JC-98-08 Cruise Report
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Scientists from the Auke Bay Laboratory of the National Marine Fisheries Service, Alaska Fisheries Science Center, conducted a 8-d cruise aboard the NOAA ship *John N. Cobb* in marine waters of the northern region of southeastern Alaska from 24 June to 01 July 1998. This cruise was the second in a series of five monthly cruises scheduled to sample the inside and coastal waters of the region.

Primary objectives of the cruises are to: 1) sample juvenile salmon (*Oncorhynchus* spp.) and ecologically related species with a rope trawl, 2) collect associated physical and biological data with each trawl haul, and 3) examine the spatial and temporal occurrence of juvenile chum salmon (*O. keta*) and pink salmon (*O. gorbuscha*) and their diets and prey. A major focus of these cruises is to use otolith marked juvenile salmon to assess potential interactions between hatchery and wild stocks in the region.

Sampling was scheduled at twenty four stations throughout the inside and coastal waters of the northern region of southeastern Alaska (Table 1). At each station, the sampling protocol involved: one 20-min trawl haul, one CTD cast, one double oblique bongo tow, one 20-m vertical plankton tow, and in coastal waters only, one deep vertical plankton tow. An exception to this protocol was the sampling at Auke Bay Monitor (ABM) station where three additional vertical hauls were planned and trawling was not scheduled on account of the shallow bottom depth.

Trawl gear:

Fish were sampled using a Nordic[1] 264 rope trawl fished directly astern the NOAA ship *John N. Cobb* at the surface. The mouth opening of the trawl was 20 m deep and 35 m wide and it was spread apart by a pair of 3.0 m Lite trawl doors. The trawl was fished fully open with 75 fathoms of main warp out for a duration of 20 min at a speed of 1.5 m/sec (3 knots). Trawl speed was monitored from the vessel using a flowmeter with an electromagnetic sensor (Marsh McBirney, Inc., Model 2000-21). To fish the headrope of the trawl at the surface, a cluster of

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

three meshed A-4 Polyform buoys were 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. To minimize the loss of fish behind the headrope, 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.

Oceanographic sampling:

The physical and biological environment was monitored and sampled at each station immediately prior to or after each trawl haul. One CTD cast was made with a Sea-Bird SBE 19 Seacat profiler to 200 m or within 10 m of the bottom. 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. Vertical plankton tows were made with a 50-cm frame and 243 micron mesh net to 20 m at each station, 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. General Oceanics or Roshiga flow meters were placed inside the bongo and deep conical nets. A Bendix time and depth recorder was used with the oblique tows to determine the maximum sampling depths. To assess zooplankton availability at the sampling stations, the 20-m NORPAC vertical plankton hauls were settled over a 24 hr period in 1 L Imhof cones at the Laboratory.

Results:

Favorable weather conditions enabled us to sample all 24 stations according to the cruise plan, despite mechanical problems with the gyro compass onboard the vessel which required the cruise to terminate a day early. Samples collected from all the stations included: 23 trawl hauls, 24 bongo tows, 24 CTD casts, and 39 vertical plankton hauls.

A total of 6,633 fish and squid representing 21 species were sampled with the rope trawl (Table 2). Of the fish captured, 3,238 were measured for length and most were retained for later laboratory analysis. All five species of juvenile Pacific salmon were captured during the cruise and over 92% of the catch was comprised of pink (67%) and chum (25%) salmon. The vast majority of salmon caught were juveniles; less than 1% of the salmon were immature (18) or adult (9). Frequency of occurrence was highest for juvenile sockeye (*O. nerka*), coho (*O. kisutch*), pink, and chum salmon.

Distribution of certain fish species was related to habitat. Juvenile salmon occurred primarily in strait habitats (4,251) as opposed to inshore (136) and coastal (37) habitats (Table 3). In the coastal habitat, no juvenile salmon were captured beyond 40 km offshore. Species such as sablefish *(Anoplopoma fimbria*), spiny dogfish, (*Squalus acanthias*), wolf-eel, (*Anarrhichthys ocellatus*), and black rockfish (*Sebastes melanops*), occurred only in coastal habitats, whereas species such as Pacific spiny lumpsucker, (*Eumicrotremus orbis*) and starry flounder (*Platichthys stellatus*) occurred only in inshore habitats (Table 4).

Oceanographic features, such as temperature and salinity readings at 2-m depths, differed between localities. In general, warmer temperatures and lower salinities were found at the inside stations, whereas colder, more saline conditions were found at the coastal stations (Table 3).
Temperatures and salinities ranged 8.4-14.9°C and 20.8-32.0 o/oo. Settled volumes of zooplankton also differed between localities but increased from the coastal to the inside stations. Settled volumes in coastal localities ranged 1-35 ml and averaged 11 ml, whereas settled volumes in strait and inshore localities ranged 20-42 ml and averaged 29 ml.

Eleven coded-wire tags (CWTs) were recovered from the 6,355 juvenile salmon sampled (Table 5). The CWT salmon included five juvenile coho, five juvenile chinook (*O. tshawytscha*), and one immature chinook salmon. All CWT coho salmon were recovered in inside waters and originated from southeastern Alaska release localities. The CWT juvenile chinook were recovered in inside and outside waters and originated from Alaska, Washington and Oregon release localities. The one CWT immature chinook salmon originated from Washington.

Onboard stomach analysis was done on 40 potential predators of juvenile salmon. Stomach contents were examined from the following species: immature chinook salmon (13), spiny dogfish (13), adult coho salmon (4), adult chum salmon (3), adult pink salmon (2), black rockfish (2), sablefish (1), Pacific sandfish (*Trichodon trichodon*) (1), and starry flounder (1). Although piscivory was noted to occur, no prey items were identified as that of juvenile salmon.

Discussion:

The initial occurrence of juvenile and immature salmon at our sampling stations is consistent with data from last year. In May of 1997 and 1998, only immature chinook salmon of primarily age -.1 were present whereas juveniles were absent. But by June, juveniles of all five species of salmon were present. The initial occurrence of specific stock groups of coded-wire tagged salmon was also consistent between years. Juvenile CWT chinook and coho from several southeastern Alaska stocks were recovered both years in June. During this same time, we additionally recovered off the coast of Alaska four juvenile stream-type chinook originating from the Columbia River Basin. A single fish from this stock group was collected in June of 1997 and the three recoveries in the same general area in June of 1998 corroborate the timing of this stock group off the Alaska coast.

Marine migration rates of CWT chinook and coho recovered in June were similar between years. The one CWT juvenile chinook originating from the Columbia River Basin recovered in 1997 migrated at least 20 km/d, whereas the three CWT juvenile chinook originating from the Columbia River Basin recovered in 1998 migrated 16-21 km/d. These marine migration rates for Columbia River chinook also do not take into account any downriver migrations or oceanic meanderings. In the case of the one CWT chinook originating from Salmon River, Idaho, this downriver migration amounted to an additional 1150 km. Migration rates of the two CWT chinook originating from southeastern Alaska recovered in 1997 averaged about 1 km/d, whereas migration rates of the two CWT chinook from southeastern Alaska recovered in 1998 averaged

about 6 km/d. Migration rates of seven CWT coho originating from southeastern Alaska recovered in 1997 ranged 2-6 km/d, whereas in 1998 migration rates of three CWT coho originating from southeastern Alaska ranged 3-5 km/d.

Abundances of some species of juvenile salmon in June were higher in 1998 than in 1997. For pink salmon, in particular, June catch rates were 40 times higher in 1998 than 1997. Chum salmon catch rates were twice as high in 1998 and catch rates of the other species of juvenile salmon were similar between years. Another indication that pink salmon were abundant in 1998 was that the ratio of pink to chum salmon increased from 0.2:1 in 1997 to 2.6:1 in 1998. If the majority of the marine mortality for pink salmon has already occurred, this suggests that adult pink salmon returns in 1999 may be 13-40 times higher than the total return in 1998. These indices of abundance will be monitored in subsequent months of sampling.

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Table 1.--Localities and coordinates of stations sampled in marine waters of the northern region of southeastern Alaska off the NOAA ship *John N. Cobb*, 24-30 June 1998.

Locality	Station	Latitude	Longitude	Offshore distance	Inter-transect distance	Depth
Inshore stations						
Auke Bay	ABM	58° 22.00' N	134° 40.00' W	1.5 km	-----	60 m
Taku Inlet	TKI	58° 11.19' N	134° 11.71' W	2.2 km	-----	175 m
False Point Retreat	FPR	58° 22.00' N	135° 00.00' W	1.8 km	-----	680 m
Lower Favorite Channel	LFC	58° 20.98' N	134° 43.73' W	1.5 km	-----	75 m
Strait stations						
Upper Chatham Strait	UCA	58° 04.57' N	135° 00.08' W	3.2 km	3.2 km	400 m
	UCB	58° 06.22' N	135° 00.91' W	6.4 km	3.2 km	100 m
	UCC	58° 07.95' N	135° 01.69' W	6.4 km	3.2 km	100 m
	UCD	58° 09.64' N	135° 02.52' W	3.2 km	3.2 km	200 m
Icy Strait	ISA	58° 13.25' N	135° 31.76' W	3.2 km	3.2 km	128 m
	ISB	58° 14.22' N	135° 29.26' W	6.4 km	3.2 km	200 m
	ISC	58° 15.28' N	135° 26.65' W	6.4 km	3.2 km	200 m
	ISD	58° 16.38' N	135° 23.98' W	3.2 km	3.2 km	234 m
Coastal stations						
Cross Sound	CSA	58° 09.53' N	136° 26.96' W	3.2 km	3.2 km	300 m
	CSB	58° 10.91' N	136° 28.68' W	6.4 km	3.2 km	60 m
	CSC	58° 12.39' N	136° 30.46' W	6.4 km	3.2 km	200 m
	CSD	58° 13.84' N	136° 32.23' W	3.2 km	3.2 km	200 m
Icy Point	IPA	58° 20.12' N	137° 07.16' W	6.9 km	16.8 km	160 m
	IPB	58° 12.71' N	137° 16.96' W	23.4 km	16.8 km	130 m
	IPC	58° 05.28' N	137° 26.75' W	40.2 km	16.8 km	150 m
	IPD	57° 53.50 N	137° 42.60' W	65.0 km	24.8 km	1,300 m
Herbert Graves	EDA	57° 39.00' N	136° 23.20' W	7.0 km	13.0 km	67 m
(Cape Edward)	EDB	57° 36.00' N	136° 34.40' W	20.0 km	13.0 km	185 m
	EDC	57° 32.50' N	136° 46.60' W	33.0 km	13.0 km	1,270 m
	EDD	57° 28.75' N	136° 56.60' W	47.0 km	13.0 km	1,800 m

Table 2.--Length, frequency of occurrence, and life history stage of measured fish and squid captured with a rope trawl off the NOAA ship *John N. Cobb* in marine waters of the northern region of southeastern Alaska 24-30 June 1998.

Common name	Species	n	Fork length (mm) min	Fork length (mm) max	Fork length (mm) x̄	Frequency of occurrence	Life[2] history stage
Pink salmon	*O. gorbuscha*	1,598	65	161	94.4	12	J
		2	479	585	532.0	2	A
Chum salmon	*Oncorhynchus keta*	1,248	65	153	101.6	10	J
		3	655	737	689.0	3	A
Sockeye salmon	*O. nerka*	116	79	192	112.1	14	J
Coho salmon	*O. kisutch*	90	111	207	166.3	12	J
		4	571	667	604.5	3	A
Chinook salmon	*O. tshawytscha*	24	103	243	155.2	6	J
		18	280	511	371.5	4	I
Pacific herring	*Clupea harengus*	69	35	207	141.6	6	L, I, A
Greenling	Hexagramidae	18	71	79	75.4	2	J
Spiny dogfish	*Squalus acanthias*	15	454	840	559.6	4	I,A
Wolf-eel	*Anarrhichthys ocellatus*	8	378	499	437.0	6	I
Sablefish	*Anoplopoma fimbria*	3	71	85	77.7	1	J
		1	353	353	353.0	1	I
Crested sculpin	*Blepsias bilobus*	3	41	186	91.3	2	J, I, A
Walleye pollock	*Theragra chalcogramma*	3	35	43	39.0	1	J
Black rockfish	*Sebastes melanops*	2	472	593	511.5	1	A
Pacific sandfish	*Trichodon trichodon*	2	62	175	118.5	2	I
Flatfish	Pleuronectidae	2	35	45	40.0	2	L
Arrowtooth flounder	*Atheresthes stomias*	2	43	45	44.0	1	J
Squid[3]	Gonatidae	2	49	59	54.0	2	J
Pacific spiny lumpsucker	*Eumicrotremus orbis*	2	35	70	52.5	2	I
Ling cod	*Ophiodon elongatus*	1	71	71	71.0	1	J
Starry Flounder	*Platichthys stellatus*	1	295	295	295.0	1	A
Soft Sculpin	*Psychrolutes sigalutes*	1	33	33	33.0	1	I
Total measured		3,238					

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

[4] Mantle lengths

Table 3.--Temperatures, salinities, zooplankton volumes, and salmon catches at stations sampled in marine waters of the northern region of southeastern Alaska off the NOAA ship *John N. Cobb*, 24-30 June 1998. No trawling occurred at station ABM (Haul# 2037).

					Two meter depth	20-m settled								
						Juvenile					Salmon			
											Immature	Adult		
Date	Haul#	Station	temp (°C)	salinity (o/oo)	zooplankton volume (ml)	Pink	Chum	Sockeye	Coho	Chinook	Chinook	Pink	Chum	Coho
24 June	2014	TKI	9.5	20.8	30	-	-	-	-	9	3	-	-	-
24 June	2015	LFC	11.3	22.4	42	-	1	-	4	9	1	-	-	-
25 June	2016 1	ISA	11.1	28.8	20	1	-	-	3	-	8	1	-	
25 June	2017	ISB	11.2	27.9	25	1,262	242	11	8	-	-	-	-	-
25 June	2018	ISC	11.2	28.6	20	363	96	4	1	-	-	-	-	-
25 June	2019	ISD	11.1	28.8	25	511	146	10	11	-	4	-	-	-
26 June	2020	IPA	10.9	30.7	6	1	5	1	-	-	-	-	-	-
26 June	2021	IPB	12.3	30.6	5	-	-	3	-	1	1	-	1	-
26 June	2022	IPC	11.3	30.9	5	-	-	1	-	1	-	-	-	-
26 June	2023 --	IPD	12.6	31.0	14	-	-	-	-	-	-	1	1	
27 June	2024 2	EDA	12.4	31.3	1	1	-	9	1	3	-	-	1	
27 June	2025	EDB	11.9	31.1	11	-	-	-	-	-	-	-	-	-
27 June	2026	EDC	12.4	31.3	35	-	-	3	-	-	-	-	-	-
27 June	2027	EDD	12.3	31.3	20	-	-	-	-	-	-	-	-	-
28 June	2028	CSA	8.4	31.7	6	-	-	-	-	-	-	-	-	-
28 June	2029 1	CSB	8.4	31.7	9	-	-	2	4	-	-	-	-	
28 June	2030	CSC	7.7	32.0	8	1	-	-	-	-	-	-	-	-
28 June	2031	CSD	7.6	31.7	12	-	-	-	-	-	-	-	-	-
29 June	2032	UCA	12.7	27.6	20	732	321	4	3	-	-	-	-	-
29 June	2033	UCC	12.9	25.4	20	371	296	32	13	1	-	-	-	-
29 June	2034	UCB	12.9	25.5	40	819	415	22	24	-	-	-	-	-
29 June	2035	UCA	12.9	29.7	30	324	119	11	4	-	-	-	-	-
29 June	2036	FPR	14.9	30.1	41	38	59	2	14	-	-	-	-	-
30 June	2037	ABM	13.6	21.4	34	-	-	-	-	-	-	-	-	-
Total catch					4,424	1,700	116	90	24	18	2	3	4	

Table 4.--Catches of non-salmoid fish and squid by rope trawl haul at stations sampled in marine waters of the northern region of southeastern Alaska off the NOAA ship *John N. Cobb*, 24-30 June 1998. No trawling occurred at station ABM (Haul# 2037).

Date	Haul#	Station	Pacific herring	Hexa-gramidae	Spiny dogfish	Wolf-eel	Sablefish	Crested sculpin	Walleye pollock	Black rockfish	Pacific sandfish	Pleuro-nectidae	Arrowtooth flounder	Pacific Sp. Lump-Sucker	Ling cod	Starry flounder	Soft sculpin
24 June	2014	TKI	164	-	-	-	-	2	-	-	1	-	-	-	1	-	1	-
24 June	2015	LFC	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
25 June	2016	ISA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
25 June	2017	ISB	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25 June	2018	ISC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25 June	2019	ISD	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
26 June	2020	IPA	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
26 June	2021	IPB	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
26 June	2022	IPC	15	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-
26 June	2023	IPD	-	-	3	-	-	-	-	-	-	-	-	1	-	-	-	-
27 June	2024	EDA	-	-	9	2	-	-	-	-	-	-	-	-	-	-	-	-
27 June	2025	EDB	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-
27 June	2026	EDC	-	4	-	-	1	-	-	-	-	1	-	-	-	1	-	-
27 June	2027	EDD	-	14	-	1	3	-	-	-	-	1	2	-	-	-	-	-
28 June	2028	CSA	1	-	-	1	-	-	3	-	-	-	-	-	-	-	-	-
28 June	2029	CSB	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-
28 June	2030	CSC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28 June	2031	CSD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29 June	2032	UCA	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29 June	2033	UCC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29 June	2034	UCB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29 June	2035	UCA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29 June	2036	FPR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30 June	2037	ABM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total catch			183	18	15	8	4	3	3	2	2	2	2	2	2	1	1	1

Table 5.--Release and recovery information for coded-wire tagged juvenile salmon captured in marine waters of the northern region of southeastern Alaska by rope trawl haul off the NOAA ship *John N. Cobb*, 24-30 June 1998.

	Release information						Recovery information					Days	Marine Distance
Species	Coded-wire tag code	Brood year	Agency[4]	Locality	Date	Size (mm) (g)	Locality	(station code)	Date	Size (mm)	(g)	since release	traveled (km)
Chinook	21:29/61	1996	QNDR	Salmon R., WA	07/31/97	- 10.1	Icy Point	(IPA)	06/26/98	327	257.9	400	1,400
Chinook	10:51/26	1996	IDFG	S. Fk. Salmon R., ID	~03/20/98	- -	Herbert Graves	(HGA)	06/27/98	210	118.4	99	1,550
Chinook	09:22/27	1996	ODFW	W. Fk. Hood R, OR	~04/07/98	- 56.8	Herbert Graves	(HGA)	06/27/98	241	182.1	79	1,550
Chinook	05:49/58	1996	FWS	Deschutes R., OR (Warm Springs hatchery)	04/15/98	- 20.6	Herbert Graves	(HGA)	06/27/98	206	97.2	73	1,550
Chinook	04:48/17	1996	HDFL	Hidden Falls, AK	05/29/98	- 39.2	Taku Inlet	(TKI)	06/24/98	168	54.5	26	190
Chinook	03:62/34	1996	NMFS	Little Port Walter, AK	~05/15/98	- 26.0	Taku Inlet	(TKI)	06/24/98	146	37.3	40	220
Coho	04:49/10	1996	HDFL	Hidden Falls, AK	06/03/98	- -	Chatham Strait	(UCB)	06/29/98	148	39.8	26	100
Coho	04:45/30	1996	ADFG	(To be determined)	98	- -	Chatham Strait	(UCB)	06/29/98	159	49.5	-	-
Coho	04:45/30	1996	ADFG	(To be determined)	98	- -	Chatham Strait	(UCB)	06/29/98	154	39.5	-	-
Coho	04:49/08	1996	HDFL	Hidden Falls, AK	06/03/98	- 25.0	Icy Strait	(ISD)	06/25/98	162	54.8	22	120
Coho	04:46/43	1996	ADFG	Taku Inlet, AK	~05/15/98	89 -	Chatham Strait	(UCD)	06/29/98	157	46.4	~45	130

[4] ADFG = Alaska Department of Fish &Game IDFG = Idaho Department of Fish and Game QDNR = Quinault Department of Natural Resources
FWS = Fish and Wildlife Service NMFS = National Marine Fisheries Service
HDFL = Hidden Falls Hatchery ODFW = Oregon Department of Fish and Wildlife