Southeast Alaska Coastal Monitoring Project

JC-02-09 June Cruise Report **11 September, 2002**

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Scientists from the Auke Bay Laboratory, Alaska Fisheries Science Center (NOAA Fisheries), conducted a 7-d cruise aboard the NOAA ship *John N. Cobb* in the marine waters of the northern region of southeastern Alaska from 22-27 June 2002, as part of the Southeast Alaska Coastal Monitoring (SECM) project. The SECM project was initiated in 1997 to study the habitat use and early marine ecology of juvenile Pacific salmon (*Oncorhynchus* spp.) as they migrate westward from natal streams into the Gulf of Alaska (GOA). In addition to Auke Bay Laboratory scientists, Rhys Smoker, a student and collaborating contractor, accompanied staff on the cruise. This cruise is the second in a series of four cruises scheduled monthly to monitor conditions in the inside and coastal marine waters of the region in spring and summer of 2002. Objectives were to: 1) collect biological data on juvenile Pacific salmon and other pelagic fish species from rope trawl samples and 2) monitor physical and biological oceanographic indices seasonally at 13 stations.

Sampling in 2002 marks the sixth year of this long-term study on how the intra- and interannual variability of physical and biological oceanographic indices relate to the distribution, abundance, growth, and survival of salmon and other fish populations at the same localities. After the first four years of sampling, the project was streamlined to target key localities by replicating trawl samples. This work continues to provide insight into potential effects of climate change on stock-specific growth and recruitment of salmonids and the utilization of marine habitat by key fish species.

METHODS

Thirteen stations were scheduled for sampling during this cruise, spanning inside waters near Juneau along a 200 km westerly migration corridor within southeastern Alaska to 65 km offshore in the Gulf of Alaska (Fig. 1, Table 1). As in 2001, the Cross Sound coastal transect and the single inshore stations TKI, LFC and FPR sampled in the first four years were omitted from the current year's sampling to free up time to collect replicate trawl samples in all habitats. Surface

trawling and oceanographic sampling were planned for all stations, as time and weather permitted. In addition, a cooperative project was arranged to compare and calibrate juvenile salmon catches between gear used by SECM in northern Southeast Alaska and by the University of Alaska Southeast, JCFOS, in southern Southeast Alaska. Two approaches were planned: 1) each project fish gear according to its standard protocol along the Icy Strait transect on two days, SECM surface trawling in daytime from the *John N. Cobb* and cooperating investigator, Dr. Milo Adkison, employing a standard townet (two-boat trawl) at nightime from the charter vessel F/V *Teasha*; and 2) at least one simultaneous pair of nightime hauls by the trawl and townet projects. Auke Bay Laboratory biologist, Alex Wertheimer, was assigned on the *Teasha* to assist Dr. Adkison and students for the two days.

Oceanographic sampling:

The physical and biological environment of the water column was monitored at each station and the 2-m surface conditions were monitored constantly throughout the cruise. To examine vertical water column structure, a SeaBird SBE-19[1] conductivity-temperature-depth (CTD) profiler was deployed at each station to 200 m or within 10 m of the bottom. To examine horizontal water structure, temperature and salinity readings from a 2-m depth were logged every minute with a SeaBird SBE-21 thermosalinograph. Surface water samples were taken at all stations; 200 ml water was filtered with a Millipore[1] system to separate phytoplankton cells from liquid and the two components were frozen for later determination of chlorophyll and nutrient content.

Plankton was sampled at each station with conical and bongo nets. The conical nets were hauled vertically and the bongo net system was towed obliquely. At each station, vertical plankton tows were made from a depth of 20 m with a 50-cm frame and 243 micron mesh (Norpac) net. In Auke Bay and in coastal transects only, a 57-cm frame and a 202 micron mesh (WP2) net was deployed to 200 m or within 20 m of the bottom. A Roshiga flow meter was used inside the 57-cm frame deep conical net to determine the amount of water volume sampled. Also at each station, one double oblique bongo tow was done to 200 m or within 20 m of the bottom using a 60-cm frame with 505 and 333 micron mesh nets. General Oceanics flow meters were placed inside each of the bongo nets to determine the amount of water volume sampled. A Bendix/Marine Advisors Model T-1 Bathykymograph time depth recorder was used with the bongo nets to validate the maximum depth of each tow.

Trawl gear:

Fish sampling was conducted with a Nordic 264 rope trawl fished directly astern the NOAA ship *John N. Cobb* at the surface. Trawl sampling was planned for each station with the exception of Auke Bay Monitor, which was not sampled due to shallow depths. The mouth opening of the trawl was approximately 20 m deep and 26 m wide, spread by a pair of 3 m Lite trawl doors. The trawl was fished fully open with 150 m of main warp out for a duration of 20 min at a speed of about 1.0-1.5 m/sec (2-3 knots). To fish the headrope of the trawl at the surface, a cluster of three meshed A-4 Polyform buoys was tethered to each wing tip of the headrope and one A-3

[1]Reference to trade names does not imply endorsement by the NOAA Fisheries.

Polyform float was clipped onto the center of the headrope. Mesh sizes ranged from 162.6 cm in the throat of the trawl near the jib lines to 8.9 cm in the cod end. A 6.1 m long, 0.8 cm knotless liner was sewn into the codend. A small mesh panel of 10.2 cm mesh was incorporated along the jib lines on the top panel of the trawl, between the head rope and the first 162.6 cm mesh, to minimize the loss of fish aft of the headrope.

Fish Processing:

After each haul, the fish were anaesthetized, identified, enumerated, measured, and the stomachs sampled (if appropriate). Tricaine methanesulfonate was used to anesthetize the fish. Fish were measured to the nearest mm fork length (FL) with a Limnotera FMB IV electronic measuring board. All captured salmon were visually examined for a missing adipose fin, indicating the potential presence of an internal planted coded-wire tag (CWT). Stomachs from potential predators of juvenile salmon were excised, weighed, and classified by fullness. Stomach contents were removed and generally identified to the family level and quantified to the nearest 10% of total volume. The weight of the stomach contents was determined as the difference between the weight of the stomach and contents minus the weight of the empty stomach.

Laboratory processing:

Data from biological samples readily processed in the laboratory are included in this cruise report. These data include: 1) settled volumes of zooplankton from the 20-m vertical hauls, and 2) CWTs from the heads of salmon lacking the adipose fin. Each sample of plankton was settled for a 24 hr period in an Imhof 1000 ml cone to determine the volume of zooplankton at each station. Volumes of settled zooplankton and phytoplankton were recorded to the nearest ml, when possible. CWTs were removed from heads of salmon lacking the adipose fin and decoded to determine the lot, location, and date the fish were released. CWT codes were verified by an independent tag reader. Release data for the CWT codes were obtained from regional mark coordinators, the Pacific States Marine Fisheries Commission (http://www.psmfc.org/rmpc/cwt_reports.html), the Alaska Department of Fish and Game (http://tagotoweb.adfg.state.ak.us), or the NOAA Fisheries, Auke Bay Laboratory. Laboratory processing in progress includes 1) measurement of weight and condition of juvenile salmon; 2) determination of energy content from frozen samples of juvenile pink, chum, and coho salmon; 3) examination for otolith thermal marks in frozen samples of juvenile chum, sockeye coho, and chinook salmon; 4) scale samples of each species of juvenile salmon for age analysis; 5) measurement of plankton displacement volumes of all bongo net samples; and 6) microscopic analysis of zooplankton species composition and abundance estimation from all NORPAC and bongo net samples taken at the Icy Strait stations. These data will be reported in annual North Pacific Anadromous Fish Commission (NPAFC) documents.

RESULTS and DISCUSSION

Thirteen core stations were sampled in June (Table 1). In addition, replicate sample series were collected twice at the Icy Strait stations and once at the Upper Chatham Strait stations to improve abundance estimation and increase sample sizes of juvenile salmon. Therefore, oceanographic

and trawl data were collected on 25 occasions (Table 2), all during daylight hours (0700-1900). To streamline high-priority laboratory processing, bongo and WP-2 samples were not collected at Upper Chatham Strait in this sixth year of sampling. A total of 25 CTD casts, 27 vertical 20-m (NORPAC) tows, 18 oblique (Bongo) tows, 9 deep vertical tows (WP2), and 24 rope trawl hauls were made during the cruise (Table 2). Additionally, thirteen water samples were collected and minimally-processed for later laboratory analysis of chlorophyll and nutrient composition.

Physical oceanography:

Surface (2-m) temperatures and salinities during the June cruise ranged from 8.3-12.7°C with a mean temperature of 11.0°C, compared to a warmer mean temperature of 12.5°C in June 2001; salinity ranged from 19.4-31.9 Practical Salinity Units (PSU) with a mean of 27.18 PSU, compared to a higher mean salinity of 26.1 PSU in June 2001 (Table 3). Although not monitored synchronously, temperatures varied between stations on a transect by 0.6°C to 3.9°C; temperatures at a given station were stable between replicate sampling days. Peak temperatures were measured at ABM and at northern stations in Icy Strait, ISC and ISD; minimum temperatures occurred at southern stations of Icy Strait, ISA and ISB. The salinity pattern, however, was noticeably lowest at the inshore station (ABM) and highest at the offshore coastal stations (i.e., IPA, IPB, IPC, and IPD). Light levels ranged from 20-660 $W*m^{-2}$, averaging 256 $W*m^{-2}$ over the 7-d cruise.

Plankton:
Zooplankton biomass, as estimated from the settled volumes of the 20-m vertical tows, ranged approximately ten-fold at the stations, from 6-58 ml (= 19 ml); zooplankton constituted 40-100% of total plankton in these surface waters (Table 3). Therefore, compared to June 2001, zooplankton settled volumes were lower and phytoplankton was present later, probably related to the colder temperatures observed in 2002. Zooplankton volumes at Icy Point were the lowest observed among transects, averaging only 7 ml, but no noticeably elevated zooplankton volumes were observed at any stations in the study area.

Fish catches:

A total of 3,314 fish from 17 taxa were captured in the 24 rope trawl hauls, including all five species of Pacific salmon (Tables 4-5). All identified fish caught were measured (Table 6). The most abundant of the 173 juvenile salmon captured were 76 chum (*O. keta*), 50 coho (*O. kisutch*), and 21 pink (*O. gorbuscha*) juveniles. Eight juvenile chinook (*O. tshawytscha*) and 18 juvenile sockeye (*O. nerka*) salmon were caught (Table 4). These low catches of juvenile salmon compared to catches in June of previous years were accompanied by low catch frequencies in 2002; no juvenile salmon species was caught in more than 21% of the hauls and only eight adult and 17 immatureg salmon were caught (Tables 4, 6). The two highest catches observed occurred at UCD and ISD, and totaled more than half the salmon caught during the cruise.

The most abundant and most-frequently caught non-salmonid species was walleye pollock (*Theragra chalcogramma*) (Table 5). More than 1000 pollock were caught at two stations in Icy Strait (Table 5), and overall, pollock were present in 62.5% of the 24 daytime hauls (Table 6). Crested sculpin (*Blepsias bilobus*) were the next most-frequently caught species, occurring in

four (16.7%) hauls. When species other than salmon and pollock were caught, they were usually represented by only one individual.

Coded-Wire Tags:

Three juvenile chinook salmon lacking adipose fins were examined for the presence of implanted coded-wire tags (CWTs). Only one contained a CWT; the fish was released by Macaulay Hatchery biologists at the Fish Creek field station near Juneau on June 13, 2001, one of 88,913 chinook from the 1999 brood (approximately 11% mark rate, code 040156). It was recovered at UCD in Upper Chatham Strait on June 25, 2002.

Fish diets:

Stomach analysis was performed on 30 immature and adult fish (Table 7), 47 of which (63.5%) were walleye pollock. Others included thirteen adult and four immature chinook, four adult chum, one adult coho, and three adult pink salmon, a Pacific sandfish and a spiny dogfish. No remains of juvenile salmon were identified from the guts of these potential predators. Piscivory was observed principally in chinook and coho salmon, as well as in pink salmon and three pollock. Prey fish found in their guts included only unidentified larval and older fish. Other common prey included hyperiid amphipods and euphausiids for pink salmon (66.7% frequency of occurrence, FO) and oikopleurans for chum salmon (100%FO). The pollock most commonly fed on crustaceans, including hyperiid amphipods, large copepods and decapod zoeae (30%, 66%, and 17%FO, respectively), but also consumed some oikopleurans (8.5%FO). Empty stomachs were observed for two chinook, the Pacific sandfish and the Spiny dogfish.

Concluding remarks:

The JC-02-09 cruise for SECM in June 2002 was successful despite vessel mechanical and trawl failures that prevented completion of one objective, the simultaneous calibration of ABL trawl fishing gear with the University of Alaska JCFOS townet fishing gear. All other objectives were met, and replicate trawl sampling of key stations provided highly useful information. The vessel returned to port a day early, the evening of July 1.

ACKNOWLEDGMENTS

We would like to acknowledge the command and crew of the NOAA ship *John N. Cobb* for their superb cooperation and performance during the cruise. We also appreciate the assistance of collaborating contractor, Rhys Smoker.

Table 1. Localities and coordinates of stations scheduled for sampling in the marine waters of the northern region of southeastern Alaska off the NOAA ship *John N. Cobb*, 22-27 June 2002.

Locality	Station	Latitude north	Longitude west	Distance offshore km	Distance between km	Depth m
Auke Bay	ABM	58° 22.00'	134° 40.00'	1.5	—	60
Upper Chatham Strait	UCA	58° 04.57'	135° 00.08'	3.2	—	400
	UCB	58° 06.22'	135° 00.91'	6.4	3.2	100
	UCC	58° 07.95'	135° 01.69'	6.4	3.2	100
	UCD	58° 09.64'	135° 02.52'	3.2	3.2	200
Icy Strait	ISA	58° 13.25'	135° 31.76'	3.2	—	128
	ISB	58° 14.22'	135° 29.26'	6.4	3.2	200
	ISC	58° 15.28'	135° 26.65'	6.4	3.2	200
	ISD	58° 16.38'	135° 23.98'	3.2	3.2	234
Icy Point	IPA	58° 20.12'	137°07.16'	6.9	—	160
	IPB	58° 12.71'	137°16.96'	23.4	16.8	130
	IPC	58° 05.28'	137°26.75'	40.2	16.8	150
	IPD	57° 53.50'	137°42.60'	65.0	24.8	1,300

Table 2. Oceanographic and biological samples collected in the marine waters of the northern region of southeastern Alaska off the NOAA ship *John N. Cobb*, 22-27 June 2002.

Date	Station	Haul Number	Rope trawl	CTD	Plankton net samples			Chloro-phyll & nutrients
					Norpac	Bongo[1]	WP2	
22 Jun	ABM	6014	0	1	3	2	1	1
22 Jun	UCD	6015	1	1	1	0	0	1
22 Jun	UCC	6016	1	1	1	0	0	1
22 Jun	UCB	6017	1	1	1	0	0	1
22 Jun	UCA	6018	1	1	1	0	0	1
23 Jun	IPD	6019	1	1	1	2	1	1
23 Jun	IPC	6020	1	1	1	2	1	1
23 Jun	IPB	6021	1	1	1	2	1	1
23 Jun	IPA	6022	1	1	1	2	1	1
24 Jun	ISA	6023	1	1	1	2	1	1
24 Jun	ISB	6024	1	1	1	2	1	1
24 Jun	ISC	6025	1	1	1	2	1	1
24 Jun	ISD	6026	1	1	1	2	1	1
25 Jun	UCD [1]	6027	1	1	1	0	0	0
25 Jun	UCC [1]	6028	1	1	1	0	0	0
25 Jun	UCB [1]	6029	1	1	1	0	0	0
25 Jun	UCA [1]	6030	1	1	1	0	0	0
26 Jun	ISA [1]	6031	1	1	1	0	0	0
26 Jun	ISB [1]	6032	1	1	1	0	0	0
26 Jun	ISC [1]	6033	1	1	1	0	0	0
26 Jun	ISD [1]	6034	1	1	1	0	0	0
27 Jun	ISD [1]	6035	1	1	1	0	0	0
27 Jun	ISC [1]	6036	1	1	1	0	0	0
27 Jun	ISB [1]	6037	1	1	1	0	0	0
27 Jun	ISA [1]	6038	1	1	1	0	0	0
Total samples			24	25	27	18	9	13

[1]Replicate trawl samples, limited oceanographic samples were collected.

Table 3. Two meter depth temperatures and salinities and settled volumes of plankton in 20-m vertical Norpac hauls at stations sampled by the NOAA ship *John N. Cobb* in marine waters of northern southeastern Alaska, 22-27 June 2002.

							Plankton Settled Volume (ml)		
Date	Station	Haul Number	Time	Temperature (°C)	Salinity (PSU)	Light ($W*m^{-2}$)	Zooplankton	Phytoplankton	Total Plankton
Jun 22	ABM	6014	10:17	12.2	19.4	400	14	4	18
Jun 22	ABM	6014	10:20	12.2	19.4	20	10	3	13
Jun 22	ABM	6014	10:23	12.2	19.4	20	15	7	22
Jun 22	UCD	6015	13:30	11.3	25.8	718	19	0	19
Jun 22	UCC	6016	15:00	10.7	27.5	202	15	19	34
Jun 22	UCB	6017	16:30	11.7	28.3	660	22	0	22
Jun 22	UCA	6018	19:00	11.7	29.1	96	17	0	17
Jun 22	IPD	6019	7:00	11.5	31.9	76	7	0	7
Jun 23	IPC	6020	10:50	11.7	31.8	425	8	0	8
Jun 23	IPB	6021	13:30	11.9	31.4	503	6	0	6
Jun 23	IPA	6022	16:00	10.8	31.7	93	13	0	13
Jun 24	ISA	6023	7:45	9.6	30.5	56	20	0	20
Jun 24	ISB	6024	10:30	9.8	29.7	92	20	0	20
Jun 24	ISC	6025	14:00	11.9	24.6	173	30	25	55
Jun 24	ISD	6026	11:50	12.1	24.9	250	16	5	21
Jun 25	UCD	6027	8:15	11.3	26.4	138	20	25	45
Jun 25	UCC	6028	10:00	11.0	25.8	480	10	13	23
Jun 25	UCB	6029	12:30	11.5	26.9	110	13	14	27
Jun 25	UCA	6030	13:30	9.7	29.6	195	10	5	15
Jun 26	ISA	6031	7:00	8.4	30.5	148	10	1	11
Jun 26	ISB	6032	8:30	11.0	26.3	138	30	20	50
Jun 26	ISC	6033	10:00	12.3	24.9	110	45	45	90
Jun 26	ISD	6034	11:20	12.3	24.9	193	35	10	45
Jun 27	ISD	6035	8:20	11.3	26.0	93	30	45	75
Jun 27	ISC	6036	10:00	11.0	26.5	140	58	12	70
Jun 27	ISB	6037	12:30	8.3	30.2	165	15	0	15
Jun 27	ISA	6038	13:50	8.0	30.5	447	16	0	16

Table 4.–Numbers of salmon caught with a rope trawl at stations sampled by the NOAA ship *John N. Cobb* in marine waters of the northern region of southeastern Alaska, 22-27 June 2002.

			Juvenile Salmon					Immature Salmon	Adult Salmon			Total Salmon
Date	Station	Haul No.	Chum	Pink	Coho	Chinook	Sockeye	Chinook	Chum	Pink	Coho	
Jun 22	6015	UCD			2							2
Jun 22	6016	UCC	2					2				4
Jun 22	6017	UCB	4									4
Jun 22	6018	UCA										0
Jun 22	6019	IPD										0
Jun 23	6020	IPC										0
Jun 23	6021	IPB						1		1		2
Jun 23	6022	IPA				2						2
Jun 24	6023	ISA						2		1		3
Jun 24	6024	ISB										0
Jun 24	6025	ISC										0
Jun 24	6026	ISD										0
Jun 25	6027[1]	UCD	17	3	30	3	8	5				66
Jun 25	6028	UCC				1	1					2
Jun 25	6029	UCB	3					2				5
Jun 25	6030	UCA				1		1				2
Jun 26	6031	ISA										0
Jun 26	6032	ISB	1		1		1	1	2			6
Jun 26	6033	ISC	9				6	1				16
Jun 26	6034	ISD	9	4	15		2	1		1	1	33
Jun 27	6035	ISD	31	14	2	1			2			50
Jun 27	6036	ISC										0
Jun 27	6037	ISB										0
Jun 27	6038	ISA						1				1
Total catch			76	21	50	8	18	17	4	3	1	198

[1]coded-wire tag present

Table 5. Numbers of fish other than salmon sampled with a rope trawl from the NOAA ship *John N. Cobb* at stations in the marine waters of the northern region of southeastern Alaska, 22-27 June 2002.

Date	Haul No.	Station	Crested sculpin	Walleye pollock	Spiny lump-sucker	Pacific sandfish	Squid	Pacific sand-lance	Prow-fish	Unkn. fish larvae	Soft sculpin	Wolf-eel	Big mouth sculpin	Spiny dogfish	Total non-salmonids caught
Jun 22	6015	UCD		4											6
Jun 22	6016	UCC		2											6
Jun 22	6017	UCB	1												5
Jun 22	6018	UCA	1	1											2
Jun 23	6019	IPD													0
Jun 23	6020	IPC					1			1					2
Jun 23	6021	IPB								1	4			1	8
Jun 23	6022	IPA							5						7
Jun 24	6023	ISA		1057									1		1061
Jun 24	6024	ISB		63											63
Jun 24	6025	ISC													0
Jun 24	6026	ISD													0
Jun 25	6027	UCD		1											67
Jun 25	6028	UCC		1											3
Jun 25	6029	UCB	2	3											10
Jun 25	6030	UCA		3											5
Jun 26	6031	ISA		20											20
Jun 26	6032	ISB		65								1			72
Jun 26	6033	ISC	1	238			1					1	1		258
Jun 26	6034	ISD		1											34
Jun 27	6035	ISD		298											348
Jun 27	6036	ISC		1334											1334
Jun 27	6037	ISB			1										1
Jun 27	6038	ISA			1										1
	Total per species		5	3091	2	1	1	5	2	4	1	2	1	1	3116

Table 6. Length, frequency of occurrence (FO), and life history (LH) stage of fish[1] captured in 24 rope trawl hauls in the marine waters of the northern region of southeastern Alaska off the NOAA ship *John N. Cobb*, 22-27 June 2002.

			Fork length (mm)					
Common name	Species name	Number caught (n)	Min.	Max.	Mean	FO	%FO	LH stage
Pink (humpy)	*Oncorhynchus gorbuscha*	21	70	116	86.1	3	12.5	J
Chum (dog)	*O. keta*	76	75	121	95.6	8	33.3	J
Sockeye (red)	*O. nerka*	18	93	157	121.7	5	20.8	J
Coho (silver)	*O. kisutch*	50	111	210	153.4	5	20.8	J
Chinook (king)	*O. tshawytscha*	8	152	290	197.3	5	20.8	J
Total juvenile salmon measured		173						
Chinook	*O. tshawytscha*	17	233	556	348.5	10	41.7	I
Pink	*O. gorbuscha*	3	465	530	505.0	3	12.5	A
Coho	*O. kisutch*	1	620	620	620.0	1	4.2	A
Chum	*O. keta*	4	628	775	707.8	2	8.3	A
Total maturing salmon measured		25						
Crested sculpin	*Blepsias bilobus*	5	38	158	65.8	4	16.7	J
Prowfish	*Zaprora silenus*	2	43	94	68.5	2	8.3	J
Pacific spiny lumpsucker	*Eumicrotremus orbis*	2	47	100	73.5	2	8.3	J
Soft sculpin	*Psychrolutes sigalutes*	1	51	51	51.0	1	4.2	J
Pacific sandfish	*Trichodon trichodon*	1	234	234	234.0	1	4.2	A
Walleye pollock	*Theragra chalcogramma*	237	39	587	269.9	15	62.5	J, A
Wolf-eel	*Anarrhichthys ocellatus*	2	171	1350	760.5	2	8.3	J
Big-mouth sculpin	*Hemitripterus bolini*	1	35	35	35.0	1	4.2	J
Squid	Gonatidae	1	69	69	69.0	1	4.2	J
Spiny dogfish	*Squalus acanthias*	1	740	740	740.0	1	4.2	A
Unidentified larvae	Teleostei	--				1	4.2	L
Total non-salmonids measured		252						
Total fish measured		451						

[1]L = larvae; J = juvenile or post larvae in first year at sea (i.e., age -.0); I = immature age -.1 or older; A = mature (-ing) adults

Table 7. Number of occurrences and percent frequency of occurrence (FO) of prey categories and number of empty stomachs observed in 30 potential predators of juvenile salmon collected in 24 rope trawls from the NOAA ship *John N. Cobb* in marine waters of the northern region of southeastern Alaska, 22-27 June 2002. The number of fish examined is shown in the heading in parentheses for each species.

Prey Category	Adult Chinook (13)	Immature Chinook (4)	Adult Chum (4)	Adult Coho (1)	Adult Pink (3)	Pacific sandfish (1)	Spiny dogfish (1)	Walleye pollock (47)
Amphipods, Hyperiids	1 (7.7)				2 (66.7)			14 (29.8)
Copepod, Lg. (> 2.5 mm)								31 (66.0)
Euphausiids	1 (7.7)				2 (66.7)			20 (42.6)
Fish, Unident. Larvae	6 (46.2)	2 (50)		1 (100)	1 (33.3)			
Fish, Unknown	4 (30.8)	1 (25)			1 (33.3)			3 (6.4)
Oikopleurans			4 (100)					4 (8.5)
Other	1 (7.7)							1 (2.1)
Pteropods			1 (25)		1 (33.3)			2 (4.2)
Shrimp								1 (2.1)
squid	1 (7.7)							
Zoeae, Decapod	1 (7.7)	1 (25)						8 (17.0)
Number of empty stomachs	1 (7.7)	1 (25)				1 (100)	1 (100)	6 (12.8)

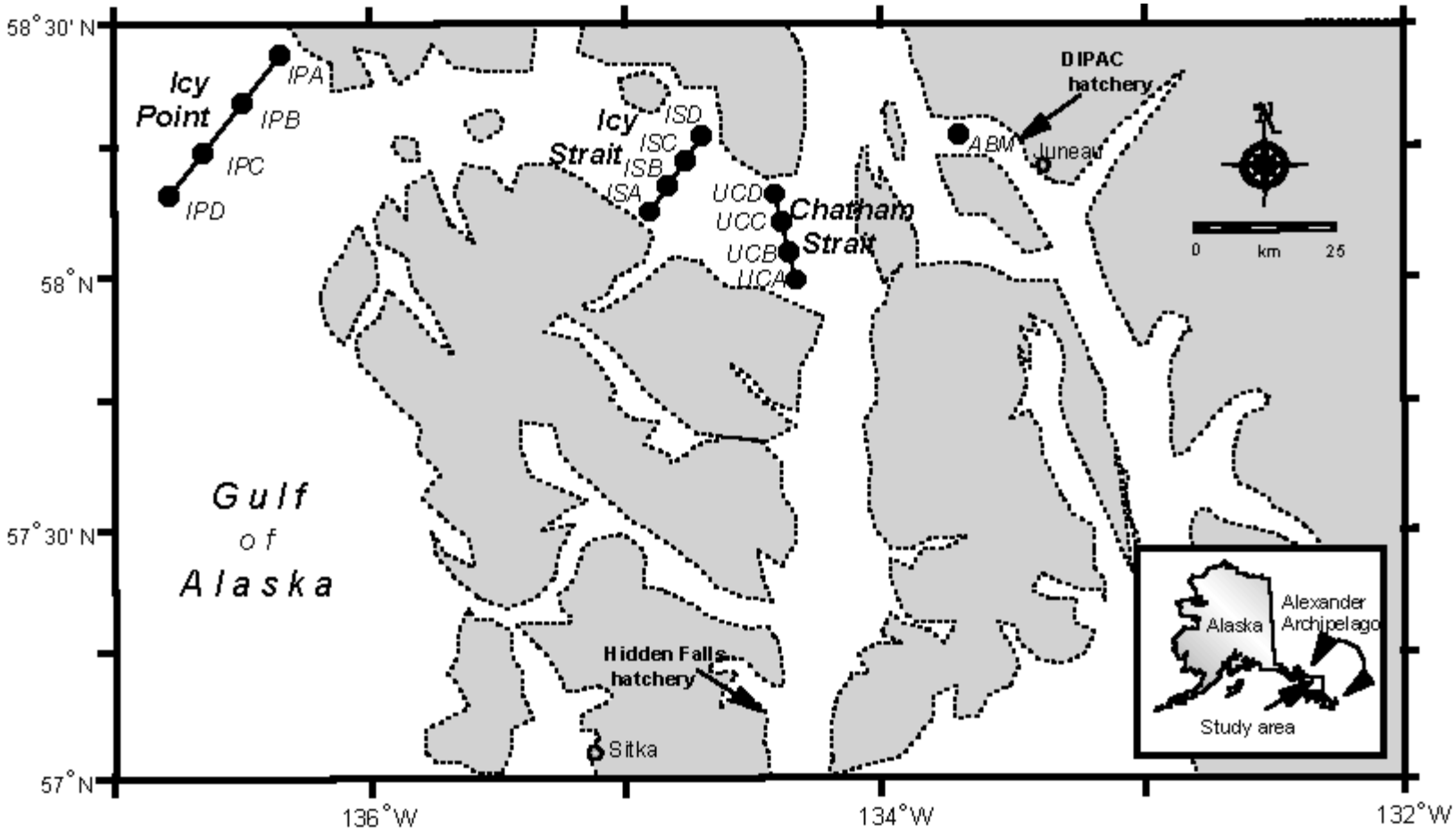

Figure 1.—Stations sampled monthly in marine waters of the northern region of southeastern Alaska, May–October 1997-2001. Arrows indicate principal enhancement facilities, DIPAC (Douglas Island Pink and Chum) and Hidden Falls hatchery.