—	—	—
Middle	Length	1	218	218.0	—				
Clarence	Weight	1	140.7	140.7	—				
Strait	Condition	1	1.4	1.4	—				
	Residual	1	0.04	0.04	—				
Lower	Length	1	233	233.0	—				
Clarence	Weight	1	165.1	165.1	—				
Strait	Condition	1	1.4	1.3	—				
	Residual	1	-0.03	-0.03	—				
Total	Length	3	218-233	226.7	4.5	—	—	—	—
	Weight	3	140.7-165.1	149.6	7.8	—	—	—	—
	Condition	3	1.2-1.4	1.3	0.0	—	—	—	—
	Residual	3	-0.11-0.04	-0.03	0.04	—	—	—	—

Table 15.—Release and recovery information, decoded from coded-wire tags recovered from coho and Chinook salmon lacking an adipose fin. Fish were captured in the marine waters of the northern and southern regions of southeastern Alaska by rope trawl, July–August 2009. Station code acronyms and coordinates are shown in Table 1.

		Release information						Recovery information							
Species	Coded-wire tag code	Brood year	Agency[1]	Locality	Date	FL (mm)	Wt. (g)	Locality	Station code	2009 date	FL (mm)	Wt. (g)	Age	Days[2] since release	Distance traveled (km)
							July								
Coho	0401060106	2007	ADFG	Berners R., AK (Wild)	6/03/2008	38	—	Icy Strait	ISB	7/27	209	98.9	1.0	419	90
Coho	04:09/88	2007	ADFG	Taku River, AK (Wild)	6/05/2009	—	—	Chatham Str.	UCD	7/30	177	68.8	1.0	55	100
Coho	04:12/06	2007	ADFG	Berners R., AK (Wild)	6/17/2009	105	—	Chatham Str.	UCB	7/29	211	105.3	1.0	42	80
Coho	04:15/46	2007	ADFG	Chilkat R., AK (Wild)	5/30/2009	—	—	Chatham Str.	UCB	7/30	199	93.1	1.0	61	125
Coho	04:17/69	2007	NSRAA	Kasnyku Bay, AK	5/22/2009	—	19.6	Icy Strait	ISC	7/28	231	131.1	1.0	67	130
Coho	04:17/69	2007	NSRAA	Kasnyku Bay, AK	5/22/2009	—	19.6	Icy Strait	ISC	7/28	241	161.1	1.0	67	130
Coho	04:17/69	2007	NSRAA	Kasnyku Bay, AK	5/22/2009	—	19.6	Icy Strait	ISC	7/28	244	146.5	1.0	67	130
Coho	04:19/75	2007	NSRAA	Kasnyku Bay, AK	5/22/2009	—	19.6	Icy Strait	ISC	7/28	182	65.2	1.0	67	130
Coho	No tag	—	—	—	—	—	—	Clarence Str.	MCB	7/21	214	127.1	—	—	—
Coho	No tag	—	—	—	—	—	—	Clarence Str.	MCB	7/21	214	113.5	—	—	—
Coho	No tag	—	—	—	—	—	—	Clarence Str.	LCD	7/23	200	93.9	—	—	—
Coho	No tag	—	—	—	—	—	—	Clarence Str.	LCD	7/23	218	136.8	—	—	—
Coho	No tag	—	—	—	—	—	—	Clarence Str.	MCD	7/24	220	127.8	—	—	—
Coho	No tag	—	—	—	—	—	—	Icy Strait	ISD	7/28	222	137.8	—	—	—
							August								
Coho	04:15/08	2007	ADFG	Chilkat R., AK (Wild)	5/30/2009	—	—	Icy Strait	ISD	8/18	229	155.3	1.0	80	140
Coho	04:19/75	2007	DIPAC	Gastineau Channel, AK	6/17/2009	—	19.2	Icy Strait	ISD	8/19	211	101.6	1.0	63	87
Coho	04:19/76	2007	DIPAC	Gastineau Channel, AK	6/17/2009	—	14.9	Chatham Str.	UCA	8/21	193	83.5	1.0	65	76
Coho	04:19/76	2007	DIPAC	Gastineau Channel, AK	6/17/2009	—	14.9	Chatham Str.	UCB	8/21	183	77.1	1.0	65	73

[1] ADFG = Alaska Department of Fish and Game; DIPAC = Douglas Island Pink and Chum; NSRAA = Northern Southeast Regional Aquaculture Association.
[2] Days since release may potentially include freshwater residence periods, such as salmon fry marked and released in fall that over wintered in freshwater and smolted the subsequent year.

Table 16.—Stock-specific information on juvenile chum salmon released from regional enhancement facilities and captured in the marine waters of the northern region of southeastern Alaska by rope trawl, July-August 2009. Length (mm, fork), weight (g), Fulton's condition [(g/mm^3) · (10^5)], and condition residuals from length-weight regression analysis are reported for each stock group by sample size (*n*), range, mean, and standard error (se) about the mean. See Table 15 for agency acronyms. L/L = late large release group.

		July				August			
Locality	Factor	n	range	mean	se	n	range	mean	se
				Northern region stocks					
				DIPAC					
Upper	Length	60	118-166	138.0	1.4	32	119-186	152.9	2.5
Chatham	Weight	60	15.6-45.0	26.7	0.9	32	20.8-62.1	44.6	2.0
Strait	Condition	60	0.9-1.2	1.0	0.1	32	1.0-1.3	1.1	0.1
	Residual	60	-0.10-0.20	0.04	0.07	32	-0.08-0.34	0.12	0.11
Icy	Length	73	111-158	138.2	1.2	32	131-182	161.6	2.3
Strait	Weight	73	11.6-38.6	25.5	0.7	32	15.0-74.7	40.0	2.2
	Condition	73	0.8-1.2	1.0	0.1	32	0.9-1.4	1.1	0.1
	Residual	73	-0.19-0.15	-0.02	0.07	32	-0.04-0.24	0.06	0.07
Middle	Length	1	121	121.0	—				
Clarence	Weight	1	17.5	17.5	—				
Strait	Condition	1	1	1.0	—				
	Residual	1	0.04	0.0	—				
Lower	Length	—	—	—	—				
Clarence	Weight	—	—	—	—				
Strait	Condition	—	—	—	—				
	Residual	—	—	—	—				

Table 16.—cont.

		July				August			
Locality	Factor	n	range	mean	se	n	range	mean	se
Total	Length	134	111-166	138.0	0.9	64	119-186	157.3	1.8
	Weight	134	11.6-45.0	25.9	0.6	64	15.0-74.7	42.3	1.5
	Condition	134	0.8-1.2	1.0	0.1	64	0.9-1.4	1.1	0.1
	Residual	134	-0.19-0.20	0.01	0.01	64	-0.08-0.34	0.09	0.02
Port Armstrong									
Upper	Length	—	—	—	—	1	170	170.0	—
Chatham	Weight	—	—	—	—	1	55.8	55.8	—
Strait	Condition	—	—	—	—	1	1.2	1.2	—
(Total)	Residual	—	—	—	—	1	0.15	0.15	—
NSRAA									
Kasnyku Bay									
Upper	Length	23	106-151	131.4	2.7	8	135-187	158.8	6.2
Chatham	Weight	23	12.3-34.8	22.9	1.4	8	25.3-71.7	43.3	5.4
Strait	Condition	23	0.9-1.2	1.0	0.1	8	1.0-1.2	1.1	0.1
	Residual	23	-0.12-0.15	0.03	0.02	8	-0.03-0.14	0.07	0.02
Icy	Length	18	106-147	133.0	3.1	17	136-177	160.8	3.4
Strait	Weight	18	13.3-31.9	22.8	1.6	17	22.6-57.1	42.1	2.7
	Condition	18	0.8-1.2	1.0	0.1	17	0.9-1.1	1.0	0.1
	Residual	18	-0.32-0.20	-0.02	0.04	17	-0.15-0.09	0.02	0.02
Middle	Length	—	—	—	—				
Clarence	Weight	—	—	—	—				
Strait	Condition	—	—	—	—				
	Residual	—	—	—	—				

Table 16.—cont.

Locality	Factor	July n	July range	July mean	July se	August n	August range	August mean	August se
Lower Clarence Strait	Length	—	—	—	—				
	Weight	—	—	—	—				
	Condition	—	—	—	—				
	Residual	—	—	—	—				
Total	Length	41	106-151	132.1	2.0	25	135-187	160.1	3.0
	Weight	41	12.3-34.8	22.9	1.0	25	22.6-71.7	42.5	2.5
	Condition	41	0.8-1.2	1.0	0.1	25	0.9-1.2	1.1	0.1
	Residual	41	-0.32-0.20	0.01	0.02	25	-0.15-0.14	0.04	0.02
Southern region stocks									
SSRAA									
Anita Bay									
Upper Chatham Strait	Length	—	—	—	—	—	—	—	—
	Weight	—	—	—	—	—	—	—	—
	Condition	—	—	—	—	—	—	—	—
	Residual	—	—	—	—	—	—	—	—
Icy Strait	Length	2	139-151	145.0	6.0	5	157-182	171.6	4.2
	Weight	2	25.9-30.4	28.2	2.3	5	40.6-64.2	54.1	4.0
	Condition	2	0.9-1.0	1.0	0.1	5	1.1-1.1	1.1	0.1
	Residual	2	-0.10-0.01	-0.05	0.05	5	0.06-0.11	0.09	0.01
Middle Clarence Strait	Length	38	116-156	139.0	1.6				
	Weight	38	16.1-39.9	28.9	1.0				
	Condition	38	1.0-1.3	1.1	0.1				
	Residual	38	-0.02-0.29	0.1	0.0				

Table 16.—cont.

Locality	Factor	July n	July range	July mean	July se	August n	August range	August mean	August se
Lower Clarence Strait	Length	—	—	—	—				
	Weight	—	—	—	—				
	Condition	—	—	—	—				
	Residual	—	—	—	—				
Total	Length	40	116-156	139.3	1.5	5	157-182	171.6	4.2
	Weight	40	16.1-39.9	28.8	1.0	5	40.6-64.2	54.1	4.0
	Condition	40	0.9-1.3	1.1	0.1	5	1.1-1.1	1.1	0.1
	Residual	40	-0.10-0.29	0.09	0.02	5	0.06-0.11	0.09	0.01
Kendrick Bay									
Upper Chatham Strait	Length	—	—	—	—	—	—	—	—
	Weight	—	—	—	—	—	—	—	—
	Condition	—	—	—	—	—	—	—	—
	Residual	—	—	—	—	—	—	—	—
Icy Strait	Length	—	—	—	—	—	—	—	—
	Weight	—	—	—	—	—	—	—	—
	Condition	—	—	—	—	—	—	—	—
	Residual	—	—	—	—	—	—	—	—
Middle Clarence Strait	Length	33	125-171	147.3	1.8				
	Weight	33	23.6-54.5	33.7	1.1				
	Condition	33	0.9-1.3	1.1	0.1				
	Residual	33	-0.10-0.28	0.10	0.0				
Lower Clarence Strait	Length	1	161	161.0	—				
	Weight	1	39.8	39.8	—				
	Condition	1	1.0	1.0	—				
	Residual	1	-0.03	0.00	—				

Table 16.—cont.

Locality	Factor	July n	July range	July mean	July se	August n	August range	August mean	August se
Total	Length	34	125-171	147.7	1.8	—	—	—	—
	Weight	34	23.6-54.5	33.9	1.1	—	—	—	—
	Condition	34	0.9-1.3	1.1	0.1	—	—	—	—
	Residual	34	-0.10-0.28	0.08	0.02	—	—	—	—
				Kendrick Bay L/L					
Upper Chatham Strait	Length	1	146	146.0	—	1	136	136.0	—
	Weight	1	26.3	26.3	—	1	28.9	28.9	—
	Condition	1	0.9	0.9	—	1	1.2	1.2	—
	Residual	1	-0.14	-0.14	—	1	0.18	0.18	—
Icy Strait	Length	—	—	—	—	—	—	—	—
	Weight	—	—	—	—	—	—	—	—
	Condition	—	—	—	—	—	—	—	—
	Residual	—	—	—	—	—	—	—	—
Middle Clarence Strait	Length	8	124-157	138.2	4.5	1	179	179.0	—
	Weight	8	18.2-38.6	27.7	2.7	1	61.6	61.6	—
	Condition	8	1.0-1.2	1.1	0.1	1	1.1	1.1	—
	Residual	8	-0.04-0.16	0.1	0.0	1	0.09	0.09	—
Lower Clarence Strait	Length	—	—	—	—				
	Weight	—	—	—	—				
	Condition	—	—	—	—				
	Residual	—	—	—	—				
Total	Length	9	124-157	139.0	4.0	2	136-179	157.5	21.5
	Weight	9	18.2-38.6	27.5	2.4	2	28.9-61.6	45.3	16.4
	Condition	9	0.9-1.2	1.1	0.1	2	1.1-1.2	1.2	0.1
	Residual	9	-0.14-0.16	0.04	0.04	2	0.09-0.18	0.14	0.05

Table 16.—cont.

		July				August			
Locality	Factor	n	range	mean	se	n	range	mean	se
		Nakat Inlet (summer)							
Lower	Length	3	119-145	131.4	7.6				
Clarence	Weight	3	14.3-30.5	21.0	4.9				
Strait	Condition	3	0.9-1.0	0.9	0.1				
(Total)	Residual	3	-0.15-0.04	-0.08	0.06				
		Neets Bay (summer)							
Upper	Length	—	—	—	—	—	—	—	—
Chatham	Weight	—	—	—	—	—	—	—	—
Strait	Condition	—	—	—	—	—	—	—	—
	Residual	—	—	—	—	—	—	—	—
Icy	Length	—	—	—	—	—	—	—	—
Strait	Weight	—	—	—	—	—	—	—	—
	Condition	—	—	—	—	—	—	—	—
	Residual	—	—	—	—	—	—	—	—
Middle	Length	44	118-174	150.8	2.0				
Clarence	Weight	44	17.6-55.4	37.2	1.3				
Strait	Condition	44	1.0-1.3	1.1	0.1				
	Residual	44	-0.06-0.28	0.10	0.02				
Lower	Length	2	165-170	167.5	2.5				
Clarence	Weight	2	42.1-50.4	46.2	4.2				
Strait	Condition	2	1.0-1.1	1.0	0.1				
	Residual	2	-0.05-0.05	0.01	0.05				

Table 16.—cont.

Locality	Factor	July				August			
		n	range	mean	se	n	range	mean	se
Total	Length	46	118-174	151.5	2.0	—	—	—	—
	Weight	46	17.6-55.4	37.6	1.3	—	—	—	—
	Condition	46	1.0-1.3	1.1	0.1	—	—	—	—
	Residual	46	-0.06-0.28	0.10	0.02	—	—	—	—
				Neets Bay (fall)					
Upper Chatham Strait	Length	—	—	—	—	—	—	—	—
	Weight	—	—	—	—	—	—	—	—
	Condition	—	—	—	—	—	—	—	—
	Residual	—	—	—	—	—	—	—	—
Icy Strait	Length	—	—	—	—	—	—	—	—
	Weight	—	—	—	—	—	—	—	—
	Condition	—	—	—	—	—	—	—	—
	Residual	—	—	—	—	—	—	—	—
Middle Clarence Strait	Length	20	93-135	118.6	2.5				
	Weight	20	7.9-24.2	17.8	1.0				
	Condition	20	1.0-1.4	1.1	0.1				
	Residual	20	-0.04-0.37	0.10	0.03				
Lower Clarence Strait	Length	1	115	115.0	—				
	Weight	1	13.3	13.3	—				
	Condition	1	0.9	0.9	—				
	Residual	1	-0.09	-0.09	—				
Total	Length	21	93-135	118.4	2.4	—	—	—	—
	Weight	21	7.9-24.2	17.6	1.0	—	—	—	—
	Condition	21	0.9-1.4	1.1	0.1	—	—	—	—
	Residual	21	-0.09-0.37	0.09	0.03	—	—	—	—

Table 16.—cont.

Locality	Factor	July n	July range	July mean	July se	August n	August range	August mean	August se
Northern and southern regions unmarked stocks									
Upper	Length	104	98-202	133.8	1.6	146	105-187	143.2	1.3
Chatham	Weight	104	8.9-92.1	24.8	1.1	146	10.4-78.2	32.7	1.0
Strait	Condition	104	0.9-1.3	1.0	0.1	146	0.7-1.5	1.1	0.1
	Residual	104	-0.16-0.23	0.03	0.01	146	-0.44-0.42	0.11	0.01
Icy	Length	99	101-155	133.2	1.3	82	109-199	154.1	2.2
Strait	Weight	99	9.7-37.8	23.0	0.7	82	10.9-82.0	40.2	1.9
	Condition	99	0.9-1.2	1.0	0.1	82	0.9-1.3	1.1	0.1
	Residual	99	-0.18-0.21	-0.02	0.01	82	-0.13-0.23	0.06	0.01
Middle	Length	50	98-155	127.2	2.3				
Clarence	Weight	50	8.9-38.8	22.2	1.2				
Strait	Condition	50	0.8-1.4	1.1	0.1				
	Residual	50	-0.21-0.34	0.07	0.02				
Lower	Length	4	108-130	115.5	5.0				
Clarence	Weight	4	11.4-23	15.6	2.6				
Strait	Condition	4	1.0-1.1	1.0	0.1				
	Residual	4	-0.05-0.09	0.04	0.03				
Total	Length	257	98-202	132.0	1.0	228	105-199	147.1	1.2
	Weight	257	8.9-92.1	23.5	0.6	228	10.4-82.0	35.4	1.0
	Condition	257	0.8-1.4	1.0	0.1	228	0.7-1.5	1.1	0.1
	Residual	257	-0.21-0.34	0.02	0.01	228	-0.44-0.42	0.09	0.01

Table 17.—Stock-specific information on juvenile sockeye salmon released from regional enhancement facilities and captured in the marine waters of the northern region of southeastern Alaska by rope trawl, July-August 2009. Length (mm, fork), weight (g), Fulton's condition $[(g/mm^3) \cdot (10^5)]$, and condition residuals from length-weight regression analysis are reported for each stock group by sample size (*n*), range, mean, and standard error (se) about the mean. See Table 15 for agency acronyms.

		July				August			
Locality	Factor	n	range	mean	se	n	range	mean	se
		Northern region stocks							
		DIPAC							
		Speel Arm							
Upper	Length	17	121-152	138.9	2.0	10	143-175	156.5	3.5
Chatham	Weight	17	18.5-32.9	27.3	1.1	10	30.3-57.3	44.2	3.3
Strait	Condition	17	0.9-1.1	1.0	0.0	10	1.0-1.2	1.1	0.0
	Residual	17	-0.10-0.10	0.01	0.01	10	0.03-0.20	0.11	0.02
Icy	Length	37	107-154	135.5	1.6	16	146-171	160.6	1.8
Strait	Weight	37	15.2-36.1	25.5	0.9	16	33.1-56.2	45.1	1.7
	Condition	37	0.9-2.7	1.0	0.0	16	1.0-1.2	1.1	0.0
	Residual	37	-0.14-1.02	0.01	0.03	16	-0.04-0.14	0.06	0.01
Middle	Length	—	—	—	—				
Clarence	Weight	—	—	—	—				
Strait	Condition	—	—	—	—				
	Residual	—	—	—	—				
Lower	Length	—	—	—	—				
Clarence	Weight	—	—	—	—				
Strait	Condition	—	—	—	—				
	Residual	—	—	—	—				

Table 17.—cont.

Locality	Factor	July n	July range	July mean	July se	August n	August range	August mean	August se
Total	Length	54	107-154	136.5	1.3	26	143-175	159.0	1.7
	Weight	54	15.2-36.1	26.0	0.7	26	30.3-57.3	44.7	1.6
	Condition	54	0.9-2.7	1.0	0.0	26	1.0-1.2	1.1	0.0
	Residual	54	-0.14-1.02	0.01	0.02	26	-0.04-0.20	0.08	0.01
				Tahltan Lake					
Icy	Length	1	137	137.0	—	—	—	—	—
Strait	Weight	1	24.1	24.1	—	—	—	—	—
(Total)	Condition	1	0.9	0.9	—	—	—	—	—
	Residual	1	-0.06	-0.06	—	—	—	—	—
				Tatsamenie Lake					
Icy	Length	2	120-145	132.5	12.5	1	167	167.0	—
Strait	Weight	2	17.8-33.1	25.5	7.6	1	45.0	45.0	—
(Total)	Condition	2	1.0-1.1	1.1	0.0	1	1.0	0.0	—
	Residual	2	0.05-0.08	0.06	0.02	1	-0.05	-0.05	—
				Tuya Lake					
Icy	Length	—	—	—	—	1	169	169.0	—
Strait	Weight	—	—	—	—	1	51.8	51.8	—
(Total)	Condition	—	—	—	—	1	1.1	1.1	—
	Residual	—	—	—	—	1	0.05	0.05	—
				Trapper Lake					
Upper	Length	1	148	148.0	—	—	—	—	—
Chatham	Weight	1	33.9	33.9	—	—	—	—	—

Table 17.—cont.

		July				August			
Locality	Factor	n	range	mean	se	n	range	mean	se
Strait	Condition	1	1.0	1.0	—	—	—	—	—
(Total)	Residual	1	0.04	0.04	—	—	—	—	—
Southern region stocks									
SSRAA									
McDonald Lake									
Middle	Length	2	145-157	151.0	6.0				
Clarence	Weight	2	33.1-44.3	38.7	5.6				
Strait	Condition	2	1.1-1.1	1.1	0.0				
(Total)	Residual	2	0.08-0.12	0.10	0.02				
Northern and southern regions unmarked stocks									
Upper	Length	35	67-166	136.8	2.8	147	94-193	141.4	1.5
Chatham	Weight	35	2.6-42.2	27.9	1.3	147	8.7-78.5	34.1	1.1
Strait	Condition	35	0.9-1.2	1.1	0.0	147	0.9-1.5	1.2	0.0
	Residual	35	-0.10-0.15	0.05	0.01	147	-0.10-0.46	0.13	0.01
Icy	Length	56	83-202	138.8	3.1	40	101-233	164.3	4.0
Strait	Weight	56	5.4-97.3	30.2	2.5	40	12.0-147.4	52.1	4.1
	Condition	56	0.3-1.3	1.0	0.0	40	1.0-1.3	1.1	0.0
	Residual	56	-1.23-0.24	0.02	0.03	40	-0.06-0.25	0.07	0.01
Middle	Length	110	111-172	133.5	1.0				
Clarence	Weight	110	14.8-51.4	25.6	0.6				
Strait	Condition	110	0.8-1.3	1.1	0.0				

Table 17.—cont.

Locality	Factor	July n	July range	July mean	July se	August n	August range	August mean	August se
	Residual	110	-0.19-0.26	0.05	0.01				
Lower	Length	16	121-190	142.6	5.2				
Clarence	Weight	16	16.7-73.7	30.2	4.0				
Strait	Condition	16	0.9-1.1	1.0	0.0				
	Residual	16	-0.14-0.05	-0.04	0.01				
Total	Length	217	67-202	136.1	1.1	187	94-233	146.3	1.6
	Weight	217	2.6-97.3	27.5	0.8	187	8.7-147.4	38.0	1.3
	Condition	217	0.3-1.3	1.0	0.0	187	0.9-1.5	1.1	0.0
	Residual	217	-1.23-0.26	0.04	0.01	187	-0.10-0.46	0.12	0.01

Table 18.—Number examined, length (mm, fork), wet weight (g), stomach content as percent body weight (%BW), and feeding intensity (0-100% volume fullness) of potential predator species (n = 108) of juvenile salmon captured in marine waters of the northern and southern regions of southeastern Alaska by rope trawl, July–August 2009. No trawling was conducted in June in either region or in August in the southern region. See Tables 8 and 9 for scientific names, and Table 19 and Figure 17 for additional feeding data.

		July				August			
Species	Factor	*n*	range	mean	sd	*n*	range	mean	sd
Northern Region									
Pink salmon[1]	Length	52	447-589	503.6	33.3	14	370-575	503.6	49.1
	Weight		1050-2500	1570.2	305.7		600-2850	1703.6	487.7
	%BW		0-100	52.5	30.1		10-110	52.9	32.0
	Fullness		0-1.4	0.4	0.3		0.0-1.7	0.3	0.5
Chum salmon[1]	Length	3	563-633	589.0	38.3	5	585-710	644.0	45.7
	Weight		1750-3350	2450.0	818.5		2750-4400	3401.0	614.8
	%BW		25-50	41.7	14.4		0-50	22.0	18.9
	Fullness		0.2-1.0	0.5	0.4		0-0.3	0.2	0.1
Coho salmon[2]	Length	1	300-300	300.0	—	—	—	—	—
	Weight		450-450	450.0	—	—	—	—	—
	%BW		100-100	100.0	—	—	—	—	—
	Fullness		0.4-0.4	0.4	—	—	—	—	—
Chinook salmon[2]	Length	3	315-403	368.3	46.9	1	425-425	425.0	—
	Weight		550-850	733.3	160.7		1100-1100	1100.0	—
	%BW		10-110	56.7	50.3		5-5	5.0	—
	Fullness		0.0-4.1	1.5	2.3		0.1	0.1	—
Walleye pollock[2]	Length	2	410-458	434.0	33.9	1	595-595	595.0	—
	Weight		550-550	550.0	0.0		1100-1100	1100.0	—
	%BW		25-50	37.5	17.7		0-0	0.0	—
	Fullness		0.1-0.9	0.5	0.5		0-0	0.0	—

Table 18.—cont.

Species	Factor	July				August			
		n	range	mean	sd	*n*	range	mean	sd
Spiny dogfish[1]	Length	—	—	—	—	1	800-800	800.0	—
	Weight	—	—	—	—		3000-3000	3000.0	—
	%BW	—	—	—	—		50-50	50.0	—
	Fullness	—	—	—	—		3-3	3.0	—
				Southern Region					
Pink salmon[1]	Length	15	420-575	491.1	45.7	—	—	—	—
	Weight		700-2150	1436.7	376.3	—	—	—	—
	%BW		0-100	33.3	30.4	—	—	—	—
	Fullness		0-1.0	0.3	0.3	—	—	—	—
Chum salmon[1]	Length	2	626-650	638.0	17.0	—	—	—	—
	Weight		3100-3250	3175.0	106.1	—	—	—	—
	%BW		10-25	17.5	10.6	—	—	—	—
	Fullness		0.00	0.0	0.0	—	—	—	—
Coho salmon[1]	Length	1	512-512	512.0	—	—	—	—	—
	Weight		1300-1300	1300.0	—	—	—	—	—
	%BW		25.0	25-25	—	—	—	—	—
	Fullness		0.1	0.1	—	—	—	—	—
Chinook salmon[2]	Length	6	324-645	448.7	106.4	—	—	—	—
	Weight		3-3950	1358.8	1343.8	—	—	—	—
	%BW		0-75	25.0	38.7	—	—	—	—
	Fullness		0-0.9	0.3	0.4	—	—	—	—

Table 18.—cont.

Species	Factor	July				August			
		n	range	mean	sd	*n*	range	mean	sd
Sockeye salmon[1]	Length	1	605-605	605.0	—	—	—	—	—
	Weight	15	2550-2550	2550.0	—	—	—	—	—
	%BW		10-10	10.0	—	—	—	—	—
	Fullness		0.00	0.0	—	—	—	—	—

[1] Adult
[2] Immature

Table 19.—Number of potential predators of juvenile salmon examined at sea, captured by rope trawl in the marine waters of the northern and southern regions of southeastern Alaska, July–August 2009. No trawling was conducted in June in either region or in August in the southern region.

Predator species	Life history stage	Number examined	Number empty	Percent feeding	Number with salmon	Percent feeders with salmon
			Northern region			
Pink salmon	Adult	66	2	97.0	0	0
Chum salmon	Adult	8	1	87.5	0	0
Coho salmon	Imm./Adult	1	0	100.0	0	0
Chinook salmon	Immature	4	0	100.0	0	0
Spiny dogfish	Adult	1	0	100.0	0	0
Walleye pollock	Immature	3	1	66.7	0	0
			Southern region			
Pink salmon	Adult	15	3	80.0	0	0
Chum salmon	Adult	2	0	100.0	0	0
Coho salmon	Imm./Adult	1	0	100.0	0	0
Chinook salmon	Immature	6	4	33.3	0	0
Sockeye salmon	Adult	1	0	100.0	0	0
Total		108	11			

Appendix 1.— Temperature (°C), salinity (PSU), light level (W/m^3), Secchi depth (m), mixed layer depth (MLD, m; see text for definition), and zooplankton and total plankton settled volumes (ml) by haul number at each station sampled in the marine waters of the northern and southern regions of southeastern Alaska, May–August 2009. Station code acronyms are listed in Table 1. Triplicate zooplankton samples were taken at the ABM station each month.

Date	Haul #	Station	Temperature (°C)	Salinity (PSU)	Light level (W/m^3)	Secchi (m)	MLD (m)	Zoop. SV (ml)	Total SV (ml)
29 May	13001	ABM	9.6	22.7	97	2	7	32.0	40.0
								40.0	50.0
								32.0	42.0
03 June	13003	ISA	8.9	30.8	809	3	6	31.0	48.0
03 June	13004	ISB	8.9	30.6	917	3	6	21.0	32.0
03 June	13005	ISC	9.0	30.3	853	3	6	65.0	100.0
03 June	13006	ISD	9.0	29.9	432	2	6	44.5	69.5
03 June	13007	UCA	8.8	29.6	659	3	9	30.5	38.0
03 June	13008	UCB	8.2	29.9	761	4	11	51.5	103.0
03 June	13009	UCC	8.5	29.3	719	5	14	50.0	99.0
03 June	13010	UCD	12.7	27.5	699	5	7	53.5	107.0
01 July	13011	ABM	11.6	20.4	35	1	7	11.5	13.0
								12.0	14.0
								15.5	18.0
01 July	13012	ISA	12.2	25.9	222	5	6	24.0	24.0
01 July	13013	ISB	12.2	25.4	413	5	7	20.0	20.0
01 July	13014	ISC	12.1	25.3	333	4	6	8.0	8.0
01 July	13015	ISD	11.7	26.1	149	2	6	8.0	8.0
01 July	13016	UCA	11.1	26.7	258	4	6	10.0	10.0
01 July	13017	UCB	10.6	27.6	479	4	6	17.0	17.0
01 July	13018	UCC	11.0	26.9	381	3	7	8.0	8.0
01 July	13019	UCD	10.3	27.1	324	3	13	9.0	9.0

Table 18.—cont.

Date	Haul #	Station	Temperature (°C)	Salinity (PSU)	Light level (W/m^3)	Secchi (m)	MLD (m)	Zoop. SV (ml)	Total SV (ml)
21 July	13020	MCA	13.3	26.3	520	8	8	30.0	60.0
21 July	13021	MCB	13.2	26.3	293	8	6	40.0	80.0
21 July	13022	MCC	14.9	25.1	126	9	6	23.0	48.0
22 July	13023	LCA	13.2	25.8	128	9	7	12.5	25.0
22 July	13024	LCB	13.3	24.1	138	9	7	17.5	35.0
22 July	13025	LCC	12.4	26.0	148	6	6	20.0	40.0
22 July	13026	LCD	11.0	28.7	151	8	6	10.0	20.0
23 July	13027	LCD	10.4	29.1	68	5	11	7.5	15.0
23 July	13028	LCC	11.9	27.2	53	6	8	9.0	18.0
23 July	13029	LCB	13.3	24.6	64	6	7	17.5	35.0
23 July	13030	LCA	13.7	23.5	60	8	12	12.0	24.0
24 July	13031	MCD	10.9	29.1	115	5	6	15.0	30.0
24 July	13032	MCA	12.6	26.0	113	10	6	15.0	16.0
24 July	13033	MCB	12.3	26.4	166	10	7	14.0	14.0
24 July	13034	MCC	11.9	27.4	151	8	6	15.5	29.5
26 July	13036	ISA	9.3	30.3	76	6	8	4.5	9.0
26 July	13037	ISB	10.4	29.2	219	5	10	4.5	7.5
26 July	13038	ISC	11.4	27.7	157	5	6	10.0	20.0
26 July	13039	ISD	13.1	23.9	191	6	7	4.3	8.5
27 July	13040	ISD	13.2	24.0	78	6	7	4.8	9.5
27 July	13041	ISC	13.4	22.3	129	6	6	7.5	15.0
27 July	13042	ISB	11.3	27.4	198	5	6	8.3	12.0
27 July	13043	ISA	10.2	29.4		5	7	7.0	14.0
27 July	13044	ISC	13.1	22.9	114	5	6	8.5	17.0
27 July	13045	ISD	13.2	23.0	106	6	6	7.5	15.0
28 July	13046	ISA	12.9	23.7	106	5	6	5.5	11.0
28 July	13047	ISB	11.3	27.5	488	5	6	6.8	12.0
29 July	13052	UCD	13.9	20.0	219	5	6	3.0	5.0

Table 18.—cont.

Date	Haul #	Station	Temperature (°C)	Salinity (PSU)	Light level (W/m^3)	Secchi (m)	MLD (m)	Zoop. SV (ml)	Total SV (ml)
29 July	13053	UCC	13.7	21.9	475	4	6	3.0	5.0
29 July	13054	UCB	13.4	24.6	692	6	6	4.3	6.5
29 July	13055	UCA	14.4	20.8	785	4	6	4.3	6.5
29 July	13057	UCB	14.5	20.7	650	5	6	6.0	6.0
30 July	13059	UCB	13.5	24.2	540	6	7	6.0	6.0
30 July	13060	UCC	13.9	23.8	622	6	7	8.0	8.0
30 July	13061	UCD	14.3	23.4	786	6	6	3.8	6.5
30 July	13063	UCC	14.3	23.5	728	6	6	6.5	6.5
31 July	13064	ABM	14.8	18.8	782	3	6	12.0	12.0
								13.0	13.0
								12.0	12.0
17 August	13067	ABM	12.2	20.7	122	3	6	32.0	32.0
								19.0	19.0
								10.0	20.0
18 August	13068	ISD	10.6	29.5	69	7	11	4.5	9.0
18 August	13069	ISC	12.3	27.8	36	4	7	35.0	35.0
18 August	13070	ISB	11.1	29.0	100	5	6	5.3	7.5
18 August	13071	ISA	9.7	30.1	185	6	7	8.0	14.0
19 August	13072	ISA	9.8	29.8	133	6	7	5.5	11.0
19 August	13073	ISB	10.7	29.6	317	6	7	3.0	6.0
19 August	13074	ISC	10.1	30.0	225	6	9	4.0	4.0
19 August	13075	ISD	10.1	30.0	288	7	14	3.0	3.0
19 August	13076	UCD	11.8	25.5	118	5	6	6.5	6.5
19 August	13077	UCC	11.4	27.0	88	4	7	5.0	5.0
20 August	13078	UCD	12.3	19.4	48	4	8	8.5	8.5
20 August	13079	UCC	12.1	22.4	145	4	12	5.8	11.5
20 August	13080	UCB	12.1	21.8	116	3	8	10.0	10.0
20 August	13081	UCA	11.5	25.3	151	4	15	4.0	4.0

Table 18.—cont.

Date	Haul #	Station	Temperature (°C)	Salinity (PSU)	Light level (W/m^3)	Secchi (m)	MLD (m)	Zoop. SV (ml)	Total SV (ml)
21 August	13082	UCA	12.0	22.0	37	3	11	11.0	11.0
21 August	13083	UCB	12.0	21.8	186	4	9	4.5	4.5

Appendix 2.—Catch and life history stage of salmonids captured in the marine waters of the southern and northern regions of southeastern Alaska, July–August 2009. No trawling was conducted in June in either region or in August in the southern region. Station code acronyms are listed in Table 1.

			Juvenile salmon					Immature and adult salmon				
Date	Haul #	Station	Pink	Chum	Sockeye	Coho	Chinook	Pink	Chum	Sockeye	Coho	Chinook
21 July	13020	MCA	0	0	2	9	0	2	0	0	0	1
21 July	13021	MCB	32	28	7	9	0	1	0	0	0	1
21 July	13022	MCC	14	16	1	5	0	1	1	1	0	0
22 July	13023	LCA	6	3	1	9	0	0	0	0	0	0
22 July	13024	LCB	4	3	13	22	0	2	0	0	0	0
22 July	13025	LCC	0	1	0	18	0	1	0	0	0	0
22 July	13026	LCD	1	0	0	17	0	3	0	0	0	0
23 July	13027	LCD	0	0	1	12	0	2	0	0	1	0
23 July	13028	LCC	0	0	0	2	1	0	0	0	0	0
23 July	13029	LCB	3	1	0	3	0	0	0	0	0	0
23 July	13030	LCA	3	4	1	1	0	0	0	0	0	0
24 July	13031	MCD	69	62	13	5	0	0	1	0	0	1
24 July	13032	MCA	325	176	1	2	0	0	0	0	0	1
24 July	13033	MCB	194	304	40	0	1	0	0	0	0	2
24 July	13034	MCC	488	642	20	2	0	2	0	0	0	0
24 July	13035	MCD	24	35	32	6	0	1	0	0	0	0
26 July	13036	ISA	0	0	1	3	0	0	0	0	0	1
26 July	13037	ISB	8	12	1	5	0	0	0	0	0	0
26 July	13038	ISC	172	118	14	19	0	2	0	0	0	0
26 July	13039	ISD	28	32	1	12	0	1	0	0	0	0
27 July	13040	ISD	488	478	35	32	0	3	1	0	0	0
27 July	13041	ISC	48	97	5	6	0	3	0	0	0	0
27 July	13042	ISB	13	31	3	29	0	7	0	0	0	0
27 July	13043	ISA	1	19	1	12	0	4	1	0	0	0
27 July	13044	ISC	27	30	1	4	0	0	0	0	0	0
27 July	13045	ISD	152	186	16	23	0	1	0	0	0	1

Table 18.—cont.

Date	Haul #	Station	Juvenile salmon Pink	Chum	Sockeye	Coho	Chinook	Immature and adult salmon Pink	Chum	Sockeye	Coho	Chinook
28 July	13046	ISA	26	86	3	14	0	5	0	0	0	0
28 July	13047	ISB	65	116	5	43	0	0	0	0	0	0
28 July	13048	ISC	64	134	1	56	0	2	0	0	0	0
28 July	13049	ISD	127	252	4	13	1	0	0	0	0	0
28 July	13050	ISB	22	101	2	20	0	0	0	0	0	0
28 July	13051	ISA	121	515	9	27	0	0	0	0	0	0
29 July	13052	UCD	18	71	2	5	0	2	0	0	0	0
29 July	13053	UCC	9	21	6	13	0	0	0	0	0	0
29 July	13054	UCB	53	82	9	11	0	2	0	0	0	0
29 July	13055	UCA	181	462	23	5	0	1	0	0	0	0
29 July	13056	UCA	1	4	0	33	0	2	0	0	0	0
29 July	13057	UCB	15	24	0	16	0	5	0	0	1	0
30 July	13058	UCA	17	62	5	36	0	2	0	0	0	0
30 July	13059	UCB	9	72	4	18	0	2	0	0	0	0
30 July	13060	UCC	7	109	0	17	0	1	0	0	0	0
30 July	13061	UCD	2	3	0	18	0	1	1	0	0	1
30 July	13062	UCD	3	45	0	17	0	1	0	0	0	0
30 July	13063	UCC	54	54	6	24	0	5	0	0	0	0
31 July	13065	UCD	1	8	0	14	0	0	0	0	0	0
31 July	13066	UCD	8	33	1	27	0	8	0	0	0	2
18 August	13068	ISD	43	30	17	25	0	0	0	0	0	0
18 August	13069	ISC	104	81	26	3	0	1	0	0	0	0
18 August	13070	ISB	8	13	3	6	0	0	1	0	0	0
18 August	13071	ISA	24	121	17	2	0	0	0	0	0	0
18 August	13084	ISA	27	38	5	1	0	0	0	0	0	0
19 August	13072	ISA	34	37	7	3	0	0	0	0	0	0
19 August	13073	ISB	7	9	1	4	0	1	0	0	0	0
19 August	13074	ISC	13	12	1	0	0	0	0	0	0	0
19 August	13075	ISD	2	4	0	4	0	2	2	0	0	0

Table 18.—cont.

Date	Haul #	Station	Juvenile salmon					Immature and adult salmon				
			Pink	Chum	Sockeye	Coho	Chinook	Pink	Chum	Sockeye	Coho	Chinook
19 August	13076	UCD	19	28	2	4	0	1	0	0	0	1
19 August	13077	UCC	78	107	21	8	0	1	0	0	0	0
20 August	13078	UCD	104	123	20	3	0	2	0	0	0	0
20 August	13079	UCC	91	203	68	6	0	1	1	0	0	0
20 August	13080	UCB	2	0	3	6	0	1	0	0	0	0
20 August	13081	UCA	36	17	4	9	0	4	1	0	0	0
21 August	13082	UCA	95	80	82	6	0	0	0	0	0	0
21 August	13083	UCB	52	38	34	6	0	0	0	0	0	0

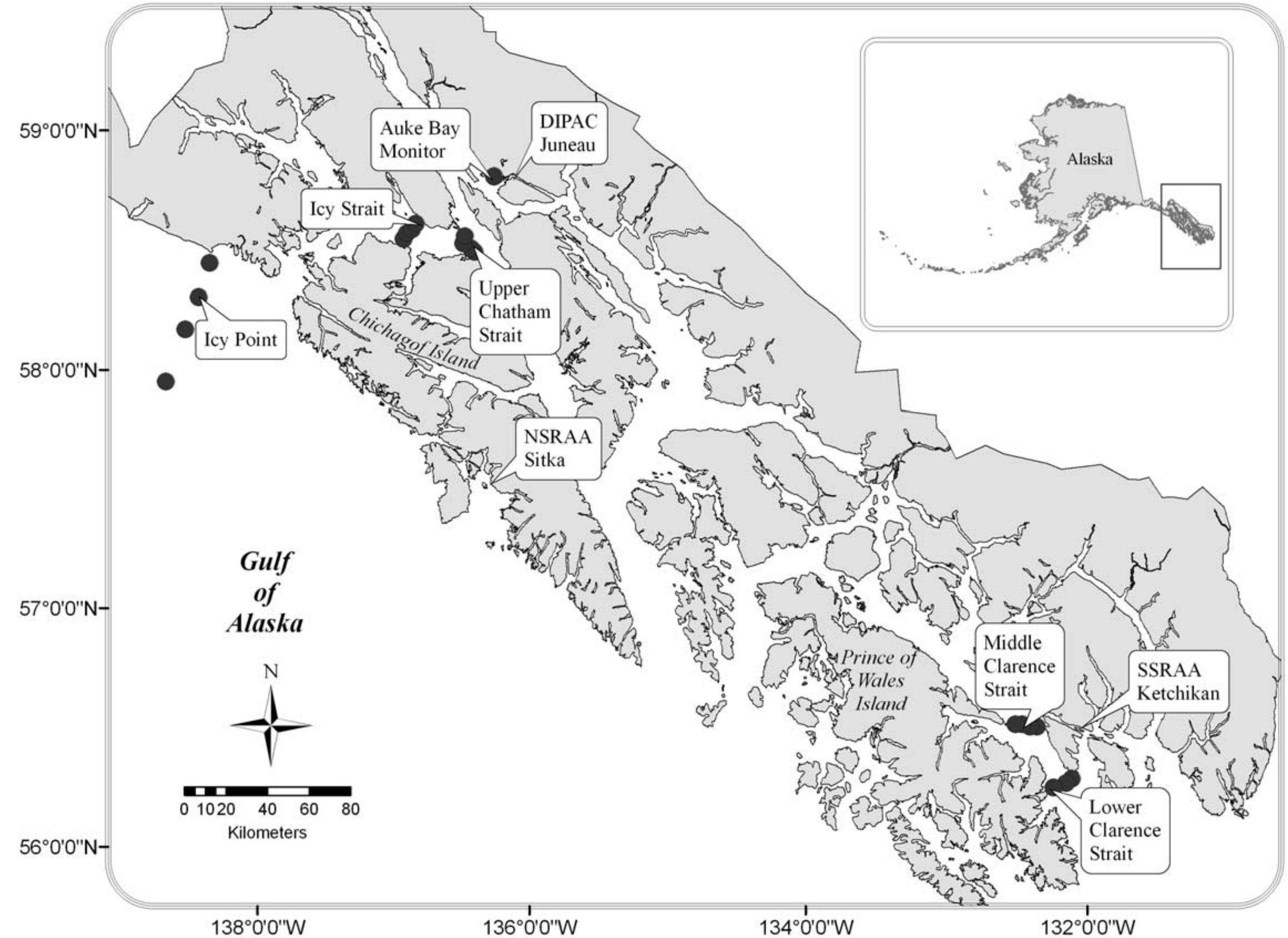

Figure 1.—Stations sampled in the marine waters of the northern and southern regions of southeastern Alaska, May–August 2009. Transect and station coordinates and station code acronyms are shown in Table 1.

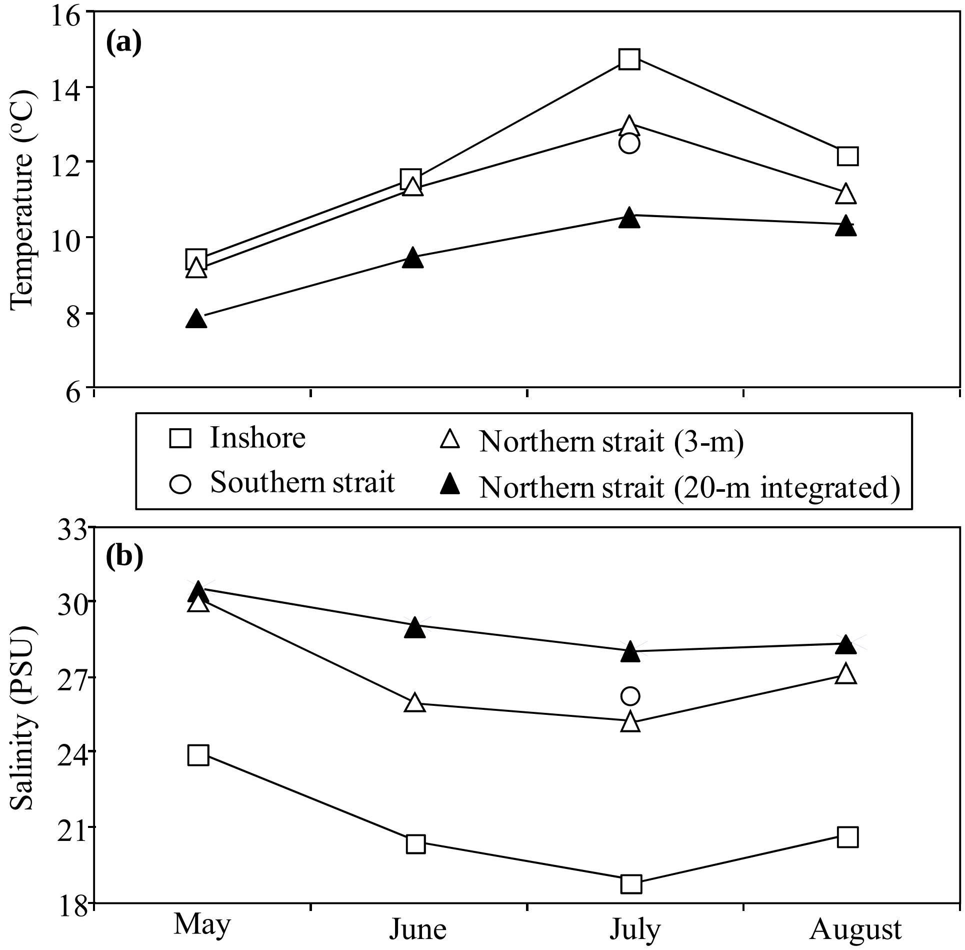

Figure 2.—Mean surface (3-m) and 20-m integrated temperature (a) and salinity (b) measures in the marine waters of the northern and southern regions of southeastern Alaska, May–August 2009. The 3-m measures represent the most active segment of the water column, while the 20-m integrated measures represent more stable waters also sampled by the trawl (see also Figure 3). See Table 2 for monthly sample sizes and Appendix 1 for data values.

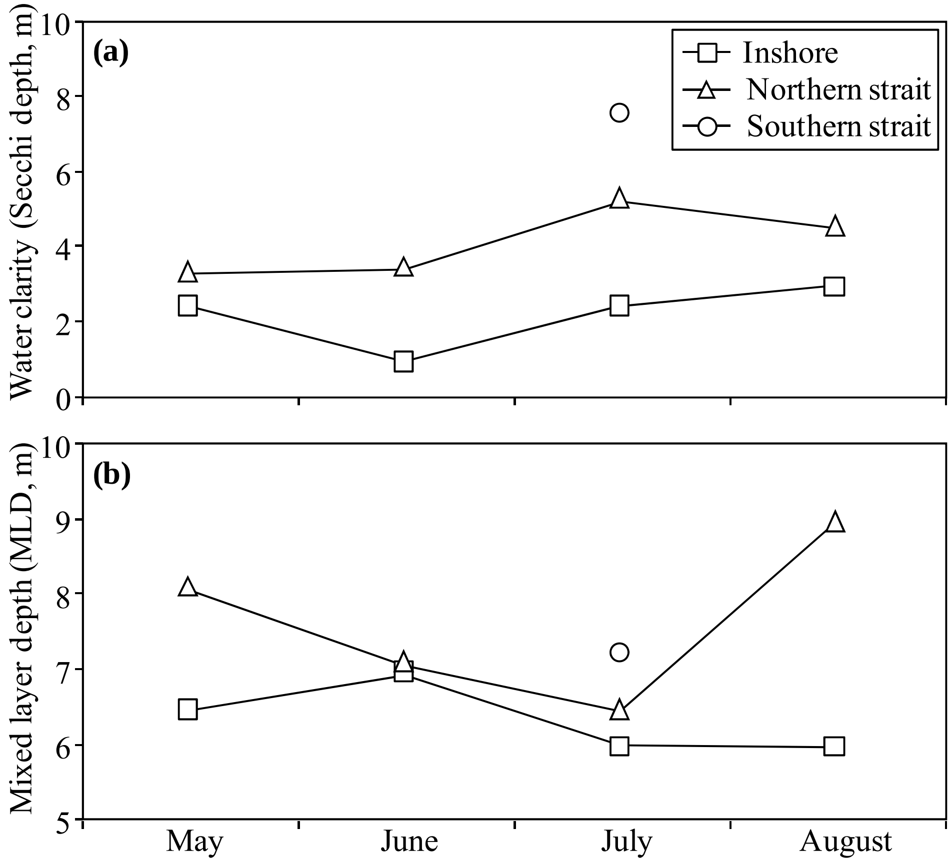

Figure 3.—Water clarity (a) as mean depth (m) of Secchi disappearance and mixed layer depth (MLD, m) (b) calculated from CTD profiles of the marine water column in the northern and southern regions of southeastern Alaska, May–August 2009. See Table 2 for monthly sample sizes and Appendix 1 for data values.

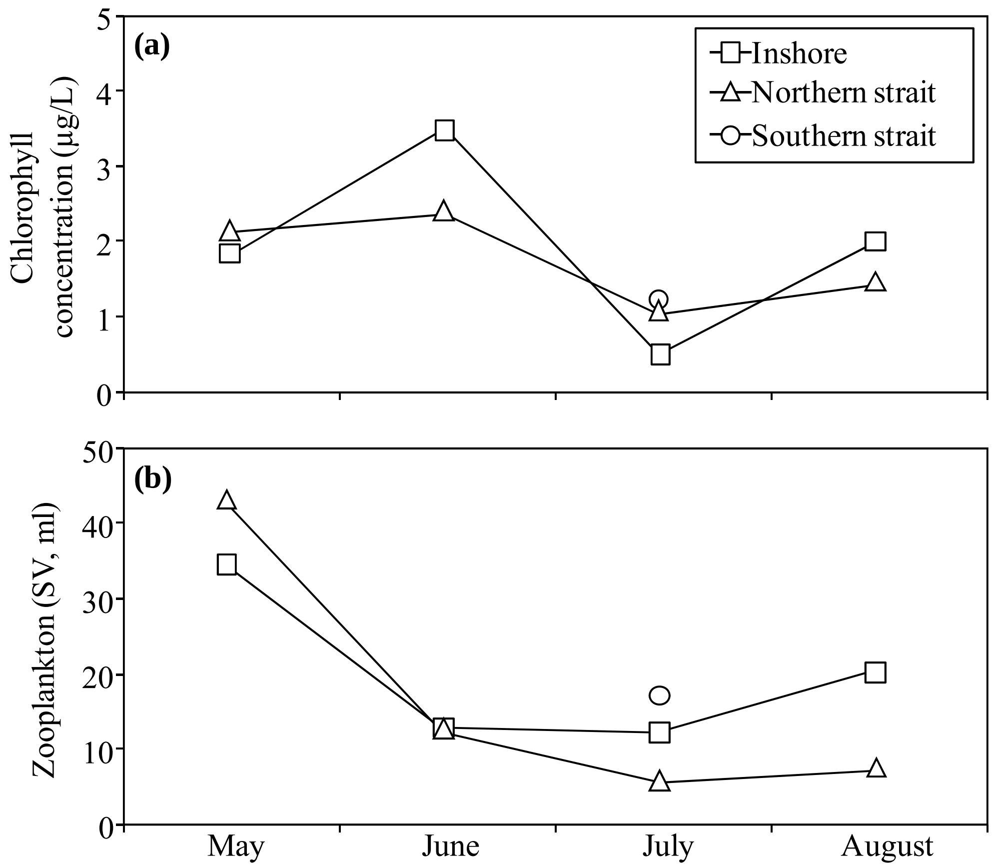

Figure 4.—Mean chlorophyll-a concentration (µg/L) (a) from surface water samples, and zooplankton settled volumes (ZSV, ml) (b) from 20-m vertical Norpac hauls in the marine waters of the northern and southern regions of southeastern Alaska, May–August 2009. Chlorophyll was estimated from single monthly samples per station, while ZSV was measured during all hauls at each station. See Table 2 for monthly sample sizes and Appendix 1 for data values. Zooplankton standing stock (ml/m^3) can be computed by dividing by the water volume filtered, a constant factor of 3.9 m^3 for these samples.

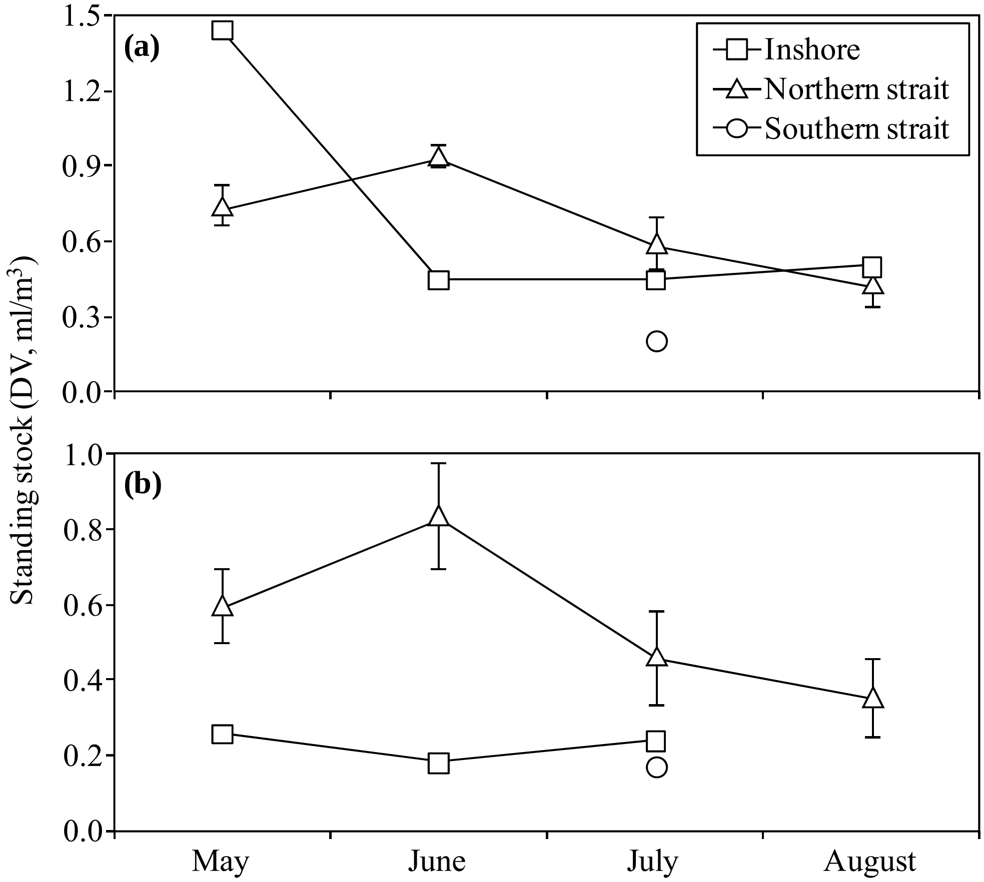

Figure 5.—Monthly zooplankton standing stock (mean ml/m^3, ± 1 standard error) from (a) 333-µm and (b) 505-µm mesh double oblique bongo net samples hauled from ≤ 200 m depths during daylight in the marine waters of the northern and southern regions of southeastern Alaska, May–August 2009.

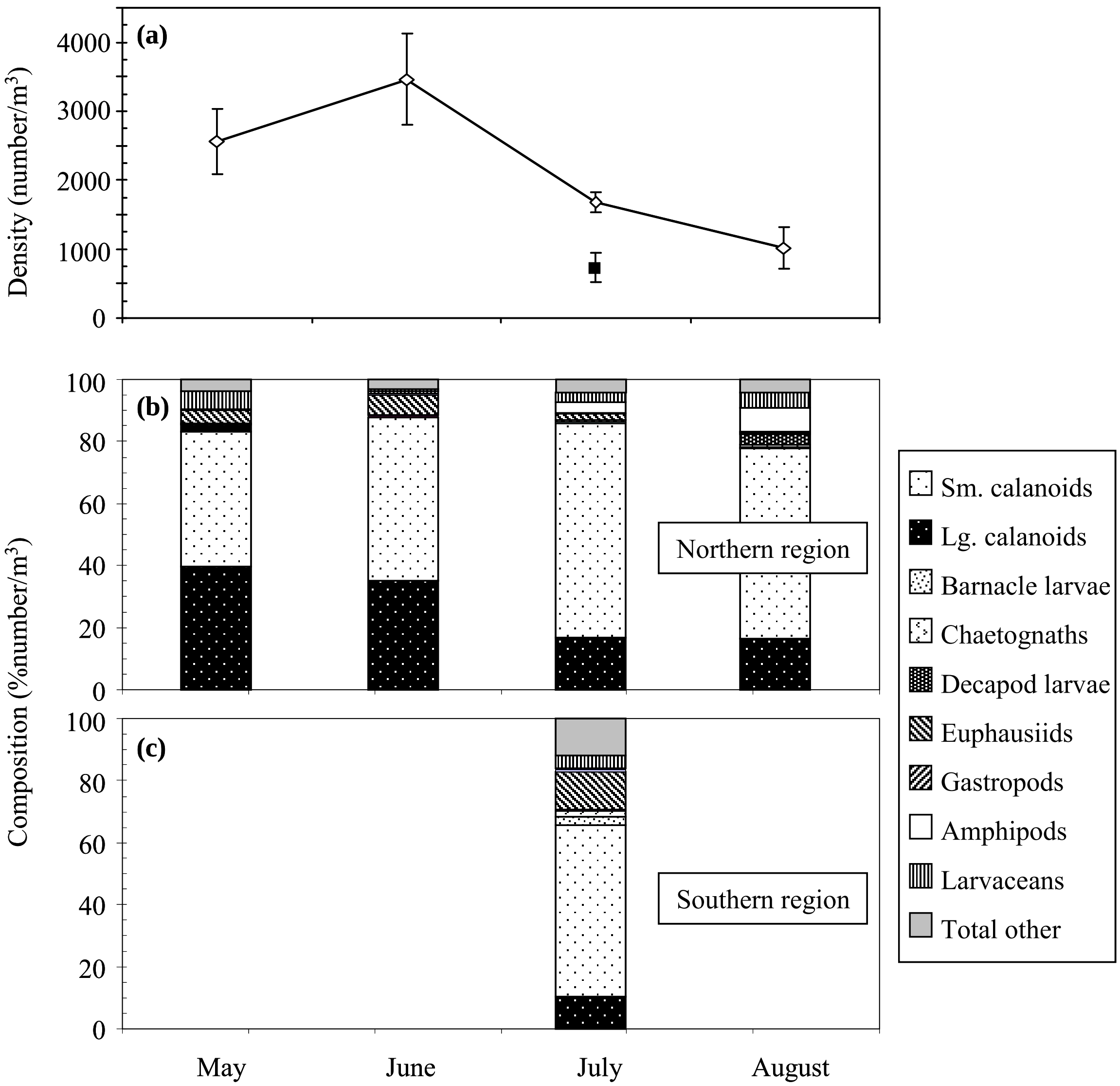

Figure 6.—Monthly "deep" (≤ 200 m depth) zooplankton collected in marine waters of the northern region of southeastern Alaska, May–August 2009. Data include (a) mean total density of organisms (thousands/m^3) ± 1 standard error, and (b), (c) taxonomic composition (mean percent/m^3). Samples were collected using a 333-µm mesh bongo net towed in double oblique fashion during daylight, each month. The northern region is represented by Icy Strait (n = 4 stations) and the southern region is represented by Lower Clarence Strait (n = 4 stations).

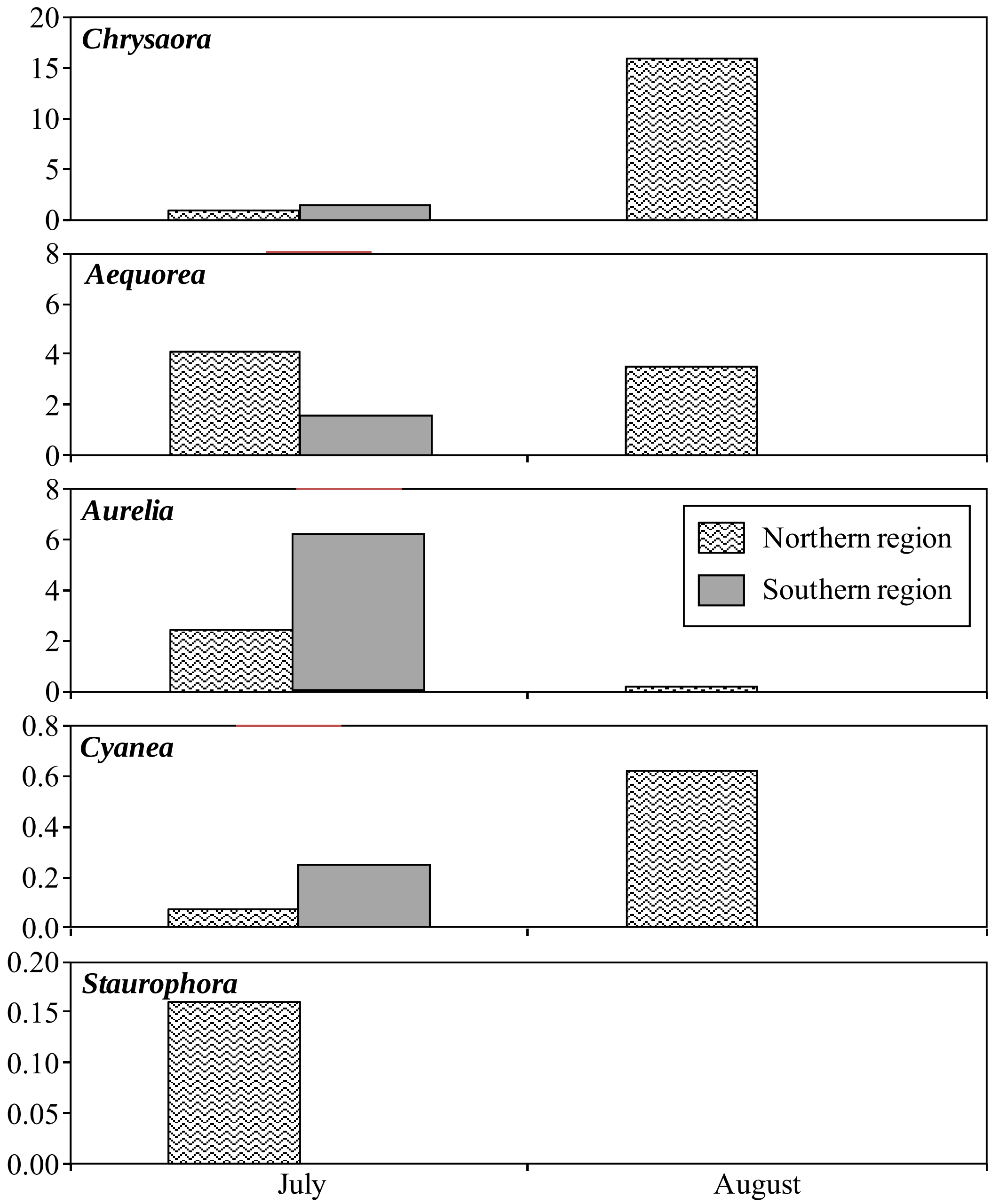

Figure 7.—Mean volume (L) of jellyfish captured in the marine waters of the northern and southern regions of southeastern Alaska by rope trawl, July and August 2009. See Table 2 for monthly sample sizes. No trawling was conducted in either region in June or in the southern region in August.

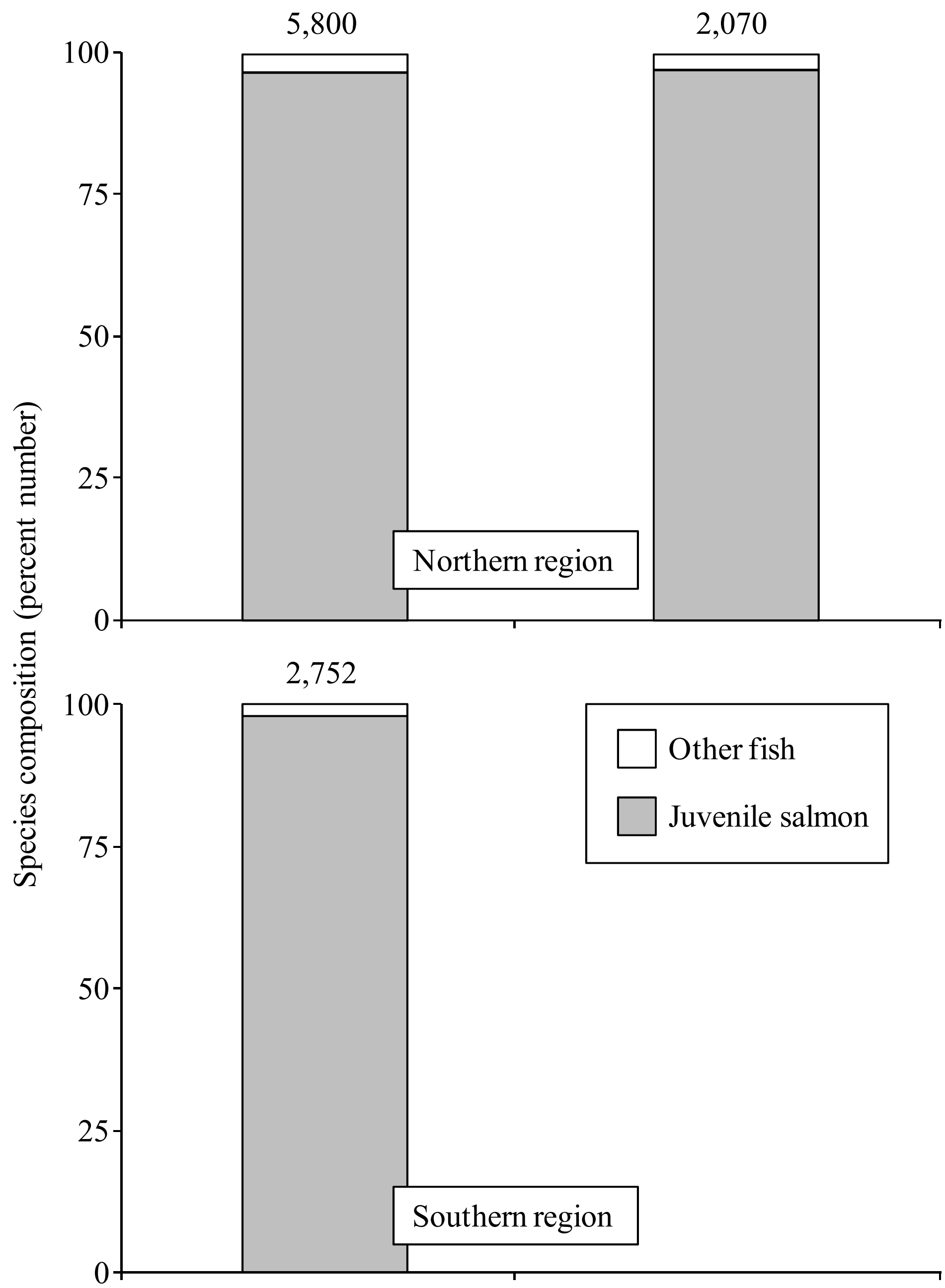

Figure 8.—Fish composition from rope trawl catches in the marine waters of the northern and southern regions of southeastern Alaska, July–August 2009. Number of fish is indicated above each bar. See Table 2 for monthly sample sizes. No trawling was conducted in June in either region or in the southern region in August.

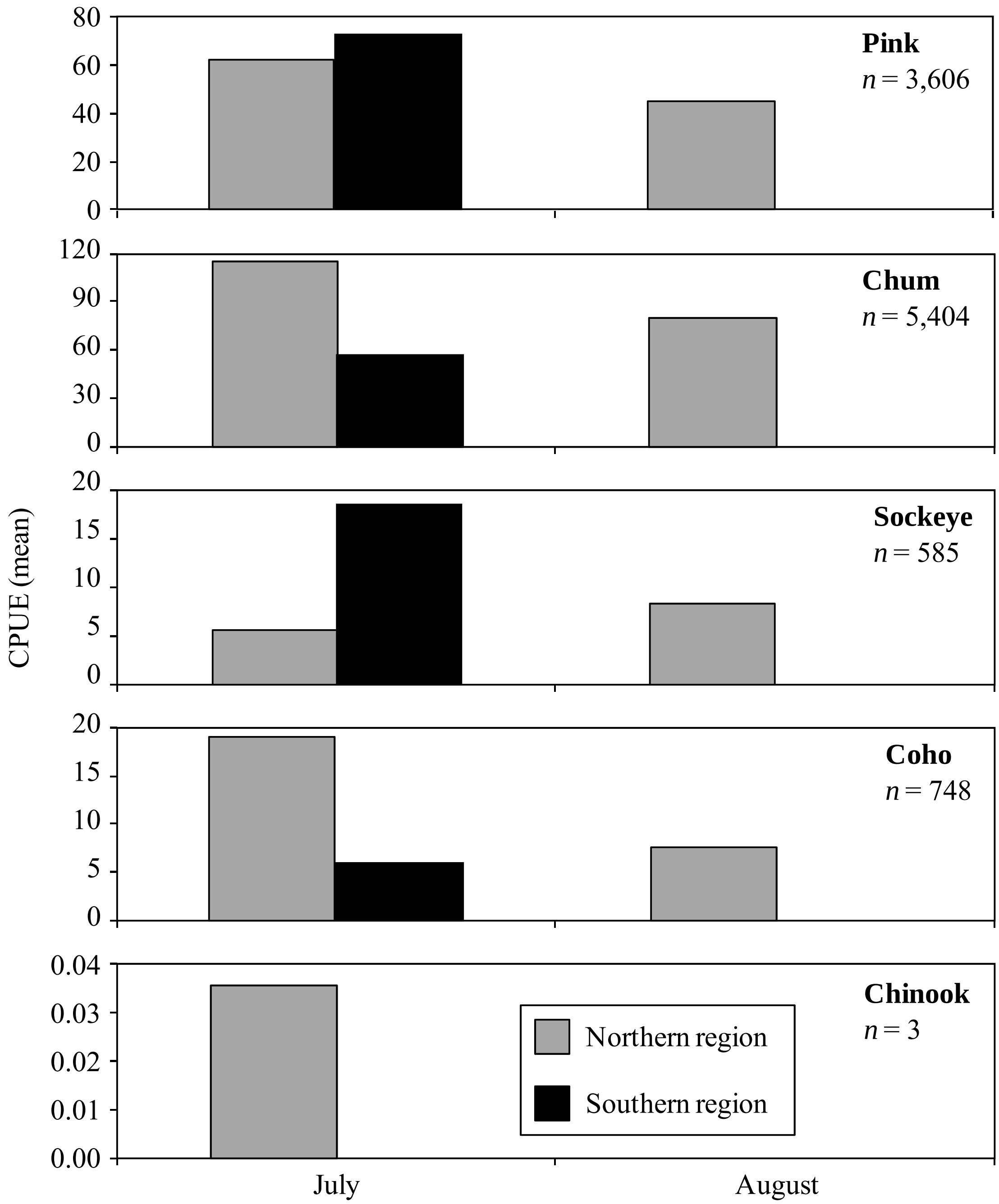

Figure 9.—Catch-per-unit-effort (CPUE, mean catch per trawl haul) of juvenile salmon captured in the marine waters of the northern and southern regions of southeastern Alaska, July–August 2009. Total catch is indicated for each species. See Table 2 for monthly sample sizes. No trawling was conducted in June in either region or in August in the southern region.

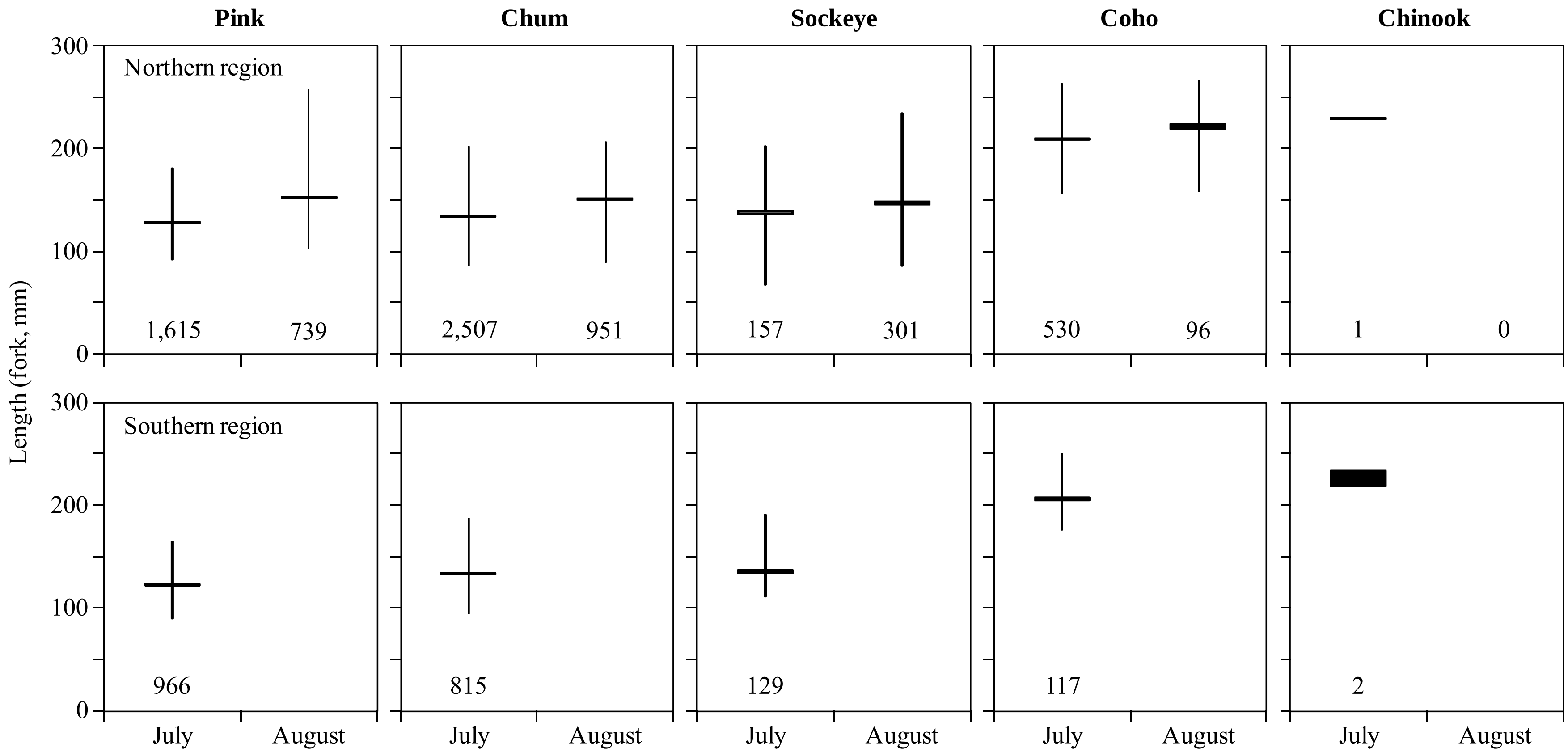

Figure 10.—Length (mm, fork) of juvenile salmon captured by rope trawl in the marine waters of the northern and southern regions of southeastern Alaska, July–August 2009. Length of vertical bars is the size range for each sample, and the boxes within the size range are one standard error on either side of the mean. Sample sizes are indicated for each month. No trawling was conducted in June in either region or in August in the southern region.

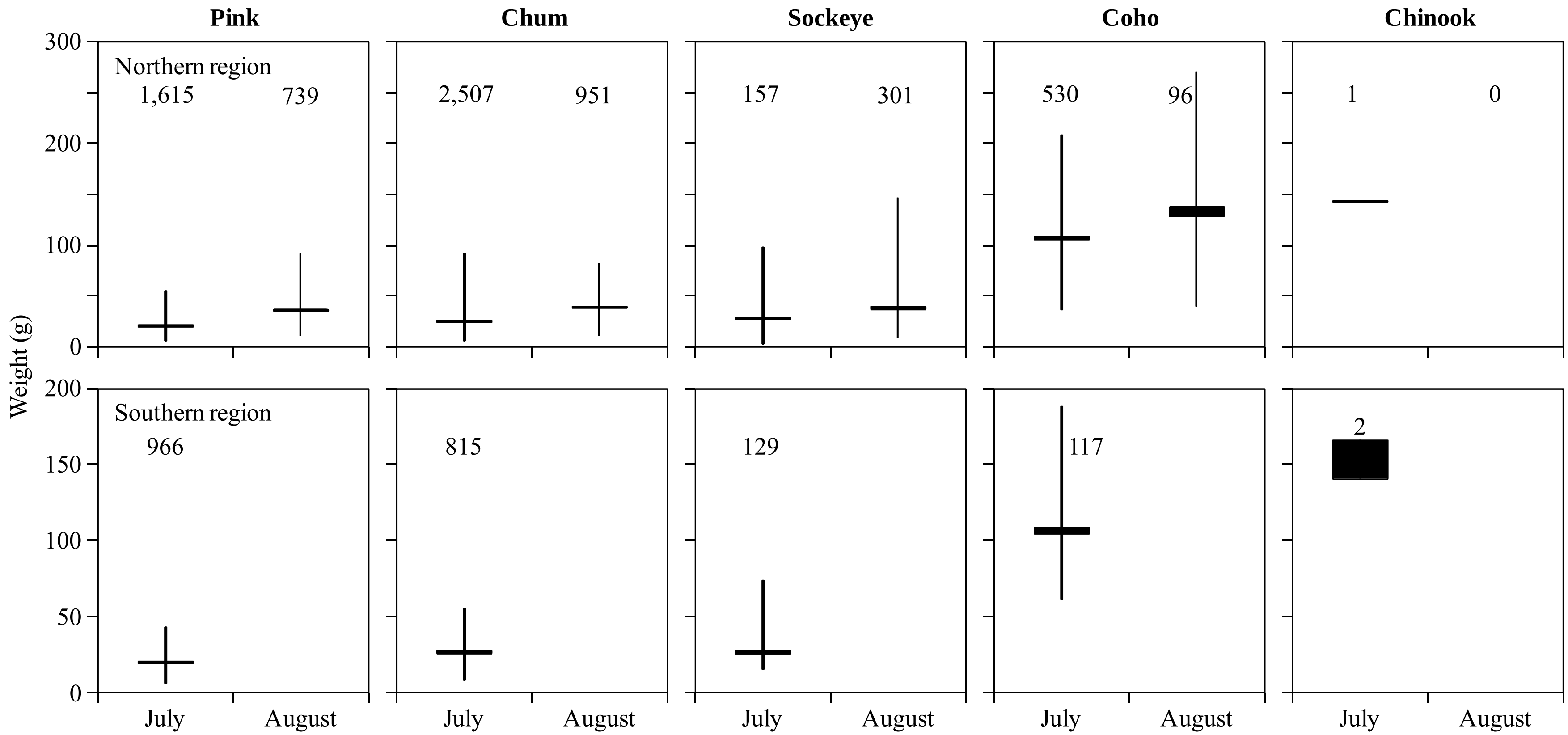

Figure 11.—Weight (g) of juvenile salmon captured by rope trawl in the marine waters of the northern and southern regions of southeastern Alaska, July–August 2009. Length of vertical bars is the size range for each sample, and the bars within the size range are one standard error on either side of the mean. Sample sizes are indicated for each month. No trawling was conducted in June in either region or in August in the southern region.

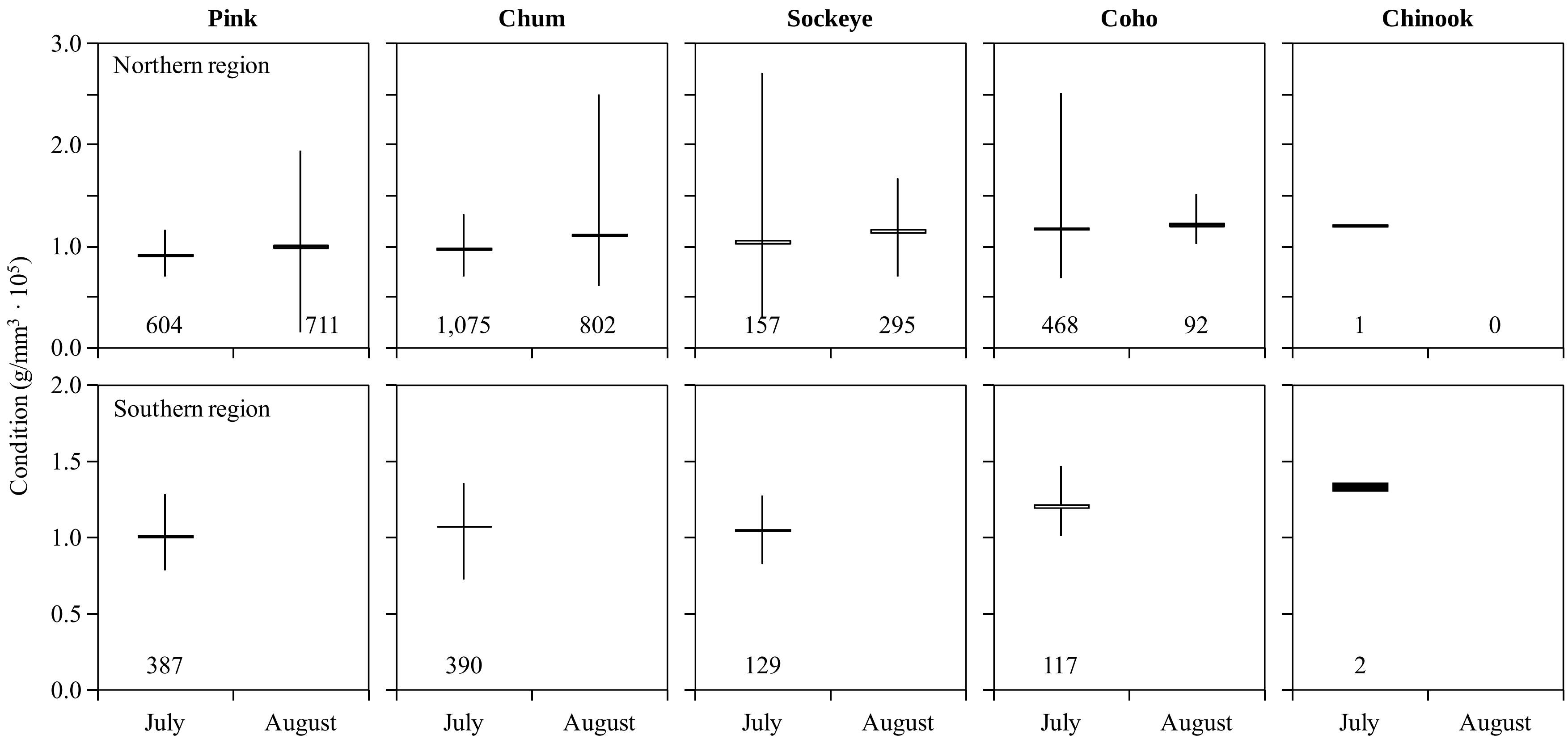

Figure 12.—Fulton's condition (g/mm^3 · 10^5) of juvenile salmon captured by rope trawl in the marine waters of the northern and southern regions of southeastern Alaska, July–August 2009. Length of vertical bars is the size range for each sample, and the bars within the size range are one standard error on either side of the mean. Sample sizes are indicated for each month. No trawling was conducted in June in either region or in August in the southern region.

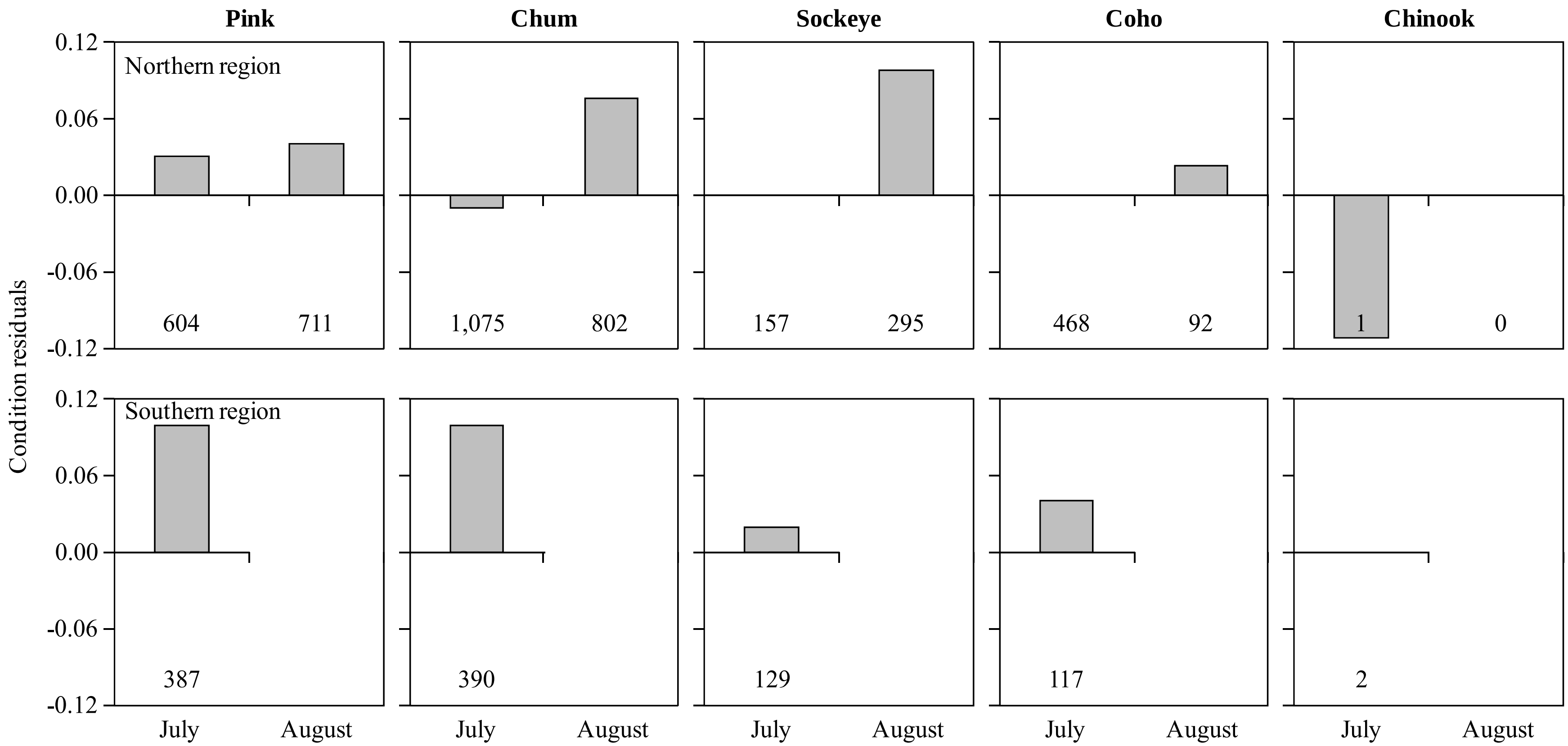

Figure 13.—Condition residuals from length-weight regression analysis of juvenile salmon captured by rope trawl in the marine waters of the northern and southern regions of southeastern Alaska, July–August 2009. Sample sizes are indicated for each month. No trawling was conducted in June in either region or in August in the southern region.

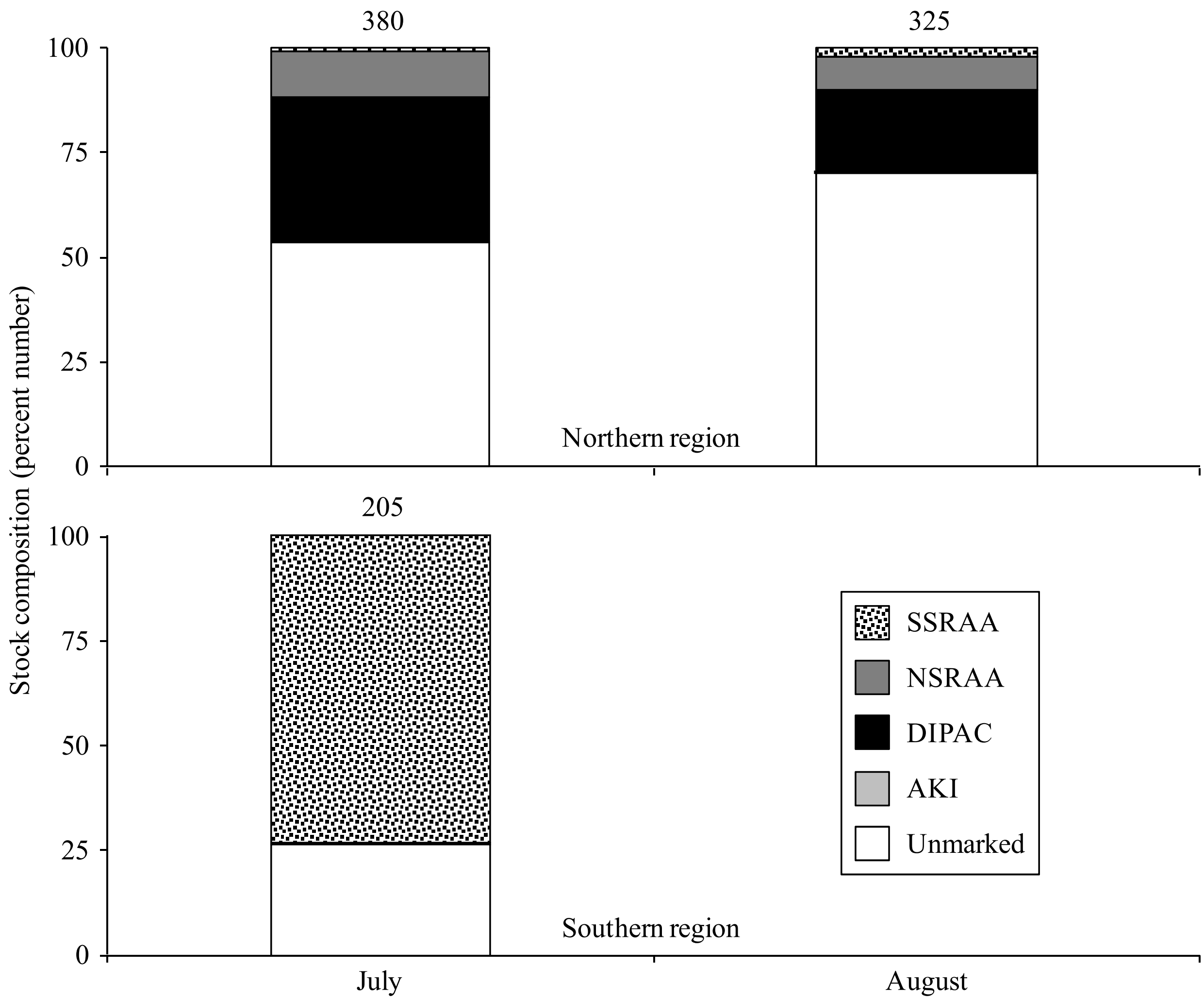

Figure 14.—Monthly stock composition (based on otolith thermal marks) of juvenile chum salmon captured by rope trawl in the marine waters of the northern and southern regions of southeastern Alaska, July–August 2009. Number of salmon sampled per month is indicated above each bar. No trawling was conducted in June in either region or in August in the southern region.

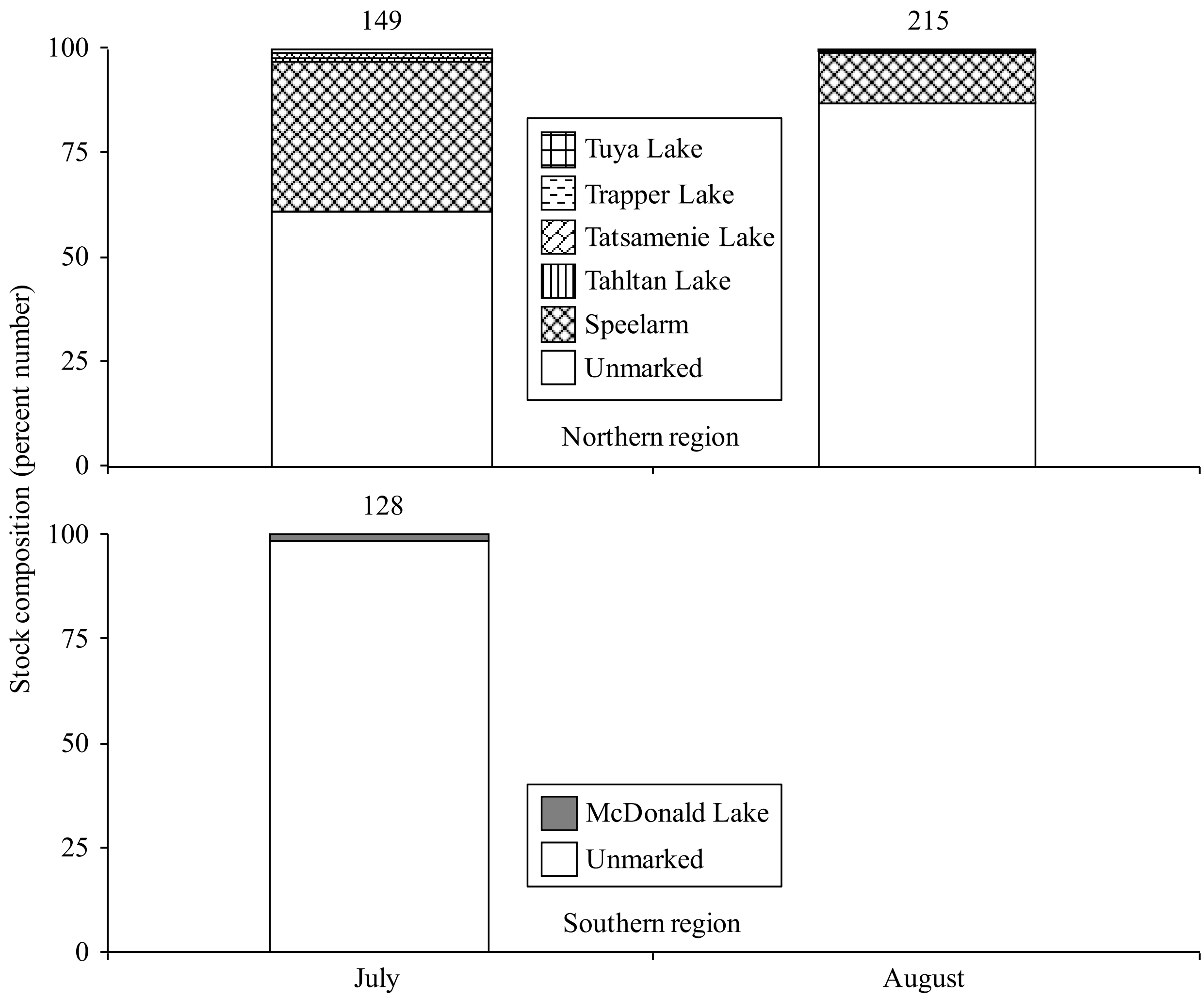

Figure 15.—Monthly stock composition (based on otolith thermal marks) of juvenile sockeye salmon captured by rope trawl in the marine waters of the northern and southern regions of southeastern Alaska, July–August 2009. Number of salmon sampled per month is indicated above each bar. No trawling was conducted in June in either region or in August in the southern region.

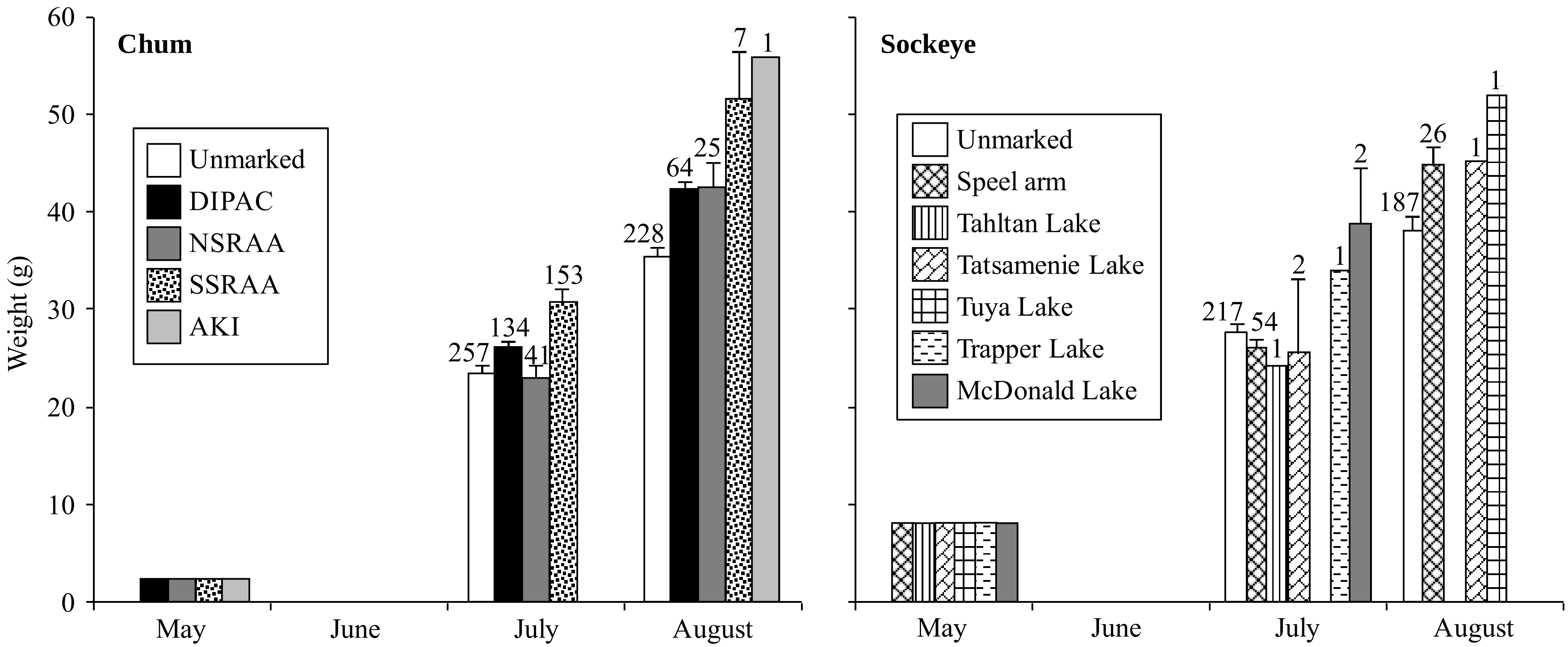

Figure 16.—Stock-specific growth trajectories of juvenile chum and sockeye salmon captured by rope trawl in the marine waters of the northern and southern regions of southeastern Alaska, July–August 2009. Weights of May fish are mean values at time of hatchery release. No trawling was conducted in June in either region or in August in the southern region. The sample sizes and the standard error of the mean are indicated above each bar.

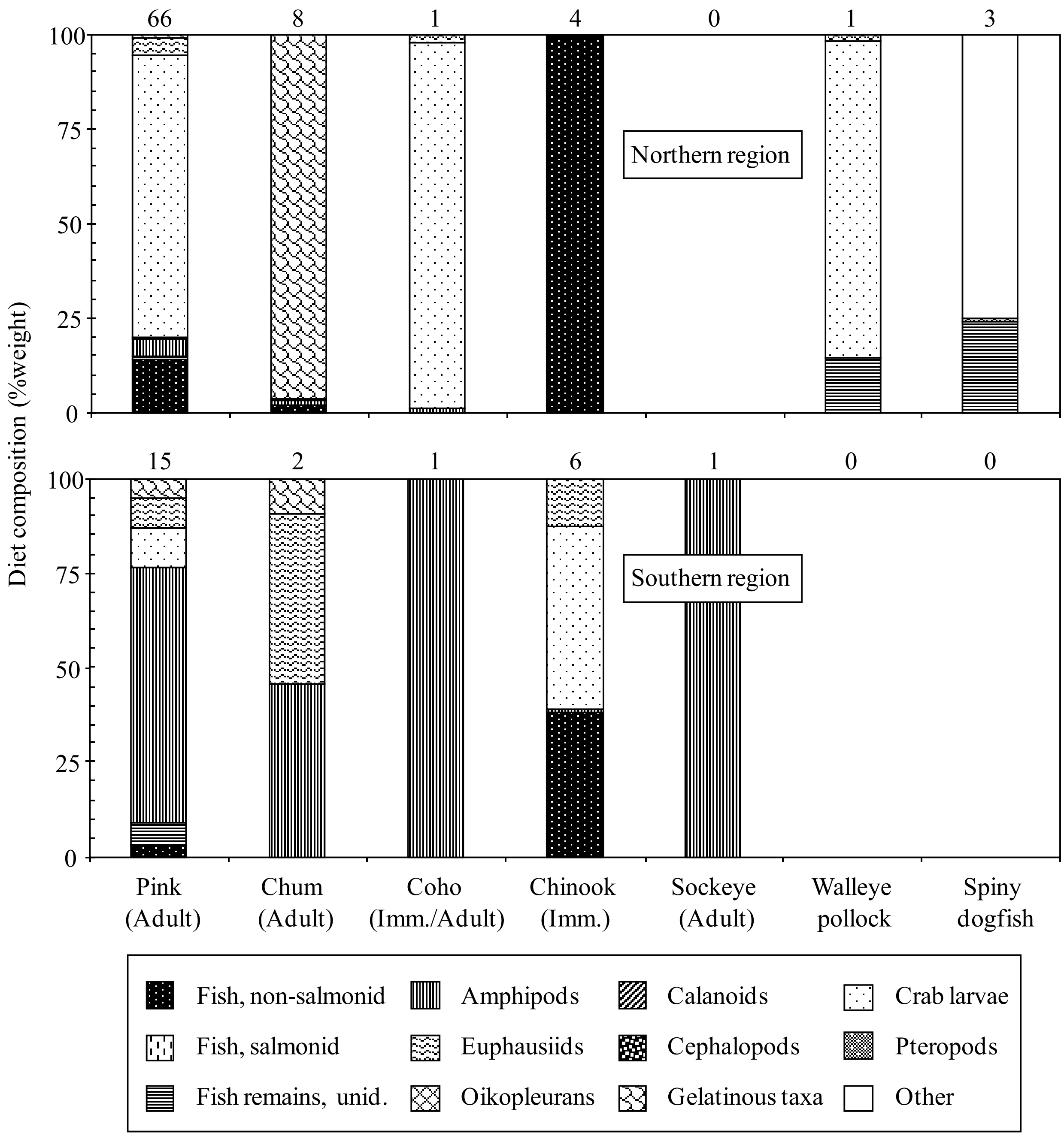

Figure 17.—Prey composition of 108 potential predators of juvenile salmon captured in 60 rope trawl hauls in the marine waters of the northern and southern regions of southeastern Alaska, July–August 2009. No trawling was conducted in June in either region or in August in the southern region. The numbers of fish examined per species are shown above the bars. See Tables 18-19 for additional feeding attributes.

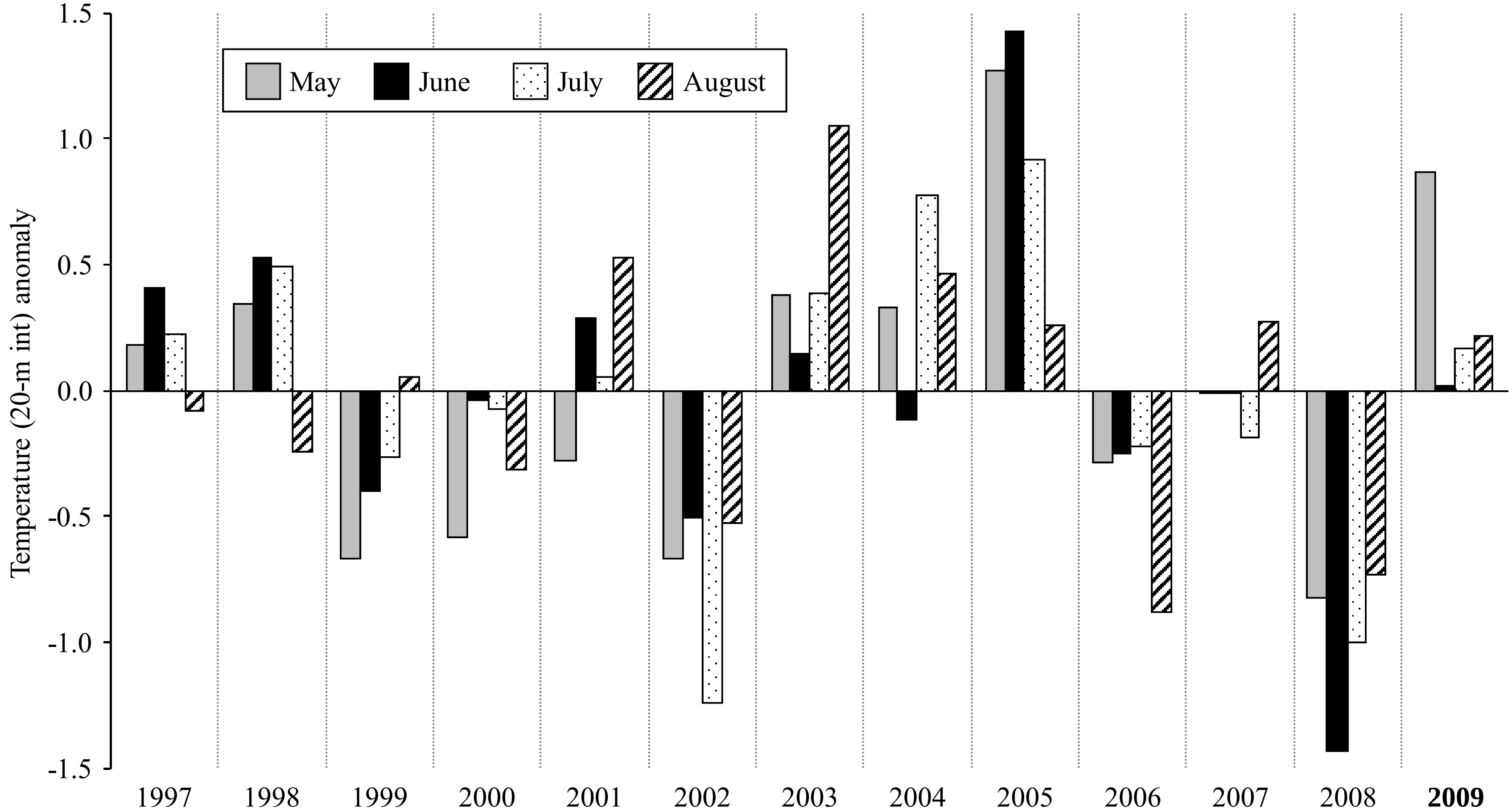

Figure 18.—Monthly temperature (20-m integrated, °C) anomalies across the 13-yr time series from Icy Strait in the northern region of southeastern Alaska, 1997-2009. Data (shaded bars) are deviations from monthly mean values (0-lines) by year. See also Figures 2 and 3.

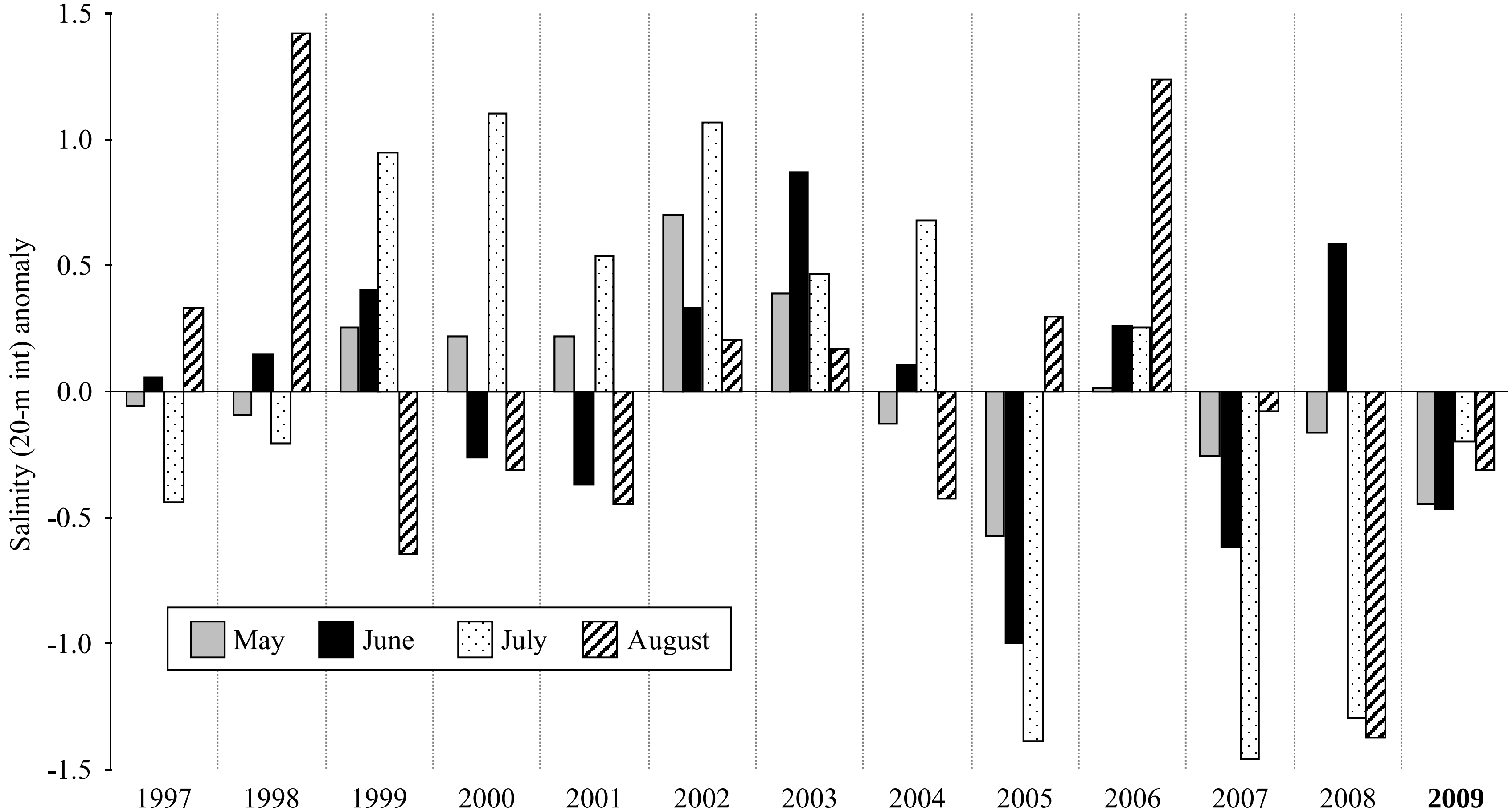

Figure 19.—Monthly anomalies for salinity (20-m integrated, PSU) across the 13-yr time series from Icy Strait in the northern region of southeastern Alaska, 1997-2009. Data (shaded bars) are deviations from monthly mean values (0-lines) by year. See also Figures 2 and 3.

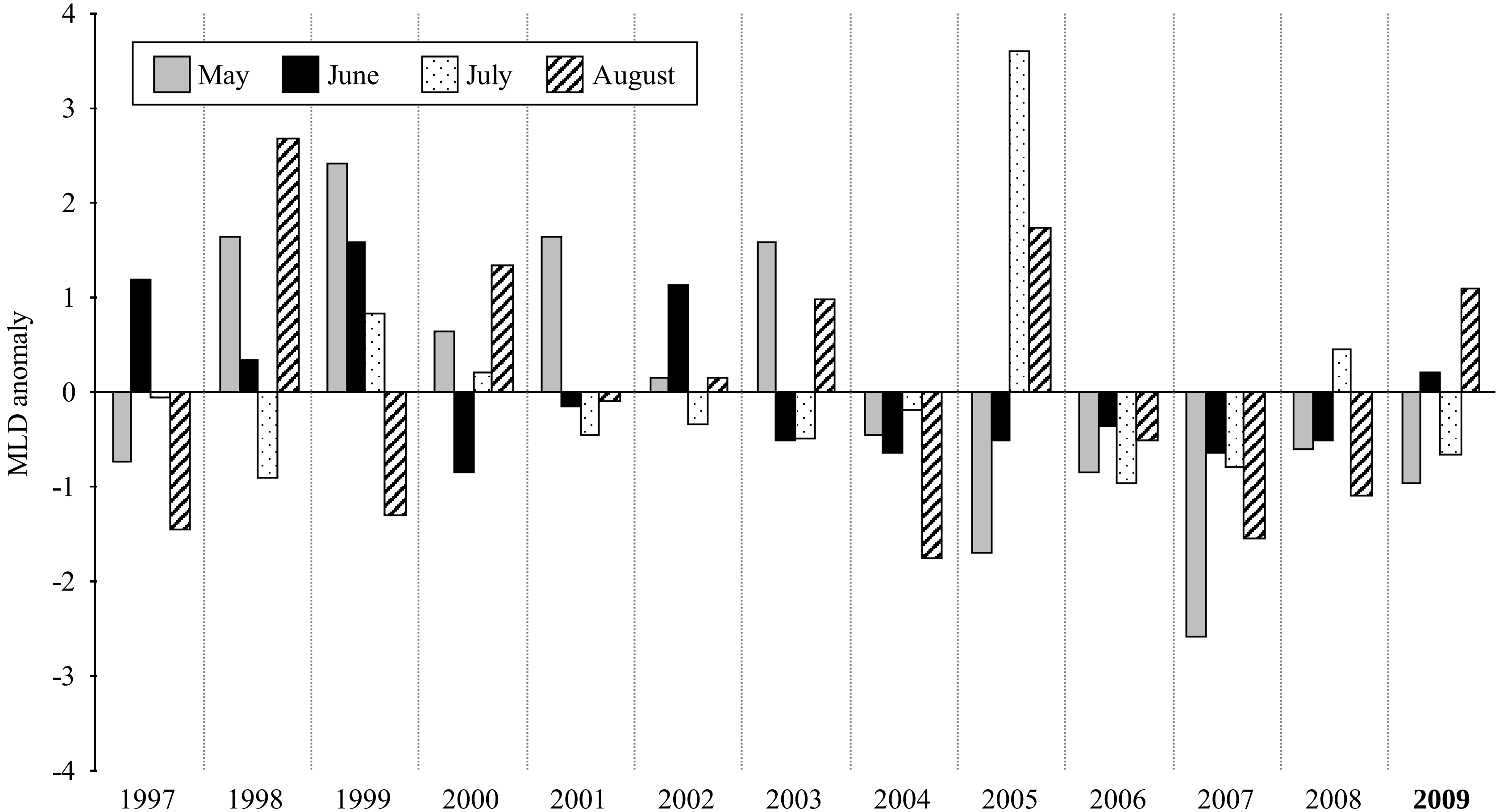

Figure 20.—Monthly anomalies for mixed layer depth (MLD, m) across the 13-yr time series from Icy Strait in the northern region of southeastern Alaska, 1997-2009. Data (shaded bars) are deviations from monthly mean values (0-lines) by year. See also Figures 2 and 3.

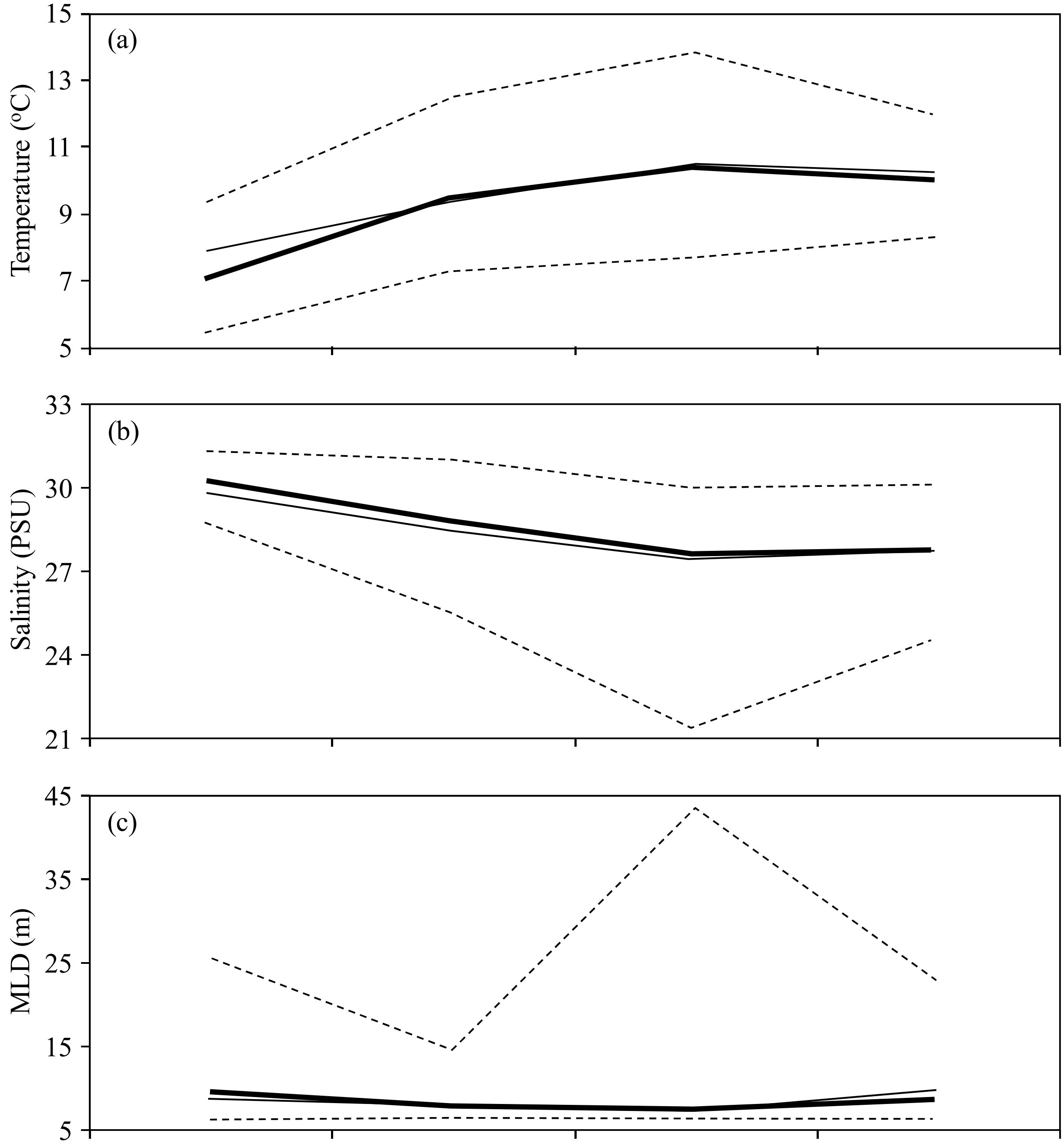

Figure 21.—Temperature (20-m integrated; ºC), salinity (20-m integrated, PSU), and mixed layer depth (MLD, m) across a 13-yr time series from the vicinity of Icy Strait in the northern region of southeastern Alaska, 1997-2009. Data compare the 2009 means for (a) temperature, (b) salinity, and (c) mixed layer depth (thick solid lines) to grand mean values (thin solid lines) within observed ranges (minimum and maximum, dashed lines), by month. See also Figures 2 and 3.

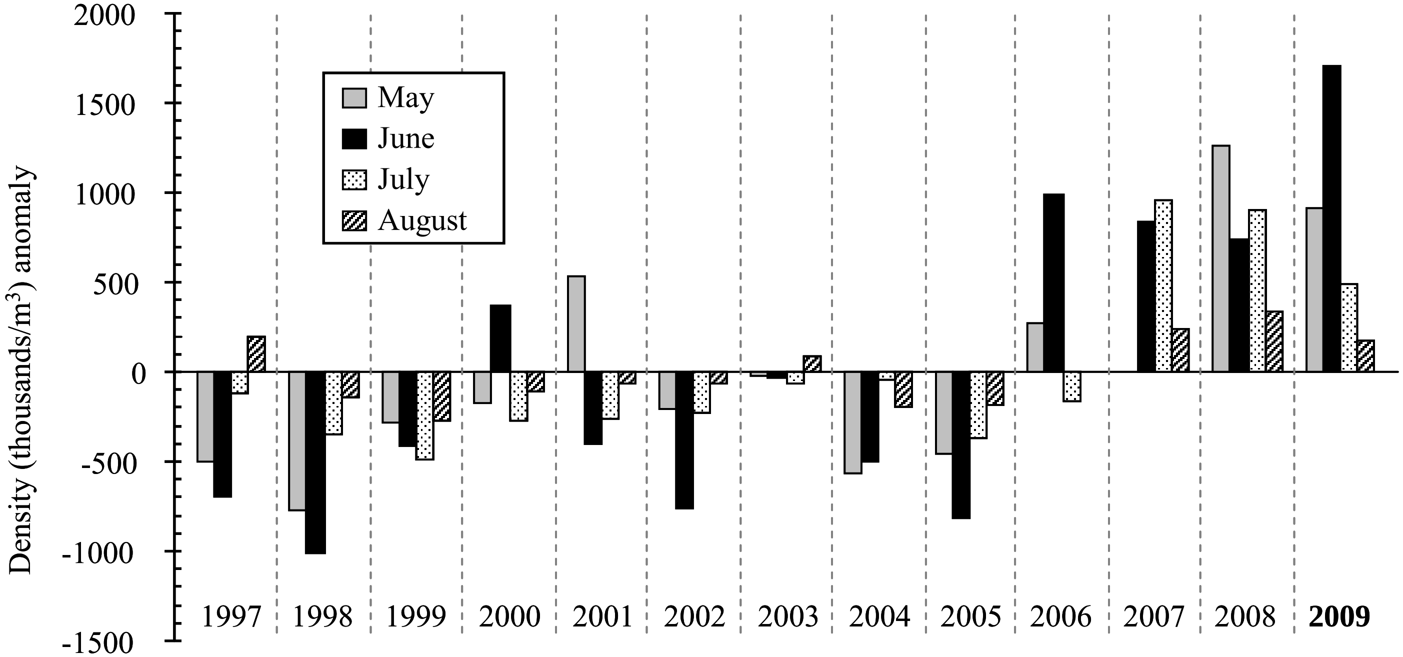

Figure 22.—Zooplankton total density (thousands/m^3) across the 13-yr time series from Icy Strait in the northern region of southeastern Alaska, 1997-2009. Data (shaded bars) are deviations from monthly mean density (0-line) by year. Samples represent "deep" (≤200 m depth; n = 4 stations) 333-µm mesh bongo net towed in double oblique fashion during daylight. No samples were collected in August 2006 or May 2007. See also Figure 6.

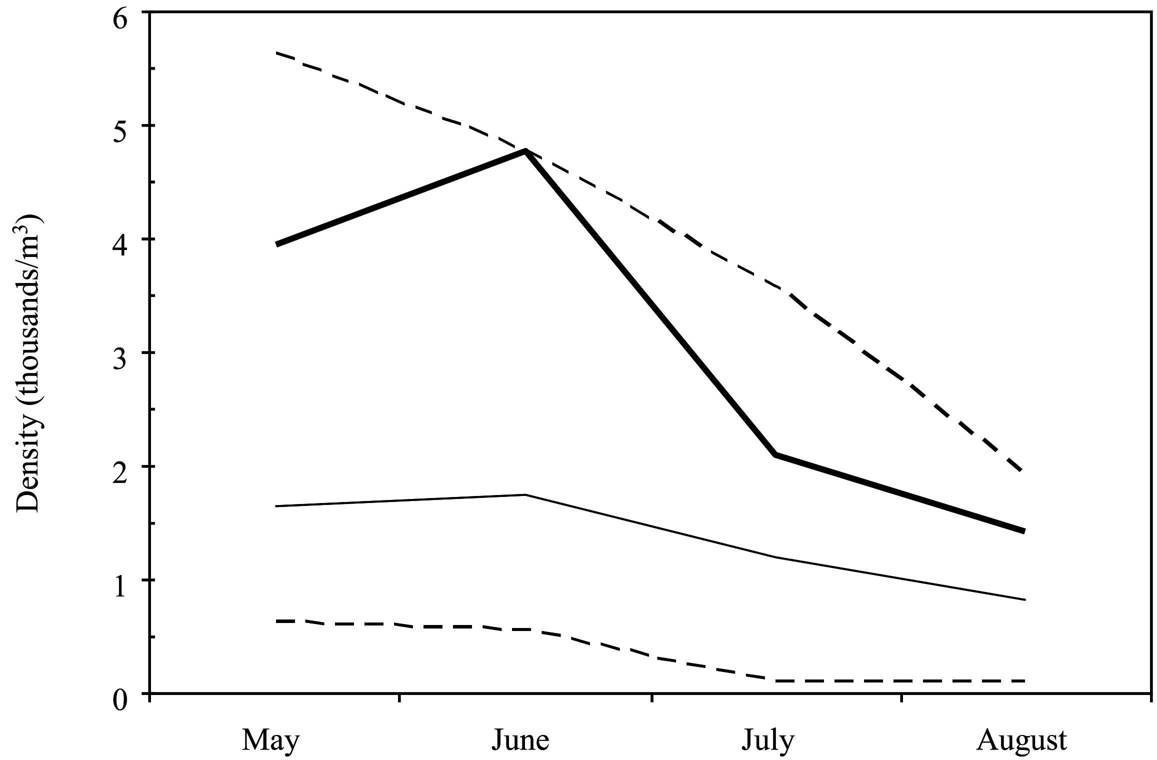

Figure 23.—Monthly zooplankton total density (thousands/m^3) for 2009 compared to the 13-yr time series from Icy Strait in the northern region of southeastern Alaska, 1997-2009. Data are mean densities for 2009 (thick solid line) compared to grand mean densities (thin solid line) within observed density range (minimum and maximum, dashed lines) by month. Samples represent "deep" ($\leq$ 200 m depth; n = 4 stations) 333-µm mesh bongo net towed in double oblique fashion during daylight. No samples were collected in August 2006 or May 2007. See also Figure 6.

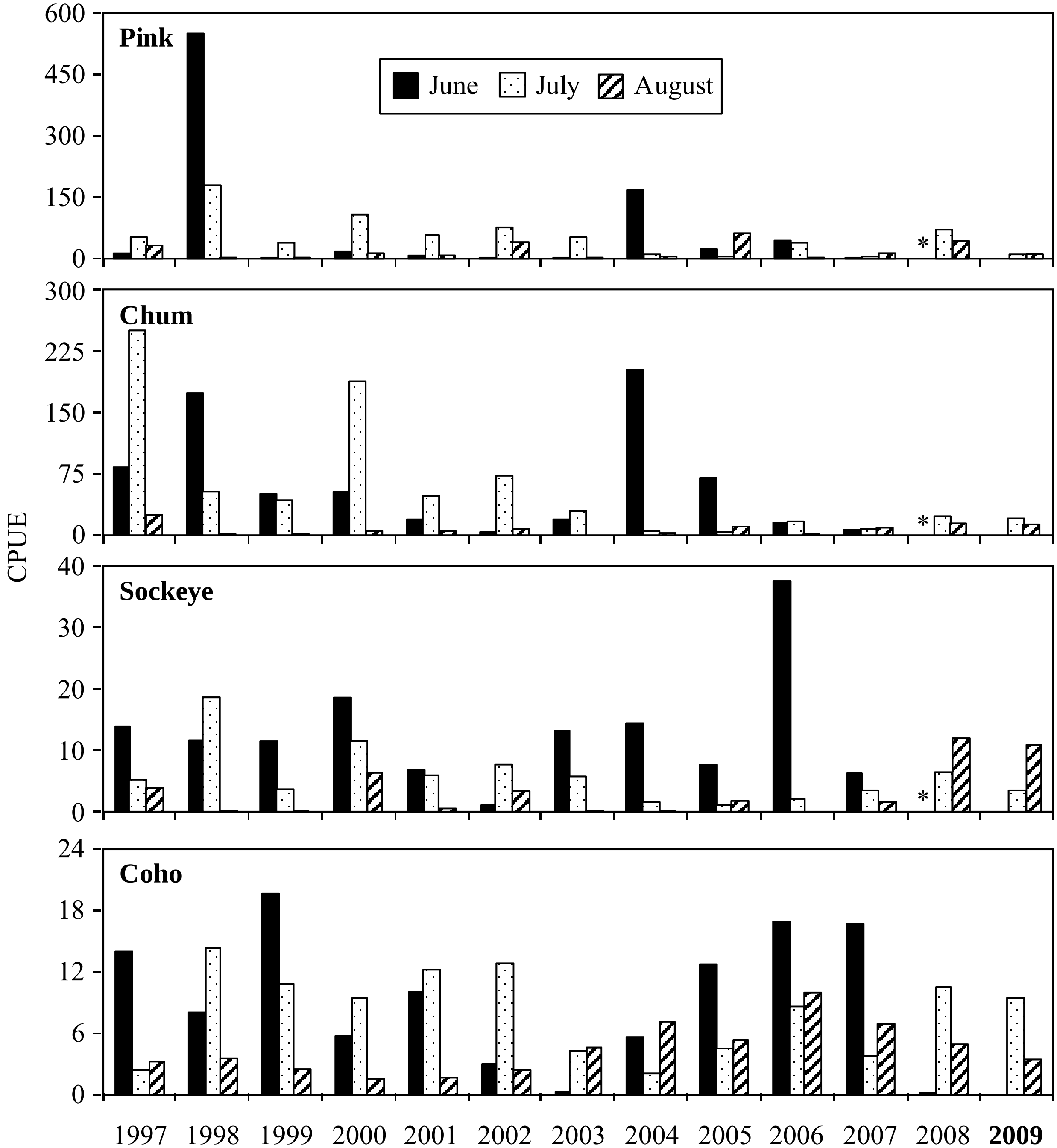

Figure 24.—Catch-per-unit-effort (CPUE, mean catch per trawl haul) for juvenile pink, chum, sockeye, and coho salmon across a 13-yr time series from Icy Strait in the northern region of southeastern Alaska, 1997-2009. Asterisks indicate a zero catch. Note differences in scale of y-axes by species. No trawling was conducted in June, 2009. See also Figure 9.

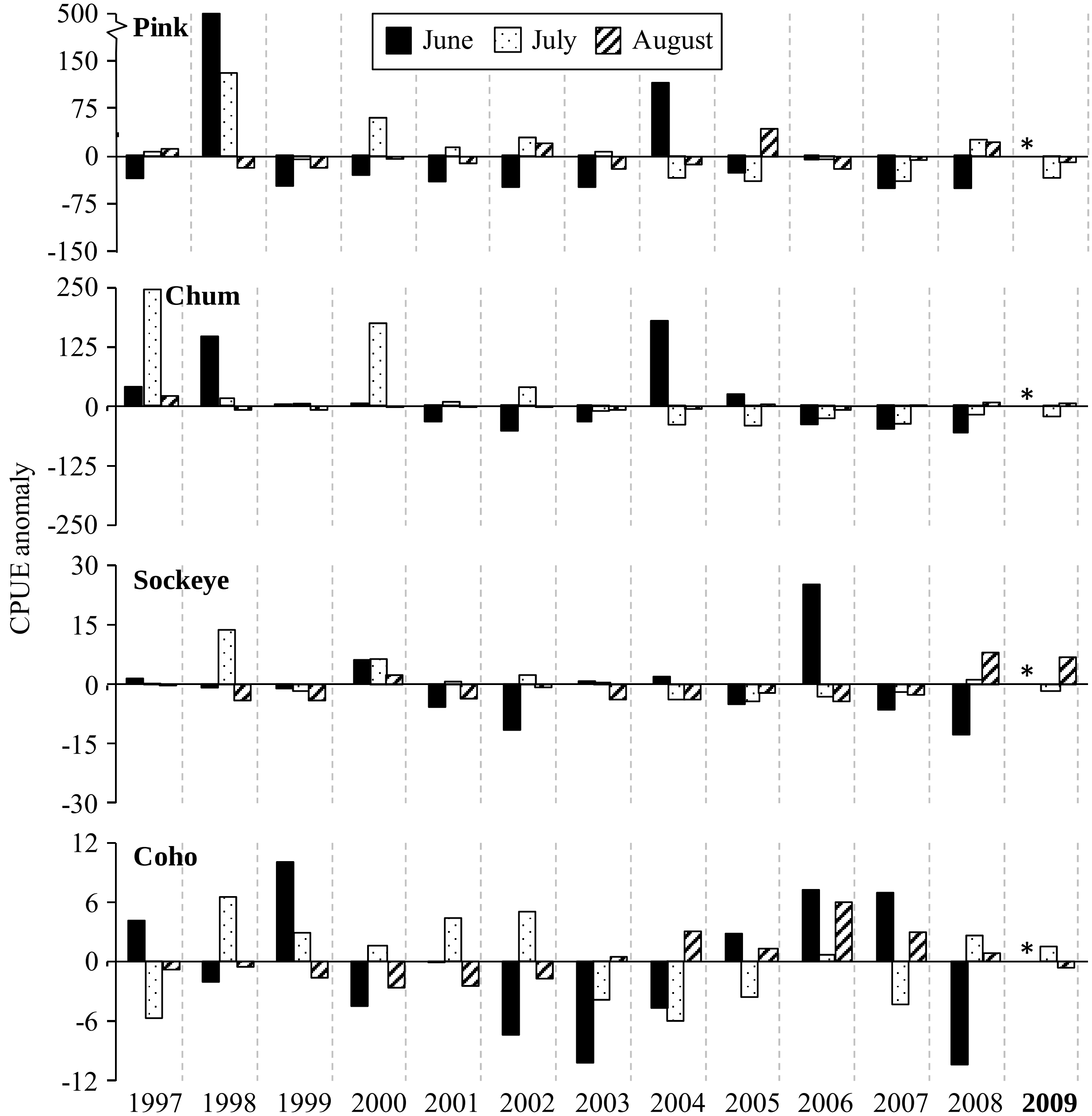

Figure 25.—Catch-per-unit-effort (CPUE, mean catch per trawl haul) anomalies for juvenile pink, chum, sockeye, and coho salmon across a 13-yr time series from Icy Strait in the northern region of southeastern Alaska, 1997-2009. Data (shaded bars) are deviations from the 13-yr monthly mean CPUE (0-lines). No trawling was conducted in June 2009 (asterisks). Note differences in scale of y-axes by species. See also Figure 9.

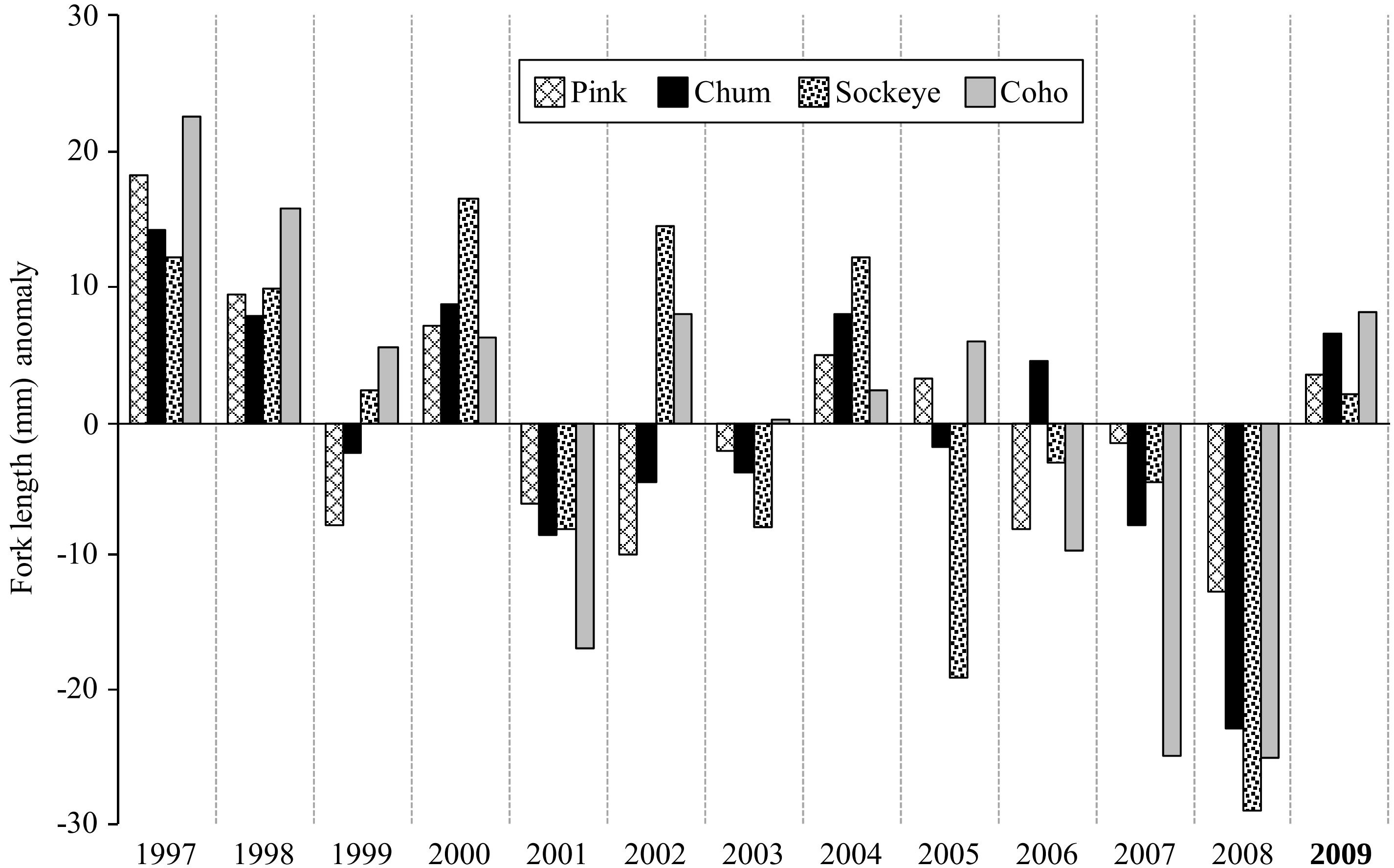

Figure 26.—Annual size at time (fork length, mm, on July 24) anomalies for juvenile pink, chum, sockeye, and coho salmon across a 13-yr time series from Icy Strait in the northern region of southeastern Alaska, 1997-2009. Data (shaded bars) are deviations from the 13-yr monthly mean size at time (0-line). See also Figure 10.

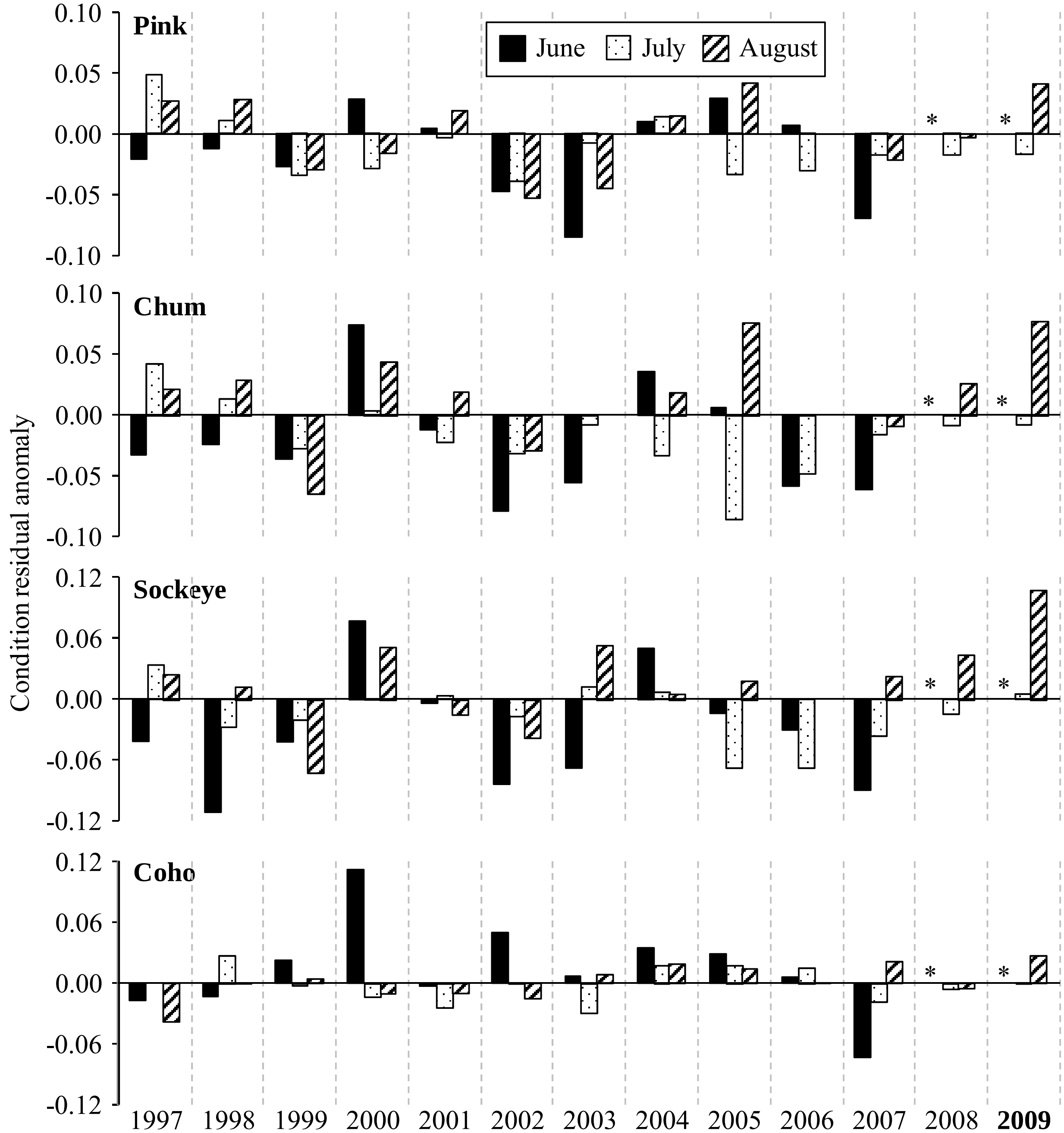

Figure 27—Condition residuals (CR) from length-weight linear regressions for juvenile pink, chum, sockeye, and coho salmon across a 13-yr time series from Icy Strait in the northern region of southeastern Alaska, 1997-2009, by year. Data (shaded bars) are deviations from 13-yr monthly mean CR (0-lines). No trawling was conducted in June, 2009. Asterisks also indicate insufficient samples available for processing in June 2008. See also Tables 10-13 and Figure 13.