

**GLOBEC Northeast Pacific, Gulf of Alaska
Cruise Report, F/V *Great Pacific*
15 October-12 November 2004
J.H. Moss and E.D. Cokelet**

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Port of Departure: Dutch Harbor, Alaska

Port of Return: Dutch Harbor, Alaska

Cruise Goals/Scientific Purpose

The purpose of this October-November 2004 OCC/GLOBEC (Ocean Carrying Capacity and Global Ocean Ecosystem Dynamics) cruise was to investigate the relationships between physical and biological oceanographic processes that affect the distribution and biology of juvenile salmon (*Oncorhynchus* spp.) in the Gulf of Alaska. Measurements focused on the spatial pattern of salmon distribution, oceanographic properties, and the distribution of zooplankton along six transects (Fig. 1). The participating laboratories were NOAA's Alaska Fisheries Science Center/Auke Bay Laboratory (AFSC/ABL) and the Pacific Marine Environmental Laboratory (PMEL).

Cruise Objectives

1. Determine the distribution of salmon along the six transects sampled.
2. Determine the distribution of zooplankton within the study area.
3. Determine the continuous distribution of surface temperature, nutrient concentration, salinity and chlorophyll fluorescence.
4. Measure vertical profiles of oceanographic water properties at discrete sampling stations in the Gulf of Alaska.
5. Measure vertical profiles of ocean current velocity continuously along the cruise track.

GLOBEC Cruise Participants

Angela Middleton	Biologist/ AFSC/ABL
Mary Drew	Biologist/ AFSC/ABL
Kristin Ceiceil	Biologist/ AFSC/ABL
Neal Muirhead	Biologist/ AFSC/ABL
Antonio Jenkins	Oceanographer/ UW/JISAO

Sampling Activities

The OCC/GLOBEC survey along the coastal waters of the Gulf of Alaska was conducted 19 October-8 November 2004. The survey area included 6 transects beginning with the Cape Kumlik (K) transect, located southeast of Kodiak Island, Alaska; and ending with the Cape Douglas (E) transect northwest of Afognak Island, Alaska (Fig. 1). Transects sampled during the survey were perpendicular to shore and extended from nearshore (less than 4 km from shore) across the continental shelf to oceanic waters beyond the 200-m shelf break.

The survey was conducted aboard the commercial fishing vessel F/V *Great Pacific* (124 ft). Fish samples were collected using a 198-m long mid-water rope trawl with hexagonal mesh wings and body, and a 1.2-cm mesh liner in the codend. The rope trawl was towed at 3.5 to 5 kts, at or near surface, and had a typical spread of 40-m horizontally and 14-m vertically. All tows lasted 30 minutes and were done during daylight hours.

Salmon and other fishes were sorted by species and counted. Standard biological measurements including fork length, body weight, and sex were made. Scale samples from the preferred area (to document age and growth) were taken from subsamples of all salmon species. Sub-samples of juvenile pink (*Oncorhynchus gorbuscha*), chum (*O. keta*), and sockeye (*O. nerka*) salmon were frozen whole for laboratory analyses of food habits, hatchery thermal marks on otolith (pink and chum salmon), and genetic analysis (pink and chum salmon). Tissues and otoliths were also saved from immature chum salmon to determine stock distribution and migration. All other fish species were counted.

Oceanographic measurements were made at trawl stations immediately prior to each trawl haul. Depth profiles of temperature, salinity, oxygen concentration, photosynthetically available radiation (PAR), chlorophyll fluorescence, and optical transmittance were collected from surface to near-bottom using a Sea-Bird SBE 25 CTD (conductivity-temperature-depth) profiler with automatic firing mechanism (AFM) water-bottle rosette lowered at 20 m/min¹. On each cast, Niskin bottles collected discrete water samples at 5, 15, 25, 35, 50, 75 and 100 m depth for nutrient concentrations. Chlorophyll samples were taken from the bottle depth nearest the chlorophyll maximum, usually in

¹ Reference to trade names does not imply endorsement by NOAA.

the upper 35 m. Salinity samples were taken alternately at the shallowest and deepest bottle depth for calibration with the CTD. For CTD casts 21-27, the AFM stopped working owing to computer communication problems. For these casts, an SBE 25 CTD without oxygen sensor or rosette was used. In those cases, one Niskin bottle was tripped at 15 m.

Plankton samples were collected using a Bongo net frame fitted with 505- μ m and 330- μ m mesh nets that were towed obliquely relative to surface (approximately 1 knot) to a depth of 20 m. The volume of water filtered by the net was estimated using a flow meter, and the plankton samples were preserved in 5% formalin.

The ocean current beneath the ship was measured continuously with a 300-kHz acoustic Doppler current profiler (ADCP). A differential Global Positioning System (GPS) receiver and a GPS-based attitude determination unit provided associated position and heading measurements.

A thermosalinograph, nutrient sampler and fluorometer sampling water from the sea chest provided continuous measurements of near-surface temperature, salinity, nutrients and fluorescence. Water samples were taken from this system 1-2 times per day and sent back to the laboratory to calibrate the salinity, nutrient concentrations and chlorophyll fluorescence.

Satellite-tracked drifting buoys were deployed at designated trawl stations to measure the strength and direction of the current along the continental shelf (Table 1).

Daily Cruise Summary

Leg 1: 15 October – 31 October ADT

Sampling gear and oceanographic equipment was loaded on the vessel during 15 October and 16 October. The cruise departed Dutch Harbor, Alaska, on 17 October and proceeded to the nearshore station along the Cape Kumlik (K) transect. Work on this transect began on the morning of 19 October and ended on 20 October. Standard work at each station included vertical CTD casts to near bottom, oblique tow for zooplankton using a Bongo net, and a surface tow for salmon and other marine fishes using the rope trawl. Eight stations located in Shelikof Strait (H, G, F, and E transects) were sampled from 23 October until 26 October. Three stations extending seaward of Chiniak Bay (F transect) were sampled on 28 October. The vessel was docked in Kodiak Alaska from 29 October through 31 October to transfer scientific personnel and gear.

Leg 2: 1 November – 12 November ADT

On 1 November the cruise departed Kodiak, Alaska, and proceeded to Dangerous Cape. Stations off Dangerous Cape (G transect) were sampled 1-3 November. Stations off Cape Igvak (I transect) were sampled during 6-8 November. The cruise departed the sampling area on evening of 8 November and arrived in Dutch harbor, Alaska, on the morning of

12 November. Sampling gear and Oceanographic equipment was offloaded on 12 November.

Summary of Salmon Sampling

During the survey, 31 trawl stations were completed beginning nearshore off Cape Kumlik and ending off Cape Douglas (Figure 1). A total of 3,549 salmon were captured (Table 2). Juvenile salmon were distributed along the shelf and the salmon species represented in the catch included pink (63.5%), chum (28.2%), sockeye (6.9%), coho (*O. kisutch*; 1.4%), and chinook (*O. tshawytscha*; <1%). Immature salmon were located on the shelf and offshore. Species of immature salmon represented in the catch were chum (<1%) and chinook (<1%). No maturing salmon were caught. Other species captured during the survey are listed in Table 3.

Acknowledgments

We wish to thank the crew serving aboard the F/V *Great Pacific*, and thank Captain Matthew Zimney for his assistance with many aspects of our field survey.

Tables

Table 1. 2004 GLOBEC cruise event log. Instrument/action times and positions correspond to their beginning-points.

Station Name	Cast/Bongo/ Trawl No.	CTD Cast	Bongo Haul	Trawl Drifter	Time (GMT)	Lat. (deg. N)	Lon. (deg. W)	Bottom Depth (m)	Sampling Depth (m)
K9	1		x		10/19/2004 16:40	56.567	157.433	44	20
K9	1	x			10/19/2004 17:30	56.502	157.442	61	51
K9	1			x	10/19/2004 17:58	56.533	157.433	44	0
K8	2		x		10/19/2004 20:56	56.283	157.433	100	20
K8	2	x			10/19/2004 21:25	56.290	157.123	126	112
K8	2			x	10/19/2004 21:50	56.267	157.100	100	0
K7	3	x			10/20/2004 00:41	55.994	156.821	93	83
K7	3		x		10/20/2004 00:51	56.983	156.817	102	20
K7	3			x	10/20/2004 01:14	55.967	156.800	102	0
K3	4	x			10/20/2004 16:37	54.370	155.342	3658	200
K3	4		x		10/20/2004 16:43	54.367	155.333	5400	20
K3	4			x	10/20/2004 17:08	54.400	155.350	5400	0
K4	5	x			10/20/2004 20:28	54.785	155.717	5486	200
K4	5		x		10/20/2004 20:36	54.783	155.717	3600	20
K4	5			x	10/20/2004 20:58	54.800	155.733	3600	0
K5	6	x			10/21/2004 00:01	55.165	156.067	1518	200
K5	6		x		10/21/2004 00:07	55.167	156.067	1440	20
K5	6			x	10/21/2004 00:31	55.183	156.217	1440	0
K6	7			x	10/21/2004 03:28	55.517	156.533	227	0
K6	7	x			10/21/2004 04:48	55.583	156.448	258	200
K6	7		x		10/21/2004 04:58	56.583	156.450	227	20
I8	8	x			10/21/2004 16:39	56.850	155.033	77	65
I8	8		x		10/22/2004 16:42	56.850	155.033	77	20
I8	8			x	10/22/2004 17:06	56.850	154.983	75	0
H3	9			x	10/23/2004 00:32	56.767	153.567	97	0
G7	10			x	10/23/2004 19:24	58.067	153.600	212	0
G7	9	x			10/23/2004 20:29	58.075	153.660	119	105
G7	9		x		10/23/2004 20:33	58.067	153.650	119	20
H2	10	x			10/25/2004 17:45	57.707	154.482	220	190
H2	10		x		10/25/2004 17:51	57.700	154.483	220	20
H2	11			x	10/25/2004 18:12	57.717	154.450	205	0
H1	11	x			10/25/2004 20:35	57.935	154.675	249	200
H1	11		x		10/25/2004 20:41	57.933	154.667	245	20
H1	12			x	10/25/2004 21:07	57.933	154.633	230	0
G8	12	x			10/26/2004 01:08	58.340	153.968	57	51
G8	12		x		10/26/2004 01:10	58.333	153.967	57	20
G8	13			x	10/26/2004 01:32	58.333	153.983	73	0
F1	13	x			10/26/2004 16:39	58.702	153.320	41	30
F1	13		x		10/26/2004 16:58	58.700	153.317	43	20
F1	14			x	10/26/2004 17:08	58.700	153.317	50	0
E1	14	x			10/26/2004 19:52	58.920	152.997	162	150
E1	14		x		10/26/2004 19:56	58.917	152.983	160	20
E1	15			x	10/26/2004 20:17	58.917	152.967	162	0
E2	15	x			10/26/2004 22:39	58.752	152.562	196	180
E2	15		x		10/26/2004 22:44	58.750	152.600	196	20
E2	16			x	10/26/2004 23:03	58.750	152.550	183	0

Table 1. Con'd.

Station Name	Cast/Bongo/ Trawl No.	CTD Cast	Bongo Haul	Bongo Trawl	Drifter	Time (GMT)	Lat. (deg. N)	Lon. (deg. W)	Bottom Depth (m)	Sampling Depth (m)
F3	16	x				10/28/2004 17:08	57.747	152.033	97	85
F3	16		x			10/28/2004 17:12	57.733	152.033	97	20
F3	17			x		10/28/2004 17:34	57.717	152.000	113	0
F4	17	x				10/28/2004 20:05	57.433	151.782	66	55
F4	17		x			10/28/2004 20:06	57.433	151.767	64	20
F4	18			x		10/28/2004 20:28	57.417	151.783	64	0
F5	18	x				10/28/2004 22:14	57.280	151.635	63	52
F5	18		x			10/28/2004 22:17	57.267	151.633	63	20
F5	19			x		10/28/2004 22:38	57.267	151.617	61	0
G6	19		x			11/02/2004 01:04	57.183	152.750	135	20
G6	19	x				11/02/2004 01:20	57.185	152.752	135	125
G6	20			x		11/02/2004 01:38	57.250	152.733	138	0
G4	21			x		11/02/2004 17:16	56.550	152.433	88	0
G5	20	x				11/05/2004 18:37	56.818	152.435	171	161
G5	20		x			11/05/2004 18:42	56.817	152.433	171	20
G5	22			x		11/05/2004 19:01	56.817	152.433	171	0
	53291				x	11/06/2004 03:29	55.535	152.587	5300	40
I1	21	x				11/06/2004 17:27	54.285	152.578	5304	205
I1	21		x			11/06/2004 17:36	54.283	152.583	5222	20
I1	23			x		11/06/2004 17:57	54.283	152.583	5222	0
I2	24			x		11/06/2004 21:27	54.617	152.933	4208	0
I2	22	x				11/06/2004 22:40	54.652	152.977	4206	210
I2	22		x			11/06/2004 22:47	54.650	152.967	4208	20
I2	53289				x	11/06/2004 22:55	54.652	152.977	4200	40
I3	23	x				11/07/2004 01:38	54.983	153.248	4535	210
I3	23		x			11/07/2004 01:46	54.983	153.250	4464	20
I3	25			x		11/07/2004 02:12	54.983	153.267	4464	0
I3	53293				x	11/07/2004 03:04	55.032	153.323	4540	40
I4	24	x				11/07/2004 17:06	55.373	153.622	4563	210
I4	24		x			11/07/2004 17:14	55.367	153.633	5256	20
I4	26			x		11/07/2004 17:41	55.367	153.583	5256	0
I4	53292				x	11/07/2004 18:33	55.389	153.507	5370	40
I5	25	x				11/07/2004 22:21	55.767	154.003	1189	230
I5	25		x			11/07/2004 22:29	55.767	154.000	1170	20
I5	27			x		11/07/2004 22:50	55.767	153.967	1170	0
I6	28			x		11/08/2004 02:58	56.050	154.350	127	0
I6	26	x				11/08/2004 04:05	56.118	154.383	115	105
I6	26		x			11/08/2004 04:10	56.117	154.383	115	20
I7	27	x				11/08/2004 17:06	56.700	154.918	32	22
I7	27		x			11/08/2004 17:10	56.700	154.917	36	20
I7	29			x		11/08/2004 17:31	56.717	154.933	36	0
I9	28	x				11/08/2004 21:10	57.173	155.352	243	210
I9	28		x			11/08/2004 21:16	57.167	155.350	243	20
I9	30			x		11/08/2004 21:38	57.183	155.367	248	0
I10	29	x				11/08/2004 23:18	57.325	155.497	268	210
I10	29		x			11/08/2004 23:24	57.333	155.500	268	20
I10	31			x		11/08/2004 23:43	57.300	155.500	266	0

Table 2. Catch per unit effort (30 minute net tow) of juvenile (J) and immature (I) salmon by species and station by the F/V *Great Pacific* in the Gulf of Alaska, October 19 – November 8, 2004.

Station Name	Haul No.	Pink J	Pink A	Chum J	Chum I	Chum A	Sockeye J	Sockeye I	Sockeye A	Coho J	Coho A	Chinook J	Chinook I	Chinook A
E1	15	3		20								4	1	
E2	16	86		34										
F1	14	4		6			1							
F3	17	194		37			28							
F4	18	38		28			2			2				
F5	19	43		2			5			5				
G4	21	32					6			1				
G5	22	189		23			48							
G6	20	318		116			25			1				
G7	10	49		120						6		2		
G8	13	8					1					1		
H1	12	22		80	1					1				
H2	11	23		84								1		
H3	9	84		57						1				
I1	23									6				
I2	24													
I3	25				5					5				
I4	26													
I5	27	33		12			3							
I6	28	13		1			2							
I7	29	75		83			26			1			1	
I8	8	349		36			12			5				
I9	30	54		67			26							
I10	31	87		74										
K3	4				11					1			1	
K4	5									2				
K5	6	5		1						1				
K6	7	14		8			2			9				
K7	3	144		14			11			1				
K8	2	151		44			4			1				
K9	1	236		55			14							

Table 3. Catch per unit effort (30 minute net tow) of marine fishes by species and station by the F/V *Great Pacific* in the Gulf of Alaska, October 19 – November 8, 2004. Life history stages for Pollock include juvenile (J) and adult (A).

Station Name	Haul No.	Pollock J	Pollock A	Herring	Daggertooth	Prowfish	Sablefish	Rockfish A	Dogfish	Sandfish	Lumpsucker	Pacific Cod J
E1	15						1					
E2	16			1								
F1	14	1		408						1		
F3	17	1										
F4	18										1	
F5	19											
G4	21										2	
G5	22										1	
G6	20			1			1					
G7	10	1		26			3					1
G8	13			1								
H1	12						18					
H2	11			2			1					
H3	9			1			12			17	3	
I1	23											
I2	24							1				
I3	25											
I4	26											
I5	27											
I6	28											
I7	29			1						3	1	
I8	8						1					
I9	30											
I10	31						1					
K3	4				1				1			
K4	5											
K5	6											
K6	7		1			1						
K7	3											
K8	2	2				1					1	
K9	1		1	4			4				1	

Figures

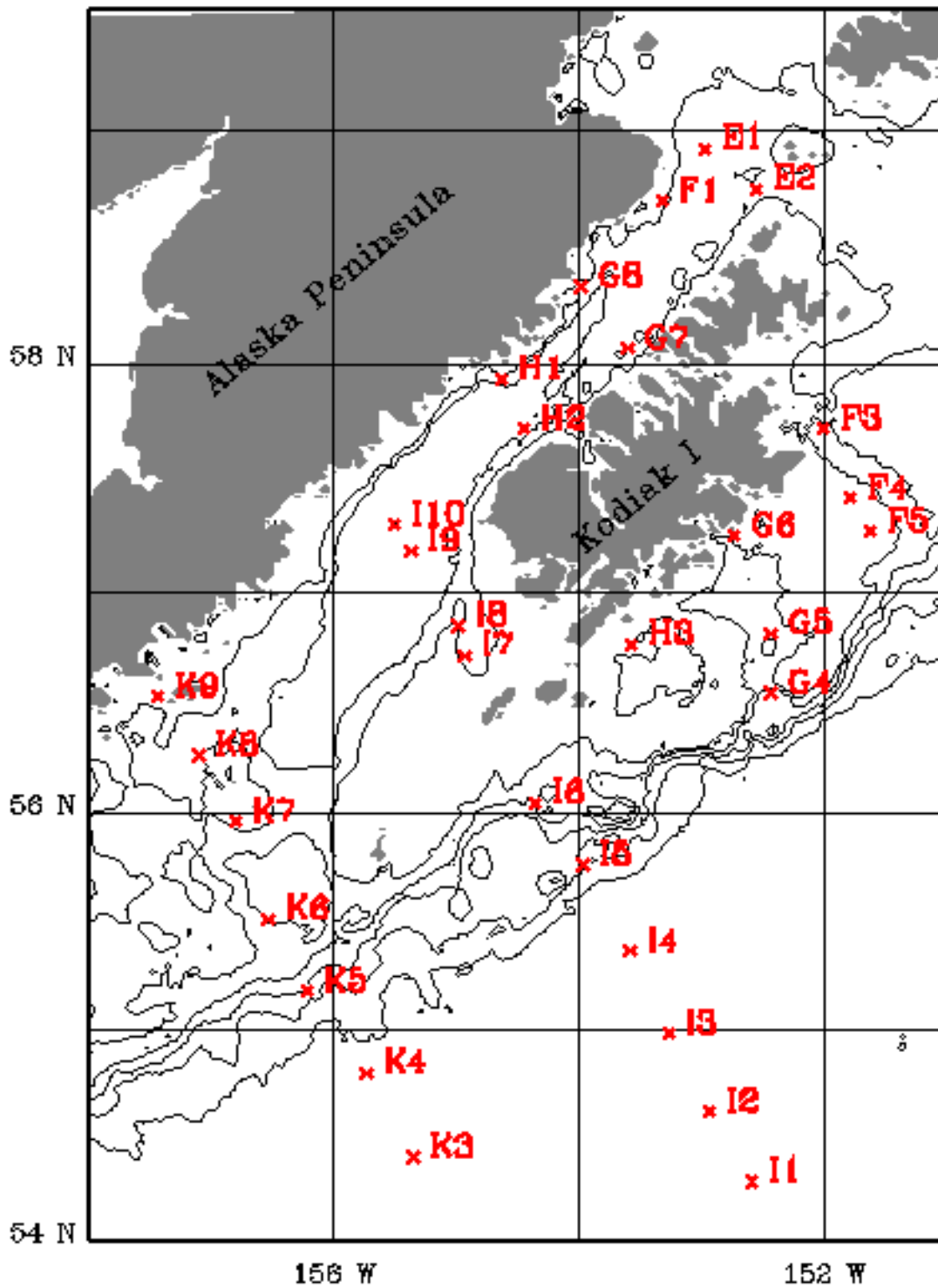


Figure 1. Transects and stations sampled during OCC/GLOBEC cruise GP-04-01 in the Gulf of Alaska, 19 October-8 November 2004.