

**Southeast Alaska Coastal Monitoring Survey: Salmon Distribution,
Abundance, Size, and Origin, 2020**

by

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Submitted to the

NORTH PACIFIC ANADROMOUS FISH COMMISSION

by

United States of America

March 2022

THIS PAPER MAY BE CITED IN THE FOLLOWING MANNER:

Murphy, J.M., A.W. Piston, W.W. Strasburger, J.H. Moss, J.A. Dimond, S.C. Heinl,
E.A. Fergusson, and A. K. Gray. 2022. Southeast Alaska coastal monitoring survey:
salmon distribution, abundance, size, and origin, 2020. NPAFC Doc. 2023. 23 pp.
National Marine Fisheries Service, Alaska Fisheries Science Center, and Alaska Department
of Fish and Game (Available at <https://npafc.org>).

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Keywords: Southeast Alaska, juvenile salmon, surface trawl, coded-wire tags, otolith thermal marks

ABSTRACT

Information on the distribution, abundance, size, and origin of salmon were collected as part of Southeast Alaska Coastal Monitoring (SECM) survey in 2020. SECM has included monthly rope trawl and oceanographic sampling in the northern region of Southeast Alaska since 1997 to monitor ocean conditions and the status of juvenile salmon. Information on juvenile salmon were collected at eight stations in the strait habitat (Icy Strait and Upper Chatham stations) and four stations in the inshore habitat (Stephens Passage stations) aboard the ADF&G vessel R/V *Medeia*. A total of 58,295 fish (2,013 salmon, and 56,282 non-salmon species) and 635 kg of jellyfish were captured during 26.6 hours of rope trawl effort during 2020. Pacific herring was the most abundant species in the trawl catch ($n = 55,819$), chum salmon ($n = 1,014$) was the most abundant species of juvenile salmon, and Chinook salmon was the most abundant species of immature salmon ($n = 11$). The average length of juvenile salmon in July in the strait habitat decreased from their size in 2019 (with the exception of coho salmon); however, all juvenile salmon species reached an average July length in 2020 was very close to their annual average. The peak calibrated catch rates for pink and chum salmon in Icy Strait increased from levels in 2019; however, peak catch rates for all species of juvenile salmon were below their annual average in 2020. Catch rates of juvenile pink salmon in 2020 resulted in a strong outlook for the harvest of Southeast Alaska pink salmon in 2021 (19–42 million fish) after correcting for the effect of temperature on pink salmon catch rates. The average catch rate of juvenile Chinook salmon in Stephens Passage in 2020 (18 fish/hr) was consistent with rates observed in 2019 (17 fish/hr). The proportion of juvenile Chinook salmon from the Douglas Island Pink and Chum Salmon (DIPAC) hatchery in 2020 (74%) was slightly higher than their proportion in 2019 (69%) based on the recovery of coded wire tags (CWTs). All juvenile coho salmon CWTs were recovered in Stephens Passage ($n = 5$) and were from DIPAC. DIPAC coho accounted for 61% of the juvenile coho captured in the Stephens Passage stations. The 2020 stock proportions of juvenile chum salmon in the strait habitat were consistent with their overall average based on the recovery of otolith thermal marks. DIPAC chum salmon were the most abundant stock group of chum salmon in June (76%). Unmarked (43%) and Hidden Falls hatchery chum salmon (22%) were the most abundance stock groups of juvenile chum salmon in July.

INTRODUCTION

Southeast Alaska Coastal Monitoring (SECM) surveys were designed to provide insight into oceanographic conditions and the early marine ecology of Southeast Alaska (SEAK) salmon (*Oncorhynchus* spp.). SECM surveys began in 1997 (Murphy et al. 1999; Orsi et al. 2000) 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 (*O. kisutch*) (LaCroix et al. 2009), and other pelagic species (Orsi et al. 2007). SECM surveys have also supported research

on the foraging ecology of salmon (Sturdevant et al. 2012; Fergusson et al. 2013) and zooplankton dynamics (Fergusson et al. 2021) in the northern region of SEAK. Long-term monitoring projects like SECM provide important insight into factors impacting the survival of salmon due to the dynamic and multi-dimensional nature of survival (Orsi et al. 2016; Murphy et al. 2017; Farley et al. 2020). Temperature is well known to be a key factor in the survival of salmon within freshwater and marine habitats (Pyper et al. 2005; Beauchamp et al. 2007; Taylor 2008; Bryant 2009; Orsi et al. 2016). Trophic linkages, growth, and condition also play an important role in the survival of salmon (Mortensen et al. 2000; Cooney et al. 2001; Brodeur et al. 2007; Farley et al. 2009; Weitkamp et al. 2011; Fergusson et al. 2013; Miller et al. 2013; Moss et al. 2016). Changes in salmon survival and production have a widespread impact on the ecosystems and communities within SEAK as salmon and salmon fisheries are an integral part of the ecological and socio-economic framework of SEAK. The use of SECM surveys in harvest forecast models for SEAK pink salmon fisheries has been an important use of SECM surveys to fisheries management (Wertheimer et al. 2006; Orsi et al. 2016; Murphy et al. 2019; Piston et al. 2020).

The objectives of the 2020 SECM survey were to:

- 1.) Conduct pelagic trawl (Nordic 264) operations to maintain standardized catch and size indices of 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.

This report summarizes the first two objectives of the SECM survey and includes an overview of the survey design, surface trawl catch, and juvenile salmon size and origin during the 2020 SECM survey aboard the R/V *Medeia*. Due to COVID-19 restrictions on travel, the 2020 SECM survey was limited to scientists in Juneau, Alaska (the home port of the R/V *Medeia*) and the August survey was discontinued.

METHODS

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, 2020 (Figure 1; 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 during June and 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. 2012). A detailed description of the trawl is included in Orsi et al. (2016). Each trawl was towed for 20 or 60 minutes and replicate trawl sets were completed at each station. The trawl duration in the strait habitat was 20 minutes to maintain consistency with historical sampling. The trawl duration in inshore habitat was increased to 60 minutes during 2018 to minimize variability in the catch data and to increase the number of juvenile Chinook salmon collected in Stephens Passage. The start of each trawl set was

offset by approximately one nautical mile from the station coordinates to allow the vessel to trawl through or near the station coordinates during each trawl set. A SBE39 temperature and depth sensor was added to the center of the footrope to provide an estimate of the footrope depth and temperature during each trawl set.

All survey operations, collection protocols, and sample requests were defined in the AFSC cruise instructions and the ADF&G operational plan. Trawl catches were sorted and weighed 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). The catch in numbers of fish were defined by the count of fish caught (catches less than 30) or by dividing the total catch weight by the average weight of measured fish. 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. Juvenile salmon specimens were frozen whole for diet, energetic condition, otolith thermal mark identification, and genetic stock identification of Chinook salmon. Stomachs of immature and mature salmon were collected for diet analysis. Pacific herring (*Clupea pallasii*) and juvenile pink salmon were collected to monitor harmful algal blooms toxin levels in fish. All specimens were assigned a unique specimen barcode tag for the survey 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 the R/V *Medeia*. Sagittal otoliths were removed from juvenile chum, and sockeye salmon in the laboratory and sent to DIPAC for thermal mark processing. Genetic tissue samples were collected from all Chinook salmon in the laboratory and sent to the ADF&G Gene Conservation Laboratory to estimate genetic mixtures with a 13-locus GAPS microsatellite baseline for Chinook salmon.

RESULTS AND DISCUSSION

A total of 8 to 12 stations were sampled each month from May–July during 11 days of sampling in 2020 (Table 2). A total of 32 CTD casts and chlorophyll samples were collected during 2020. Two surface rope trawl hauls were completed at each station during June and July, resulting in a total of 48 surface rope trawl events. A total of 16 bongo net samples were collected from May to July.

A total of 58,295 fish (2,013 salmon, and 56,282 non-salmon species) and 635 kg of jellyfish were captured during 26.6 hours of rope trawl effort during 2020 (Table 3; Appendix 1 and 2). Pacific herring (*Clupea pallasii*) was the most abundant species in the trawl catch ($n = 55,819$), chum salmon ($n = 1,014$) was the most abundant species of juvenile salmon, and Chinook salmon was the most abundant species of immature salmon ($n = 11$). The total catch of juvenile Chinook salmon in inshore habitats ($n = 289$) was much higher than the strait habitat ($n = 1$) and highlights the significance of the new Stephens Passage stations (inshore habitat) to research on juvenile Chinook salmon. The overall catch rate (catch/hr) of juvenile Chinook in Stephens Passage during 2020 (18 fish/hr) (Table 3) was similar to the catch rate in 2019 (17 fish/hr; Murphy et al. 2021). A pooled-species fishing power coefficient (1.19) (Table 4) was used to calibrate the R/V *Medeia* catches of juvenile salmon in Icy Strait to the NOAA Ship John N. Cobb. Vessel calibrations were based on fishing power experiments (Wertheimer et al. 2008, 2009, and 2010). The peak calibrated catch rates for pink and chum salmon in Icy Strait increased from levels observed in 2019; however, catch rates for all species of juvenile salmon were below average in 2020. (Table 5).

SEAK pink salmon harvests were forecasted for 2021 using a combination of calibrated juvenile pink salmon CPUE ($\ln(\text{CPUE}+1)$) and the upper 20m temperature data collected during

SECM surveys in the strait habitat (Piston et al. 2020). Harvest forecast models were originally developed by Wertheimer et al. (2006) and refined by Orsi et al. (2016). The forecast model approach chosen for the 2021 harvest forecast was similar to the approach proposed in Murphy et al. (2019), where temperature is treated as a factor in survey catchability and CPUE and temperature are used to model juvenile pink salmon abundance in SEAK. The 2021 harvest of pink salmon in Southeast Alaska (48.5 million fish; ADF&G 2021) was higher than the SECM forecast of 31.4 million fish, and above the predicted range of 19–42 million fish.

The average July length of juvenile salmon in the strait habitat decreased from their size in 2019 (with the exception of coho salmon); however, all juvenile salmon species reached an average length in July that was very close to their overall average (Table 6 and Table 7). Differences in the overall average length of pink, chum, sockeye, and coho salmon between June and July, were 27, 20, 7, and 50 mm, respectively. As the June and July surveys were roughly 39 days apart, this reflects an apparent growth rate of 0.7 and 0.5 mm/day for pink and chum salmon, respectively. Apparent growth rates for coho salmon were higher at 1.3 mm/day. The presence of multiple freshwater ages of sockeye salmon is likely contributing to minimal differences in size of juvenile sockeye salmon between June and July (Murphy et al. 1999; Murphy et al. 2020). The presence of multiple ages and stocks, as well as the movement of juvenile salmon through Icy Strait, introduces error in estimates of growth rate from juvenile size distribution in Icy Strait. An understanding of the relative magnitude of these errors is required to interpret apparent growth rates of juvenile salmon from their size distributions.

All Chinook ($n = 290$ juveniles, $n = 11$ immature) and coho ($n = 178$ juveniles, $n = 1$ maturing) salmon were scanned for the presence of a CWT on-board the survey. CWT recoveries were pooled over time periods and by age. CWT recoveries during 2020 were compared with the history of CWTs recovered during the June and July SECM surveys in inshore and strait habitats since 1997. Chinook salmon were assigned ages with European notation where the freshwater and marine ages separated by a period. Age assignments were based on length using age-length keys of known aged Chinook salmon from CWT recoveries. The CWT summary included: age 1.0 (juvenile), age 1.1, and age 1.2 Chinook salmon. Older ages of Chinook salmon were not included due to the low catch ($n = 10$) and recoveries of CWTs ($n = 2$) over the history of the SECM survey. Stock origins of coho salmon were estimated for a mixed freshwater age during the juvenile stage (age x.0). Stock mixtures were estimated by expanding CWT recoveries by the proportion of the stock that was tagged (tagging ratio) and defined the known stock proportions. The unknown proportion was allocated to the known stock proportions based on the assumption of incomplete mixing of the tagged and untagged fractions. Tagging ratios for hatchery stocks were based on tagged and untagged releases with adjustments for tag loss rates recorded in the Regional Mark Information System (www.rmis.org). Tagging ratios for wild stocks were based on the recovery of CWTs from returning adults and were provided by Ed Jones (Alaska Department of Fish and Game, personal communication) for Taku River Chinook salmon, Brian Elliot (Alaska Department of Fish and Game, personal communication) for Chilkat River Chinook salmon, and Justin Priest (Alaska Department of Fish and Game, personal communication) for wild coho stocks in northern Southeast Alaska. Tagging ratios of Auke Creek coho salmon were based on tagged and untagged smolt counts migrating through the Auke Creek weir and provided by Scott Vulstek (Auke Bay Laboratory, personal communication).

A total of 161 CWTs have been recovered from juvenile Chinook salmon during June and July SECM surveys in inshore and strait habitats since 1997, and 51 of these CWTs were recovered in 2020 (Table 8). Most of the CWTs recovered in 2020 were from the DIPAC Hatchery ($n = 44$); three tags were from the Taku River, three tags were from the Little Port Walter (LPW) Hatchery, and one tag was from the Hidden Falls (HF) Hatchery. The number of

hatchery Chinook salmon in Stephens Passage ($n = 229$; 88%) was estimated by expanding the number of hatchery CWTs by their known tagging ratios. The remaining catch of juvenile Chinook salmon ($n = 66$; 22%) should reflect the wild stock proportion as the unknown proportion is expected to be minimal based on sampling in 2018 and 2019. The tagging ratio for Taku River Chinook salmon in 2020 (brood year 2018) will be available once a sufficient number of adults have returned to the Taku River, but it is reasonable to assume that they are the primary wild stock fraction due to the absence of CWTs from other wild Chinook salmon stocks at these stations.

The proportions of DIPAC and Taku River Chinook salmon in Stephens Passage during 2018 were different than 2019 and 2020 and may be due to the different stations sampled in 2018. The proportion of DIPAC Chinook salmon in 2018 was 35%, which was much lower than their proportion in 2019 (69%) and 2020 (75%). The Stephens Passage station locations during June and July of 2018 were centered on the current (2019 and 2020) stations of SPA and SPB (Murphy et al. 2020) and the June stations included a station in Taku Inlet. This station was sampled during the early years of SECM. The Taku Inlet station was discontinued after the first attempt in June 2018 due to difficulty conducting trawl sampling amid high levels of vessel traffic at this location. This change in station locations within Stephens Passage does not allow direct comparisons of the 2018 survey data with the data collected in 2019 and 2020.

A total of 44 CWTs have been recovered from age 1.1 and 1.2 Chinook salmon during June and July SECM surveys in inshore and strait habitats since 1997. No CWTs were recovered from these age classes during 2020 (Table 9). Most of the immature Chinook salmon captured during SECM surveys were identified to be age 1.1 (89%). Due to the low number of immature Chinook salmon captured during the survey, estimates of stock origin for ages older than age 1.1 are limited. DIPAC Chinook salmon were the largest stock group of both age 1.1 and 1.2 Chinook salmon in the strait habitat (46 and 48%, respectively) from 2001 to 2017. Chilkat River (20%) and HF (24%) Chinook salmon were also important contributors of age 1.1 Chinook salmon, and Chilkat River Chinook salmon were an important contributor (39%) of the age 1.2 Chinook salmon.

The recovery of CWTs from Chinook salmon provides insight into the rearing and migration behavior of SEAK Chinook salmon stocks. The presence of CWTs from LPW and HF Chinook salmon in Stephens Passage indicates that at least some portion of these stocks exhibit an inshore migration pattern rather than the typical migration from inshore to coastal (offshore) habitats. The majority of juvenile Chinook salmon in the strait habitat (Icy Strait) were from HF (59%) and HF Chinook salmon were an important contributor (24%) of age 1.1 Chinook in strait habitats. Very few juveniles in the strait habitat were from DIPAC (6%) (2001 to 2017), yet DIPAC Chinook salmon were the most abundant stock during later (immature) marine life-history stages. This likely indicates a more prolonged residency of juvenile DIPAC Chinook salmon within inshore habitats during their juvenile stage and perhaps a higher tendency for DIPAC Chinook salmon to exhibit an inside rearing pattern during their first few years at sea. The proportion of juvenile Chinook salmon from the Taku River in strait habitats was relatively high (31%), but this estimate is based on a recovery of a single tag and therefore the uncertainty is very high. Additional work on the genetic stock origin of juvenile Chinook salmon and classification of wild and hatchery Chinook salmon through otolith microstructure is in progress and this is expected to provide additional insight into the distribution and migration patterns of SEAK Chinook salmon stocks.

A total of 311 CWTs have been recovered from juvenile coho salmon during June and July SECM surveys in inshore and strait habitats since 1997. Five CWTs were recovered in Stephens Passage (inshore habitat) during 2020 (Table 10). The proportion of Coho salmon from

the HF was much higher (79%) during 1997 to 2000 than during recent sampling in inshore habitats (0%). Stations near the northern end of Admiralty Island (False Point Retreat) were included in the inshore habitat during 1997 to 2000, but were not included in the recent sampling (2018 to 2020), which only includes stations in Stephens Passage (Figure 1). Differences in the inshore mixtures most likely reflect the change in station locations and highlights complications associated with comparisons of recent and historical sampling in inshore habitats. Coho salmon from the Chilkat River, Taku River, DIPAC, and HF were the primary contributors to the stocks in Icy Strait (strait habitat). Contributions from HF (25–45%) were typically higher than DIPAC (14–26%) and Chilkat River (21–26%) for periods when more than one CWT was recovered. Contributions from the Taku River were variable, ranging from 16% to 32% during time periods when more than one CWT was recovered.

Otolith thermal marks are used to provide information on the origin of hatchery chum salmon captured during SECM surveys (Table 11). DIPAC chum salmon accounted for 76% of the total chum salmon and 86% of the hatchery chum salmon captured in June 2020. Wild (unmarked) chum salmon (43%) and HF chum salmon (22%) were the largest stock groups in July. Adjustments to the mark recoveries were applied in 1997 for DIPAC chum salmon as they marked only 76% of their releases. Adjustments were also applied to mark recoveries in 1997–2000, 2003, and 2009 for HF chum salmon as they marked approximately 50% of their releases during those years. The particularly low proportion of DIPAC chum salmon observed during June 2002 reflected the poor brood-year survival of DIPAC chum salmon associated with feeding complications that occurred during rearing in net pens. The proportions of NSEAK and Southern Southeast Regional Aquaculture Association (SSRAA) chum salmon were highest during 2016 when record warm temperatures were observed in Icy Strait (Fergusson et al. 2021). The average annual proportion of DIPAC marks decreased from June (58%) to July (18%), and the proportion of HF chum salmon increased from June (12%) to July (27%). These proportions reflect a relatively higher abundance of DIPAC chum salmon in Icy Strait and the closer proximity of DIPAC (85 km) to Icy Strait compared to the Hidden Falls stock (120 km distant) (Murphy et al. 2019). These proportions will be used to construct stock-specific abundance estimates of juvenile chum salmon to assist with forecast models for these two stocks of chum salmon.

ACKNOWLEDGMENTS

We thank the captain and crew of the R/V *Medeia*: Jim De LaBruere, Cedar Stark, Craig Conger, and Luke Erickson, for their excellent support of SECM surveys. We thank Brad Weinlaeder and Matt Rogers for their assistance and support on the May 2020 R/V *Sashin* survey. We would like to thank Ed Jones, Brian Elliot, Justin Priest, and Scott Vulstek for providing unpublished coded-wire-tag ratios for wild salmon stocks in Southeast Alaska. ADF&G provided funding support for the R/V *Medeia* during 2020 through the Pink Salmon Disaster Relief Fund. The Northern Fund of the Pacific Salmon Commission provided funding support to NOAA for field and laboratory supplies, field and scientific travel, and the analysis of diet and energetic condition of juvenile salmon. Otolith thermal mark processing was completed by DIPAC with funding support from ADF&G through the Pink Salmon Disaster Relief Fund.

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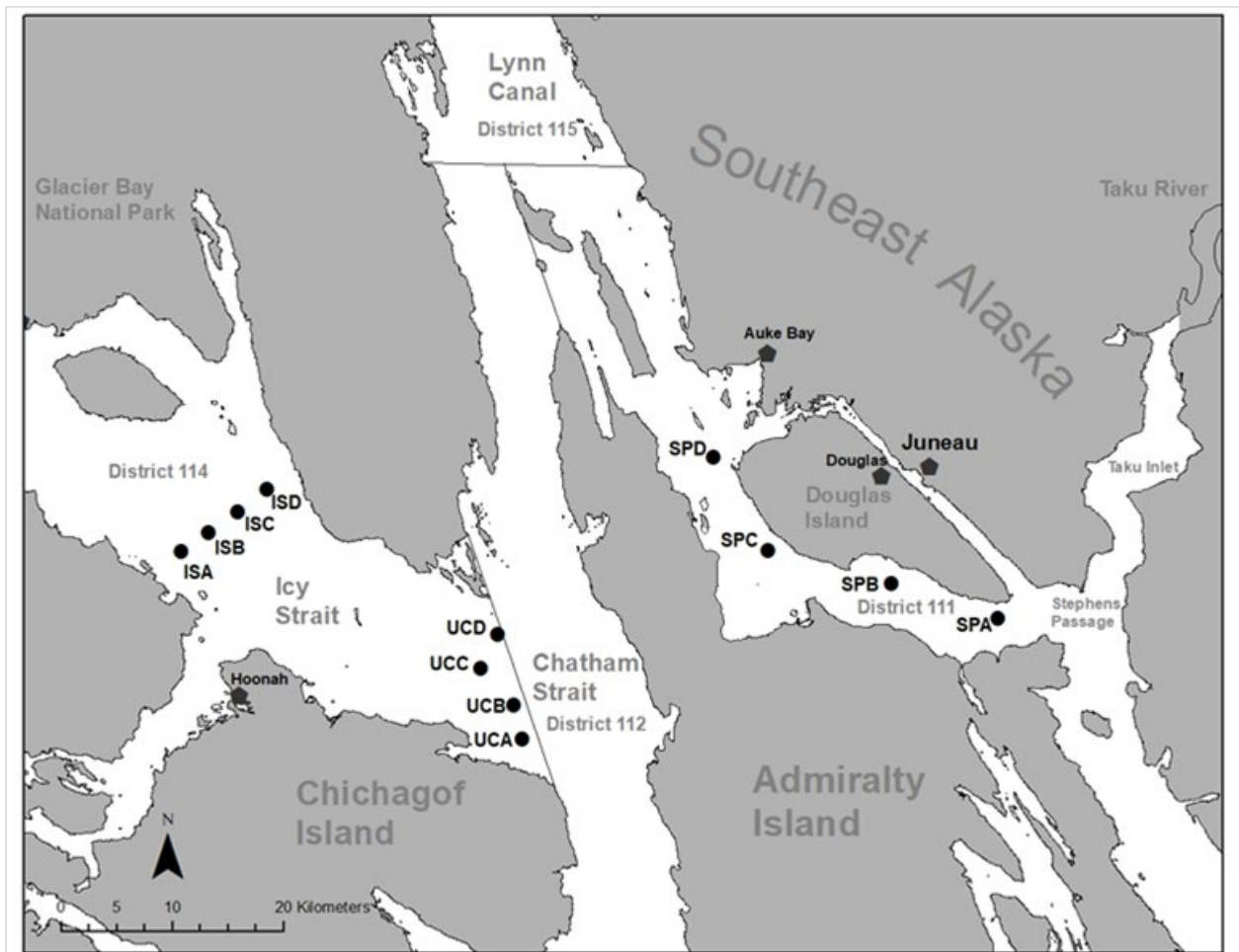


Figure 1. Station locations sampled during the Southeast Alaska Coastal Monitoring survey, 2020.

Table 1. Names, habitats, coordinates, and depths of stations sampled during the Southeast Alaska Coastal Monitoring survey, 2020.

Station ¹	Habitat	Latitude (N)	Longitude (W)	Bottom Depth (m)
SPA	Inshore	58° 10.76'	134° 16.70'	100
SPB		58° 12.37'	134° 26.52'	80
SPC		58° 13.91'	134° 37.85'	55
SPD		58° 18.38'	134° 42.97'	65
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

¹First two letters of the station name identify the transect: SP = Stephens Passage, UC = Upper Chatham Strait, IS = Icy Strait.

Table 2. Number and types of sampling gear deployed during the Southeast Alaska Coastal Monitoring survey, 2020.

Dates (days)	Vessel	Habitat	Stations	Data Collection Type			
				Rope trawl ¹	CTD ²	Bongo ³	Chlorophyll ⁴
06/01 (1)	R/V Sashin	Strait	8	0	8	4	8
06/18-06/22 (5)	R/V Medeia	Inshore	4	8	4	2	4
		Strait	8	16	8	4	8
07/26-07/30 (5)	R/V Medeia	Inshore	4	8	4	2	4
		Strait	8	16	8	4	8
Total			32	48	32	16	32

¹ 20-min hauls (Strait habitat) 60-min hauls (Inshore habitat) with Nordic 264 surface trawl

² To 200m or within 20m of the bottom

³ 60-cm frame, 505- & 333- μ m mesh, oblique tows from 200m or within 20m of bottom.

⁴ Chlorophyll are from surface seawater samples.

Table 3. Surface trawl effort and catch of jellyfish (kg) and fish (*n*) at selected life-history stages by month and habitat during the Southeast Alaska Coastal Monitoring survey, 2020.

Species	Scientific name	Strait		Inshore	
		June	July	June	July
Effort (hrs)		5.3	5.3	8.0	8.0
Jellyfish (kg)	<i>Aurelia sp.</i>	0.6	113.7	2.5	256.7
	<i>Cyanea capillata</i>	41.5	51.2	67.6	31.9
	<i>Aequorea sp.</i>	0.4	27.5	0.0	0.0
	<i>Phacellophora camtschatica</i>	1.5	0.0	14.4	0.0
	<i>Chrysaora melanaster</i>	0.4	9.7	1.0	2.1
	<i>Staurophora mertensi</i>	1.4	10.4	<0.01	0.1
Jellyfish subtotals		46	213	86	291
Salmon (<i>n</i>)					
Chum (juvenile)	<i>Oncorhynchus keta</i>	772	238	3	1
Pink (juvenile)	<i>O. gorbuscha</i>	75	301	1	3
Chinook (juvenile)	<i>O. tshawytscha</i>	1	0	95	194
Coho (juvenile)	<i>O. kisutch</i>	12	58	66	42
Sockeye (juvenile)	<i>O. nerka</i>	88	45	0	3
Chinook (imm/adult)	<i>O. tshawytscha</i>	3	0	5	3
Pink (adult)	<i>O. gorbuscha</i>	0	1	0	1
Chum (adult)	<i>O. keta</i>	0	0	0	1
Coho (adult)	<i>O. kisutch</i>	0	0	0	1
Salmon subtotals		951	643	170	249
Non-salmon (<i>n</i>)					
Pacific herring	<i>Clupea pallasii</i>	1	3	53,384	2,431
Walleye pollock (age-0)	<i>Gadus chalcogramma</i>	119	0	9	0
Pacific spiny lumpsucker	<i>Eumicrotremus orbis</i>	1	2	51	55
Crested sculpin	<i>Blepsias bilobus</i>	2	26	10	69
Starry flounder	<i>Platichthys stellatus</i>	0	0	35	9
Surf smelt	<i>Hypomesus pretiosus</i>	0	0	12	14
Pacific sandfish	<i>Trichodon trichodon</i>	0	0	12	2
Soft sculpin	<i>Gilbertidia sigalutes</i>	0	0	9	0
Walleye pollock (age-1+)	<i>Gadus chalcogramma</i>	1	0	3	3
Sablefish (age-1+)	<i>Anoplopoma fimbria</i>	1	1	3	0
Prowfish	<i>Zaprora silenus</i>	0	3	0	1
Wolf eel	<i>Anarrhichthys ocellatus</i>	2	1	0	0
Capelin	<i>Mallotus villosus</i>	2	0	1	0
Threespine stickleback	<i>Gasterosteus aculeatus</i>	1	0	0	0
Salmon shark	<i>Lamna ditropis</i>	0	1	0	0
Lingcod	<i>Ophiodon elongatus</i>	1	0	0	0
Dover Sole	<i>Microstomus pacificus</i>	0	0	1	0
Non-salmon subtotals		131	37	53,530	2,584

Table 4. 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 5. Average calibrated log(CPUE+1) by year, vessel, and month for juvenile salmon species in the Strait habitat (Icy Strait and Upper Chatham Strait stations) during the Southeast Alaska Coastal Monitoring survey (June and July), 1997-2020.

Year	Vessel	June					July				
		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	0.27	0.04	2.15	2.02	0.87	1.08	0.00
Average (97-20)		1.71	2.24	1.44	1.57	0.17	2.32	2.37	1.21	1.64	0.12

Table 6. Number of fish measured (*n*), average and standard deviation (stdev) of fork length and weight of juvenile salmon by habitat and month during the Southeast Alaska Coastal Monitoring survey, 2020.

Size	Habitat	Month	Chinook	Chum	Coho	Pink	Sockeye	
Sample Size (<i>n</i>)	Inshore	June	95	3	66	1	2	
		July	194	1	42	3	3	
	Strait	June	2	318	12	75	86	
		July	--	237	58	243	45	
Average (Stdev) of Length (mm) (<i>n</i> > 10)	Inshore	June	147 (21)	--	155 (18)	--	--	
		July	175 (20)	--	192 (27)	--	--	
	Strait	June	--	116 (10)	152 (17)	100 (12)	128 (19)	
		July	--	136 (17)	202 (24)	127 (12)	135 (16)	
	Average (Stdev) of Weight (mm) (<i>n</i> > 10)	Inshore	June	40 (19)	--	40 (13)	--	--
			July	68 (23)	--	82 (37)	--	--
Strait		June	--	15 (4)	42 (15)	9 (4)	21 (10)	
		July	--	25 (9)	97 (35)	19 (6)	26 (11)	

Table 7. Average fork length (mm) of juvenile salmon sampled in the Strait habitat (Icy Strait and Upper Chatham Strait stations) during the Southeast Alaska Coastal Monitoring survey (June and July), 1997–2020.

Year	Pink		Chum		Sockeye		Coho	
	June	July	June	July	June	July	June	July
1997	96	136	96	136	109	140	147	211
1998	94	129	101	133	105	140	168	212
1999	97	118	103	128	126	137	157	212
2000	95	125	106	132	115	145	171	201
2001	93	122	96	123	119	125	164	189
2002	86	114	96	123	122	148	153	210
2003	98	122	115	124	117	125	174	201
2004	99	130	105	140	110	137	168	202
2005	93	127	106	124	115	123	184	207
2006	102	121	112	138	109	131	168	200
2007	102	117	101	121	126	128	162	185
2008		109		107		103		179
2009		125		134		136		208
2010	96	126	104	126	116	120	181	211
2011	86	118	99	129	132	146	176	202
2012	91	123	94	136	120	139	174	208
2013	102	133	95	131	131	144	169	198
2014	102	127	104	128	125	148	180	209
2015	117	163	124	159	130	147	188	222
2016	116	155	123	156	134	133	192	242
2017		128	96	140	105	152	165	188
2018		115	100	129	116	125	159	187
2019	108	152	114	155	131	152	161	192
2020	100	127	116	136	128	135	152	202
Average	99	128	105	133	120	136	169	203

Table 8. Estimated stock proportions of juvenile Chinook salmon based on recoveries of coded-wire tags (shown in parentheses) and known tagging fractions by time periods within inshore and strait habitats sampled during the Southeast Alaska Coastal Monitoring Survey (June-August), 1997-2020. The unknown (Unk.) proportion is the percentage of the catch that is not identified to a stock from coded-wire-tag recoveries.

Year	Inshore Habitat						Strait Habitat						Unk.
	Catch (n)	Wild Origin Taku R.	Hatchery Origin ¹			Unk.	Catch (n)	Wild Origin Taku R.	Hatchery Origin ¹			Unk.	
			DIPAC	LPW	HF				AKI	DIPAC	LPW		
1997-2000	203	0.33 (1)	0.61 (16)	< 0.01 (1)	0.06 (1)	0.00	47	--	--	--	--	1.00 (2)	0.44
2001-2017	6	1.00 (1)	--	--	--	0.00	347	0.31 (1)	0.02 (1)	0.06 (2)	0.02 (4)	0.59 (10)	0.36
2018	130	0.64 (3)	0.35 (4)	0.01 (1)	--	0.08	1	--	--	--	--	--	1.00
2019	470	0.31 (6)	0.69 (53)	0.01 (3)	--	0.00	4	--	--	--	--	--	1.00
2020	295	-- (3)	0.75 (44)	0.01 (3)	0.03 (1)	--	1	--	--	--	--	--	1.00

¹ Armstrong-Keta Inc. (AKI), Douglas Island Pink and Chum, Inc. (DIPAC), Little Port Walter (LPW), Hidden Falls (HF)

Table 9. Estimated stock proportions of immature and maturing Chinook salmon based on recoveries of coded-wire tags (shown in parentheses) and known tagging fractions by time period and primary ages (age 1.1 and 1.2) within inshore and strait habitats sampled during the Southeast Alaska Coastal Monitoring Survey (June-August), 1997-2020. The unknown (Unk.) proportion is the percentage of the catch that is not identified to a stock from coded-wire-tag recoveries.

Age	Year	Catch	Inshore Habitat ¹		Strait Habitat							Unk.
			DIPAC	Unk.	Catch	Wild Origin	Hatchery Origin ²					
						Chilkat R.	DIPAC	HF	LPW	Pullen Cr	Other ³	
Age 1.1	1997-2000	11	--	1.00	79	--	1.00 (1)	--	--	--	--	0.93
	2001-2017	--	--	--	468	0.20 (4)	0.46 (17)	0.24 (7)	0.01 (3)	0.01 (1)	0.07 (2)	0.33
	2018-2020	29	1.00 (2)	0.23	8	--	--	--	--	--	--	1.00
Age 1.2	1997-2000	1	--	--	9	--	--	--	--	--	--	1.00
	2001-2017	--	--	--	60	0.39 (2)	0.48 (4)	--	--	0.13 (1)	--	0.04
	2018-2020	1	--	--	3	--	--	--	--	--	--	1.00

1 Inshore habitats not sampled 2001-2017.

2 Douglas Island Pink and Chum, Inc. (DIPAC), Little Port Walter (LPW), Hidden Falls (HF).

3 Other stocks include: Clackamas River, OR, and Crystal Lake

Table 10. Estimated stock proportions of juvenile coho salmon based on recoveries of coded-wire tags (shown in parentheses) and known tagging fractions by time periods within inshore and strait habitats sampled during the Southeast Alaska Coastal Monitoring Survey (June-August), 1997-2020. The unknown (Unk.) proportion is the percentage of the catch that is not identified to a stock from coded-wire-tag recoveries.

		Inshore Habitat ¹				Strait Habitat											
		Wild Origin		Hatchery Origin				Wild Origin					Hatchery Origin ²				
Year	Catch	Taku R.	DIPAC	HF	Unk.	Catch	Auke Cr.	Berners R.	Chilkat R.	Taku R.	Other ³	AKI	DIPAC	HF	Other ⁴	Unk.	
1997-2000	139	--	0.21 (3)	0.79 (2)	0.59	922	<0.01 (2)	0.07 (6)	0.10 (1)	0.12 (1)	<0.01 (1)	--	0.21 (15)	0.45 (9)	0.05 (1)	0.45	
2001-2010	--	--	--	--	--	4629	<0.01 (3)	0.04 (22)	0.21 (14)	0.32 (10)	--	0.03 (4)	0.14 (38)	0.25 (22)	<0.01 (2)	0.30	
2011-2017	--	--	--	--	--	8551	<0.01(17)	0.05 (29)	0.26 (17)	0.16 (6)	0.04 (3)	--	0.18 (57)	0.27 (28)	--	0.47	
2018-2020	291	.60 (1)	0.40 (7)	--	0.17	426	--	0.01 (1)	0.72 (1)	--	--	--	0.26 (5)	--	--	0.28	
1 Inshore habitats were not sampled 2001-2017.																	
2 Armstrong-Keta Inc. (AKI), Douglas Island Pink and Chum, Inc. (DIPAC), Hidden Falls (HF)																	
3 Other wild stocks include Duck Creek, Cowee Creek, and Stikine River.																	
3 Other hatchery stocks include: Burro Creek, Indian River, and Neck Lake.																	

Table 11. The number of chum salmon otoliths examined for thermal marks and the estimated hatchery stock proportions in the Strait habitat (Icy Strait and Upper Chatham Strait stations) during the Southeast Alaska Coastal Monitoring survey (June and July), 1997-2020.

Year	June							July						
	Otoliths	Stock Group ¹					Not Marked	Otoliths	Stock Group ¹					Not Marked
		DIPAC	HF	SSRAA	SECove	NSEAK ²			DIPAC	HF	SSRAA	SECove	NSEAK ²	
1997	258	0.62	0.06	0.00	0.00	0.00	0.32	214	0.15	0.44	0.00	0.00	0.00	0.42
1998	359	0.35	0.23	0.00	0.00	0.00	0.41	354	0.20	0.30	0.00	0.00	0.00	0.50
1999	276	0.25	0.71	0.00	0.00	0.00	0.03	83	0.06	0.63	0.00	0.00	0.00	0.31
2000	356	0.66	0.14	0.00	0.00	0.01	0.19	613	0.15	0.38	0.00	0.00	0.00	0.47
2001	341	0.53	0.00	0.00	0.00	0.00	0.47	565	0.04	0.22	0.00	0.00	0.00	0.74
2002	89	0.04	0.02	0.00	0.00	0.00	0.93	590	0.03	0.57	0.00	0.00	0.00	0.41
2003	156	0.86	0.02	0.00	0.00	0.00	0.12	457	0.05	0.28	0.02	0.00	0.00	0.66
2004	1108	0.81	0.01	0.01	0.00	0.00	0.18	221	0.07	0.14	0.25	0.00	0.00	0.54
2005	698	0.37	0.35	0.00	0.00	0.00	0.28	134	0.04	0.31	0.00	0.00	0.00	0.64
2006	415	0.54	0.30	0.00	0.00	0.00	0.15	413	0.21	0.53	0.00	0.00	0.00	0.26
2007	167	0.65	0.07	0.01	0.00	0.01	0.26	272	0.20	0.20	0.01	0.00	0.00	0.59
2008	8	--	--	--	--	--	--	671	0.30	0.09	0.00	0.00	0.00	0.61
2009	0	--	--	--	--	--	--	408	0.33	0.20	0.01	0.00	0.00	0.47
2010	393	0.64	0.11	0.00	0.00	0.01	0.25	494	0.31	0.25	0.00	0.00	0.01	0.43
2011	470	0.57	0.05	0.00	0.00	0.00	0.38	324	0.39	0.10	0.02	0.00	0.01	0.49
2012	360	0.72	0.01	0.00	0.00	0.01	0.26	758	0.26	0.28	0.10	0.00	0.05	0.31
2013	304	0.48	0.09	0.00	0.00	0.00	0.42	497	0.46	0.06	0.01	0.05	0.01	0.42
2014	557	0.78	0.03	0.00	0.00	0.01	0.18	492	0.16	0.25	0.01	0.05	0.02	0.51
2015	223	0.49	0.10	0.01	0.02	0.02	0.35	252	0.16	0.14	0.02	0.14	0.01	0.53
2016	218	0.50	0.10	0.00	0.02	0.12	0.27	271	0.08	0.04	0.13	0.30	0.05	0.41
2017	56	0.55	0.02	0.00	0.00	0.00	0.43	98	0.17	0.21	0.11	0.11	0.01	0.38
2018	53	0.96	0.00	0.00	0.00	0.00	0.04	53	0.30	0.57	0.00	0.04	0.00	0.60
2019	250	0.68	0.02	0.00	0.00	0.01	0.29	250	0.17	0.22	0.00	0.04	0.00	0.25
2020	229	0.76	0.12	0.00	0.00	0.00	0.11	187	0.09	0.22	0.01	0.16	0.09	0.43
Average 97-20	306	0.58	0.12	0.00	0.00	0.01	0.29	361	0.18	0.27	0.03	0.04	0.01	0.47

1--Douglas Island Pink and Chum, Inc. (DIPAC), Hidden Falls (HF), Southern Southeast Regional Aquaculture Association (SSRAA),

1--Southeast Cove (SECove), and Other Northern Southeast Alaska hatchery stocks (NSEAK).

2-- Chilkat River, Deep Inlet, Port Armstrong, and Gunnuk Creek Hatchery stocks.

Appendix 1. Surface trawl catch of juvenile salmon and trawl duration (minutes) in Strait and Inshore habitats during the June Southeast Alaska Coastal Monitoring Survey, 2020.

Habitat	Station	Replicate	Duration	Chinook	Chum	Coho	Pink	Sockeye
Inshore	SPA	1	60	9	0	10	0	0
	SPB	1	60	6	0	0	0	0
	SPC	1	60	9	0	7	0	0
	SPD	1	60	29	0	10	0	0
	SPA	2	60	7	0	3	0	0
	SPB	2	60	6	0	9	0	0
	SPC	2	60	11	2	22	1	0
	SPD	2	60	18	1	5	0	0
Strait	ISD	1	20	0	0	0	0	2
	ISC	1	20	0	10	0	0	1
	ISB	1	20	0	18	0	3	1
	ISA	1	20	0	21	2	1	3
	ISB	2	20	0	34	0	2	2
	ISA	2	20	0	91	0	25	24
	ISD	2	20	1	39	1	4	7
	ISC	2	20	0	243	2	21	7
	UCD	1	20	0	15	0	0	3
	UCC	1	20	0	48	6	0	9
	UCB	1	20	0	2	0	0	0
	UCA	1	20	0	33	0	2	1
	UCA	2	20	0	22	0	1	2
	UCB	2	20	0	191	0	12	19
	UCC	2	20	0	2	0	3	6
	UCD	2	20	0	3	1	1	1

Appendix 2. Surface trawl catch of juvenile salmon and trawl duration (minutes) in Strait and Inshore habitats during the July Southeast Alaska Coastal Monitoring Survey, 2020.

Habitat	Station	Replicate	Duration	Chinook	Chum	Coho	Pink	Sockeye
Inshore	SPA	1	60	7	0	2	0	0
	SPB	1	60	31	0	2	1	2
	SPC	1	60	40	0	8	0	0
	SPD	1	60	11	0	3	0	2
	SPA	2	60	42	0	11	0	0
	SPB	2	60	38	1	8	2	0
	SPC	2	60	13	0	4	0	0
	SPD	2	60	12	0	4	0	1
	ISD	1	20	0	6	2	21	1
Strait	ISC	1	20	0	14	3	11	0
	ISB	1	20	0	15	2	35	1
	ISA	1	20	0	16	4	19	1
	ISA	2	20	0	4	2	5	1
	ISB	2	20	0	17	4	23	0
	ISD	2	20	0	0	0	0	0
	ISC	2	20	0	1	7	2	2
	UCD	1	20	0	36	9	30	14
	UCC	1	20	0	9	3	16	5
	UCB	1	20	0	14	0	7	1
	UCA	1	20	0	37	8	81	2
	UCA	2	20	0	10	1	7	4
	UCB	2	20	0	4	0	5	2
	UCC	2	20	0	31	5	20	6
	UCD	2	20	0	24	8	19	5