

JC-99-12 Cruise Report
07 September 1999

Prepared by

Joseph A. Orsi, Donald G. Mortensen, and Molly V. Sturdevant
Auke Bay Laboratory, 11305 Glacier Highway
Juneau, Alaska 99801-8626

TEL (907) 789-6034 FAX (907) 789-6094

E-mail: joe.orsi@noaa.gov, don.mortensen@noaa.gov, molly.sturdevant@noaa.gov

Scientists from the Auke Bay Laboratory of the National Marine Fisheries Service, Alaska Fisheries Science Center conducted a 7-d cruise aboard the NOAA ship *John N. Cobb* in the marine waters of the northern region of southeastern Alaska from 24 to 30 July, 1999. In addition to Auke Bay Laboratory scientists, Kristen M. Munk, a scientist from the Alaska Department of Fish and Game accompanied us on the cruise. This cruise is the third in a series of five cruises scheduled to monitor the inside and coastal marine waters of the region monthly in 1999. Objectives for these monitoring cruises are to: 1) collect biological data on juvenile Pacific salmon (*Oncorhynchus* spp.) and other pelagic fish species from rope trawl samples, and 2) monitor physical and biological oceanographic indices seasonally at 24 stations.

Sampling in 1999 marks the third year of a long-term study on how the intra- and inter-annual 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. The information will also 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

Twenty four stations were scheduled for sampling during this cruise, spanning from inside waters near Juneau to 60 km offshore in the Gulf of Alaska (Table 1). Oceanographic measurements and surface trawl sampling were planned for all 24 stations, as time and weather permitted.

Oceanographic sampling:

The physical and biological environment was monitored at each station, and 2-m depth temperature and salinity readings were continuously logged on board the vessel. A SeaBird SBE-19¹ conductivity-temperature-depth (CTD) profiler was deployed at each station, as depth

¹Reference to trade names does not imply endorsement by the National Marine Fisheries Service.

permitted, to 200 m or within 10 m of the bottom. Logging of 2-m depth temperatures and salinities was accomplished on board the vessel with a SeaBird SBE-21 thermosalinograph that recorded measurements every minute throughout the cruise.

Plankton was sampled at each station with conical and bongo nets. The conical nets were towed vertically and a bongo net 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 net. In Auke Bay and in coastal transects only, a 57-cm frame and a 202 micron mesh 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 deployment depth of each tow, and it was also used to validate the fishing depth of the footrope during one trawl haul. Water samples were taken at selected stations for later determination of chlorophyll and nutrient content.

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 attempted on account of shallow depths in the vicinity. The mouth opening of the trawl was approximately 20 m deep and 26 m wide spread by a pair of 3.0 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 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. Along the jib lines on the top panel of the trawl, between the head rope and the first 162.6 cm mesh, a small mesh panel of 10.2 cm mesh was incorporated to minimize the loss of fish aft of the headrope.

Fish Processing:

After each haul, the fish were anesthetized, identified, enumerated, measured, and 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 electronically scanned or 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 adipose fin-clipped salmon. 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 release data of the fish. CWT codes were verified by an independent tag reader. Release data for the CWT codes were obtained from regional mark coordinators, the http://www.psmfc.org/rmpc/cwt_reports.html), the Alaska Department of Fish and Game (<http://tagotoweb.adfg.state.ak.us>), or the National Marine Fisheries Service, Auke Bay Laboratory.

RESULTS and DISCUSSION

Sampling was accomplished at 23 of the 24 stations scheduled. To maximize sampling opportunities along coastal stations, repetitive excursions to the outer coast were necessary. Despite these excursions, inclement weather still precluded sampling at the furthest offshore station along the Icy Point transect (IPD). Consequently, oceanographic data were taken at 23 stations and trawling was conducted at 22 stations (Table 2). A total of 23 CTD casts, 25 vertical 20-m tows, 23 bongo tows, and 4 deep vertical tows were made during the cruise. Seventeen water samples were taken at selected stations for later analysis of chlorophyll and nutrients.

On this cruise, the fishing depth of the foot rope was validated using a Bathykymograph placed on the center of the foot rope during a trawl haul in Icy Strait on 27 July 1999. Prior to this depth validation, a Bathykymograph rated for 50 m depths was sea truthed against a CTD to a depth of 30 m. The results of this test indicated the foot rope initially reached a maximum depth of 26 m during trawl deployment, then it fished consistently at a depth of 24 m for the duration of the 20 minute trawl haul, and finally reached a depth of 30 m briefly as the haul back process was initiated. During this validation the trawl head rope was tethered with buoys on the surface. Therefore, the nominal vertical opening of the trawl identified by this test during a standard 20-minute haul extends from the surface to 24 m in depth.

Surface (2-m) temperatures and salinities during the cruise ranged 7.7-12.9°C and 13.9-31.8 (Table 3). Temperatures varied between stations, however salinities were lowest at the inshore stations (i.e., TKI, ABM, LFC, and FPR). Temperatures at the strait and coastal stations in 1999 were about a degree cooler than the previous two years of study (1997 and 1998), however, temperatures in the inshore stations were somewhat warmer in 1999.

Zooplankton biomass, as determined from the settled volumes from the 20-m vertical tows, ranged 2-20 ml at the stations, with the highest levels observed in the inshore stations (12-20 ml), with variable amounts occurring at the coastal (5-16 ml) and strait (2-19 ml) stations. Zooplankton biomass was relatively higher than the previous two years in coastal habitats and substantially lower in strait habitats in 1999.

A total of 2,902 fish from 16 taxa were captured in the 22 rope trawl hauls, including all five

species of Pacific salmon (Tables 3-5). The primary catch component was juvenile salmon, particularly chum salmon (*O. keta*), pink salmon (*O. gorbuscha*), Pacific herring (*Clupea pallasii*), and sockeye salmon (*O. nerka*). The frequency of occurrence was highest for, coho salmon (*O. kisutch*), sockeye salmon, chum salmon, and pink salmon, whereas Pacific herring were the third most abundant species but only occurred at two inshore stations (Table 5).

Onboard stomach analysis was done on 118 potential fish predators of juvenile salmon: 54 sablefish (*Anchoa mitchilli*), 45 pink salmon, 7 immature chinook salmon (*O. tshawytscha*), 5 walleye pollock (*Gadus chalcogrammus*), 2 Pacific sandfish (*Trichodon trichodon*), 1 coho salmon, 1 chum salmon, 1 starry flounder (*Paralichthys stellatus*), 1 Pacific cod (*Gadus macrocephalus*), and 1 black rockfish (*Sebastes melanops*). The remains of juvenile salmon were found in 22 sablefish stomachs (41%) and in the one adult coho salmon stomach. Individual sablefish predators had consumed up to four juvenile salmon. This high rate of predation on juvenile salmon by sablefish was surprising. Two pieces of evidence suggested that the concentration of predators and prey resulted in net feeding: 1) many salmon appeared freshly preyed upon by the sablefish, and 2) the rate of predation on salmon generally increased as the salmon:sablefish catch ratio increased. However, the hypothesis that predation occurred outside the net was also supported by two pieces of evidence: 1) some identifiable juvenile salmon remains were well-digested, and 2) a sablefish had fed on salmon when no salmon were caught in the trawl. Age of a sample (69) of the captured sablefish was reported as exclusively age 1+ by Kristen Munk of the Alaska Department of Fish and Game, who aged otoliths from these fish after the cruise. Predation on juvenile salmon by sablefish was also documented in the prior cruise during late June.

Of the six juvenile coho salmon, one juvenile chinook salmon, and one immature chinook salmon lacking adipose fins, all but two of the coho contained previously implanted CWTs (Table 6). All CWTed fish had originated from the northern region of southeastern Alaska. From release to recovery, the CWT fish migrated 5-165 km from their tagging localities and had spent 45-415 days at sea. The two chinook salmon had relatively slower daily migration rates (0.1 and 0.4 km/d) than the four juvenile coho salmon (0.3, 2.8, 2.8, 3.4 km/d). Data documenting the occurrence of CWT coho and chinook juveniles in the study area in July, is consistent with results from the prior two years of study.

ACKNOWLEDGMENTS

We would like to acknowledge the command and crew of the NOAA ship *John N. Cobb* (Bill Cobb, Mike Devany, George Eimes, Scott Hill, Shannon King, Bill Lamoureux, Strydr Nutting, Dan Roby, and Del Sharp) for their superb cooperation and performance. In addition we appreciate the assistance given to us on this cruise by Kristen M. Munk of the Alaska Department of Fish and Game, and the sablefish age information from otoliths she provided to us after the cruise.

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*, 24-30 July 1999.

Locality	Latitude Station	Longitude north	offshore west	Distance		m
				between km	Depth km	
Auke Bay	ABM	58° 22.00'	134° 40.00'	1.5		60
Taku Inlet	TKI	58° 11.19'	134° 11.71'	2.2	17.0	175
Lower Favorite Channel	LFC	58° 20.98'	134° 43.73'	1.5	17.0	75
False Point Retreat	FPR	58° 22.00'	135° 00.00'	1.8	34.0	680
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
Cross Sound	CSA	58° 09.53'	136° 26.96'	3.2		300
	CSB	58° 10.91'	136° 28.68'	6.4	3.2	60
	CSC	58° 12.39'	136° 30.46'	6.4	3.2	200
	CSD	58° 13.84'	136° 32.23'	3.2	3.2	200
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
Cape Edward	EDA	57° 39.00'	136°23.20'	8.0		90
	EDB	57° 36.00'	136°34.40'	20.0	12.0	185
	EDC	57° 32.50'	136°46.60'	33.0	13.0	1,270
	EDD	57° 28.75'	136°56.60'	47.0	13.0	1,800

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*, 24-30 July 1999.

Date	Haul#	Station	CTD	Plankton net samples			Chlorophyll & nutrients	Rope trawl
				Norpac	Bongo	WP-2		
24 July	3040	TKI	1	1	2	0	1	1
24 July	3041	FPR	1	1	2	0	1	1
25 July	3042	IPA	1	1	2	1	1	1
25 July	3043	IPB	1	1	2	1	1	1
25 July	3044	IPC	1	1	2	1	1	1
26 July	3045	CSA	1	1	2	0	1	1
26 July	3046	CSB	1	1	2	0	0	1
26 July	3047	CSC	1	1	2	0	0	1
26 July	3048	CSD	1	1	2	0	1	127 July 3049 ISA
27 July	3050	ISB	1	1	2	0	0	1
27 July	3051	ISC	1	1	2	0	0	1
27 July	3052	ISD	1	1	2	0	1	1
28 July	3053	EDA	1	1	2	0	1	1
28 July	3054	EDB	1	1	2	0	1	1
28 July	3055	EDC	1	1	2	0	1	1
28 July	3056	EDD	1	1	2	0	1	1
29 July	3057	UCA	1	1	2	0	1	1
29 July	3058	UCB	1	1	2	0	0	1
29 July	3059	UCC	1	1	2	0	0	1
29 July	3060	UCD	1	1	2	0	1	1
30 July	3061	LFC	1	1	2	0	1	1
30 July	3062	ABM	1	3	2	1	1	0
Total			23	25	46	4	17	22

Table 3.--Two meter depth temperatures and salinities, settled volumes of plankton from 20-m vertical Norpac hauls, and catches of salmon with a rope trawl at stations sampled by the NOAA ship *John N. Cobb* in marine waters of the northern region of southeastern Alaska, 24-30 July 1999.

Date	Haul#	Station	Temp. (°C)	Salinity (o/oo)	Settled plankton (ml)			Juvenile salmon					Immature Adult				
					Zoop-	Phyto-	Total	Chum	Pink	Sockeye	Coho	Chinook	Chinook	Chum	Pink	Coho	
24 July	3040	TKI	9.9	13.9	20	10	30					◻					
26 June	3041	FPR	12.6	23.7	14	0	14	◻◻△	◻◻◻	○	◻◻		◻			◻	
25 July	3042	IPA	12.1	31.5	12	3	15	◻◻	◻◻	◻◻						◻	
25 July	3043	IPB	12.9	31.7	8	0	8	◻△◻	◻△	◻◻◻	◻			◻		◻	
25 July	3044	IPC	12.1	31.5	16	0	16										
26 July	3045	CSD	7.8	31.5	5	0	5			◻							
26 July	3046	CSC	7.8	31.8	6	0	6					◻					
26 July	3047	CSB	7.7	31.8	5	0	5	◻◻	◻◻	◻							
26 July	3048	CSA	11.3	31.7	12	0	12	△	◻	◻						◻	
27 July	3049	ISA	11.1	28.2	11	0	11	◻			◻◻		◻			◻◻	
27 July	3050	ISB	12.0	27.8	4	0	4	◻△	◻◻	○	◻△		◻				
27 July	3051	ISC	12.1	26.6	8	0	8	◻◻◻	◻◻◻	△	◻◻						
27 July	3052	ISD	12.5	26.1	8	0	8	◻◻◻	◻◻◻	△	◻◻	◻	◻			◻	◻
28 July	3053	EDA	12.3	◻◻◻◻	5	0	5	◻	◻								
28 July	3054	EDB	12.1	◻◻◻◻	12	0	12				◻						
28 July	3055	EDC	12.1	◻◻◻◻	10	0	10										
28 July	3056	EDD	12.5	◻◻◻◻	5	0	5								◻	◻	
29 July	3057	UCA	10.6	◻◻◻◻	8	0	8				△					◻	
29 July	3058	UCB	11.2	◻◻◻◻	2	0	2	○		◻	◻◻					◻	
29 July	3059	UCC	12.8	◻◻◻△	◻◻	0	19				◻						
29 July	3060	UCD	12.5	◻◻◻△	10	0	10				◻						◻
30 July	3061	LFC	11.9	16.5	15	10	25			◻		◻◻					
30 July	3062	ABM	12.4	15.4	12	3	15	na	na	na	na	na	na	na	na	na	na
Total catch			—					870	670	363	117	22	7	2	45	1	

Table 4.--Catches of fish other than salmon with a rope trawl at stations sampled by the NOAA ship *John N. Cobb* in marine waters of the northern region of southeastern Alaska, 24-30 July 1999.

Date	Haul#	Station	Pacific herring	Sablefish	Capelin	Prowfish	Walleye pollock	Pacific spiny lumpsucker	Crested sculpin	Pacific sandfish	Starry flounder	Pacific cod	Black rockfish
24 July	3040	TKI	⊙▪▪▪		⊙⊙	⊙	⊙		⊙		⊙		
25 July	3041	FPR	⊙	⊙⊙△	⊙				⊙				
25 July	3042	IPA								⊙			
25 July	3043	IPB											
25 July	3044	IPC					⊙						
26 July	3045	CSA				⊙			⊙			⊙	
26 July	3046	CSB											
26 July	3047	CSC											
26 July	3048	CSD		—	△								
27 July	3049	ISA											
27 July	3050	ISB		⊙									
27 July	3051	ISC		⊙⊙									
27 July	3052	ISD	—				⊙						
28 July	3053	EDA											
28 July	3054	EDB				⊙		—					⊙
28 July	3055	EDC		⊙									
28 July	3056	EDD											
29 July	3057	UCA					⊙						
29 July	3058	UCB		⊙									
29 July	3059	UCC				⊙							
29 July	3060	UCD	—	⊙		⊙							
30 July	3061	LFC					⊙	⊙	⊙	⊙			
30 July	3062	ABM	na	na	na	na	na	na	na	na	na	na	na
Total catch			569	149	59	8	7	4	4	2	1	1	1

Table 5.--Length, frequency of occurrence, and life history stage of measured fish captured with a rope trawl in the marine waters of the northern region of southeastern Alaska off the NOAA ship *John N. Cobb*, 24-30 July 1999.

Common name	Species	n	Fork length (mm)			Frequency of occurrence	Life ² stage
			min	max	x		
Chum salmon	<i>Oncorhynchus keta</i>	648 ³	90	190	129.7	11	J
Pink salmon	<i>O. gorbuscha</i>	501 ³	84	169	114.9	9	J
Sockeye salmon	<i>O. nerka</i>	159 ³	99	182	145.0	11	J
Coho salmon	<i>O. kisutch</i>	117	127	273	207.0	13	J
Chinook salmon	<i>O. tshawytscha</i>	22	106	225	160.2	3	J
Chinook salmon	<i>O. tshawytscha</i>	7	322	1140	485.9	4	I
Chum salmon	<i>O. keta</i>	2	333	396	364.5	2	A
Pink salmon	<i>O. gorbuscha</i>	45	416	543	478.7	9	A
Coho salmon	<i>O. kisutch</i>	1	634	634	634.0	1	A
Total salmonids measured		1,502					
Pacific herring	<i>Clupea pallasii</i>	56 ³	93	187	153.2	2	I-A
Sablefish							
Capelin							
Prowfish							
Walleye pollock							
P. Spiny lump sucker	<i>Eumicrotremus orbis</i>	4	55	76	65.0	1	I
Crested sculpin	<i>Blepsias bilobus</i>	4	73	116	97.8	4	I-A
Pacific sandfish	<i>Trichodon trichodon</i>	2	183	199	191.0	2	I
Starry flounder							
Pacific cod	<i>Gadus macrocephalus</i>	1	636	636	636.0	1	A
Black rockfish	<i>Sebastes melanops</i>	1	574	574	574.0	1	A
Total non-salmonids measured		276					
Total fish measured		1,778					

²J = juvenile or post larvae in first year at sea (i.e., age -.0), I = immature age -.1 or older in pre-spawn condition, and A = mature adult or near age of maturity.

³The samples of fish measured for these species are a portion of the total number captured. The total number captured for each of these species is given in Tables 3 and 4.

Table 6.--Release and recovery information for coded-wire tagged salmon captured in the northern region of southeastern Alaska by rope trawl, NOAA ship *John N. Cobb*, 24-30 July 1999.

Species	Coded-wire tag code	Brood year	Release information				Recovery information				Days release	Distance since (km)
			Agency ⁴	Locality	Date	Size (mm) (g)	Locality (station code)	Date	Size (mm) (g)			
Chinook	50:04/42	1996	DIPC	Gastineau Channel, AK	06/02/98	24.1	Icy Strait (ISD)	07/22/99	362	640.0	415	165
Chinook	50:04/55	1997	DIPC	Auke Bay, AK	06/04/99	26.4	L.Fav. Channel (LFC)	07/30/99	159	48.1	58	5
Coho	04:48/58	1997	NSRA	Kasnyku Bay, AK	06/07/99	19.8	False Pt. Retreat (FPR)	07/24/99	220	120.0	47	130
Coho	04:48/58	1997	NSRA	Kasnyku Bay, AK	06/07/99	19.8	Icy Strait (ISD)	07/22/99	226	137.8	⊙⊙	130
Coho	50:31/04	1997	DIPC	Gastineau Channel, AK	06/07/99	17.1	Icy Strait (ISD)	07/22/99	190	82.2	⊙△	165
Coho	50:04/47	1997	DIPC	Sheep Creek, AK	06/09/99	15.8	Taku Inlet (TKI)	07/24/99	150	32.3	47	15
Coho	No Tag						Chatham Strait (UCD)	07/29/99	179	69.6		
Coho	No Tag						False Pt. Retreat (FPR)	07/24/99	247	174.2		

⁴ DIPC = Douglas Island Pink and Chum Corporation
 NSRA = Northern Southeast Regional Aquaculture Association