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Southeast Alaska Coastal Monitoring Survey
May–July 2021

by

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ABSTRACT

Juvenile Pacific salmon, ecologically-related species, and associated biophysical data were collected from the marine waters of the northern and central regions of southeastern Alaska (SEAK) in 2022. This annual survey, conducted by the Southeast Coastal Monitoring (SECM) project, marks 24 consecutive years of systematically monitoring how juvenile salmon utilize marine ecosystems during a period of climate change. The survey was implemented to identify the relationships between year-class strength of juvenile salmon and biophysical parameters that influence their habitat use, marine growth, prey fields, predation, and stock interactions. Up to 20 stations were sampled monthly in epipelagic waters from May to July. Fish, zooplankton, surface water samples, and physical profile data were collected during daylight at each station using a surface rope trawl, bongo nets, a water sampler, and a conductivity-temperature-depth profiler. Of the juvenile salmon examined for otolith marks, Alaska enhanced stocks comprised 88% of the juvenile chum and 12% of the juvenile sockeye salmon. Of the 26 potential predators of juvenile salmon, no incidences of predation on juvenile salmon was observed. The long term seasonal time series of SECM juvenile salmon stock assessment and biophysical data is used in conjunction with basin-scale ecosystem metrics to annually forecast pink salmon harvest in SEAK. Long term seasonal monitoring of key stocks of juvenile salmon and associated ecologically-related species, including fish predators and prey, permits researchers to understand how growth, abundance, and interactions affect year-class strength of salmon in marine ecosystems during a period of rapid climate change.

INTRODUCTION

The Southeast Alaska Coastal Monitoring (SECM) survey was designed to provide insight into oceanographic conditions and the early marine ecology of Southeast Alaska (SEAK) salmon (*Oncorhynchus* spp.). SECM surveys started in 1997 (Murphy et al. 1999) and have provided insight into the early marine ecology of pink salmon (*O. gorbuscha*) (Orsi et al. 2016; Murphy et al. 2019), chum salmon (*O. keta*) (Orsi et al. 2004), Chinook salmon (*O. tshawytscha*) (Weitkamp et al. 2011, Orsi et al. 2013), coho salmon (LaCroix et al. 2009), other pelagic species (Orsi, et al. 2007), hatchery/wild interactions (Sturdevant et al. 2012a, Fergusson et al. 2013, Fergusson et al. 2020,) and zooplankton dynamics (Fergusson and Orsi, 2017) in the northern region of SEAK.

Relationships between climate shifts and production have impacted year-class strength of Pacific salmon throughout their distribution (Beamish et al. 2010a, b). In particular, climate variables such as temperature have been associated with freshwater production (Bryant 2009; Taylor 2008) and ocean production and survival of both wild and hatchery salmon (Wertheimer et al. 2001; Beauchamp et al. 2007). Biophysical attributes of climate may influence trophic linkages and lead to variable growth and survival of salmon (Brodeur et al. 2007; Coyle et al. 2011). However, research is lacking on the links between salmon production and climate variability, intra- and interspecific competition and carrying capacity, and biological interactions among stock groups (Beamish et al. 2010a). In addition, past research has not provided adequate time series data to explain these links (Pearcy 1997; Beamish et al. 2008). Increases in salmon production throughout the northern Pacific Rim in recent decades has elevated the need to understand the consequences of population changes and potential interactions on the growth, distribution, migratory rates, timing, and survival of all salmon species and stock groups (Rand et al. 2012). Furthermore, region-scale spatial effects that are important to salmon production (Pyper et al. 2005) may be linked to local dynamics in complex marine ecosystems like SEAK (Weingartner et al. 2008).

A goal of the SECM project is to identify mechanisms linking salmon production to climate change using a time series of synoptic data related to ocean conditions and salmon, including stock-specific life history characteristics. The SECM project obtains stock information from coded-wire tags (CWT; Jefferts et al. 1963) or otolith thermal marks (Courtney et al. 2000) from four of the five Pacific salmon species: chum salmon, sockeye salmon (*O. nerka*), coho salmon (*O. kisutch*), and Chinook salmon. Portions of wild and hatchery salmon stocks are tagged or marked prior to ocean entry by enhancement facilities or state and federal agencies in SEAK, Canada, and the Pacific Northwest states. Catches of these marked fish by the SECM project in the northern, southern, and coastal regions of SEAK have provided information on habitat use, and migration rates and timing (e.g., Orsi et al. 2004, 2007); in addition, interceptions in the regional common property fisheries have documented substantial contributions of enhanced fish to commercial harvests (White 2011). Therefore, examining trends in early marine ecology and potential interactions of these marked stock groups provides an opportunity to link wild and hatchery salmon production to climate change (Ruggerone and Nielsen 2009; Rand et al. 2012).

Examining the extent of interactions between salmon stock groups and co-occurring species in marine ecosystems is also important with regard to carrying capacity, and should examine both “bottom-up” and “top-down” production controls (Miller et al. 2013). For example, increased hatchery production of juvenile chum salmon coincided with declines of some wild chum salmon stocks, suggesting the potential for negative stock interactions in the marine environment (Seeb et al. 2004; Reese et al. 2009). In SEAK, however, SECM and other studies have indicated that growth is not food limited and that stocks interact extensively with little negative impact (Orsi et al. 2004; Sturdevant et al. 2012a). Zooplankton prey fields are more likely to be cropped by the more abundant planktivorous forage fish, including walleye pollock (*Gadus chalcogrammus*) and Pacific herring (*Clupea pallasi*) (Orsi et al. 2004; Sigler and Csepp 2007), than by juvenile salmon. Monitoring the composition, abundance, energetic content, and timing of zooplankton taxa with different life history strategies may permit the detection of climate-related changes in the seasonality and interannual abundance of prey fields (Coyle and Paul 1990; Fergusson et al. 2017, 2020). In contrast, “top-down” predation events can also influence salmon year-class strength (Sturdevant et al. 2009, 2013). Highly abundant smaller juvenile salmon species, such as wild pink salmon, may be a predation buffer for less abundant, larger species, such as juvenile coho salmon (LaCroix et al. 2009; Weitkamp et al. 2011). These findings also stress the need to examine the entire epipelagic community in the context of trophic interactions (Cooney et al. 2001; Fergusson et al. 2013, 2020; Sturdevant et al. 2012b) and to compare ecological processes, community structure, and life history strategies among salmon production areas (Brodeur et al. 2007; Orsi et al. 2007, 2013).

Salmon and salmon fisheries are an integral part of the ecological and socio-economic framework of SEAK. Changes in salmon survival and production have widespread impacts on the ecosystems and communities within SEAK. The SECM survey supports the management of pink salmon fisheries by providing preseason harvest forecasts for SEAK pink salmon (Wertheimer et al. 2006; Orsi et al. 2016; Murphy et al. 2019; Piston et al. 2020).

In 2021, SECM sampling was conducted in the northern region of SEAK for the 25th consecutive year to continue annual ecosystem and climate monitoring, to document juvenile salmon abundance in relation to biophysical parameters, and to support models to forecast adult pink salmon returns. Sampling was expanded into the central region of SEAK, including Sumner Strait and Cape Ommaney. This document summarizes data collected by the SECM project in 2021 on juvenile salmon, ecologically-related species, and associated biophysical parameters. Subsets of the long term time series are examined in several recent documents (ESRs).

2021 SECM survey objectives were:
1.) Conduct pelagic trawl (Nordic 264) operations to maintain standardized catch and size indices of juvenile salmon and other epipelagic fish species in the northern region of Southeast Alaska.
2.) Collect coded wire tags, otoliths, and genetic tissue samples to study the origin and age of salmon in the northern region of Southeast Alaska.
3.) Collect salmon specimens for the analysis of diet and energetic condition to monitor and evaluate the feeding ecology and energetic status of salmon and other epipelagic species in the northern region of Southeast Alaska.
4.) Collect data on temperature, salinity, chlorophyll, and zooplankton with CTD (SBE 49) and bongo net sampling to monitor the ecosystem status of northern Southeast Alaska.
5) Conduct pilot station sampling in Sumner Strait and off Cape Ommaney.

METHODS

Trawl sampling

Monthly sampling was conducted in strait (Icy Strait and Upper Chatham Strait transects) and inshore (Stephens Passage) habitats within the northern region of SEAK from May to July 2021 (Figure 1; Table 1). Pilot stations in central southeast Alaska were sampled in July (Figure 2; Table 1). Oceanographic data were collected in May aboard the 12-m NOAA Fisheries vessel R/V Sashin, and both oceanographic and surface trawl data were collected in June-July aboard the ADF&G vessel R/V Medeia (Table 2).

A Nordic 264 pelagic rope trawl was fished at the surface to sample fish and other pelagic nekton within the upper 20m of the water column. This trawl was 184 m long with typical fishing dimensions of 18 m wide by 24 m deep (Sturdevant et al. 2012a). A detailed description of the trawl is included in Orsi, et al. (2016). Each trawl was towed for 20 or 60 minutes and two trawl sets were made at each station (replicate tows), except at pilot stations where only one 60-minute trawl per station occurred. Trawl duration in the strait habitat (Icy Strait and Upper Chatham Strait transects) were 20 minutes for consistency with historical sampling. Trawl duration in Stephens Passage was increased to 60 minutes in 2018 to minimize variability in the catch data and to increase the number of juvenile salmon collected in Stephens Passage. The start of each trawl set was offset by approximately 1 nautical mile from the station coordinates to allow the vessel to trawl through or near the station coordinates during each trawl set.

Trawl catches were sorted by species and selected life history stages. Catch and specimen data were recorded in an electronic catch logging system known as Catch Logging for Acoustic and Midwater Trawl System (CLAMS) during June and July. All specimens were collected following sample requests and collection protocols as defined in the annual cruise instructions. Lengths, weights, and specimens were collected from a subsample of up to 30 fish for each species and selected life-history-stages per trawl haul during June and July. Juvenile salmon specimens were collected for diet, energetics, otolith thermal mark identification, and genetic stock identification. Fin clips and stomachs were collected for genetic stock identification (Chinook salmon) and diet analysis of immature and mature salmon. Pacific herring and juvenile pink salmon were collected to monitor toxin levels in fish due to harmful algal blooms. All specimens saved for further laboratory analysis were given a specimen barcode tag and scanned into CLAMS with a barcode scanner. All Chinook and coho salmon were examined for a missing adipose fin and screened for the presence of a CWT with a handheld CWT tag detector. CWTs were removed and read on-board during June and July. Sagittal otoliths were removed from juvenile chum and sockeye salmon in the laboratory and sent to the Douglas Island Pink and Chum, Inc. hatchery (DIPAC) for thermal mark processing. Genetic tissue samples were collected from all Chinook salmon and mixtures will be estimated with the 13-locus GAPS microsatellite baseline for Chinook salmon at the ADF&G Gene Conservation Laboratory.

Adult salmon captured in the trawl were identified, measured (FL, mm), weighed (g), and stomachs were frozen for diet analysis. In the laboratory, stomach content weight (0.1 g) was determined by subtracting the empty stomach weight from the full stomach weight. General prey composition was determined by visually estimating the contribution of major taxa to the nearest 10% of total volume, and the wet-weight contribution to the diets was calculated by multiplying the % by the total content weight (%W). Overall diets of each species were summarized by %W of major prey taxa. Whenever possible, fish prey was identified to species and FLs were measured.

In the laboratory, frozen individual juvenile salmon were weighed (0.001 g) and otoliths were removed from chum and sockeye salmon. Mean lengths, weights, and residuals from a length-weight linear regression (condition residuals, CR) were computed for each species by habitat and sampling month. Mean energy density (kJ/g dry weight) of monthly subsets of each species was determined through calorimetry (Fergusson et al. 2010). Diet composition (%wt) was also determined for this subset of fish. 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). Stock compositions of thermally marked fish were determined for each month and habitat.

Oceanographic sampling

The oceanographic data collected at each station consisted of one conductivity-temperature-depth profiler (CTD) cast, one water sample, and one plankton tow. The CTD data were collected with a Sea-Bird1 SBE 49 ‘Fastcat’ profiler deployed, in tandem with the bongo net, to 200 m or within 20 m of the bottom. The CTD profiles were used to determine the surface (3-m) and 20-m integrated water column temperatures (°C) and salinities (PSU). Water samples for chlorophyll (µg/L) concentrations were taken at the surface once at each station per month.

Zooplankton was collected monthly with a bongo net towed obliquely to 200 m or within 10 m of bottom. The bongo net had a 60-cm diameter tandem frame with 333- and 505-µm meshes. General Oceanics Model 2031 flow meters were placed inside the opening of bongo nets to allow for the calculation of water volume filtered.

Zooplankton samples were immediately preserved in a 5% formalin-seawater solution buffered with a 2.5% borax-seawater solution. In the laboratory, displacement volumes (DV, ml), standing stock (DV/m^3), and density (number/m^3) were determined. Standing stock was calculated using DV and filtered water volumes. Detailed zooplankton species composition from the 333- and 505-µm samples was determined microscopically from subsamples obtained using a Folsom splitter. Densities were then estimated using the subsample counts, split fractions, and water volumes filtered. 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), larvaceans, decapod larvae, hyperiid amphipods, chaetognaths, pteropods, and combined minor taxa.

RESULTS AND DISCUSSION

In 2021, up to 20 stations were sampled from the Northern and Central regions of SEAK from May to July (Table 1; Figure 1&2). In total, data were collected from 55 rope trawl hauls, 59 CTD casts, 24 bongo net samples, and 36 surface water samples during 13 days at-sea.

Oceanography

Sea surface (3-m) temperature (SST) means ranged from 7.6 - 13.5 ºC while the integrated (top 20-m) temperatures ranged from 7.2 - 10.7 °C from May to July (Table 3; Figure 3). For the northern region, seasonal 3-m and integrated 20-m temperature patterns were similar among habitats, with a peak in July. Monthly mean 3-m and integrated temperatures were higher in the strait habitat. For the central habitat, temperatures were similar between the two habitats and were lower than those in the northern region.

Sea surface (3-m) salinities ranged from 17.1 - 31.5 PSU while the integrated (top 20-m) salinities ranged from 25.4 - 31.6 PSU from May to July (Table 3; Figure 3). For the northern region, seasonal 3-m salinities increased from June to July in the inshore habitat while the integrated 20-m salinities decreased from May to July. Salinities in the inshore habitat were lower than salinities in the strait habitat indicating the close proximity of the inshore habitat to the freshwater output of the Taku River. For the central region, salinities were similar between the two habitats across metrics (3-m and 20-m) and were higher than those in the northern region.

Chlorophyll-*a* concentrations ranged from 1.3 - 8.3 µg/L from May to July (Table 3; Figure 4). For the northern region, chlorophyll concentrations decreased over the season in both habitats. Chlorophyll concentrations in the inshore habitat were higher than those in the strait habitat. For the central region, chlorophyll concentrations were similar between the two habitats and were higher than those in the northern region in July, the only month samples were taken in the central region.

Zooplankton standing stock from oblique bongo net tows (333- and 505-µm mesh) ranged from 0.2 to 1.4 ml/m^3 from May to July (Table 3; Figure 5). Mean standing stock was highest in May and generally decreased seasonally to July. Total density of zooplankton prey fields in the strait habitat of the northern region ranged from 3,313 - 1,292 and 962 - 453 organisms/m^3 from the 333- and 505-µm mesh nets, respectively (Table 3; Figure 6). Mean density was highest in May and generally decreased in June and July for both mesh net samples; however, total density was 2-3 times higher in the 333-µm mesh samples compared to the 505-µm mesh samples. Copepods were the dominant species in the zooplankton communities sampled by both mesh nets however, the small copepods (mainly *Pseudocalanus* spp.) occurred in higher proportion in the 333-µm mesh samples while the large copepods (mainly *Metridia okhotensis*) occurred in higher proportion in the 505-µm mesh samples (Figure 7).

Catch composition

Jellyfish catches included six species (*Aequorea* spp., *Aurelia* spp., *Chrysaora melanaster*, *Cyanea capillata*, *Phacellophora* spp., and *Staurophora mertensi*) and an "other" category (Table 4). In addition to jellyfish, salps and the hydrozoan *Polyorchis* spp. are also reported in table 4. Total biomass (kg) of jellyfish ranged from 9.6 kg (June) to 258.1 kg (July). Both the low and high monthly catches of jellyfish occurred in the strait habitat in the northern region. Jellyfish biomass and species composition varied by month and habitat, generally increasing overall from June to July. In the coastal habitat, the dominant species were *Aequorea* sp., *Aurelia* sp., and *Cyanea capillata*. In the inshore and strait habitats, the dominant species were the same, though not in the same order of abundance (Table 4).

A total of 6,758 fish (1,937 salmon, and 4,821 non-salmon species) were captured during 44 hours of rope trawl effort during 2021 (Table 4). Pacific herring was the most abundant species in the trawl catch (n = 4,547), and juvenile chum salmon (n = 1,320) was the most abundant species of salmon. The total catch of juvenile Chinook salmon in inshore habitats (*n*=15) were much higher than the strait habitat (*n*=1) and highlights the significance of the new Stephens Passage stations (inshore habitat) to research on Chinook salmon.

Juvenile salmon size and condition

Length, weight, condition, and energy density of juvenile salmon differed among species and months (Tables 7; Figures 8-11). For the northern region, all species increased in length and weight from June to July, with the exception of juvenile sockeye salmon in the inshore habitat, which were similar in size in both June and July. For both regions, the CRs were at or below average for all species in all months, except for Chinook salmon in June in the northern inshore habitat, which were slightly above average. For northern strait habitat, energy density decreased from June to July for pink, chum, and coho salmon, while energy density increased from June to July for sockeye salmon. The decrease in size could indicate energy being allocated to growth rather than storage, while the increase observed in the sockeye salmon energy may indicate the influx of smaller fish entering the sampling area in July.

Juvenile salmon origin

All Chinook (*n* = 18 juveniles, *n* = 4 immature) and coho (*n* = 174 juveniles, *n* = 1 maturing) salmon were scanned for the presence of a CWT on-board the survey. Reading tags on-board the vessel was a highly effective way of communicating catch information from the survey. A total of 1 CWT was recovered from juvenile Chinook salmon in Stephens Passage during 2021, which was considerably lower than the total number of juvenile Chinook salmon tags in recent years. The single tag recovered in Stephens Passage was from the Little Port Walter research station (LPW, Table 8). The presence of this LPW tag in Stephens Passage indicates that there is likely northward migration of juvenile Chinook salmon up through Stephens Passage. Although juveniles could enter Stephens Passage from the north via Lynn Canal, the migration distance and complexity make this route less likely. One additional tag was recovered in the strait habitat and was also from LPW. No CWTs were recovered from immature Chinook salmon during 2021. Five CWTs were recovered from juvenile coho salmon in 2021; three of the tags were from the DIPAC hatchery, and one each from the Taku and Chilkat Rivers (Table 8).

Stock-specific information was obtained from recoveries of otolith-marked hatchery juvenile chum and sockeye salmon. Releases of these species from SEAK enhancement facilities are commonly mass-marked and not tagged. These facilities include: Douglas Island Pink and Chum Hatchery (DIPAC), Northern Southeast Regional Aquaculture Association (NSRAA), Southern Southeast Regional Aquaculture Association (SSRAA), and Armstrong Keta, Inc. (AKI). A total of 472 juvenile salmon were examined for thermal marks: 361 chum salmon and 111 sockeye salmon (Tables 9-10; Figures 12-13).

For juvenile chum salmon, stock-specific information was derived from a subsample of 361 from the 1,320 chum salmon (27%) caught in June and July in both regions (Table 9). For otoliths examined from northern strait habitat catches, 314 (89%) were marked by hatcheries in SEAK and 40 (11%) were not marked. Of the marked fish, 247 (79%) were from DIPAC, 50 (16%) were from NSRAA, 9 (3%) were from SSRAA, and 8 (3%) were from AKI. For otoliths examined from central strait habitat catches, 1 (50%) was marked and 1 (50%) was not marked. The marked fish was from SSRAA. For otoliths examined from central coastal habitat catches, 3 (60%) were marked and 2 (40%) were not marked. All of the marked fish were from SSRAA.

Hatchery chum salmon catch composition shifted monthly through Icy Strait, with northern stocks such as DIPAC peaking in June and central stocks peaking in July (Figure 12). Hatchery chum salmon catch composition was similar between the central strait and coastal habitats in July.

For juvenile sockeye salmon, stock-specific information was derived from a subsample of 111 from the 119 sockeye salmon (93%) caught in June and July in both regions (Tables 10). For otoliths examined from northern inshore habitat catches, 2 (7%) were marked by DIPAC and 25 (93%) were not marked. For otoliths examined from northern strait habitat catches, 11 (15%) were marked by DIPAC and 60 (85%) were not marked. None of the otoliths were marked from the central strait and coastal catches (100% examined). Of the marked fish, 8 (62%) were from Speel Arm, 1 (8%) was from Tatsamenie Lake, and 4 (31%) were from Tatsamenie Lake ER. For otoliths examined from inshore habitat catches, 1 (33%) was marked by DIPAC and 2 (67%) were not marked. The marked fish was from Tatsamenie Lake. Hatchery sockeye salmon catch composition was similar between June and July in the northern strait habitat and increased in the northern inshore habitat from June to July (Figure 13).

Adult salmon diets

Stomachs of 26 potential predators of juvenile salmon were examined from a suite of eight fish species. Of the fish examined, 46% were feeding and no evidence of predation on juvenile salmon was observed. (Table 11). Diet compositions differed by predator species and region/habitat (Figure 14). For feeding fish, the adult chum salmon consumed gelatinous prey, the adult pink salmon consumed euphausiids, and the immature Chinook salmon, Dolly Varden (*Salvelinus malma*), Lingcod (*Ophiodon elongatus*), and Pacific sandfish (*Trichodon trichodon*) consumed varying amounts of Pacific herring, Pacific sandlance (*Ammodytes personatus*), and digested/unidentified fish.

Juvenile salmon diets

Stomachs of 166 juvenile salmon were examined in the laboratory, fish examined for diet composition were the same fish analyzed for energy density (Table 12). Of the fish examined, 90% were feeding. Diet compositions differed by species and habitat (Figure 15). For the northern inshore habitat, juvenile sockeye salmon consumed fish (digested) and decapod larvae and juvenile coho and Chinook salmon consumed fish (digested and Pacific sandlance). For the northern strait habitat, juvenile pink, chum, and sockeye salmon consumed gelatinous prey (oikopleurans) and fish (digested) and juvenile coho salmon consumed fish (Gadidae). For the central strait habitat, juvenile pink salmon consumed fish (sculpins), gelatinous prey, and decapod larvae, juvenile chum salmon consumed euphausiid and decapod larvae, juvenile sockeye salmon consumed fish (digested) and decapod larvae, and juvenile coho salmon consumed fish (greenlings). For the central coastal habitat, euphausiids were consumed by all species; juvenile pink salmon also consumed gelatinous prey and amphipods and juvenile coho salmon also consumed fish (sandlance).

Summary

This document summarizes the trophic ecology and bioenergetics data of salmon collected during the 2021 SECM surveys in the northern and central regions of SEAK. These data continue to be used in conjunction with basin-scale data to 1) develop forecast models and predictive tools for pink salmon production in SEAK; 2) develop a Chinook salmon production index for SEAK; and 3) explore year-class strength relationships for other commercially important species. Subsets of the 25-year time series were also examined in recent ecosystem documents. Comparing annual effects of biophysical parameters to long term mean values permits climate-related changes in marine conditions to be detected. Long term monitoring of key stocks of juvenile salmon, on seasonal and interannual time scales, will permit researchers to understand how growth, abundance, and ecological interactions affect year-class strength of salmon in SEAK and to better understand their role in North Pacific marine ecosystems.

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TABLES AND FIGURES

Table 1. Localities and coordinates of stations sampled May–July 2021. Transect and station positions are shown in Figure 1.

Station[a]	Habitat	Latitude N	Longitude W	Bottom depth (m)
		Northern region		
SPA	Inshore	58° 10.76’	134° 16.70’	99
SPB		58° 12.37’	134° 26.52’	78
SPC		58° 13.91’	134° 37.85’	56
SPD		58° 18.38’	134° 42.97’	64
UCA	Strait	58° 04.57’	135° 00.08’	400
UCB		58° 06.22’	135° 00.91’	100
UCC		58° 07.95’	135° 01.69’	100
UCD		58° 09.64’	135° 02.52’	200
ISA		58° 13.25’	135° 31.76’	128
ISB		58° 14.22’	135° 29.26’	200
ISC		58° 15.28’	135° 26.65’	200
ISD		58° 16.38’	135° 23.98’	234
		Central region		
SSA	Strait	56° 04.25’	133° 57.44’	65
SSB		56° 02.44’	133° 54.11’	230
SSC		56° 01.14’	133° 51.42’	270
SSD		55° 59.65’	133° 48.46’	140
COA	Coastal	56° 08.62’	134° 40.22’	
COB		56° 04.25’	134° 35.72’	485
COC		56° 04.25’	134° 30.25’	330
COD		56° 04.25’	134° 24.85’	80
COE		56° 08.62’	134° 40.22’	680

[a]SP* = Stephens Passage; UC* = Upper Chatham Strait; IS* = Icy Strait

Table 2. Numbers and types of data collected in different habitats sampled monthly in marine waters of the northern and central regions of southeastern Alaska, May–July 2021.

		Data collection type			
Dates	Habitat	Rope trawl[a]	CTD cast[b]	Oblique bongo[c]	Water sample[d]
Northern region					
26 May	Strait	0	4	4	4
18-22 June	Inshore	7	7	2	4
	Strait	16	16	4	8
27-31 July	Inshore	8	8	2	4
	Strait	16	16	4	8
Central region					
2-3 August	Strait	4	4	4	4
	Coastal	4	4	4	4

[a] 20-min hauls with Nordic 264 surface trawl 18m wide by 24m deep
[b] To 200m or within 10m of the bottom
[c] 60-cm frame, 505- & 333-µm mesh, oblique tows down to & up from 200m or within 20m of bottom.
[d] chlorophyll are from surface seawater samples.

Table 3. Monthly surface (3-m) and top 20-m integrated temperatures (°C) and salinities (PSU) from CTD casts, surface chlorophyll-a and phaeopigment concentrations from water samples, and zooplankton standing stock (DV/m^3) and total density (number/m^3) from oblique bongo tows (333- and 505-µm mesh) collected May–July 2021. Each station was sampled once each month. Standing stock is computed using flowmeter readings and depth of tow to determine water volume filtered. A 1 ml zooplankton volume approximates 1 g biomass. Dashes indicate no samples. Asterisks indicate too much phytoplankton in sample to process zooplankton.

	Northern region										Central region			
	Inshore				Strait						Strait		Coastal	
	June		July		May		June		July		July		July	
	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
Temperature														
Surface (3-m)	9.5	0.1	11.9	0.5	7.6	0.5	11.2	1.2	13.5	0.5	9.6	1.2	10.2	1.0
20-m integrated	7.6	1.4	10.1	1.3	7.2	0.5	8.7	1.8	10.7	2.1	8.8	0.9	9.3	0.8
Salinity														
Surface (3-m)	17.1	1.8	18.6	0.9	30.8	0.5	27.0	2.2	23.2	2.4	31.5	0.2	30.6	0.8
20-m integrated	26.5	5.9	25.4	4.4	31.0	0.5	29.5	2.1	27.8	3.1	31.6	0.1	30.9	0.6
Chlorophyll-a														
Surface (3-m)	8.3	1.6	2.0	0.9	7.3	2.3	3.4	1.2	1.3	0.2	4.4	1.6	4.7	3.2
Phaeopigment														
Surface (3-m)	19.6	1.7	21.1	3.2	29.2	10.9	40.2	12.0	19.6	8.0	35.1	20.2	31.7	13.1
333-µm mesh														
Standing stock	0.4	0.1	0.3	0.0	1.4	0.5	1.0	0.2	0.8	0.1	1.1	0.4	0.3	0.1
Total density	*		*		3313	492	1292	185	1782	136	*		*	
505-µm mesh														
Standing stock	0.2	0.0	0.1	0.0	0.8	0.2	1.0	0.3	0.6	0.1	0.4	0.2	0.2	0.1
Total density	*		*		962	174	769	291	453	248	*		*	

Table 4. Monthly catch of jellyfish (kg) and fish (n) captured during June and July 2021. Stations in the central region were only sampled in July. See Table 2 for sampling effort by month, habitat, and region. Catches were not adjusted for standard 20-min trawl durations or vessel calibrations; see table 9 for standardized catch values.

		Northern region				Central region	
		Inshore		Strait		Strait	Coastal
Species	Scientific name	June	July	June	July	July	July
Jellyfish (kg)	*Aequorea* spp.	0.2	81.0	1.1	73.0	133.8	18.9
	Aurelia spp.	0.2	231.9	0.3	50.6	30.4	9.0
	Chrysaora melanaster	0	0.2	0.4	0.7	4.1	2.0
	Cyanea capillata	3.6	55.5	2.5	119.9	77.5	52.2
	Phacellophora spp.	8.8	0	3.2	1.5	0	5.1
	Polyorchis spp.	0	0	0.02	0	0	0
	Salps	0	0	0	0	0	3.8
	Staurophora mertensi	0	11.8	2.1	12.4	0	2.0
	Other	0	0	0	0	0.2	0.01
Jellyfish subtotals		**12.8**	**380.4**	**9.62**	**258.1**	**246**	**93.01**
Salmon (*n*)							
Pink (juvenile)	*Oncorhynchus gorbuscha*	0	0	154	128	9	3
Chum (juvenile)	*O. keta*	0	0	1,133	179	3	5
Sockeye (juvenile)	*O. nerka*	1	30	61	14	3	10
Coho (juvenile)	*O. kisutch*	0	16	112	21	12	13
Chinook (juvenile)	*O. tshawytscha*	2	13	1	0	0	2
Pink (adult)	*O. gorbuscha*	0	0	1	0	2	1
Chum (adult)	*O. keta*	0	0	1	1	0	0
Sockeye (adult)	*O. nerka*	0	1	0	0	0	0
Coho (adult)	*O. kisutch*	0	0	0	0	1	0
Chinook (imm/adult)	*O. tshawytscha*	3	0	1	0	0	0
Salmon subtotals		**6**	**60** **0**	**1,464**	**343** **0**	**30** **0**	**34**

Species	Scientific name	Northern region				Central region	
		Inshore		Strait		Strait	Coastal
		June	July	June	July	July	July
Non-salmon							
Pacific herring	*Clupea pallasii*	1,726	548	2,264	9	0	0
Soft sculpin	*Gilbertidia sigalutes*	61	2	9	0	0	0
Capelin	*Mallotus villosus*	43	0	0	0	0	0
Crested sculpin	*Blepsias bilobus*	4	14	5	10	0	0
Starry flounder	*Platichthys stellatus*	28	1	1	0	0	0
Spiny lumpsucker	*Eumicrotremus orbis*	7	17	2	0	0	0
Pacific sandfish	*Trichodon trichodon*	8	9	0	0	0	0
Pollock	*Gadus chalcogramma*	2	7	1	1	0	6
Pollock larvae	*Gadus chalcogramma*	0	1	10	0	0	3
Wolf-eel	*Anarrhichthys ocellatus*	0	0	2	1	4	0
Big mouth sculpin	*Hemitripterus bolini*	3	0	2	0	0	0
Prowfish	*Zaprora silenus*	0	1	0	2	0	1
River lamprey	*Lampetra ayresi*	0	2	0	0	0	0
Pacific cod	*Gadus macrocephalus*	0	0	0	0	0	1
Lingcod	*Ophiodon elongatus*	0	1	0	0	0	0
Squid	Gonatidae	0	0	0	0	0	1
Dolly varden	*Salvelinus malma*	1	0	0	0	0	0
Non-salmon subtotals		**1,883**	**603**	**2,296**	**23**	**4**	**12**

Table 5. Estimated fishing power coefficients for juvenile salmon catches of vessels used during the Southeast Alaska Coastal Monitoring survey (from Wertheimer et al. 2008, 2009, and 2010).

Species	Medeia:Cobb	Chellissa:Cobb[1]	Steller:Cobb[2]	Medeia:Steller	Chellissa:Medeia
Pink	1.13	1.44	0.96	1.18	1.27
Chum	1.21	1.44	1.16	1.04	1.19
Sockeye	1.19	1.18	1.05	1.13	0.99
Coho	1.26	1.32	0.85	1.48	1.05
Pooled Salmon	1.19	1.36	1.05	1.13	1.14

[1] calculated from Chellissa:Medeia and Medeia:Cobb

[2] calculated from Steller:Medeia (inverse of Medeia:Steller) and Medeia:Cobb

Table 6. Average calibrated catches [ln(CPUE+1); pooled-salmon coefficients] by year, vessel, and month for juvenile salmon species in the strait habitat of the northern region during June and July, 1997-2021.

		June					July				
Year	Vessel	Pink	Chum	Sockeye	Coho	Chinook	Pink	Chum	Sockeye	Coho	Chinook
1997	Cobb	1.92	3.14	2.10	2.23	0.26	2.48	3.86	1.31	1.04	0.00
1998	Cobb	5.62	4.67	2.15	1.95	0.09	4.03	3.30	2.35	2.50	0.21
1999	Cobb	1.18	3.09	1.61	2.12	0.14	1.60	2.12	0.93	2.27	0.14
2000	Cobb	1.55	2.62	1.80	1.54	0.06	3.73	4.71	1.90	2.15	0.49
2001	Cobb	1.33	2.57	1.54	2.09	0.48	2.87	2.82	1.40	2.13	0.36
2002	Cobb	0.36	0.98	0.41	0.57	0.26	2.78	3.13	1.46	2.30	0.11
2003	Cobb	0.77	1.91	1.43	0.18	0.09	3.08	3.10	1.32	1.37	0.00
2004	Cobb	3.90	4.96	2.22	1.66	0.29	1.46	1.28	0.65	0.87	0.13
2005	Cobb	2.04	3.21	1.57	2.28	0.28	1.21	1.13	0.53	1.34	0.17
2006	Cobb	2.58	2.36	2.23	2.49	0.00	2.32	2.10	0.71	2.01	0.16
2007	Cobb	0.27	1.39	1.56	2.49	0.53	1.17	1.58	1.14	1.29	0.17
2008	Steller	0.00	0.00	0.00	0.08	0.08	2.32	2.36	1.27	1.92	0.37
2009	Chellissa	--	--	--	--	--	2.33	2.96	1.01	2.06	0.04
2010	NW Exp	4.01	2.76	2.03	2.11	0.17	4.11	2.95	2.05	1.96	0.06
2011	NW Exp	0.58	1.04	0.82	0.94	0.00	1.51	1.11	0.31	0.99	0.02
2012	NW Exp	1.74	1.32	0.74	1.13	0.12	3.52	3.14	2.00	2.16	0.08
2013	NW Exp	0.52	0.96	0.79	1.36	0.24	2.14	3.12	2.04	1.69	0.11
2014	NW Exp	2.68	2.66	2.34	1.65	0.00	3.80	2.51	2.30	2.02	0.06
2015	NW Exp	2.45	2.82	1.72	2.22	0.32	0.92	0.87	0.24	1.92	0.09
2016	NW Exp	4.35	3.33	2.45	2.48	0.18	3.41	2.81	1.69	1.88	0.02
2017	NW Exp	0.00	0.62	0.43	1.95	0.13	0.35	0.53	0.40	1.11	0.03
2018	Medeia	0.00	0.54	0.57	0.81	0.00	1.17	1.76	0.32	0.63	0.00
2019	Medeia	0.63	2.08	1.40	1.56	0.07	1.14	1.71	0.81	0.75	0.04
2020	Medeia	0.90	2.48	1.21	0.30	0.58	2.20	2.02	0.87	1.10	0.00
2021	Medeia	0.85	2.35	0.90	1.28	0.04	0.87	1.09	0.33	0.47	0.00

Table 7. Monthly mean length (mm, fork), weight (g), condition residuals (CR) from length-weight regression analysis, and energy density (kJ/g) of juvenile salmon captured during June and July 2021.

	June			July			June			July		
Factor	n	mean	sd	n	mean	sd	n	mean	sd	n	mean	sd
Northern region												
	Inshore habitat						Strait habitat					
Pink salmon												
Length	—	—	—	—	—	—	49	80	9	88	126	15
Weight	—	—	—	—	—	—	49	4.3	1.6	88	17.8	6.6
CR	—	—	—	—	—	—	49	-0.24	0.07	88	-0.24	0.06
Energy	—	—	—	—	—	—	10	21.6	0.5	10	20.6	0.3
Chum salmon												
Length	—	—	—	—	—	—	247	93	13	120	137	15
Weight	—	—	—	—	—	—	247	7.6	4.2	120	26.1	8.9
CR	—	—	—	—	—	—	247	-0.26	0.08	120	-0.32	0.07
Energy	—	—	—	—	—	—	10	21.1	0.6	10	20.3	0.4
Sockeye salmon												
Length	1	74		28	81	11	61	114	24	14	128	21
Weight	1	2.8		28	4.7	2.3	61	15.6	11.1	14	21.5	11.2
CR	1	-0.29		28	-0.25	0.09	61	-0.26	0.08	14	-0.16	0.06
Energy	—	—	—	10	21.3	0.4	10	20.5	0.6	13	21.9	0.7
Coho salmon												
Length	—	—	—	16	200	27	112	151	19	21	194	21
Weight	—	—	—	16	90.4	38.1	112	40.3	15	21	83.1	27.7
CR	—	—	—	16	-0.18	0.06	112	-0.43	0.09	21	-0.14	0.06
Energy	—	—	—	10	20.8	0.5	10	20.9	0.4	10	20.6	0.4
Chinook salmon												
Length	2	121	34	13	167	16	1	189		—	—	—
Weight	2	23.9	22.3	13	55.9	16.4	1	75.8		—	—	—
CR	2	-0.07	0.17	13	-0.03	0.04	1	-0.07		—	—	—
Energy	2	20.0	0.4	13	21.0	0.5	1	20.7		—	—	—

	June			July			June			July		
Factor	n	mean	sd	n	mean	sd	n	mean	sd	n	mean	sd
Central region												
	Strait habitat						Coastal habitat					
Pink salmon												
Length	—	—	—	9	160	12	—	—	—	3	158	15
Weight	—	—	—	9	38.6	9.9	—	—	—	3	39.5	12.9
CR	—	—	—	9	-0.13	0.07	—	—	—	3	-0.03	0.04
Energy	—	—	—	9	22.1	0.9	—	—	—	3	22.5	0.4
Chum salmon												
Length	—	—	—	3	161	9	—	—	—	5	189	22
Weight	—	—	—	3	37.8	8	—	—	—	5	71.3	28.2
CR	—	—	—	3	-0.16	0.06	—	—	—	5	-0.08	0.06
Energy	—	—	—	3	20.5	0.3	—	—	—	5	21.2	0.8
Sockeye salmon												
Length	—	—	—	3	145	3	—	—	—	10	177	16
Weight	—	—	—	3	27.3	1.6	—	—	—	10	59.5	17.3
CR	—	—	—	3	-0.15	0.01	—	—	—	10	-0.09	0.05
Energy	—	—	—	3	22.0	0.3	—	—	—	10	22.6	0.6
Coho salmon												
Length	—	—	—	12	186	11	—	—	—	12	230	19
Weight	—	—	—	12	70.5	11.9	—	—	—	12	144.3	33.8
CR	—	—	—	12	-0.16	0.07	—	—	—	12	-0.08	0.05
Energy	—	—	—	12	20.1	0.6	—	—	—	12	21.1	0.4
Chinook salmon												
Length	—	—	—	—	—	—	—	—	—	2	234	18
Weight	—	—	—	—	—	—	—	—	—	2	159.7	39.2
CR	—	—	—	—	—	—	—	—	—	2	-0.06	0.01
Energy	—	—	—	—	—	—	—	—	—	2	22.7	0.5

Table 8. Origin information decoded from coded-wire tags (CWT) recovered from coho and Chinook salmon lacking an adipose fin captured during June and July 2021. Dashes indicate no sample.

				Northern region				Central region	
				Inshore		Strait		Strait	Coastal
Species	CWT code	Agency	Release site	June	July	June	July	July	July
Chinook	030182	NMFS	Little Port Walter, AK	—	—	1	—	—	—
	030188	NMFS	Little Port Walter, AK	—	1	—	—	—	—
	No tag			—	1	—	—	—	1
Coho	045062	ADFG	Taku River, AK	—	—	1	—	—	—
	045422	ADFG	Chilkat River, AK	—	—	1	—	—	—
	045492	DIPAC	Gastineau Channel, AK	—	—	3	—	—	—
	No tag			—	—	—	—	—	1

NMFS = National Marine Fisheries Service
ADFG = Alaska Department of Fish and Game
DIPAC = Douglas Island Pink and Chum

Table 9. Information on juvenile chum salmon released from regional enhancement sites and captured during June and July 2021. Factor includes length (mm, fork), weight (g), and condition residual (CR) from length-weight regression analysis and are reported for each Agency - Release site. LL in Agency - Release site denotes a late, large release strategy was used. Dashes indicate no samples. No chum salmon were caught in the Northern region inshore habitat.

	Northern region						**Central region**					
	Strait habitat						Strait habitat			Coastal habitat		
	June			July			July			July		
Factor	n	mean	sd	n	mean	sd	n	mean	sd	n	mean	sd
					DIPAC – multiple sites							
Length	180	90	9.2	67	136	16.1	—	—	—	—	—	—
Weight	180	6.5	2.3	67	25.2	9.5	—	—	—	—	—	—
CR	180	-0.08	0.07	67	-0.02	0.07	—	—	—	—	—	—
					NSRAA – Bear Cove LL							
Length	1	112	1	—	—	—	—	—	—	—	—	—
Weight	1	12.8	1	—	—	—	—	—	—	—	—	—
CR	1	-0.04	1	—	—	—	—	—	—	—	—	—
					NSRAA – Burnett Inlet (fall)							
Length	1	87		—	—	—	—	—	—	—	—	—
Weight	1	5.4		—	—	—	—	—	—	—	—	—
CR	1	-0.11		—	—	—	—	—	—	—	—	—
					NSRAA – Deep Inlet							
Length	1	86	—	—	—	—	—	—	—	—	—	—
Weight	1	5.4	—	—	—	—	—	—	—	—	—	—
CR	1	-0.07	—	—	—	—	—	—	—	—	—	—
					NSRAA – Hidden Falls							
Length	21	98	11.7	23	138	12.7	—	—	—	—	—	—
Weight	21	8.6	3.4	23	27.4	7.9	—	—	—	—	—	—
CR	21	-0.09	0.08	23	0.04	0.06	—	—	—	—	—	—

	Northern region						Central region					
	Strait habitat						Strait habitat			Coastal habitat		
	June			July			July			July		
Factor	n	mean	sd	n	mean	sd	n	mean	sd	n	mean	sd
					NSRAA – SE Cove LL							
Length	—	—	—	3	135	12.3	—	—	—	—	—	—
Weight	—	—	—	3	24.8	6.7	—	—	—	—	—	—
CR	—	—	—	3	0.03	0.02	—	—	—	—	—	—
					SSRAA – McLean							
Length	—	—	—	1	152		—	—	—	—	—	—
Weight	—	—	—	1	35.4		—	—	—	—	—	—
CR	—	—	—	1	0.03		—	—	—	—	—	—
					SSRAA – Nakat Inlet (summer)							
Length	2	86	4.9	4	138	9.3	—	—	—	—	—	—
Weight	2	5.4	0.7	4	26.5	6.5	—	—	—	—	—	—
CR	2	-0.1	0.04	4	0.03	0.06	—	—	—	—	—	—
					SSRAA – Neet's Bay (summer)							
Length	—	—	—	2	154	9.2	1	153	—	3	181	26.6
Weight	—	—	—	2	35.6	7.7	1	31.7	—	3	64.0	36.6
CR	—	—	—	2	-0.01	0.03	1	-0.1	—	3	-0.01	0.09
					AKI – Port Armstrong LL							
Length	8	130	8.5	—	—	—	—	—	—	—	—	—
Weight	8	20.5	5.4	—	—	—	—	—	—	—	—	—
CR	8	-0.05	0.08	—	—	—	—	—	—	—	—	—
					Unmarked							
Length	26	100	16.8	14	138	16	1	160		2	201	7.1
Weight	26	9.7	5.8	14	27	10.1	1	34.6906		2	82.3	9.3
CR	26	-0.06	0.07	14	0	0.07	1	-0.15		2	0	0

AKI = Armstrong Keta, Inc.; DIPAC = Douglas Island Pink and Chum; NSRAA = Northern Southeast Regional Aquaculture Association; SSRAA = Southern Southeast Regional Aquaculture Association

Table 10. Information on juvenile sockeye salmon released from regional enhancement sites and captured during June and July 2021. Factor includes length (mm, fork), weight (g), and condition residual (CR) from length-weight regression analysis and are reported for each Agency - Release site. ER in Agency - Release site denotes an early release strategy was used. See Table 11 for Agency acronyms. Dashes indicate no samples.

	Northern region												**Central region**					
	Inshore habitat						Strait habitat						Strait habitat			Coastal habitat		
	June			July			June			July			July			July		
Factor	n	mean	sd	n	mean	sd	n	mean	sd	n	mean	sd	n	mean	sd	n	mean	sd
							DIPAC – Speel Arm											
Length	—	—	—	—	—	—	6	113	18.1	2	162	7.1	—	—	—	—	—	—
Weight	—	—	—	—	—	—	6	15.2	7.2	2	42.3	6.3	—	—	—	—	—	—
CR	—	—	—	—	—	—	6	-0.03	0.10	2	-0.04	0.01	—	—	—	—	—	—
							DIPAC – Tatsamenie Lake											
Length	—	—	—	—	—	—	1	120		—	—	—	—	—	—	—	—	—
Weight	—	—	—	—	—	—	1	18.0123		—	—	—	—	—	—	—	—	—
CR	—	—	—	—	—	—	1	0.05		—	—	—	—	—	—	—	—	—
							DIPAC – Tatsamenie Lake ER											
Length	—	—	—	2	76	0.7	2	90	0	—	—	—	—	—	—	—	—	—
Weight	—	—	—	2	3.9	0.3	2	5.9	0.2	—	—	—	—	—	—	—	—	—
CR	—	—	—	2	-0.06	0.05	2	-0.16	0.04	—	—	—	—	—	—	—	—	—
							Unmarked											
Length	1	74		24	81	11.2	48	116	25	12	123	16.6	3	145	3.1	10	177	15.5
Weight	1	2.8		24	4.9	2.4	48	16.6	11.8	12	18.0	7.3	3	27.3	1.6	10	59.5	17.3
CR	1	-0.28		24	-0.10	0.09	48	-0.08	0.08	12	-0.07	0.06	3	-0.13	0.01	10	0.00	0.05

Table 11. Information on stomachs from 26 potential predators of juvenile salmon captured in the inshore and strait habitats during June and July 2021. Factors include fork length (mm), wet weight (g), stomach content as percent body weight (%BW), number with empty stomachs, and number with juvenile salmon in stomachs (w/ salmon). Dash indicates no samples.

	June			July			June			July		
Factor	n	mean	sd	n	mean	sd	n	mean	sd	n	mean	sd
						Northern region						
	Inshore habitat						Strait habitat					
						Chinook salmon (immature/adult)						
Length	3	355	54	—	—	—	1	338		—	—	—
Weight	3	596	272	—	—	—	1	544		—	—	—
%BW	3	1.2	0.9	—	—	—	1	2.2		—	—	—
# empty	0			—	—	—	0			—	—	—
w/ salmon	0			—	—	—	0			—	—	—
						Chum salmon (adult)						
Length	—	—	—	—	—	—	1	661		1	550	
Weight	—	—	—	—	—	—	1	3,900		1	1,858	
%BW	—	—	—	—	—	—	1	0.0		1	0.3	
# empty	—	—	—	—	—	—	1			1		
w/ salmon	—	—	—	—	—	—	0			0		
						Pink salmon (adult)						
Length	—	—	—	—	—	—	1	534		—	—	—
Weight	—	—	—	—	—	—	1	1,860		—	—	—
%BW	—	—	—	—	—	—	1	0.0		—	—	—
# empty	—	—	—	—	—	—	1			—	—	—
w/ salmon	—	—	—	—	—	—	0			—	—	—
						Sockeye salmon (adult)						
Length	—	—	—	2	388	98	—	—	—	—	—	—
Weight	—	—	—	2	835	566	—	—	—	—	—	—
%BW	—	—	—	2	0.0	0.0	—	—	—	—	—	—
# empty	—	—	—	2			—	—	—	—	—	—
w/ salmon	—	—	—	0			—	—	—	—	—	—
						Dolly varden						
Length	1	308		—	—	—	—	—	—	—	—	—
Weight	1	317		—	—	—	—	—	—	—	—	—
%BW	1	0.8		—	—	—	—	—	—	—	—	—
# empty	0			—	—	—	—	—	—	—	—	—
w/ salmon	0			—	—	—	—	—	—	—	—	—

Factor	June n	June mean	June sd	July n	July mean	July sd	June n	June mean	June sd	July n	July mean	July sd
					Lingcod							
Length	—	—	—	1	586		—	—	—	—	—	—
Weight	—	—	—	1	2,114		—	—	—	—	—	—
%BW	—	—	—	1	0.1		—	—	—	—	—	—
# empty	—	—	—	0			—	—	—	—	—	—
w/ salmon	—	—	—	0			—	—	—	—	—	—
					Pacific sandfish							
Length	—	—	—	9	193	9	—	—	—	—	—	—
Weight	—	—	—	9	106	22	—	—	—	—	—	—
%BW	—	—	—	9	3.3	4.2	—	—	—	—	—	—
# empty	—	—	—	4			—	—	—	—	—	—
w/ salmon	—	—	—	0			—	—	—	—	—	—
					Central region							
	Strait habitat						Coastal habitat					
					Pink salmon (adult)							
Length	—	—	—	2	457	11	—	—	—	3	474	67
Weight	—	—	—	2	968	134	—	—	—	3	1,103	590
%BW	—	—	—	2	0.0	0.0	—	—	—	3	0.0	0.0
# empty	—	—	—	2			—	—	—	2		
w/ salmon	—	—	—	0			—	—	—	0		
					Coho salmon (adult)							
Length	—	—	—	1	513		—	—	—	—	—	—
Weight	—	—	—	1	1435		—	—	—	—	—	—
%BW	—	—	—	1	0.0		—	—	—	—	—	—
# empty	—	—	—	1			—	—	—	—	—	—
w/ salmon	—	—	—	0			—	—	—	—	—	—

Table 12. Information on stomachs from 166 juvenile salmon captured in the inshore and strait habitats during June and July 2021. Factors include fork length (mm), wet weight (g), stomach content as percent body weight (%BW), and number with empty stomachs. Dash indicates no samples.

	June			July			June			July		
Factor	n	mean	sd	n	mean	sd	n	mean	sd	n	mean	sd
						Northern region						
	Inshore habitat						Strait habitat					
						Pink salmon						
Length	—	—	—	—	—	—	10	78	2	10	111	3
Weight	—	—	—	—	—	—	10	4.4	0.4	10	14.3	1.2
%BW	—	—	—	—	—	—	10	1.5	0.7	10	1.1	0.3
# empty	—			—			1			0		
						Chum salmon						
Length	—	—	—	—	—	—	10	83	3	10	124	2
Weight	—	—	—	—	—	—	10	5.6	0.4	10	20.4	0.8
%BW	—	—	—	—	—	—	10	1.3	0.8	10	1.7	0.6
# empty	—			—			2			0		
						Sockeye salmon						
Length	—	—	—	10	77	3	10	101	11	13	118	18
Weight	—	—	—	10	4.7	0.7	10	10.2	3.7	13	19.5	8.9
%BW	—	—	—	10	1.2	0.9	10	1.6	1.2	13	0.9	0.6
# empty	—			0			0			1		
						Coho salmon						
Length	—	—	—	10	198	11	10	148	2	10	194	16
Weight	—	—	—	10	93	16.4	10	40.1	2.1	10	91	24.9
%BW	—	—	—	10	1.5	2.0	10	2.9	1.3	10	1.59	1.4
# empty	—			2			0			0		
						Chinook salmon						
Length	2	120	36	13	161	15	1	180		—	—	—
Weight	2	23.9	22.3	13	55.9	16.4	1	75.8		—	—	—
%BW	2	2.8	2.9	13	0.8	0.8	1	0		—	—	—
# empty	0			4			1			—		
						Central region						
	Strait habitat						Coastal habitat					
						Pink salmon						
Length	—	—	—	9	151	12	—	—	—	3	151	14
Weight	—	—	—	9	38.6	9.9	—	—	—	3	39.5	12.9
%BW	—	—	—	9	1.1	1.0	—	—	—	3	0.8	0.4
# empty	—			1						0		

Factor	June			July			June			July		
	n	mean	sd	n	mean	sd	n	mean	sd	n	mean	sd
					Chum salmon							
Length	—	—	—	3	152	9	—	—	—	5	180	22
Weight	—	—	—	3	37.8	8	—	—	—	5	71.3	28.2
%BW	—	—	—	3	1.1	1.3	—	—	—	5	1.9	0.9
# empty	—			1			—			0		
					Sockeye salmon							
Length	—	—	—	3	138	2	—	—	—	10	169	15
Weight	—	—	—	3	27.3	1.6	—	—	—	10	59.5	17.3
%BW	—	—	—	3	1.6	0.2	—	—	—	10	1.7	1.3
# empty	—			0			—			0		
					Coho salmon							
Length	—	—	—	12	179	11	—	—	—	12	223	18
Weight	—	—	—	12	70.5	11.9	—	—	—	12	144.3	33.8
%BW	—	—	—	12	2.9	2.1	—	—	—	12	0.9	0.7
# empty	—			0			—			2		
					Chinook salmon							
Length	—	—	—	—	—	—	—	—	—	2	222	18
Weight	—	—	—	—	—	—	—	—	—	2	159.7	39.2
%BW	—	—	—	—	—	—	—	—	—	2	0.1	0.1
# empty	—			—			—			1		

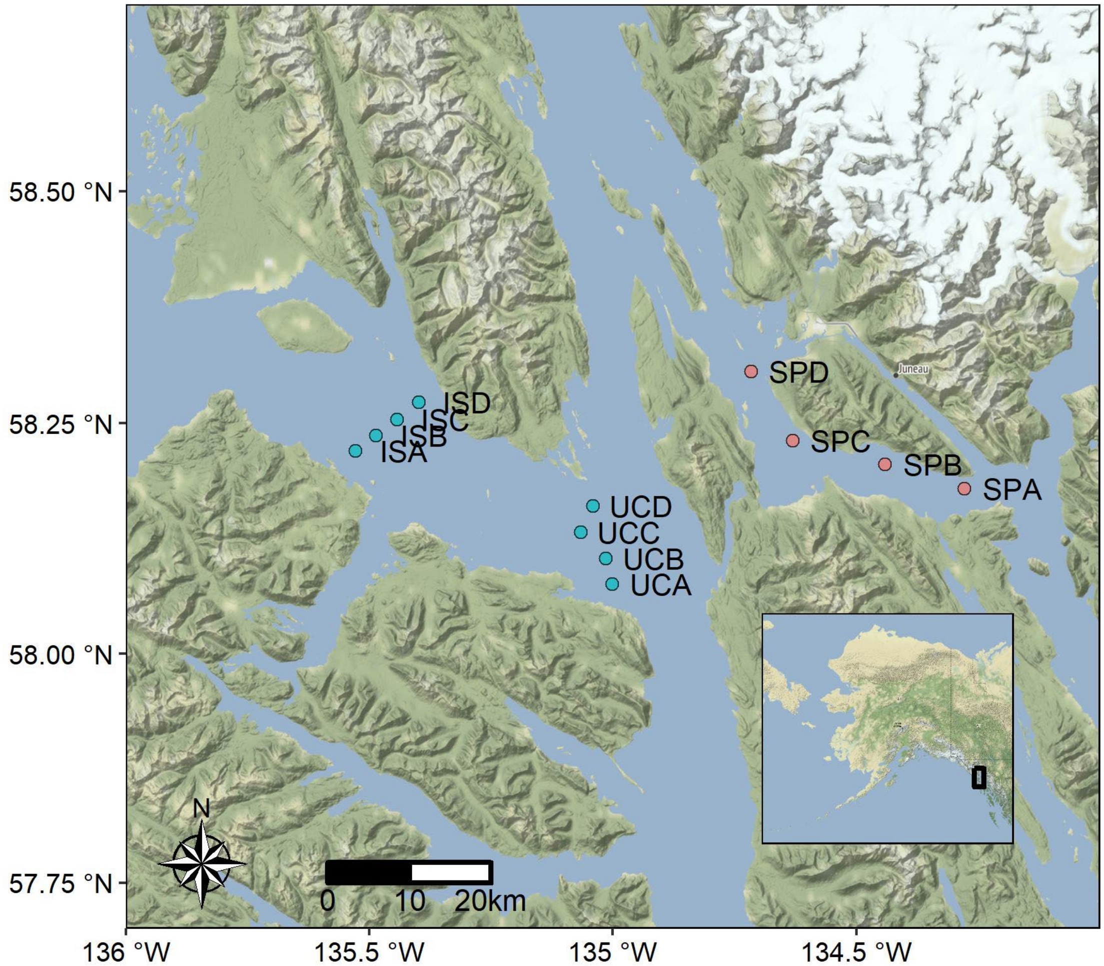

Figure 1. Stations sampled in the Northern region of Southeast Alaska during May-July 2021. See Table 1 for stations details.

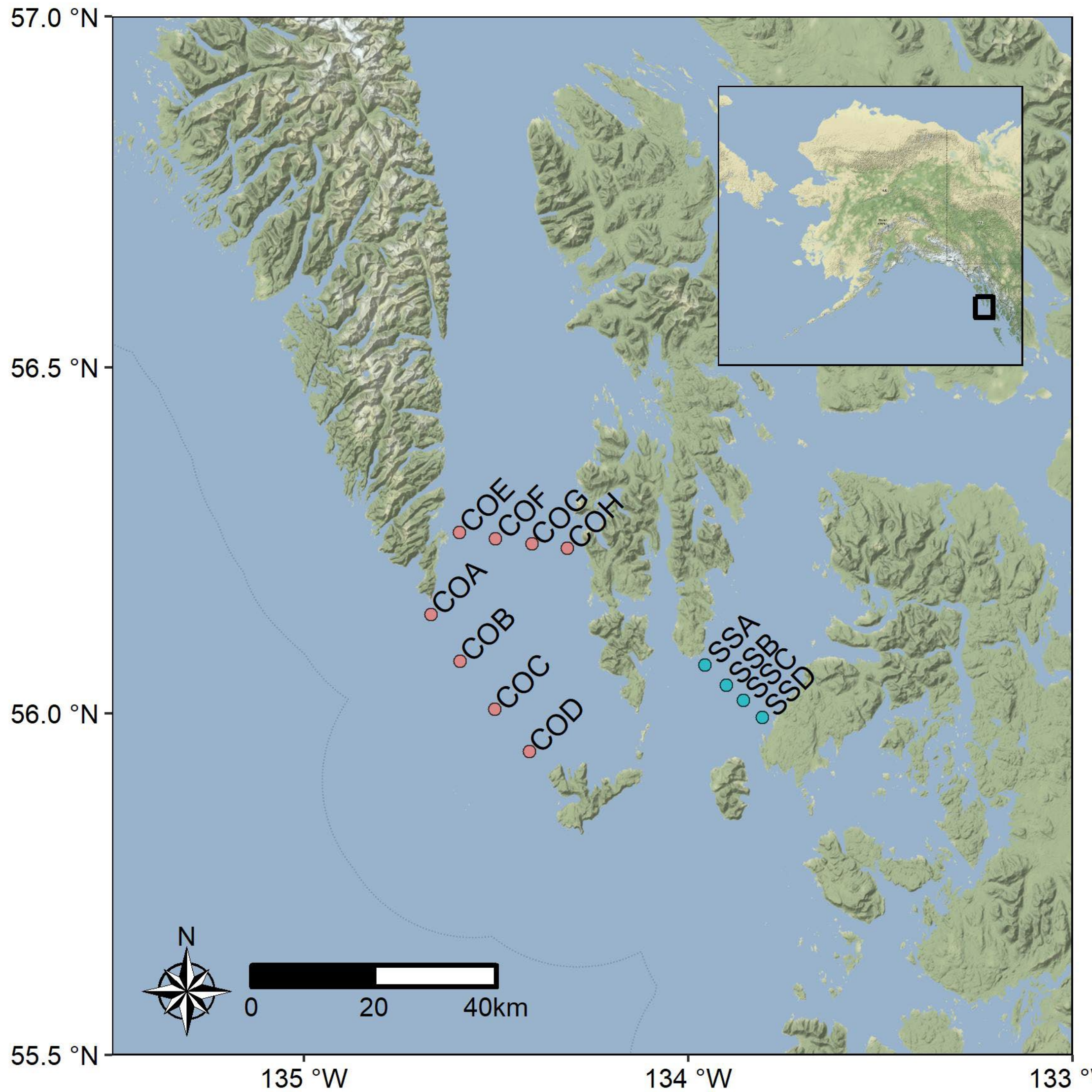

Figure 2. Stations sampled in the Central region of Southeast Alaska during July 2021. See Table 1 for stations details.

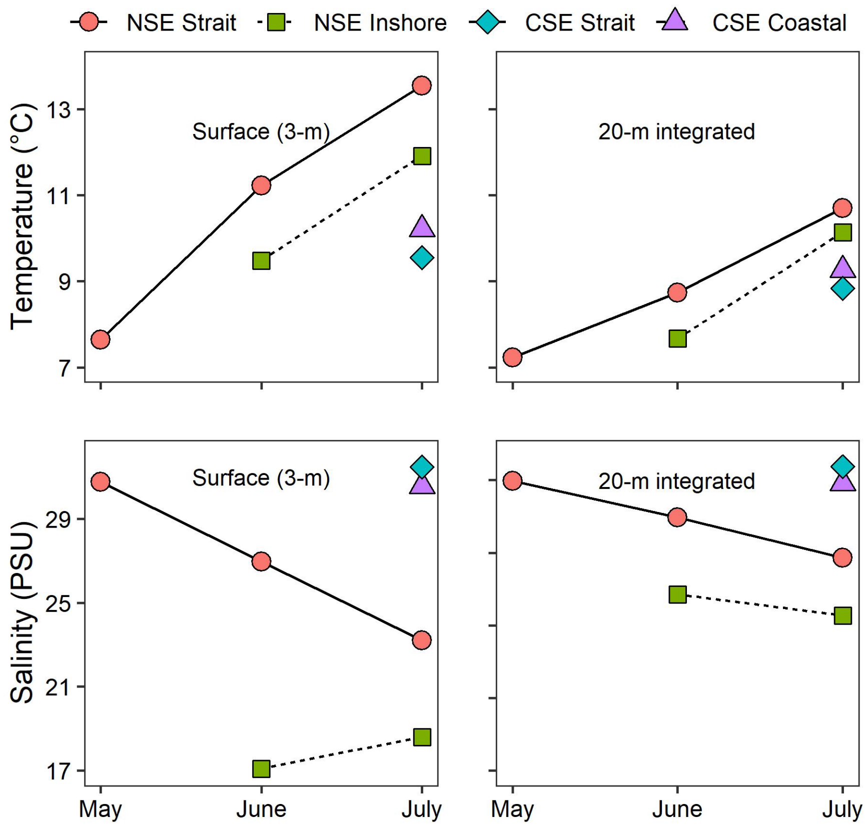

Figure 3. Mean surface (3-m) and 20-m integrated temperature (°C; average of top 20 m temperatures) and salinity (PSU) measured during May-July 2021. The surface measures represent the active segment of the water column, while the 20-m represent more stable waters sampled by trawl. The central region (CSE) stations were only sampled in July.

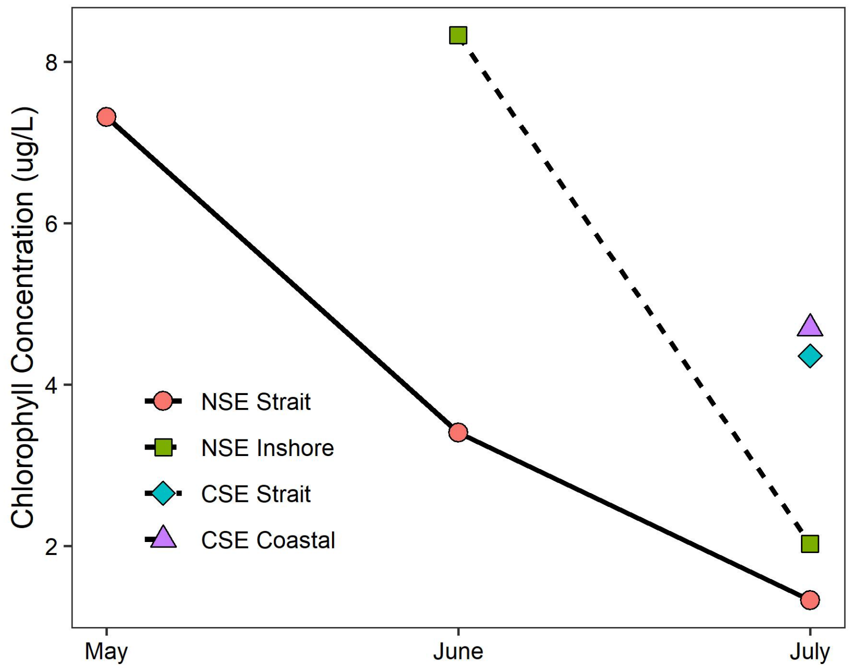

Figure 4. Mean chlorophyll-a concentration (µg/L) from surface water samples collected May-July 2021. Central region stations were only sampled in July.

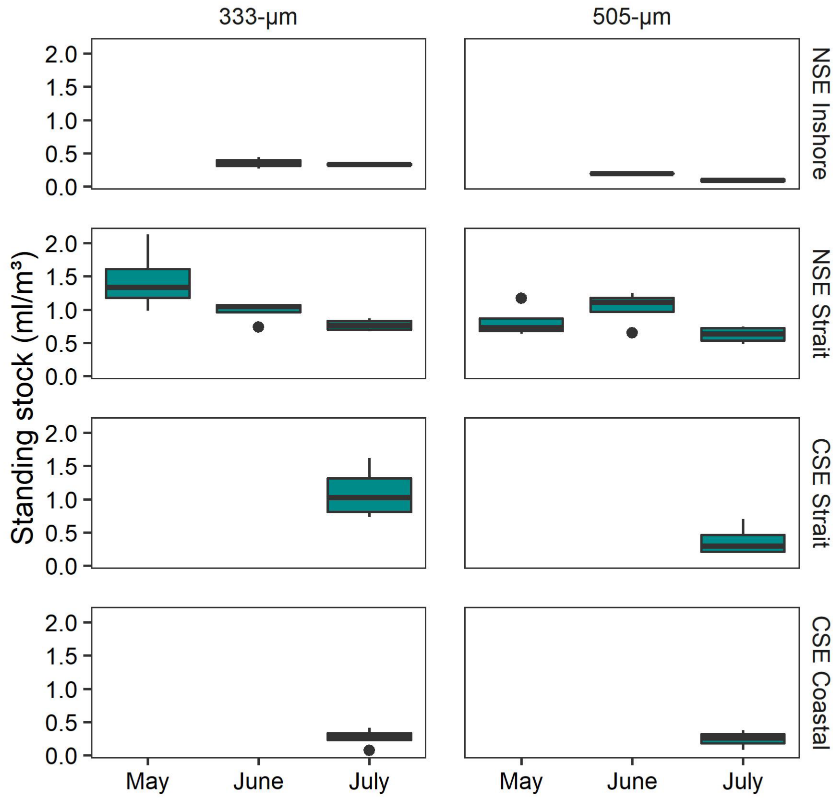

Figure 5. Monthly zooplankton standing stock (ml/m^3) from 333- and 505-µm mesh oblique bongo net samples towed from ≤ 200-m depths during daylight, May-July 2021. Horizontal bars represent medians and box widths are the 25th and 75th percentiles. Whiskers extend 1.5 times the box span (interquartile range).

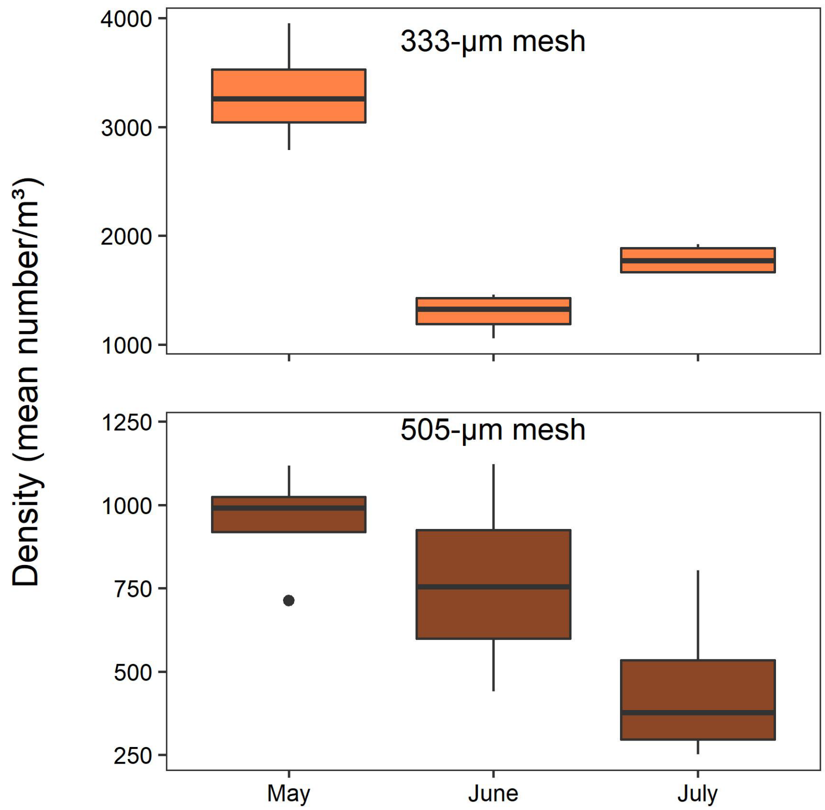

Figure 6. Monthly zooplankton density from 333- and 505-um mesh bongo net samples towed obliquely from ≤ 200-m depths during daylight in Icy Strait, May-July 2021. Horizontal bars represent medians and box heights are the 25th and 75th percentiles. Whiskers extend 1.5 times the box span (interquartile range).

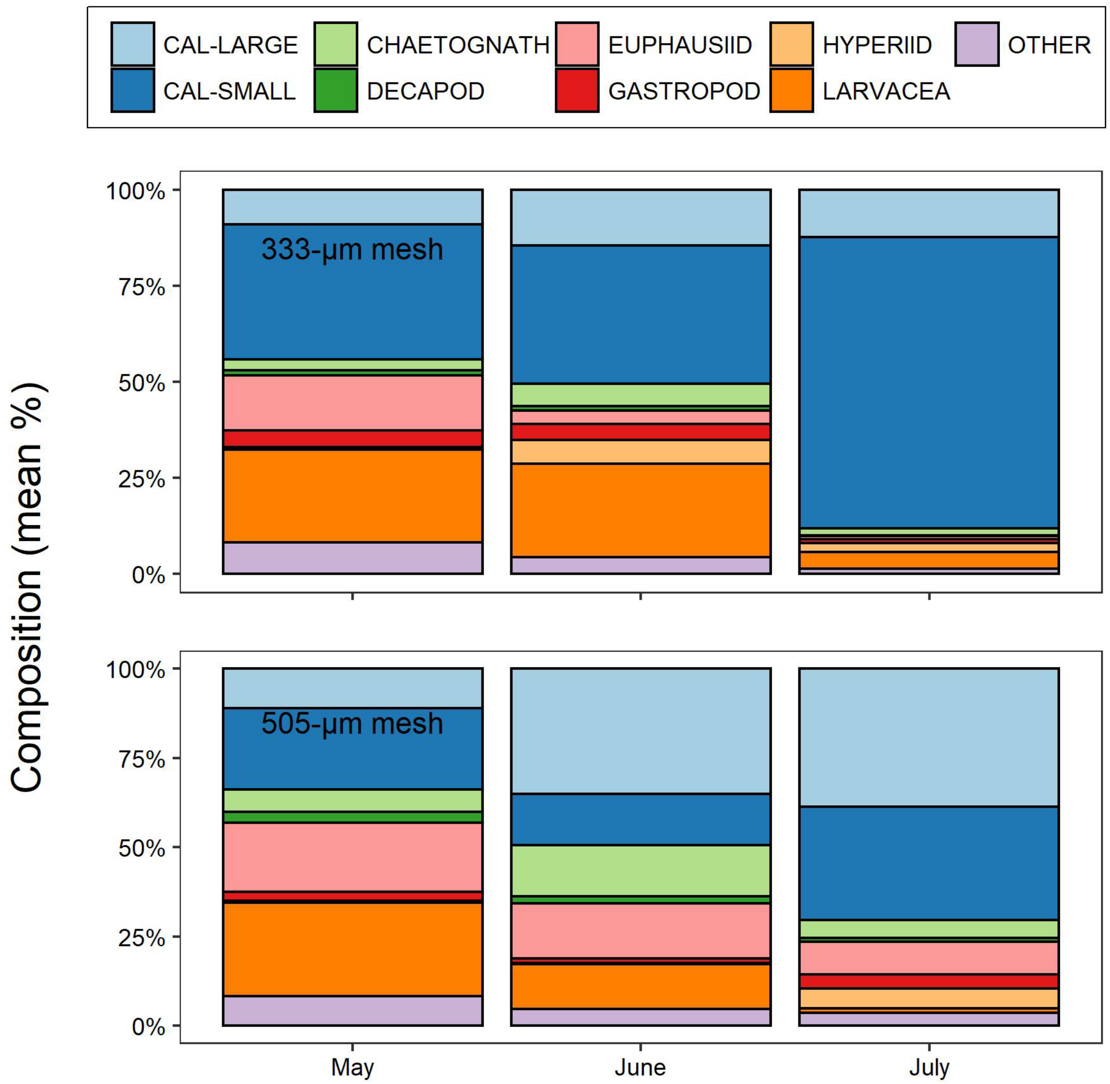

Figure 7. Monthly zooplankton taxonomic composition from 333- and 505-um mesh bongo net samples towed obliquely from ≤ 200-m depths during daylight in Icy Strait, May-July 2021. Cal-large and Cal-small are calanoid copepods.

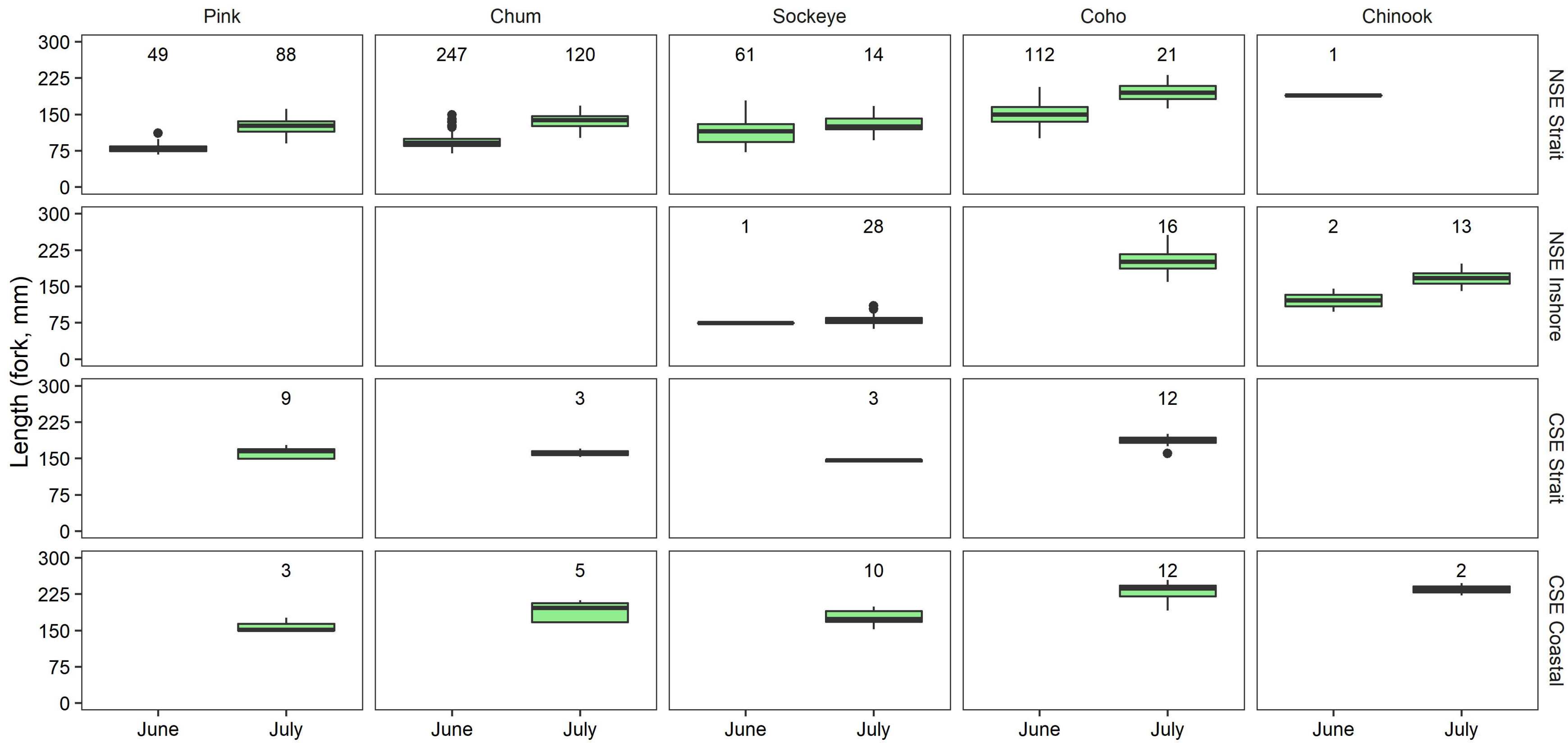

Figure 8. Monthly length (mm, fork) distributions of juvenile salmon caught during June and July 2021. Sample sizes are given as numbers in each box. Horizontal bars represent medians and box widths are the 25th and 75th percentiles. Whiskers extend 1.5 times the box span (interquartile range).

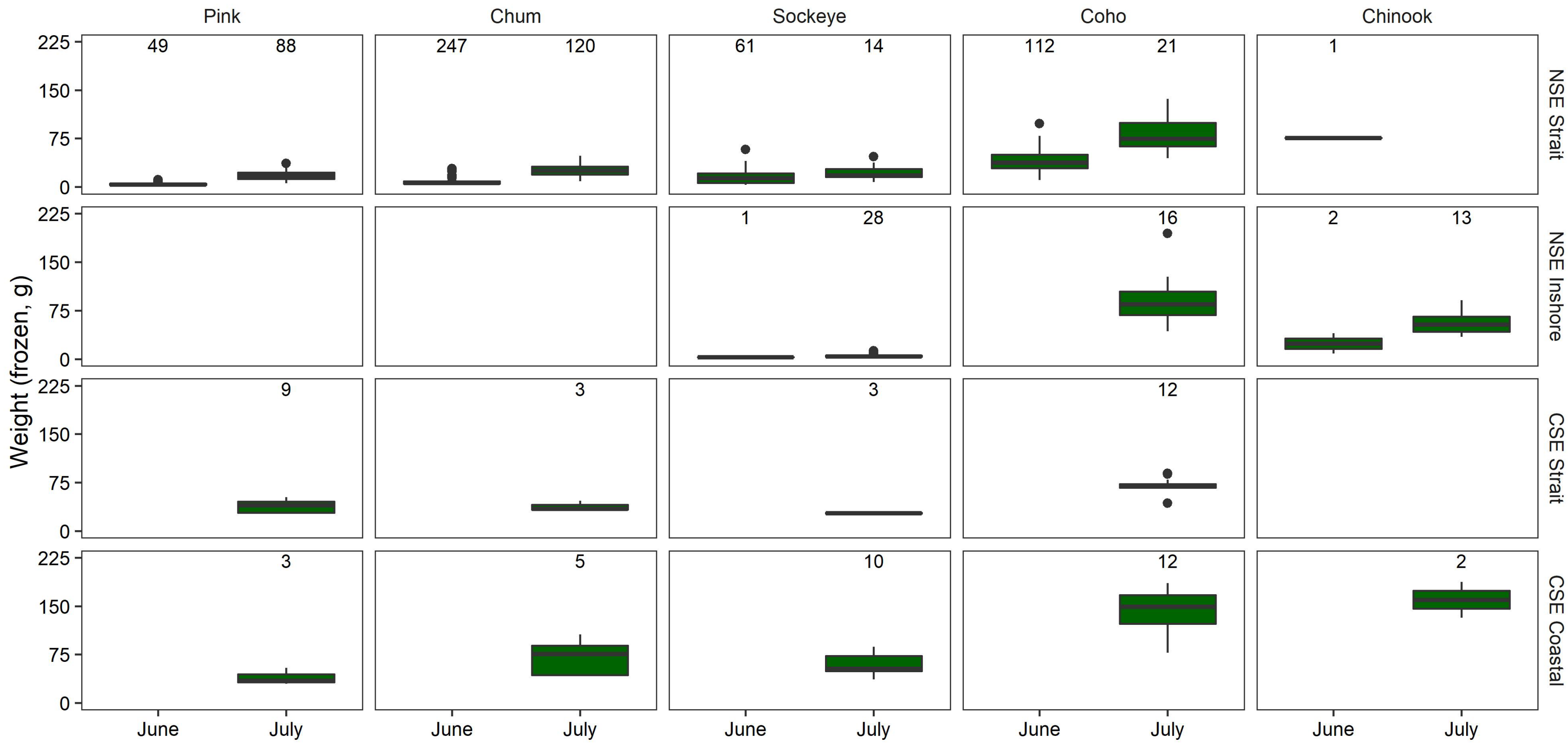

Figure 9. Monthly weight (g) distributions of juvenile salmon caught during June and July 2021. Sample sizes are given as numbers in each box. Horizontal bars represent medians and box widths are the 25th and 75th percentiles. Whiskers extend 1.5 times the box span (interquartile range).

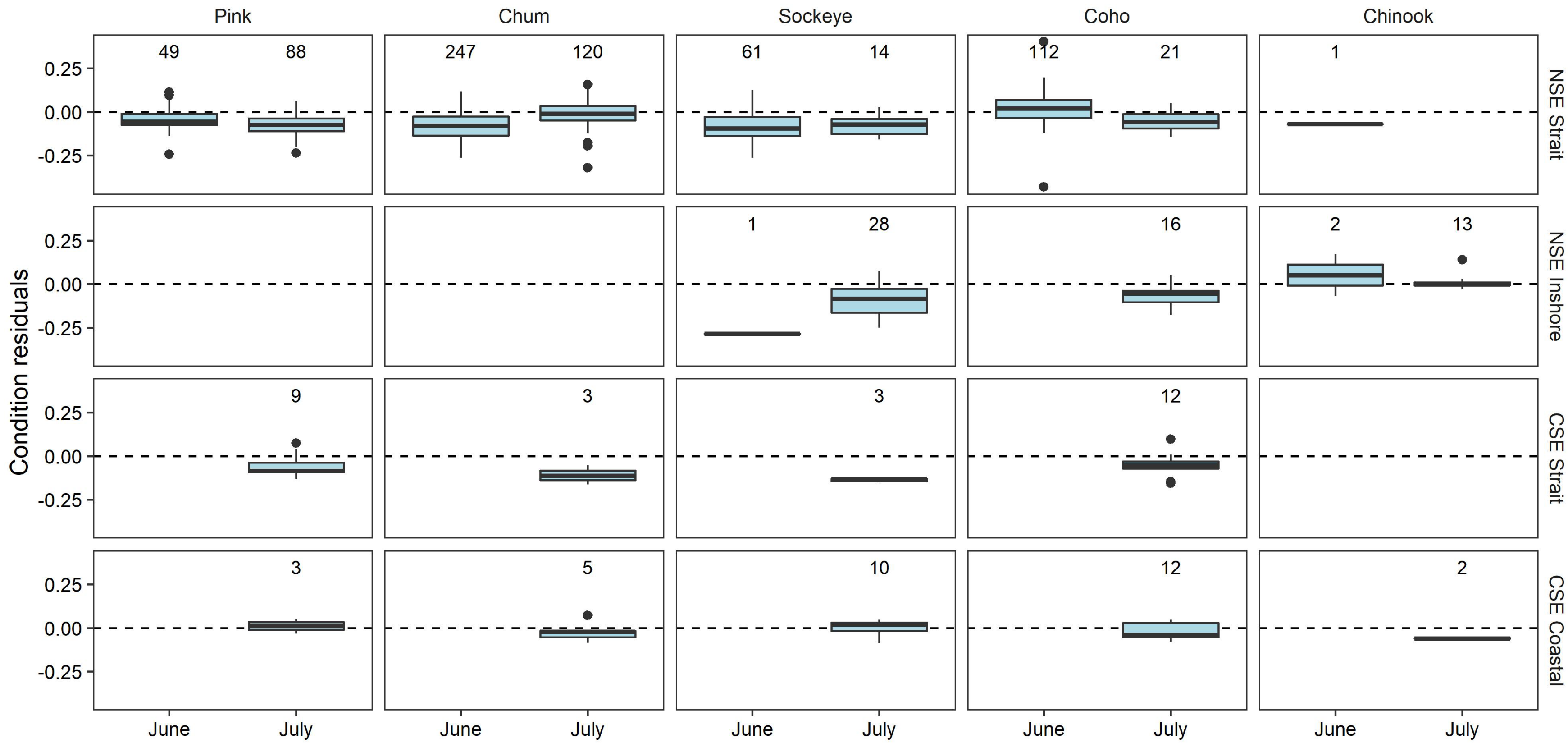

Figure 10. Condition residuals from length-weight regressions of juvenile salmon caught during June and July 2021. Regression analysis included all length and weight measures in the 25-year time series. Sample sizes are given as numbers in each box. Horizontal bars represent medians and box widths are the 25th and 75th percentiles. Whiskers extend 1.5 times the box span (interquartile range).

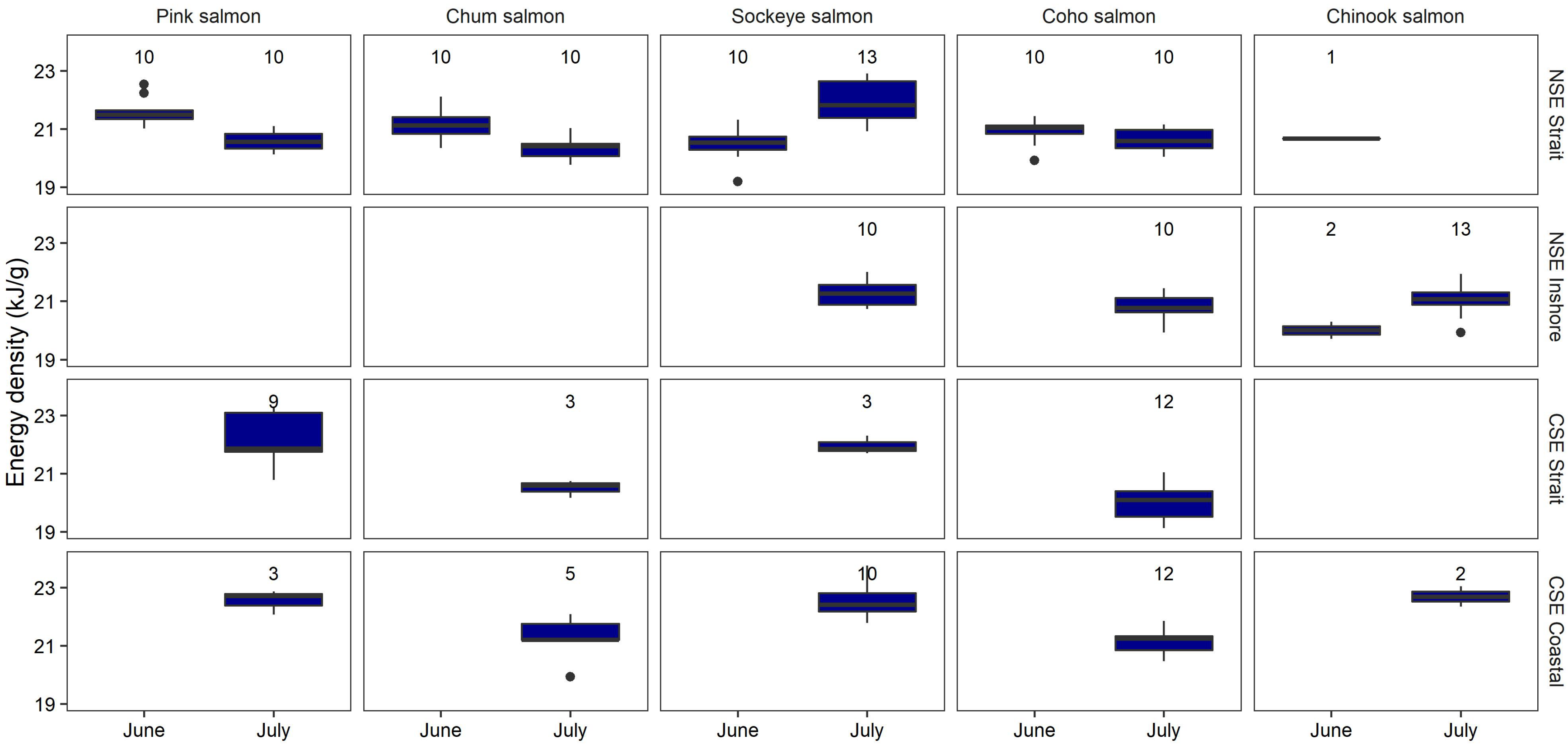

Figure 11. Energy density (kJ/g dry weight) of juvenile salmon caught during June and July 2021. Sample sizes are given as numbers in above each box. Horizontal bars represent medians and box widths are the 25th and 75th percentiles. Whiskers extend 1.5 times the box span (interquartile range).

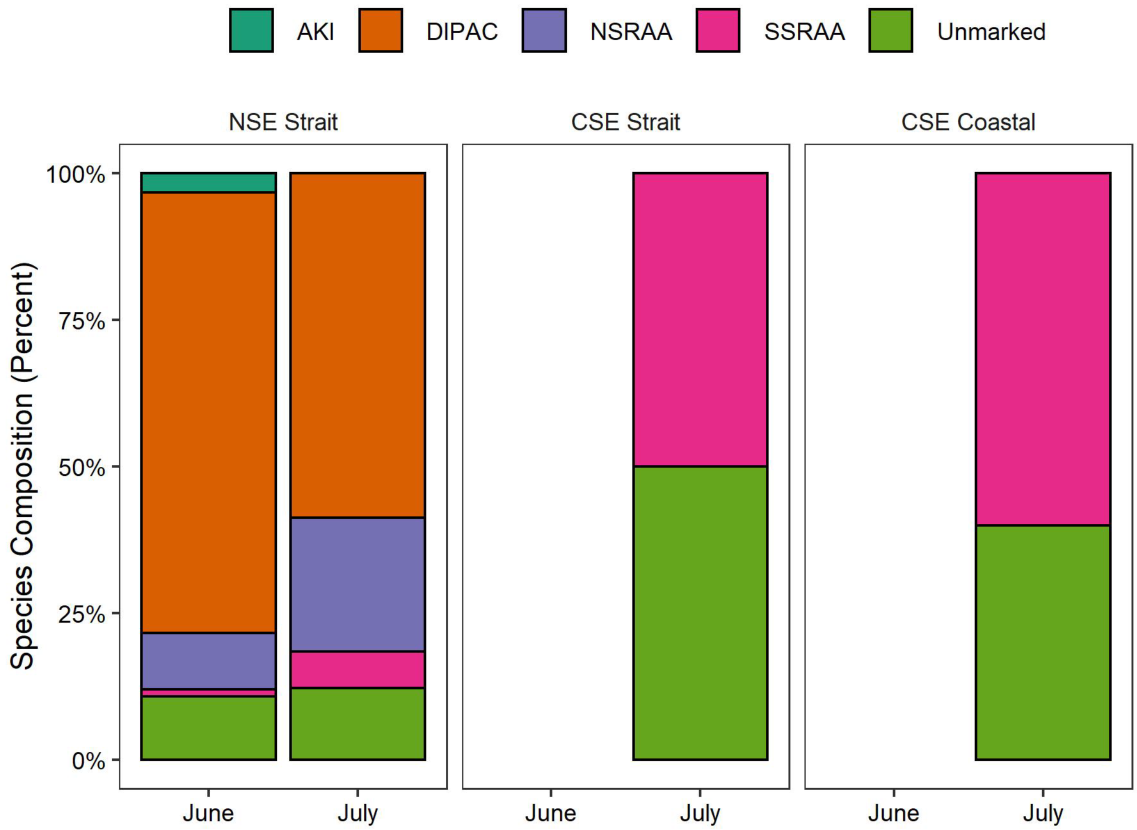

Figure 12. Monthly stock composition (based on otolith marks) of juvenile chum salmon caught during June and July 2021. See Table 9 for sample sizes.

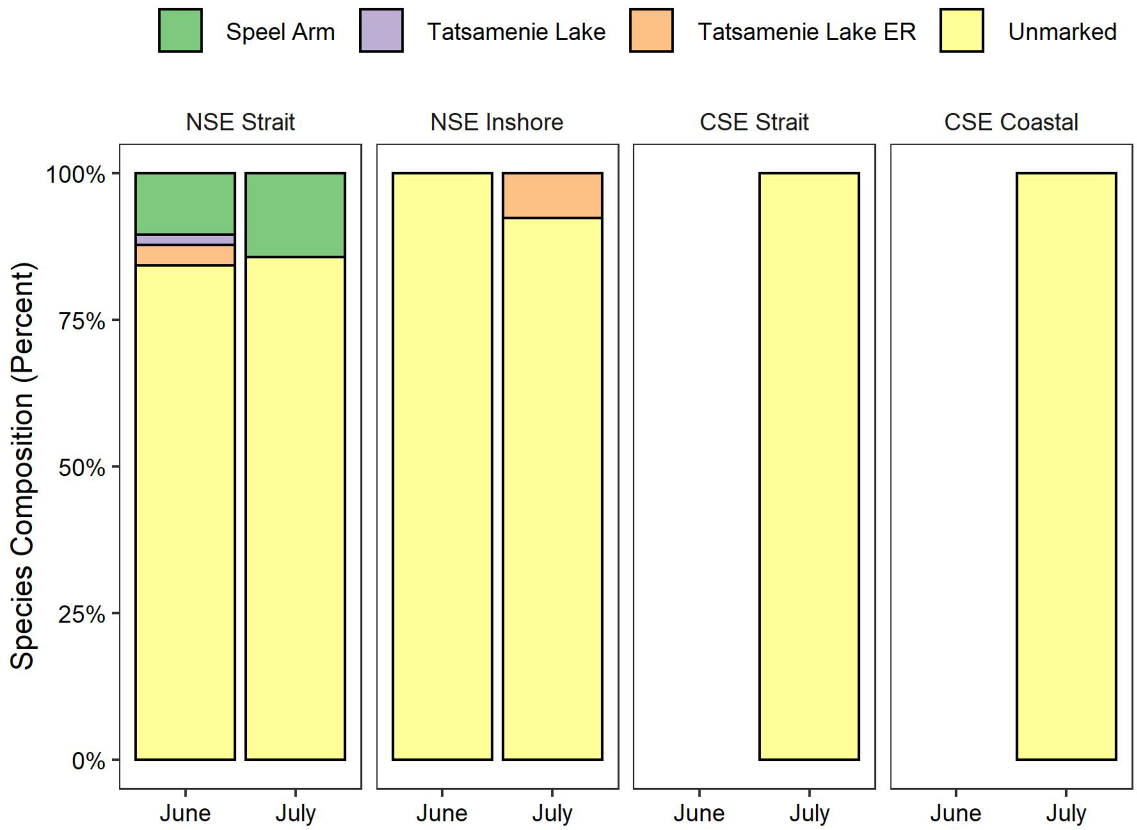

Figure 13. Monthly stock composition (based on otolith marks) of juvenile sockeye salmon captured during June and July 2021. See Table 10 for sample sizes.

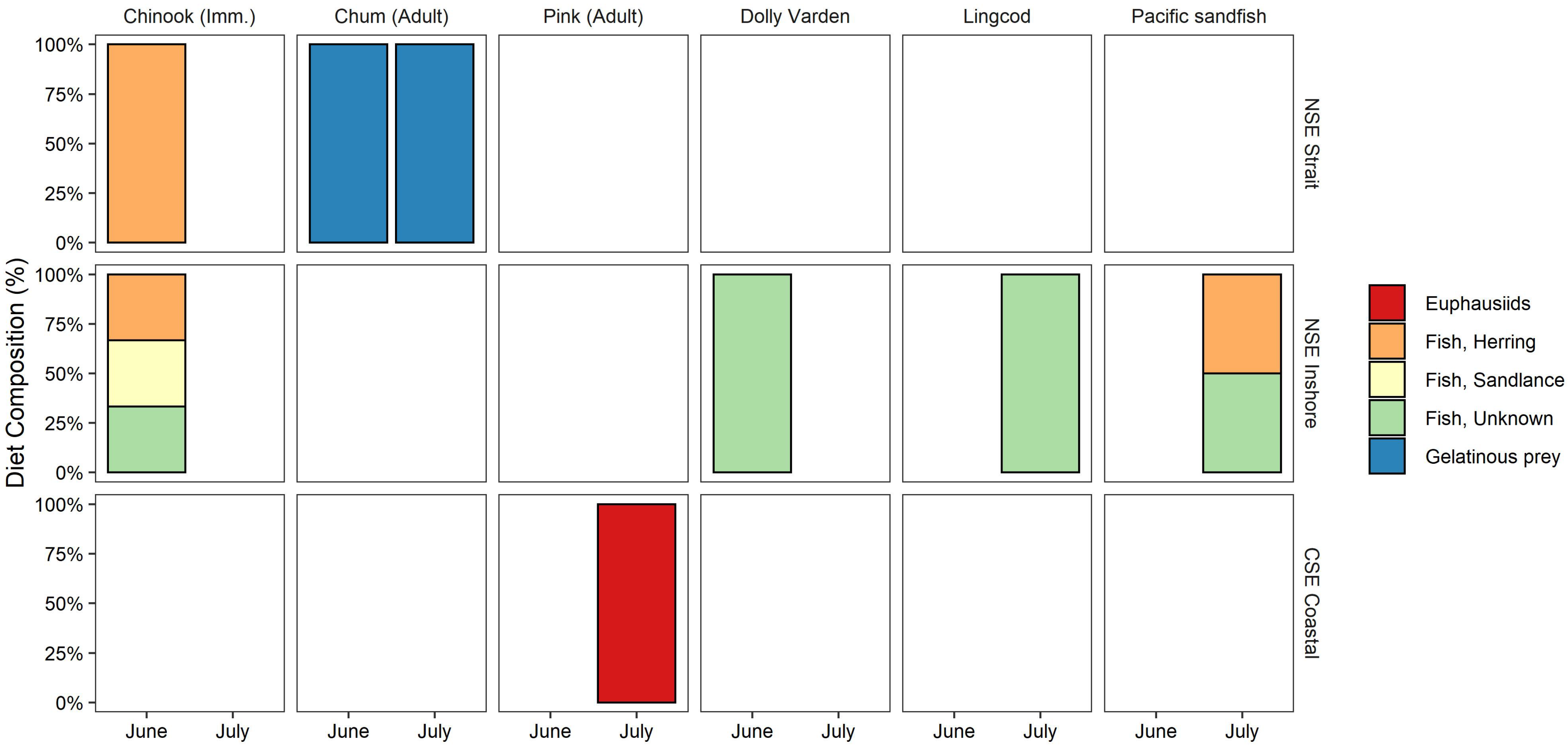

Figure 14. Diet composition (% by weight) of immature and adult salmon captured during June and July 2021. See Tables 8 for sample counts. Fish with empty stomachs not shown.

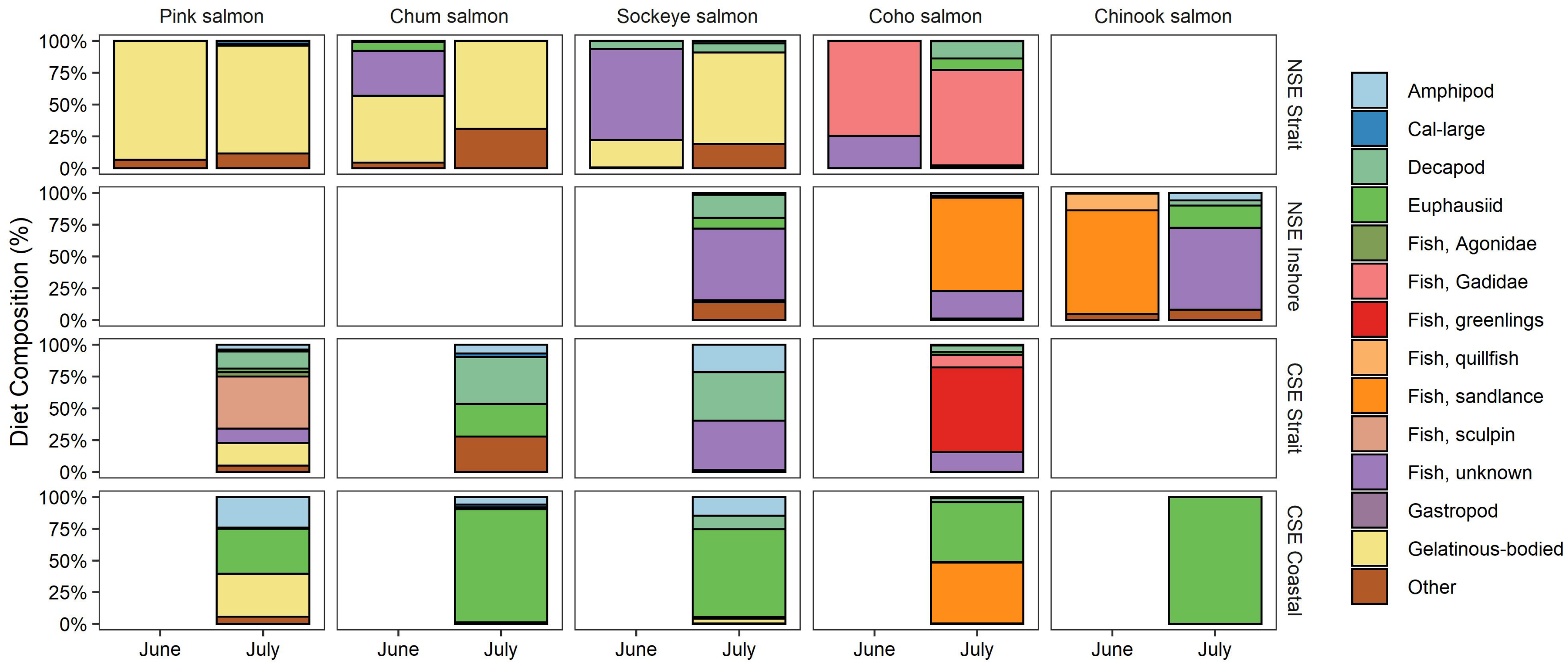

Figure 15. Diet composition (% by weight) of juvenile salmon captured during June and July 2021. See Tables 14 for sample counts. Fish with empty stomachs not shown.