NOAA Data Report ERL PMEL-28

FISHERIES-OCEANOGRAPHY COORDINATED INVESTIGATIONS (FOCI) FIELD OPERATIONS - 1987

L. A. Lawrence
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Pacific Marine Environmental Laboratory
Seattle, Washington
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LIST OF ABBREVIATIONS

AOML	Atlantic Oceanographic and Meteorological Laboratory, Miami, FL (NOAA/OAR/ERL)
ARGOS	a French satellite communications network
BNL	Brookhaven National Laboratory, Upton, NY
ERL	Environmental Research Laboratories (NOAA/OAR)
FAO	United Nations Fisheries and Agricultural Organization
FOCI	Fisheries-Oceanography Coordinated Investigations
FOX	Fishery Oceanography eXperiment (a FOCI program)
FY	Fiscal Year
GMT	Greenwich Mean Time
GOES	Geostationary Operational Environmental Satellite
JD	Julian Day
METNET	METeorological NETwork of remote surface stations
NESDIS	National Environmental Satellite Data and Information Service
NMFS	National Marine Fisheries Service (NOAA)
NOAA	National Oceanic and Atmospheric Administration (U.S. Department of Commerce)
NWAFC	NorthWest and Alaska Fisheries Center, Seattle, WA (NOAA/NMFS)
OAR	(Office of) Oceanic and Atmospheric Research (NOAA)
OCSEAP	Outer Continental Shelf Environmental Assessment Program (an interagency program with NOAA and the Minerals Management Service)
PMEL	Pacific Marine Environmental Laboratory, Seattle, WA (NOAA/OAR/ERL)
RIBS	Recruitment Investigations in the Bering Sea (a FOCI program)
RSMAS	Rosensteil School of Marine and Atmospheric Sciences/University of Miami, FL
SDSD	Satellite Data Services Division, Suitland, MD (NOAA/NESDIS)
UW	University of Washington, Seattle, WA

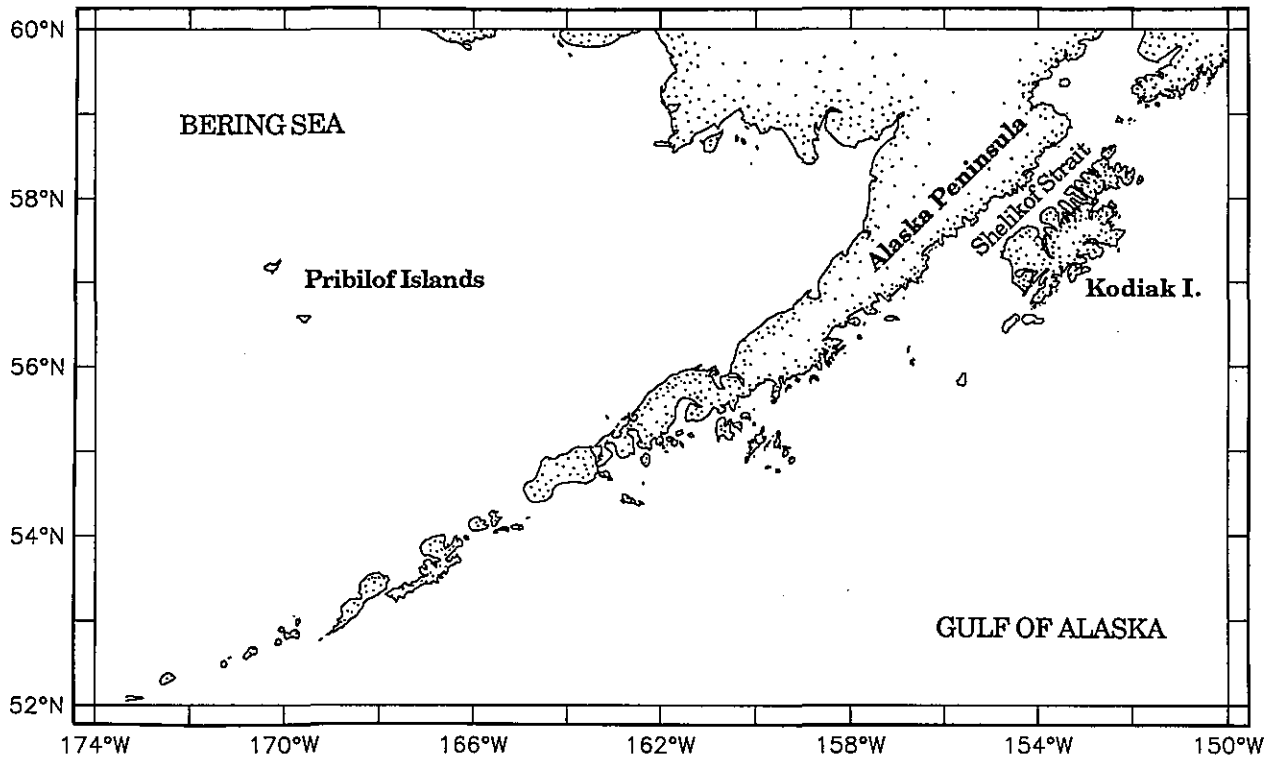

Figure 1a. Geographical area of FOCI research.

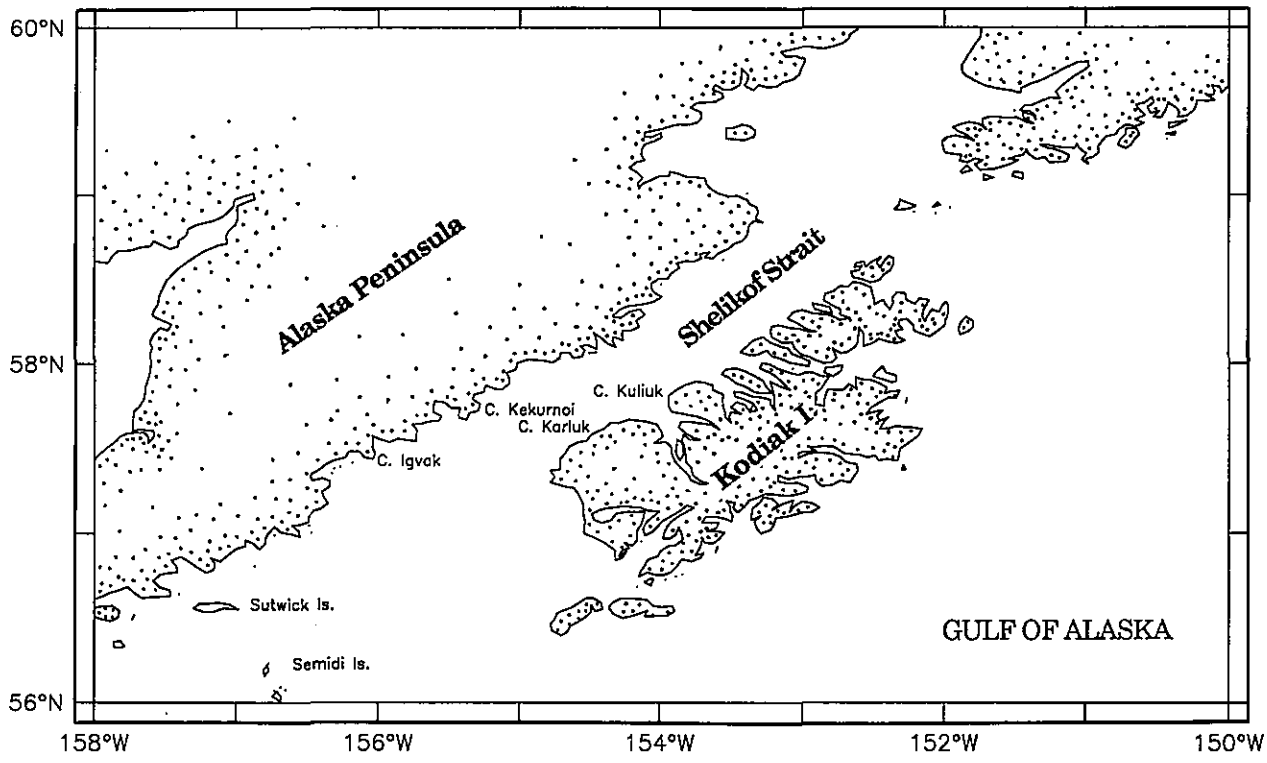

Figure 1b. Shelikof Strait area.

Fisheries-Oceanography Coordinated Investigations (FOCI) Field Operations – 1987

Leslie A. Lawrence[1], Judith Gray[1] and Deborah M. Blood[2]

1. INTRODUCTION

The field operations outlined in this report were conducted as part of the Fisheries Oceanography Coordinated Investigations (FOCI), a joint project of Pacific Marine Environmental Laboratory (PMEL) and the Northwest and Alaska Fisheries Center (NWAFC), with affiliates from several other research facilities and universities. FOCI is a long-term, multi-disciplinary research project which seeks to better understand the biological and physical processes that influence the early life stages and recruitment of walleye pollock (*Theragra chalcogramma*). The long-range objective is to enable improved prediction of interannual variations in year-class strength of this commercially important fish stock.

The primary geographical area of investigation is the western Gulf of Alaska, with particular emphasis on Shelikof Strait and west along the Alaska Peninsula. This area was chosen because of its importance to the American fishing industry and because the majority of the pollock spawn in a well-defined region in the deepest part of the Shelikof Strait during a brief period in spring. The resulting eggs and larvae tend to form a fairly distinct "patch" which is exceptionally conducive to fisheries oceanographic study. FOCI has also conducted some exploratory research in the Bering Sea, under the rubric RIBS (Recruitment Investigations in the Bering Sea).

FOCI field work in fiscal year 1987 included six oceanographic cruises (FOCI I-IV and RIBS I & II), the continued acquisition of satellite images of the study area, and remote weather station servicing via helicopter. Operations during the cruises included: continuation of long-term time-series Conductivity/Temperature/Depth (CTD) sampling; deployment of satellite-tracked drifting buoys and current meter moorings; recovery of current meter moorings deployed during the preceding field season; acquisition of data from a ship-mounted Acoustic Doppler Current Profiler (ADCP); biological and chemical sampling of water; distribution studies of pollock eggs, larvae, and juveniles; and maintenance and recovery of the PEGGY station, which consisted of a meteorological buoy, a current meter mooring, and a moored ADCP in close proximity, for the purpose of observing the relationship between surface winds and currents. Oceanographic sampling was done primarily according to the grid system devised for the FOX project (Fig. 2); RIBS stations do not follow any standard grid pattern. Individual cruise operations are outlined in Table 1, and summary cruise reports comprise Section 3. Remote weather station and satellite image summaries can be found in Sections 5 and 7, respectively.

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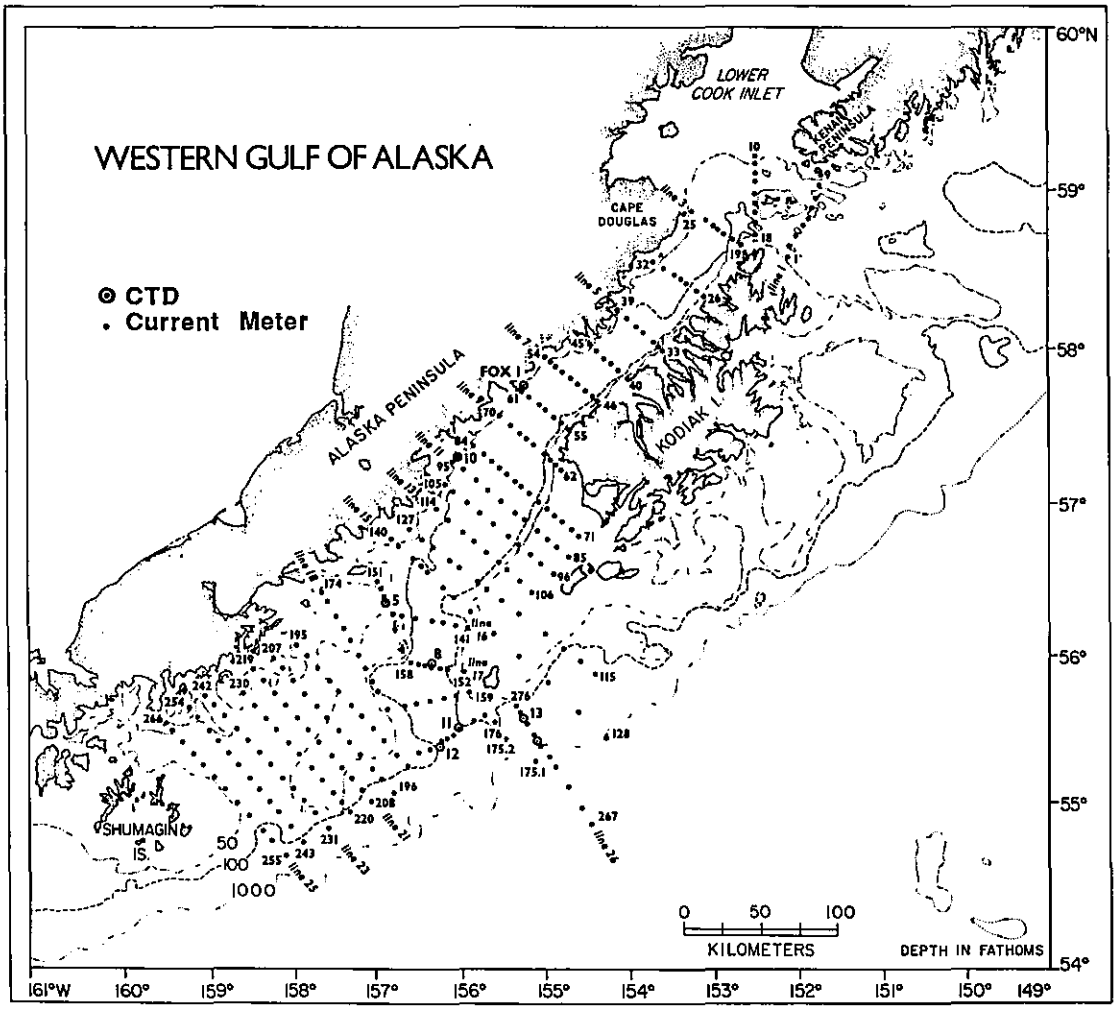

Figure 2. FOCI master station grid.

2. MATERIALS AND METHODS

2.1 Shipboard Sampling

There were six cruises that conducted sampling for FOCI in FY 1987 (designated FOCI 87-I through IV and RIBS-87-I and II). These are summarized in Table 1 and detailed in Sec. 3. Materials and methods of sampling were as follows except where specifically noted otherwise in Sec. 3.

Shipboard Meteorological Observations

Ship personnel conducted hourly measurements of surface meteorological variables during all cruises. Sea-level pressure was determined from an aneroid barometer, air temperature and wet-bulb temperature from sling psychrometer readings on the upwind bridge wing (except the NOAA Ship *Miller Freeman* which has a ventilated housing on the port-side bridge wing), wind speed and direction from a Bendix-Friez aerovane mounted on the mast head, and sea-surface temperature from the ship's seawater-intake port or bucket thermometer. All sensors were calibrated before each cruise by the Seattle National Weather Service port meteorological officer; calibrations are traceable to the National Bureau of Standards. Additional estimates of visibility, cloud type, wave and swell height and direction were made when possible.

CTD

The CTD system used on all six cruises was a Seabird SBE-9. Temperature and salinity field correction samples were obtained on most casts. Temperature was sampled via reversing thermometers; salinity samples were analyzed on an Autosal™ salinometer aboard ship.

Nutrients and Chlorophyll

Nutrient and chlorophyll samples for FOCI were obtained from 10-L Niskin bottles deployed with a rosette sampler/CTD system. Nutrient bottles were generally tripped at 0, 10, 20, 30, 50, 75, and 100-m depths. Additional nutrient samples were taken below 100 m, usually at 50-m intervals. RIBS-87-II nutrient samples were taken at 0, 20, 50, 100, 150, 200, 300, 400, 500, 600, 800, and 1000 m. The deepest samples were usually taken approximately 15 m from the bottom. Chlorophyll samples were collected at 3, 13, 23, 33, and 50 m, with one cast at depths of 0, 5, 15, 20, 25, 30, 45, and 60 m, and two casts with nutrients at 0, 10, 15, 20, 25, 30, 40, 50, and 60 m.

Nutrient samples were frozen in 250-ml aged polyethylene bottles and returned to the laboratory where they were analyzed on a Technicon Auto Analyzer™ II (Whitledge *et al.*, 1981). Chlorophyll samples (100 ml) were filtered at sea through 0.45-μm Millipore HA acetate filters and frozen. Acetone extraction and fluorometric measurements (Yentsch and Menzel, 1963) were performed after samples were returned from sea.

Plankton

Microzooplankton were sampled with 10-L Niskin bottles tripped at 0, 10, 20, 30, 40, 50, and 60 m. Water was filtered through 0.40-mm mesh filter bags that were back-flushed into storage jars with 5% buffered formalin.

Net plankton (including ichthyoplankton) were sampled with 0.333-mm or 0.505-mm mesh nets. A 60-cm (diameter) bongo collector (Posgay and Marak, 1980) was the most widely used equipment. During FOCI-87-I, II, and III, 20-cm bongo collectors were used with 0.150-mm mesh nets for zooplankton at selected stations. At those stations, 20-cm and 60-cm collectors were towed on the same wire approximately 1.5 m apart.

Bongo nets were towed according to MARMAP procedures (Smith and Richardson, 1977) except that tows were made to near bottom or to a maximum depth of 400 m. Wire angles were monitored throughout all tows and a bathykymograph (BKG) was used to monitor the depth and trajectory of bongo tows. Volume filtered by the nets was estimated using a General Oceanics flowmeter mounted inside the mouth of each net. Samples were stored in 5% buffered formalin.

A Tucker trawl was used to investigate predation by euphausids on walleye pollock eggs and collect late-stage larvae. The samplers were equipped with 0.505-mm mesh nets and either 1.4-mm (for euphausids) or 0.333-mm (for larvae) mesh cod ends. A BKG was attached to the towing wire below the deepest net to monitor the tow profile. The trawl was deployed at 50 m min^{-1} to 10 m off the bottom or to a maximum depth of 150 m. After stabilizing for 30 seconds, the first net was opened. The nets were retrieved at a wire speed of 20 m min^{-1}. Ship speed was adjusted to maintain a 45-degree wire angle during the entire tow. At a specified depth a messenger was sent to close the first net and open the second, which was allowed to stabilize for 30 seconds before the tow continued. During the FOCI-87-I egg predation study, the first net sampled the water column below 100 m and the second net sampled the upper 100 meters. During FOCI-87-III and IV and RIBS-87-II, the nets were opened at varying depths or used in an open configuration.

A MOCNESS[1] (Wiebe *et al.*, 1976) was used to sample the vertical distribution of walleye pollock eggs and larvae and zooplankton during FOCI-87-I and II. During FOCI-87-I, zooplankton was collected with a 0.150-mm mesh net and walleye pollock eggs were sampled with a 0.505-mm mesh net. Nets were opened and closed at different depth intervals for zooplankton and pollock eggs (see Table 3). Zoo- and ichthyoplankton were both sampled with 0.150-mm mesh nets during FOCI-87-II. Nets were opened and closed to sample the following nominal depth intervals, as allowed by station depth: 0-15, 15-30, 30-45, 45-60, 60-80, 80-100, 100-150, and 150-200 m. Volume, depth, temperature, and fluorescence were monitored throughout the tows during this cruise.

[1] Multiple Opening-Closing Net Environmental Sampling System.

An *in situ*, silhouette-photography, towed sampling system (referred to hereafter as the Ortner net-camera: Ortner *et al.*, 1981) was used during FOCI-87-I and II to sample small-scale (order 8 m) patchiness in the abundance of walleye pollock eggs and larvae and major zooplanktonic taxa. The instrument was towed obliquely on descent and ascent to within 20 m of bottom and the camera was actuated on the ascent. Flow, conductivity, temperature, depth, and fluorescence were continuously monitored.

A Diamond midwater trawl (Nelson and Nunnalee, 1986) was fished twice on FOCI-87-I at depths and locations where an echosounder (Simrad 38 kHz) showed signs of fish. A Marinovich trawl was fished on RIBS-87-I. Tows were about a half hour in duration and were made according to standard procedures aboard the *Miller Freeman*. Samples of fish were taken for studies of reproductive biology, egg cannibalism, and specific gravity of eggs (both cruises).

Shipboard Current Measurements

An RD Instruments Acoustic Doppler Current Profiler was deployed during MOCNESS and net-camera tows of FOCI-87-I and II. The transducer was a 300 kHz unit equipped with an on-board gyroscopic pitch-roll sensor and linked to a microcomputer. Acoustic measurements of horizontal shear were sought to examine the potential for shear dispersion within the diurnal migrating range of larval pollock and zooplankton.

2.2 Moored Instruments

During October 1986, five current meter moorings (stations 15-19) were deployed across the Shelikof Sea valley off Sutwik Island to look at lateral variations in the position and strength of the Alaska Coastal Current (ACC). These five moorings were recovered in June and July 1987. The four long-term FOCI moorings 2, 5, 8, and 14 were recycled. The moored ADCP component of PEGGY was recovered in June 1987; PEGGY's current meter mooring and meteorological buoy were recovered in July.

Current meters were standard Aanderaa RCM-4's or Neil Brown acoustic current meters. Bottom pressure gauges were mounted on all moorings. All Aanderaa current meters and bottom pressure gauges were set at a one-hour sample interval. The pressure gauges were sampled instantaneously once each hour. Aanderaa current direction, temperature, pressure, and conductivity were instantaneous samples; current speed was averaged over the hour. The Neil Brown meters averaged u and v current components over a 10-minute period and recorded the average every 10 minutes; temperature was instantaneously sampled and recorded every 10th 10-minute interval and the 9 previous sampling times were backfilled with this value.

2.3 Remote Weather Stations

During the fiscal year, five remote weather stations operated at sites along the Alaska Peninsula. The stations continued sampling begun in September 1986 and constituted the mesoscale meteorological network METNET with stations at Wide Bay, Ugaiushak Island, Chowiet Island, Chirikof Island, and Tugidak Island. A summary of remote weather station operations is contained in Sec. 5. Station names, locations, and elevations are given in Table 10.

Each station consisted of a Handar 430A wind speed sensor, a Handar 431A wind direction sensor (both certified by the National Weather Service), a Handar 432A temperature probe, a Handar 435A relative humidity sensor, and a Setra 270B pressure transducer. Winds were measured 6 m above station elevation, temperature and humidity 2 m above station elevation. Pressure was referenced to sea level. Signals from the sensors were averaged hourly and transmitted to the GOES-West satellite every three hours by a Handar 540A multiple access data acquisition system.

2.4 Drifter Studies

A total of 21 satellite-tracked drifters were deployed from research vessels (11 drops). Drifters were drogued to 40 m except three deployed during FOCI-87-I with 200-m drogues. The 7100 and 2300 series drifters were from Coastal Climate, Inc., Seattle, and used two 20-m long pieces of 1" diameter nylon rope cross-connected at 5-m intervals for the drogues. Drogues were weighted with chain and connected to surface buoys with 3/16" cable. The 5600 series constructed by Horizon Marine, Inc., Marion, MA, used a "hole-filled sock" for the drogue. Slippage of the devices relative to water motion was estimated to be less than 10%. Positions were reported via ARGOS. A summary of drifter operations is included in Sec. 6 and Table 11. Deployments are listed in the individual cruise summaries (Sec. 3).

2.5 Satellite Imagery

A search of satellite data was conducted for the 1987 field season at the NOAA/NESDIS/ Satellite Data Services Division (SDSD) in Suitland, MD. Hard-copy images and digital data tapes are stored in the FOCI satellite data archive at PMEL (Table 11). The tapes contain navigated (i.e., they have the geographic positioning associated with the image) Advanced Very High Resolution Radiometer (AVHRR) data. In addition to the SDSD imagery, digital satellite data tapes have been saved from the Gilmore Creek, Alaska satellite data receiving station for the period Feb-May, 1987 (Table 11). These tapes contain "unnavigated" AVHRR data that were collected real-time as the satellite was in sight of the dish at Gilmore Creek. All the imagery saved from these two sources was selected on the basis of clear skies over Shelikof Strait and the surrounding area.

3. SHIP CRUISE SUMMARIES

This section provides a brief summary of the objectives and activities of each cruise. Figures showing all sampling stations for each cruise are provided. In some cases, biological and physical sampling stations for a given cruise are shown in separate figures to avoid congestion and enhance clarity. A table lists all sampling activities and locations for each cruise. Abbreviations not included in Table 1 are footnoted. Cruise station numbers are those assigned during the cruise by the cruise Chief Scientist. FOCI station numbers, when given, refer to FOCI master station (reference station) numbers which are shown in Fig. 2. These stations are located on transects that are referenced by line number, beginning with line 1 (Stations 1-9) and proceeding westward to line 25. Numbering begins at the seaward end of each line. RIBS has not established a master station grid at this time. Cruises are listed in chronological order.

TABLE 1. FOCI research cruises and sampling activities during FY 1987[1,2]

Vessel, Cruise, Dates, Project, Cruise Name	CTD	B	b	MOC	T	CAM	MZ	N	Chl	MWT	Methot	STD	Other
MILLER FREEMAN MF-86-11, Oct 15-Nov 5, 1986 (RIBS-87-I)	87									18M[3]			Deploy 5 CM moorings
MILLER FREEMAN MF-87-04, Apr 2-Apr 17, 1987 (FOCI-87-I)	12	131 plus→	14 B,b	8	7	3		6		2		11	Deploy 3 CM moorings; 3 STDs drogued at 200 m; 8 drogued at 40 m.
MILLER FREEMAN MF-87-06, May 18-May 29, 1987 (FOCI-87-II)	57	58	8	12 (95)		5	8 (47)	11 (110)	10 (61)			10	96 Gut fluorescence measurements on herbivorous copepods, 57 net collections for larval experiments, 4 acoustic density measurements of zooplankton on board, and one *in vivo* transect for temperature, salinity and fluorescence; 10 STDs deployed
MILLER FREEMAN MF 87-07, Jun 2-Jun 15, 1987 (RIBS-87-II)	57				10 (48)			6 (66)					Deploy 3 CM moorings in Aleutian passes
MILLER FREEMAN MF-87-08, Jun 16-Jul 3, 1987 (FOCI-87-III)	30	15	3		8						77		Recovered 5 and deployed 3 CM moorings
MILLER FREEMAN MF-87-08, Jul 6-Jul 16, 1987 (FOCI-87-IV)	12	4			3						92		Recovered 7 and deployed 1 CM mooring

[1] Number of stations sampled is given for each category; the number of samples obtained is the same except where given in parentheses.
[2] CTD = Conductivity/Temperature/Depth cast; B = 60-cm bongo sampler; b = 20-cm bongo; MOC = MOCNESS = Multiple Opening-Closing Net Environmental Sampling System; T = Tucker trawl; CAM = Ortner net-camera; MZ = microzooplankton; N = nutrients; Chl = chlorophyll; MWT = midwater trawl; CM = current meter; STD = satellite-tracked drifter; ADCP = acoustic doppler current profiler.
[3] M is MWT with a Marinovich trawl; all other MWT are Diamond Net.

3.1 RIBS-87-I

Scientific party: Ron Reed, Chief Scientist, PMEL
Tom Jackson, PMEL
Carol DeWitt, PMEL
Peter Proctor, PMEL
Tiffany Vance, PMEL

The objectives of this cruise were to moor current meter arrays in Shelikof Strait in order to monitor flow and physical properties, which may affect the distribution, growth, and survival of pollock. In addition, two of the FOCI standard sections were to be occupied to gain additional information on the variations in conditions in the region.

A major part of this project was concerned with circulation and pollock distribution in the deep, central Bering Sea. There had been no previous surveys of this large region conducted over a short time period. A synoptic survey was designed to yield a realistic view of circulation unbiased by averaging over different seasons and years.

Five current meter moorings were deployed in Shelikof Strait (See Table 1). Because of inability to find the planned depth near CM18, the line of moorings (CM18-CM15) was displaced northward about 6 nm. The FOCI standard CTD stations 147-151 (line 16) were occupied, as were stations 153, 156, and 158 (line 17). Intermediate stations on the latter line were not taken because of rough seas. CTD casts were also made at each of the current moorings. A total of 13 CTD casts were taken in Shelikof Strait.

In the Bering Sea, 74 CTD casts were made to near the bottom or to a maximum depth of 1500 m using the PMEL Seabird system. Some stations were added on the return transit to Dutch Harbor to better define circulation patterns near complex features along the continental slope.

A total of 18 Marinovich trawls were made (at the start and end of each line or when signs of organisms were present on the echosounder trace) to sample for juvenile pollock. Few specimens were found. Of the catches logged and frozen, it is believed that some of the smaller specimens may be smelt rather than pollock.

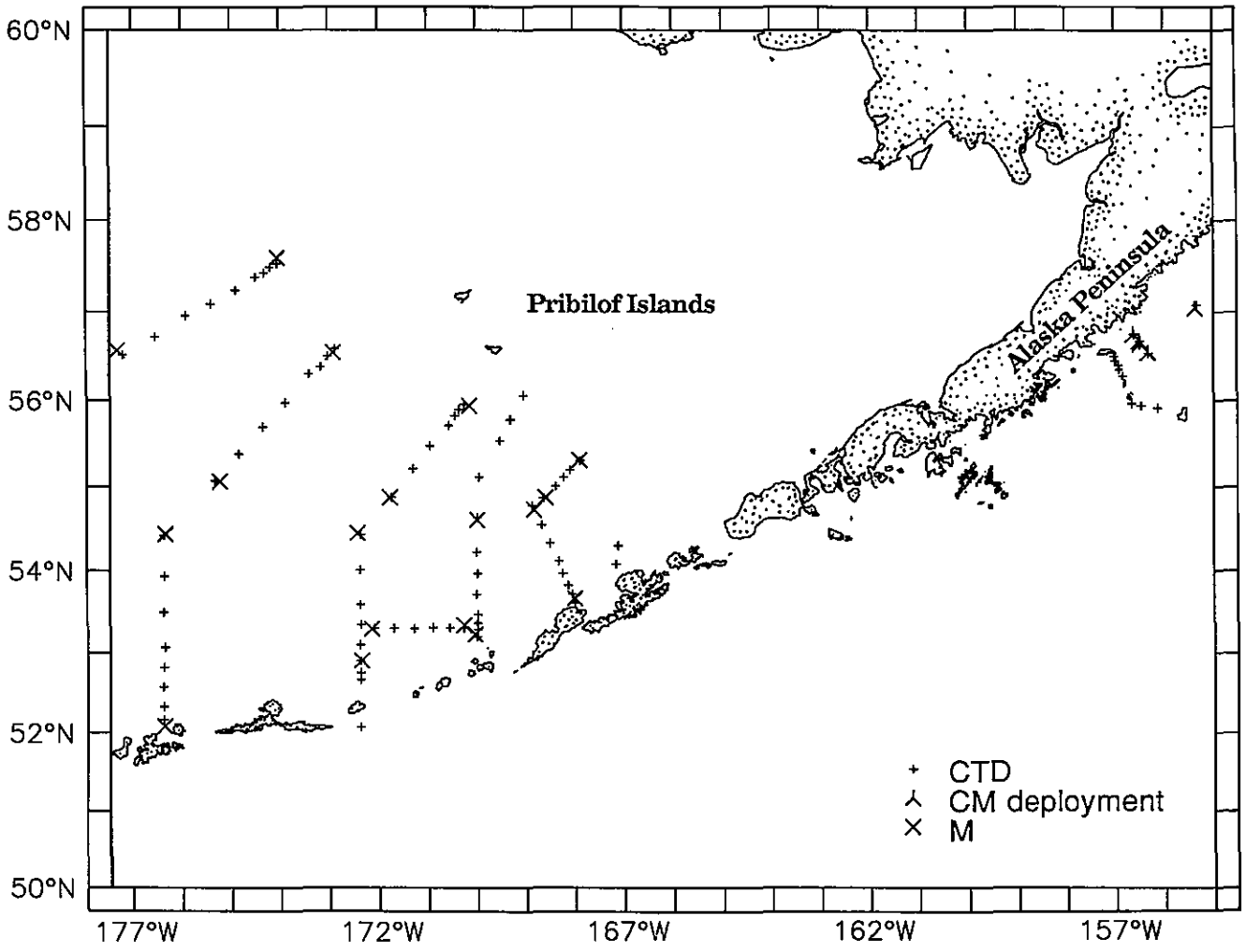

Figure 3. RIBS-87-I (MF-86-11) sampling stations.

TABLE 2. Sampling activities during RIBS-87-I (MF-86-11). See Table 1 for abbreviations.

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
Shelikof Strait						
290	17 Oct	1320	1 (147)	56 16.9	156 49.6	CTD
		1425	2 (148)	56 21.1	156 54.3	CTD
		1526	3 (149)	56 24.1	156 55.3	CTD
		1801	4 (150)	56 27.1	156 58.9	CTD
		1853	5 (151)	56 30.3	157 00.1	CTD
		2331	6 (158)	55 57.9	156 39.9	CTD
291	18 Oct	0041	7 (156)	55 56.6	156 28.9	CTD
		0309	8 (153)	55 54.8	156 08.8	CTD
		2152	1	56 32.6	156 19.4	Deploy CM18
292	19 Oct	0006	2	56 38.6	156 29.0	Deploy CM17
		0332	3	56 40.2	156 30.0	Deploy CM16
		0452	4	56 44.9	156 37.2	Deploy CM15
		0516	9	56 45.0	156 36.4	CTD at CM15
		0616	10	56 40.3	156 29.6	CTD at CM16
		0703	11	56 38.0	156 29.3	CTD at CM17
		0820	12	56 32.2	156 19.0	CTD at CM18
		1815	5	57 02.4	155 21.8	Deploy CM19
		1841	13	57 04.7	155 19.9	CTD at CM19
Bering Sea						
297	24 Oct	0218	1	52 04.9	176 21.6	M at CTD1
		0500	1	52 04.5	172 22.1	CTD
		0716	2	52 09.9	176 22.1	CTD
		0938	3	52 19.7	176 22.5	CTD
		1233	4	52 34.4	176 23.2	CTD
		1611	5	52 49.1	176 22.4	CTD
		1914	6	53 03.9	176 21.4	CTD
		2347	7	53 29.7	176 21.9	CTD
298	25 Oct	0417	8	53 56.0	176 21.4	CTD
		0827	9	54 25.2	176 22.0	CTD
		0935	2	54 26.2	176 20.0	M at CTD9
		2145	3	54 27.1	172 25.4	M at CTD10
		2351	10	54 25.9	172 21.7	CTD
299	26 Oct	0322	11	54 00.5	172 22.1	CTD
		0706	12	53 35.5	172 22.0	CTD
		0941	13	53 20.7	172 22.3	CTD
		1220	14	53 05.8	172 23.1	CTD
		1500	15	52 53.9	172 22.6	CTD
		1611	4	52 54.3	172 21.1	M at CTD15
		1834	16	52 45.3	172 22.4	CTD
		1953	17	52 40.0	172 22.2	CTD

TABLE 2. (cont.)

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
300	27 Oct	0014	5	53 17.7	172 09.2	M at CTD18
		0227	18	53 18.1	172 05.9	CTD
		0506	19	53 18.2	171 42.1	CTD
		0742	20	53 17.8	171 17.3	CTD
		1022	21	53 18.7	170 54.4	CTD
		1251	22	53 18.6	170 33.7	CTD
		1501	6	53 20.5	170 16.3	M at CTD23
		1718	23	53 18.0	170 16.3	CTD
		1900	7	53 13.8	170 02.9	M at CTD24
		2034	24	53 11.9	169 59.8	CTD
		2222	25	53 17.2	169 59.2	CTD
301	28 Oct	0007	26	53 22.0	169 59.5	CTD
		0215	27	53 28.2	169 59.2	CTD
		0511	28	53 42.8	169 59.7	CTD
		0800	29	53 58.1	169 58.6	CTD
		1050	30	54 13.5	169 59.9	CTD
		1440	31	54 38.0	169 59.4	CTD
		1548	8	54 36.7	169 59.4	M at CTD31
302	29 Oct	0043	9	53 39.9	168 00.3	M at CTD32
		0210	32	53 37.0	168 00.1	CTD
		0345	33	53 42.8	168 03.6	CTD
		0540	34	53 49.5	168 07.6	CTD
		0757	35	53 58.1	168 14.2	CTD
		1023	36	54 07.1	168 19.2	CTD
		1313	37	54 20.0	168 30.1	CTD
		1559	38	54 32.9	168 40.4	CTD
		1758	10	54 43.5	168 49.7	M at CTD39
		1938	39	54 46.2	168 51.8	CTD
		2146	40	54 52.0	168 37.9	CTD
		2339	11	54 52.4	168 35.4	M at CTD40
303	30 Oct	0214	41	55 00.6	168 23.1	CTD
		0421	42	55 06.9	168 13.0	CTD
		0623	43	55 11.8	168 05.5	CTD
		0755	44	55 18.3	167 53.1	CTD
		0901	12	55 18.6	167 53.8	M at CTD44
		1653	13	55 56.4	170 09.3	M at CTD45
		1846	45	55 57.4	170 15.7	CTD
		2019	46	55 53.6	170 21.7	CTD
		2152	47	55 49.7	170 26.6	CTD
		2348	48	55 42.7	170 34.3	CTD
304	31 Oct	0243	49	55 28.7	170 57.5	CTD
		0536	50	55 12.7	171 17.7	CTD
		0859	51	54 52.6	171 44.4	CTD
		0957	14	54 52.4	171 46.0	M at CTD51
		2044	15	55 03.7	175 13.5	M at CTD52
		2231	52	55 04.1	175 19.3	CTD

TABLE 2. (cont.)

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
305	1 Nov	0217	53	55 22.9	174 50.4	CTD
		0912	54	55 41.8	174 21.3	CTD
		1316	55	55 58.6	173 53.5	CTD
		1737	56	56 18.1	173 23.8	CTD
		2002	57	56 23.1	173 09.2	CTD
		2301	58	56 30.4	173 01.1	CTD
306	2 Nov	0059	59	56 35.3	172 52.4	CTD
		0202	16	56 32.8	172 54.3	M at CTD59
		1135	17	57 35.7	174 02.9	M at CTD60
		1253	60	57 32.0	174 03.0	CTD
		1443	61	57 29.7	174 11.8	CTD
		1651	62	57 25.7	174 18.9	CTD
		1858	63	57 22.9	174 29.7	CTD
		2142	64	57 14.2	174 53.6	CTD
307	3 Nov	0047	65	57 05.2	175 23.9	CTD
		0338	66	56 57.3	175 54.7	CTD
		0711	67	56 43.2	176 31.8	CTD
		1025	18	56 33.9	177 18.1	M at CTD68
		1226	68	56 31.0	177 11.3	CTD
308	4 Nov	1132	69	55 06.7	169 56.9	CTD
		1521	70	55 32.2	169 31.8	CTD
		1810	71	55 46.8	169 18.6	CTD
		2110	72	56 03.5	169 02.7	CTD
309	5 Nov	0844	73	54 18.0	167 06.5	CTD
		1125	74	54 04.9	167 09.0	CTD

3.2 FOCI-87-I

Scientific Party: Arthur W. Kendall, NWAFC, Chief Scientist
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Peter Proctor (4/1-4/7), PMEL
Hugh Milburn (4/11-4/17), PMEL

This cruise was intended to map the distribution of planktonic walleye pollock eggs in Shelikof Strait, and conduct several other tasks associated with FOCI.

A number of gears and methods were used to meet various cruise objectives (Table 1).

1. MARMAP 60-cm bongo tows (0.505-mm mesh) – Surface to near-bottom oblique bongo tows were conducted to map the distribution and abundance of walleye pollock eggs. At some stations 20-cm bongo nets with 0.150-mm mesh and 60-cm bongos with 0.333-mm mesh were used to collect zooplankton and conduct larval extrusion experiments.

2. Tucker Trawls – Several mechanical 1-m Tucker trawl tows were conducted, using 0.505-mm mesh and 1.4-mm mesh cod ends, to investigate predation by euphausids on walleye pollock eggs.

3. Diamond midwater trawl – Two midwater trawl tows were made to collect adult pollock for reproductive biology studies and egg cannibalism studies.

4. MOCNESS discrete-depth plankton sampler tows – Five MOCNESS tows, using eight nets on each, were made to investigate vertical distribution of zooplankton (tows included two day/night comparisons) and three tows were designed to investigate walleye pollock egg vertical distribution.

5. Net camera tows – Three tows were made to investigate small-scale distribution (patchiness) of walleye pollock eggs.

6. CTD casts were made along FOCI line 8 and at mooring sites and deep drifter release sites. Nutrient samples were collected along FOCI line 8.

7. Satellite tracked drifters – Three deep-drogued (200 m) drifters were released during the course of the cruise on FOCI line 8 to track movement of deep water in the vicinity of maximum walleye pollock spawning. Also a series of eight drifters drogued at 40 m was released along FOCI line 8.

8. Current meter/meteorological moorings – A surface moored meteorological buoy (PEGGY), a subsurface current meter array, and a doppler current profiler were deployed.

9. Live walleye pollock eggs were sorted from some extra bongo tows to evaluate an acoustical egg sensor, and to provide samples of eggs to be measured live and preserved (at NWAFC).

The cruise was remarkably free of delays associated with equipment or weather. All sampling objectives, except an optional bongo survey south of the Trinity Islands were accomplished. Two breaks were made to exchange scientists at Larsen's Bay (Tom Morrison and Peter Proctor departed the ship on 7 April, Hugh Milburn joined the ship on 11 April).

After a coarse sounding survey for adult pollock based on results from the previous cruise (MF-87-03), two midwater trawl tows were made and sufficient walleye pollock were collected to satisfy sampling requirements. Based on our sounding survey, and work of the previous cruise, we laid out a stratified grid of 121 bongo stations which we occupied from 4-10 April (Figure 4a). We then performed CTD casts, zooplankton bongo tows, MOCNESS tows, and shallow drifter releases at stations on FOCI line 8. This was followed by Tucker trawls, a MOCNESS tow, and a net camera tow off Katmai Bay. We then proceeded to the mooring sites and deployed the three moorings. Following this we steamed to the Trinity Island area and began a bongo survey, which was aborted due to bad weather. After jogging to the lee of Chirikof Island until the seas subsided, we proceeded back into Shelikof Strait, visually inspecting PEGGY on the way. We made more bongo tows along FOCI line 8, two more MOCNESS tows for pollock eggs, and two unsuccessful net camera tows before breaking operations.

Although detailed analysis must await shore-side processing of the samples, some general observations can be made. Walleye pollock eggs were found throughout the area surveyed in Shelikof Strait. They appeared most abundant on the Alaska Peninsula side of the Strait from Cape Kuliak to Portage Bay. These are the areas where the eggs have been abundant in previous years. The distribution pattern seemed more even than in previous years, with many stations over a wide area containing moderate numbers of eggs. Vertically, the MOCNESS tows indicated that most eggs were between 190 and 230 m, with few eggs above 100 m.

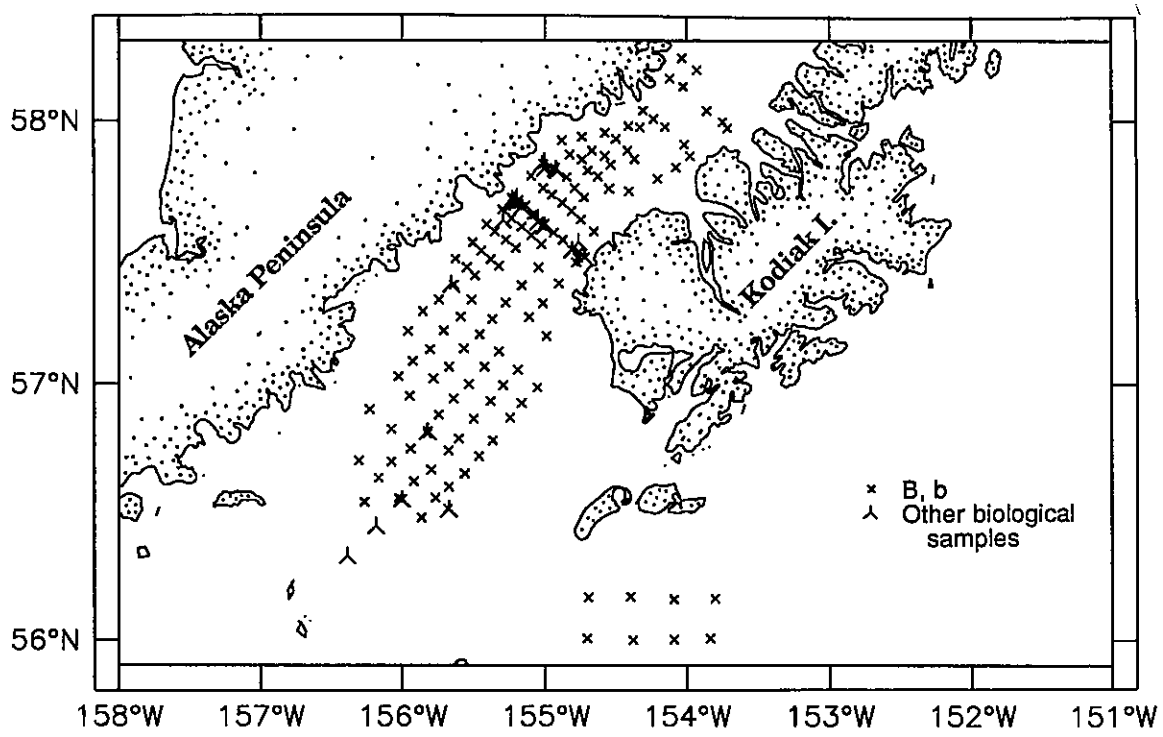

Figure 4a. FOCI-87-I (MF-87-04) biological sampling stations.

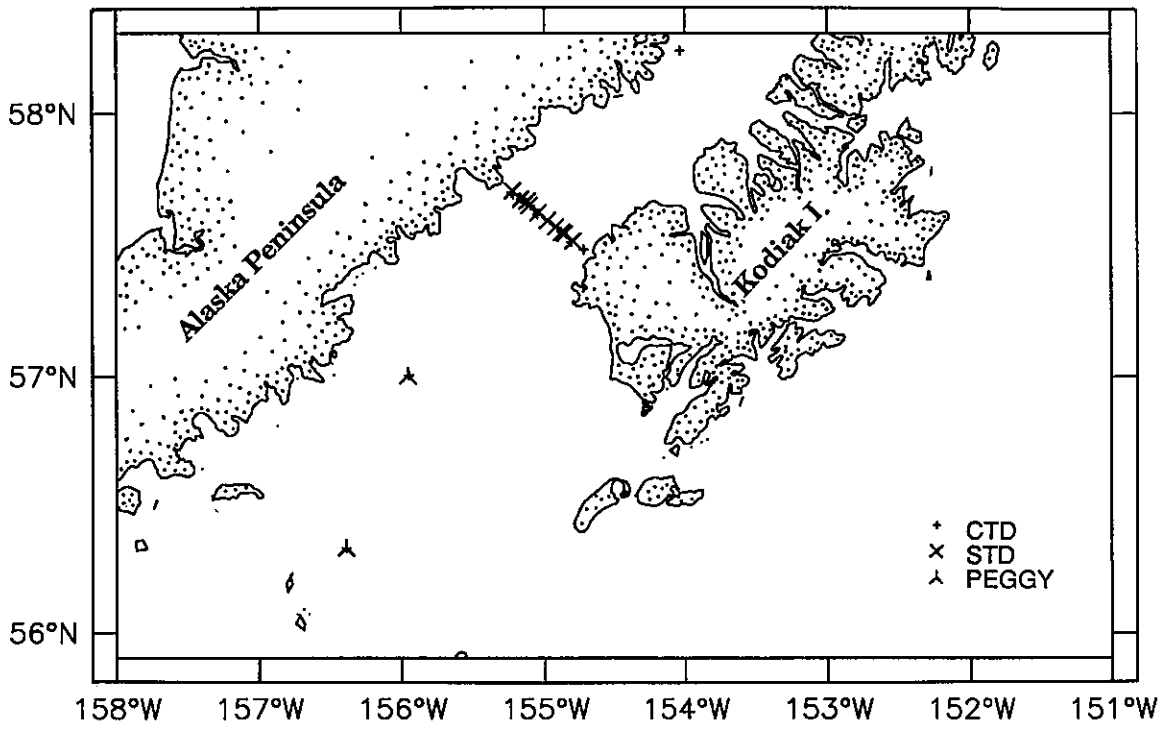

Figure 4b. FOCI-87-I (MF-87-04) physical sampling stations.

TABLE 3. Sampling activities during FOCI-87-I (MF-87-04), 2-17 April 1987. See Table 1 or footnotes for abbreviations.

CRUISE – 2MF87

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
93	03 Apr	0190		57 40.5	155 08.7	CTD
		0940		57 40.1	155 07.3	Deploy STD (200-m drogue)
94	04 Apr	0300		56 27.0	156 11.1	MWT, XBT[1]
		1311		57 37.5	155 17.7	MWT
		1935	G001A	58 09.5	154 07.3	B
		2017	G002A	58 07.7	154 01.5	B
		2131	G003A	58 02.3	153 51.5	B
		2225	G004A	57 59.7	153 44.8	B
		2318	G005A	57 58.4	153 42.7	B
95	05 Apr	0058	G006A	58 11.4	153 55.7	B
		0200	G007A	58 14.1	154 02.0	B, CTD
		0414	G008A	58 02.3	154 18.6	B
		0601	G009A	58 00.4	154 14.1	B
		0643	G010A	57 58.6	154 09.3	B
		0734	G011A	57 54.7	154 01.1	B
		0812	G012A	57 52.1	153 58.7	B
		0917	G013A	57 49.5	154 04.6	B
		1055	G014A	57 58.5	154 19.9	B
		1139	G015A	57 58.8	154 24.8	B
		1241	G016A	57 57.3	154 34.7	B
		1318	G017A	57 56.0	154 30.1	B
		1404	G018A	57 53.3	154 25.2	B
		1437	G019A	57 51.4	154 22.2	B
		1533	G020A	57 46.9	154 12.5	B
		1700	G021A	57 50.1	154 32.3	B
		1737	G022A	57 52.1	154 34.8	B
		1822	G023A	57 53.3	154 40.3	B
		1911	G024A	57 56.4	154 44.5	B
		2009	G025A	57 55.6	154 53.1	B
		2041	G026A	57 52.4	154 49.7	B
		2123	G027A	57 51.3	154 44.6	B
		2213	G028A	57 48.8	154 42.1	B
		2255	G029A	57 47.4	154 37.8	B
		2338	G030A	57 44.7	154 33.0	B

[1] XBT - expendable bathythermograph.
[2] MOC-Z indicates tows for zooplankton; depth intervals = 0-10, 10-20, 20-30, 30-50, 50-75, 75-100, 100-150, 150-200; MOC-E is for tows for eggs; depth intervals = 0-50, 50-100, 100-150, 150-170, 170-190, 190-210, 210-230, 230-250.
[3] PEGGY - meteorological buoy.
[4] ACM - acoustic current meter.
[5] EXTR.EXP - pollock larvae extrusion experiment.

TABLE 3. (cont.)

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
96	06 Apr	0042	G031A	57 44.1	154 24.6	B
		0205	G032A	57 42.7	154 43.7	B
		0245	G033A	57 44.8	154 47.6	B
		0354	G034A	57 47.3	154 50.9	B
		0517	G036A	57 50.3	155 00.8	B
		0653	G037A	57 47.6	155 06.0	B
		0743	G038A	57 44.8	155 00.8	B
		0827	G039A	57 43.3	154 57.2	B
		0912	G040A	57 41.4	154 52.9	B
		0954	G041A	57 39.6	154 49.0	B
		1035	G042A	57 37.7	154 45.0	B
		0424	G035A	57 49.4	154 56.0	B
		1122	G043A	57 34.9	154 39.5	B
		1216	G044A	57 29.0	154 46.3	B
		1303	G045A	57 33.0	154 52.7	B
		1347	G046A	57 34.7	154 56.5	B
		1433	G047A	57 36.7	155 00.4	B
		1520	G048A	57 38.8	155 04.6	B
		1618	G049A	57 40.9	155 08.4	B
		1700	G050A	57 42.1	155 11.3	B
		1753	G051A	57 40.0	155 18.1	B
		1838	G052A	57 38.0	155 14.2	B
		1925	G053A	57 36.1	155 09.9	B
		1958	G054A	57 34.1	155 05.9	B
		2039	G055A	57 32.1	155 01.7	B
		2139	G056A	57 31.2	155 12.3	B
		2226	G057A	57 33.1	155 16.6	B
		2315	G058A	57 34.9	155 21.3	B
		2355	G059A	57 36.6	155 24.6	B
97	07 Apr	0048	G060A	57 32.5	155 30.6	B
		0135	G061A	57 30.6	155 27.0	B
		0225	G062A	57 28.6	155 23.0	B
		0308	G063A	57 27.1	155 19.5	B
		0437	G064A	57 18.7	155 16.8	B
		0613	G065A	57 15.4	155 06.9	B
		0712	G066A	57 11.0	154 59.6	B
		0814	G067A	57 18.6	155 01.0	B
		0908	G068A	57 23.1	154 54.3	B
98	08 Apr	0136	G069A	57 26.8	155 02.9	B
		0236	G070A	57 22.6	155 09.9	B
		0408	G071A	57 14.9	155 22.4	B
		0514	G072A	57 19.4	155 31.0	B
		0612	G073A	57 24.9	155 29.7	B
		0656	G074A	57 26.8	155 33.0	B
		0745	G075A	57 28.7	155 37.7	B
		0853	G076A	57 22.8	155 38.4	B

TABLE 3. (cont.)

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
		0953	G077A	57 19.4	155 44.7	B
		1054	G078A	57 15.5	155 35.5	B
		1146	G079A	57 11.4	155 27.6	B
		1241	G080A	57 07.5	155 19.5	B
		1336	G081A	57 03.2	155 11.6	B
		1432	G082A	56 59.2	155 03.4	B
		1520	G083A	56 55.5	155 10.0	B
		1627	G084A	56 59.7	155 17.7	B
		1736	G085A	57 04.0	155 25.6	B
		1832	G086A	57 08.2	155 34.2	B
		1938	G087A	57 12.3	155 42.7	B
		2046	G088A	57 16.7	155 51.4	B
		2206	G089A	57 12.1	155 57.6	B
		2308	G090A	57 08.0	155 48.4	B
99	09 Apr	0002	G091A	57 03.9	155 40.4	B
		0059	G092A	56 59.9	155 32.2	B
		0200	G093A	56 56.0	155 23.1	B
		0254	G094A	56 52.2	155 14.8	B
		0355	G095A	56 46.9	155 22.0	B
		0459	G096A	56 51.9	155 30.2	B
		0605	G097A	56 56.6	155 38.5	B
		0724	G098A	57 01.2	155 47.0	B
		0908	G099A	57 05.2	155 55.7	B
		1011	G100A	57 01.7	156 01.6	B
		1155	G101A	56 57.2	155 57.0	B
		1335	G102A	56 54.1	156 13.8	B
		1502	G103A	56 42.2	156 18.3	B
		1713	G104A	56 49.5	156 04.7	B
		1925	G105A	56 52.8	155 44.8	B
		2041	G106A	56 48.5	155 49.5	B
		2149	G107A	56 45.0	155 56.6	B
		2259	G108A	56 41.9	156 04.6	B
		2354	G109A	56 38.1	156 10.0	B
100	10 Apr	0059	G110A	56 32.5	156 16.0	B
		0206	G111A	56 33.4	156 01.4	B
		0301	G112A	56 37.3	155 55.3	B
		0401	G113A	56 40.1	155 47.9	B
		0502	G114A	56 44.5	155 40.7	B
		0552	G115A	56 47.3	155 36.3	B
		0654	G116A	56 43.2	155 27.9	B
		0748	G117A	56 39.1	155 33.9	B
		0843	G118A	56 36.1	155 40.5	B
		0932	G119A	56 33.5	155 46.2	B
		1031	G120A	56 28.8	155 52.0	B
		1201	G121A	56 31.0	155 41.0	B
		2228	G122A (61)	57 41.7	155 11.8	MOC-Z-1[2]

TABLE 3. (cont.)

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
101	11 Apr	0245	G123A (61)	57 41.7	155 13.2	B,b,CTD,N
		0503	G124A (60)	57 40.6	155 10.1	B,b,CTD,N,STD (200-m drogue)
		0724	(59)	57 38.3	155 04.4	CTD
		0916	G125A (58)	57 37.1	155 03.1	B,b,CTD,N
		1030	G126A (61)	57 41.6	155 11.9	MOC-Z-2
		1245	(61)	57 42.1	155 14.0	CTD,N
		1444	(57)	57 33.3	154 53.0	CTD
		2240	G127A (58)	57 36.3	155 00.2	MOC-Z-3
102	12 Apr	0209	G128A (56)	57 32.5	154 46.1	MOC-Z-4
		0443	G129A (56)	57 30.8	154 48.8	B,b,CTD,N
		0610	G130A (55)	57 29.1	154 43.5	B,b,CTD,N
		0634		57 31.1	154 47.9	Deploy STD (40-m drogue)
		0649		57 32.8	154 51.6	Deploy STD
		0703		57 34.3	154 55.4	Deploy STD
		0715		57 35.8	154 58.8	Deploy STD
		0729		57 37.6	155 02.6	Deploy STD
		0743		57 39.2	155 06.4	Deploy STD
		0757		57 40.7	155 10.0	Deploy STD
		0810		57 42.5	155 13.5	Deploy STD
		0918	G131A (58)	57 36.3	155 00.8	MOC-Z-5
		1232	G132A	57 49.5	154 59.9	T
		1330	G132B	57 49.3	155 00.3	T
		1751	G132C	57 50.4	155 01.3	T
		1833	G132D	57 51.1	155 59.9	T
		1954	G133A	57 48.8	154 55.0	MOC-E-6
		2158	G132E	57 50.9	155 00.2	T
		2206		57 49.2	154 55.6	CAM
103	13 Apr	0726		57 00.1	155 57.4	Deploy PEGGY[3]
		0801		57 00.2	155 57.0	CTD
		1108	G134A	56 30.9	155 40.5	T
		1817		56 20.1	156 23.2	Deploy ACM[4] at PEGGY
		1844		56 19.9	156 23.1	CTD
		2118		56 19.9	156 23.1	Deploy ADCP#2 at PEGGY
104	14 Apr	0459	G135A	56 09.3	154 42.4	B
		0614	G136A	56 09.6	154 43.0	B
		0743	G137A	56 09.6	154 05.4	B
		0936	G138A	56 09.8	153 48.0	B
		1112	G139A	56 00.4	153 50.1	B
		1239	G140A	56 00.1	154 05.5	B
		1412	G141A	56 00.0	154 22.9	B
		1724	G142A	56 00.4	154 42.4	B
105	15 Apr	2231	G143A	56 33.2	156 00.2	B,b,EXTR.EXP[5]
106	16 Apr	0047	G144A	56 49.0	155 49.4	B,b,EXTR.EXP

TABLE 3. (cont.)

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
		0234		57 00.4	155 58.8	Inspect PEGGY
		0753	G145A	57 23.0	155 39.5	MOC-E-7
		1239	G146A (55)	57 27.9	154 47.0	B,b
		1318	G147A (56)	57 30.3	154 45.9	B,b
		1412	G148A (57)	57 33.1	154 52.8	B,b,CTD,STD (200-m drogue)
		1737	G149A (58)	57 36.6	155 00.8	B,b
		1823	G150A (59)	57 38.7	155 05.7	B,b
		1922	G151A (60)	57 41.2	155 11.3	B,b
		1957	G152A (61)	57 42.6	155 14.1	B,b
		2052		57 42.7	155 11.9	MOC-E-8
107	17 Apr	0006	(61)	57 42.4	155 12.3	CAM
		0139	(61)	57 42.5	155 13.7	CAM

3.3 FOCI-87-II

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Kathleen MacCauley, NWAFC
Jeff Napp, RSMAS/Univ. Miami
Mike Helser, NWAFC

The principal accomplishments of this cruise were the following: physical and biological time-series measurements made along lines 8, 16 and 17; satellite-tracked drifters deployed for a circulation study and the region of their transit examined with CTD transects; the distribution and abundance of larval pollock sampled (for interannual time-series); and vertical distribution of zooplankton and larval pollock studied in late May at finescale in the upper water column at 0-15, 15-30, 30-45, 45-60, 60-80, 80-100 m (deeper samples were 100-125, 125-150 or 100-150, 150-bottom). Larval growth studies included shrinkage with net handling and morbidity/ mortality, shrinkage and dry-weight loss on preservation, larval fresh dry-weights, and samples for examining otoliths and RNA/DNA ratios. Additional studies included periodicity of zooplankton gut fluorescence (Napp), acoustic target measurements of size-fractionated zooplankton (on board, Cummings), collection of acoustical echogram data (12, 38, and 50 kHz) during diel MOCNESS tows, and dry weights of *Neocalanus* spp. copepods. Diel studies concentrated on contrasting larval and zooplankton movements. Data collections will permit investigation of age- and/or size-dependent differences in larval migrations (see Phase III below).

Phase I consisted of sampling and satellite-tracked drifter deployments along FOCI line 8.

A dozen samples were obtained during Phase II for Soviet scientists (Sta. 26, 28, 31, 33, 36, 38, 41, 43, 45, 47, 50, 52). Twenty-four replicate samples (second side of bongo sampler) were counted for pollock larvae to provide a real-time estimate of distribution and abundance to focus later sampling on this cruise. These larvae were saved for otolith work. Special collections also were made during this phase (as marked in Table 4, "ExB").

Phase III began with station 72, located east of Sutwik Island where larval numbers were consistently the highest and flow characteristics perhaps the least complex. Sampling continued for about 55 hours at a geographically fixed site. The objective was to sample the diel distribution of larval pollock and zooplankton, focusing on possible crepuscular movements. To do this we centered MOCNESS sampling on solar midday, solar midnight, and at 20 degrees solar angle above the horizon at dawn and dusk. After each MOCNESS tow, an oblique bongo tow was taken. The sample from one side of the sampler was preserved in formalin; pollock larvae were removed from the other side and preserved in ETOH for otolith (age) examination. This will be investigated if size-differences appear in analysis of vertical movements. Camera tows at

midday and midnight were added to the suite of observations on the second day of sampling. During the course of experimental collections we often drifted 4 nm to the southwest (232°T) and found extremely clear water – evidenced by unclogged nets and good downward visibility. This "clear water" condition persisted through the 50+ hours of the diel studies despite 30+ knot winds and 8-foot seas on the second day. We investigated the contrast and transition between these sites in a series of CTD casts, bongo tows, nutrient and chlorophyll casts, and a continuous trace of T, S and *in vivo* fluorescence collected by towing the net-camera from station 80 to 81. (Neither the net nor camera were operating for this, as the transect was too long).

The first of three visits to the meteorological buoy component of PEGGY showed the wind-speed rotor was not functioning (20 May, 0445 GMT) despite 18-knot winds; the wind vane (direction) was responsive. A subsequent bypass on 25 May could detect no transmission on the satellite uplink sensor. The float is awash in a 3-foot sea or more. On 28 May the antenna was replaced at 1816 GMT, still with no transmission detectable from the vessel. Water was noted where the antenna cable enters the transmitter box.

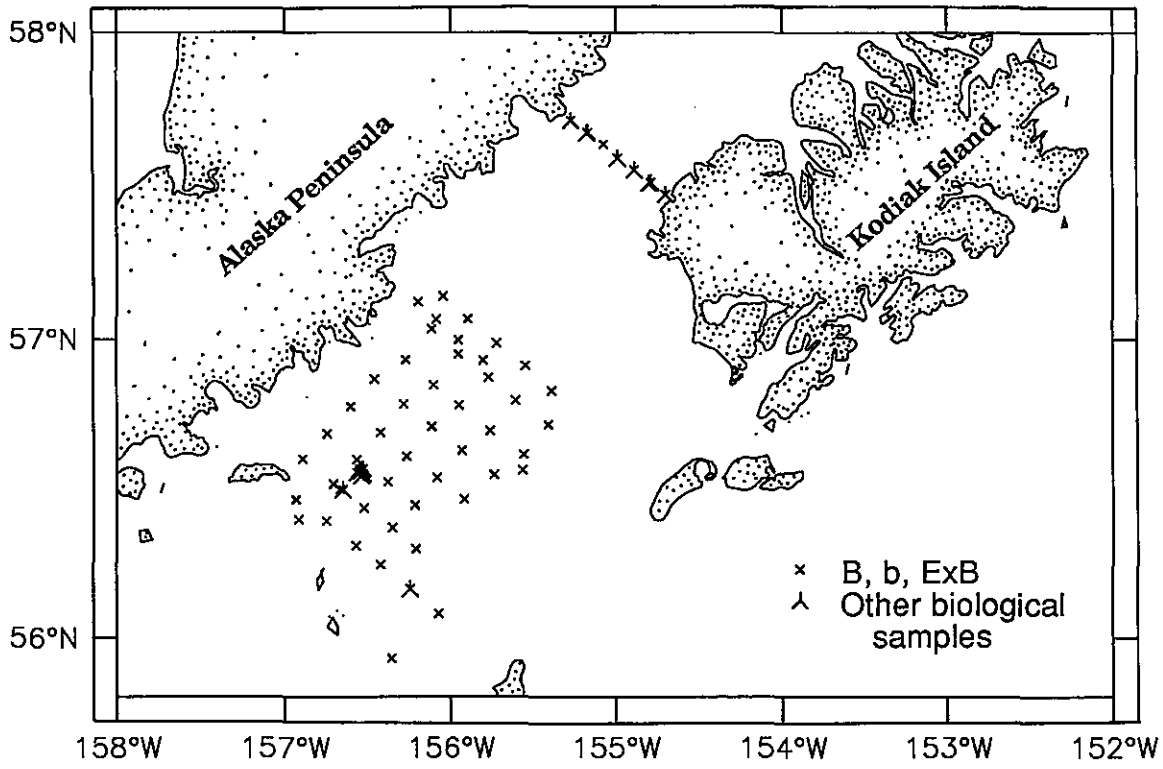

Figure 5a. FOCI-87-II (MF-87-06) biological sampling stations.

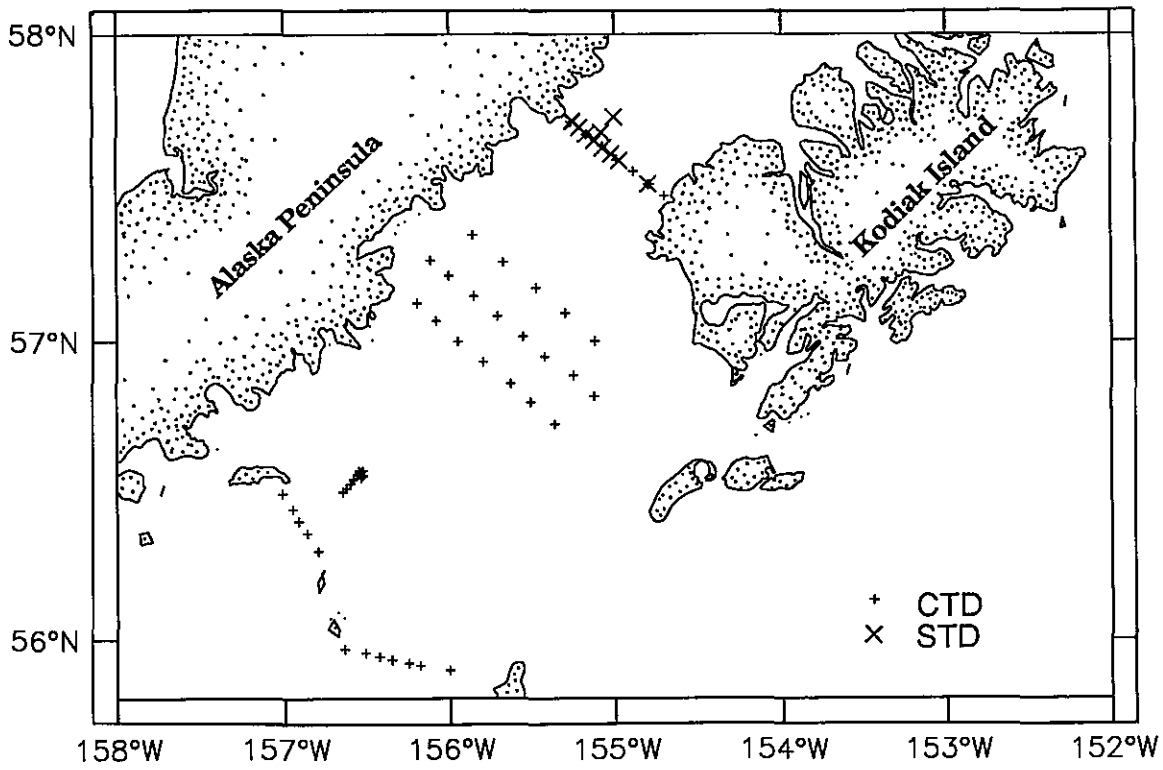

Figure 5b. FOCI-87-II (MF-87-06) physical sampling stations.

TABLE 4. Station locations, times and sampling activities during FOCI-87-II (MF-87-06). See Table 1 or footnotes for abbreviations.

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
PHASE I: Line 8 Studies and Drifter Deployments						
139	19 May	0744	1 (56)	57 30.69	154 47.93	CTD, MOC
		1357	2 (60)	57 40.63	155 09.88	CTD, N, MZ, MOC, B, b
		1736	3 (61)	57 43.00	155 15.94	CTD, N, MZ, B, b
		1945	4 (60)	57 40.53	155 10.24	CTD, MOC
		2315	5 (56)	57 30.89	154 47.23	CTD, MOC, B, b, CAM
140	20 May	0311	6 (55)	57 28.54	154 41.96	CTD, N, MZ, B, b
		0525	7 (57)	57 33.32	154 53.03	CTD, B, b
		0719	8 (58)	57 35.64	154 59.07	CTD, N, MZ, B, b,
		0932	9 (59)	57 38.32	155 04.12	CTD, B, b
		1130	10 (61)	57 43.12	155 15.23	Deploy STD #7220
		1122	11	57 41.93	155 12.69	Deploy STD #7221
		1132	12	57 40.65	155 10.03	Deploy STD #7223
		1142	13	57 39.43	155 07.00	Deploy STD #7233
		1153	14	57 41.00	155 04.88	Deploy STD #7239
		1211	15	57 43.92	155 00.22	Deploy STD #7240
		1246	16	57 37.97	155 04.00	Deploy STD #7241
		1256	17	57 36.78	155 00.98	Deploy STD #7242
		1306	18	57 35.48	154 58.08	Deploy STD #7243
		1339	19 (56)	57 30.87	154 47.58	Deploy STD #7244
PHASE II: Ichthyoplankton Survey, Special Collections, and CTD Transects at FOCI Sections 2 and 3						
		1712	20	57 08.54	156 02.79	B
		1858	21	57 04.06	155 53.47	B
		2028	22	56 59.21	155 42.99	B
		2150	23	56 54.71	155 32.57	B
		2311	24	56 49.79	155 22.99	B
141	21 May	0012	25	56 43.03	155 24.25	B
		0122	26	56 47.85	155 36.10	B
		0230	27	56 52.45	155 45.95	B
		0342	28	56 57.02	155 56.91	B

[1] ExB - Experiment Bongo to collect live animals.

[2] Acoustic target strength of size-fractionated zooplankton community conducted on board by Cummings.

[3] Acoustic data were recorded at 12, 38, and 50 kHz to correlate with MOCNESS catches. Data also were recorded between MOCNESS tows to supply temporal information.

[4] Live Net - slow vertical tow of bongo net with taped cod end for collecting undamaged zooplankton.

TABLE 4. (cont.)

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
Detour to get position fix on PEGGY @				56 59.78	155 57.02	
		0527	29	57 02.06	156 06.75	B, ExB[1]
		0628	30	56 55.88	156 16.24	B
		0737	31	56 50.94	156 06.13	B
		0915	32	56 46.86	155 56.78	B, ExB
		1034	33	56 41.77	155 45.49	B
		1153	34	56 37.04	155 33.21	B
		1300	35	56 32.97	155 44.00	B
		1420	36	56 37.84	155 55.80	B
		1551	37	56 42.62	156 06.84	B
		1702	38	56 47.09	156 17.01	B
		1832	39	56 52.06	156 27.54	B, ExB
		1928	40	56 46.59	156 36.24	B
		2043	41	56 41.43	156 25.41	B
		2259	42	56 36.66	156 15.98	B, ExB
142	22 May	0011	43	56 32.34	156 05.03	B
		0125	44	56 28.09	155 54.99	B
		0303	45	56 26.91	156 12.97	B
		0501	46	56 31.53	156 22.77	B, ExB
		0632	47	56 35.95	156 34.18	B
		0747	48	56 41.14	156 44.72	B
		0929	49	56 36.09	156 53.56	B, ExB
		1032	50	56 31.03	156 42.55	B
		1145	51	56 26.20	156 31.46	B
		1257	52	56 22.33	156 21.23	B
		1408	53	56 17.97	156 12.73	B
		1602	54	56 04.95	156 04.32	B
		1736	55	56 09.97	156 14.64	B, ExB, Acoustic sample[2]
		1918	56	56 14.85	156 25.29	B
		2036	57	56 18.66	156 34.47	B
		2154	58	56 23.65	156 45.10	B, ExB
		2307	59	56 27.92	156 55.96	B
143	23 May	0018	60 (151)	56 29.60	157 00.88	CTD
		0106	61 (150)	56 26.37	156 57.10	CTD
		0139	62 (149)	56 23.90	156 55.08	CTD, B, b
		0158	63 (148)	56 21.47	156 52.05	CTD
		0309	64 (147)	56 17.91	156 48.03	CTD
		0505	65 (158)	55 58.04	156 38.37	CTD
		0621	66 (157)	55 57.29	156 30.78	CTD
		0708	67 (156)	55 56.53	156 25.73	CTD
		0753	68 (155)	55 55.84	156 21.42	CTD, B, b
		0947	69 (154)	55 55.13	156 15.16	CTD
		1033	70 (153)	55 54.64	156 11.03	CTD
		1135	71 (152)	55 53.73	156 00.13	CTD

TABLE 4. (cont.)

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
PHASE III: Diel Studies and Special Collections						
		1544	72	56 32.72	156 32.43	CTD, MOC, Acoustic record[3], B, ExB, Live Net[4]
		2148	73	56 33.81	156 32.93	CTD, Chl, MZ, MOC, Acoustic record, B, ExB, Live Net
144	24 May	0401	74	56 34.08	156 33.06	CTD, N, Chl, MOC, Acoustic record, B (0-15 m), b (0-15 m), B, Live Net
		0947	75	56 33.10	156 31.82	CTD, MZ, Chl, MOC, Acoustic record, B, ExB (3)
		1509	76	56 33.85	156 32.61	CTD, Chl, MOC, Acoustic record, B, ExB (4)
		2108	77	56 33.65	156 32.61	CTD, MZ, Chl, CAM, MOC, Acoustic record, B, ExB, Chl (fluorometer calibr.)
145	25 May	0442	78	56 33.90	156 32.74	CTD, N, Chl, MOC, Acoustic record, B, ExB (2)
		0934	79	56 34.12	156 31.89	CTD, MZ, Chl, MOC, Acoustic record, CAM, B, ExB (2)
		1548	80	56 29.91	156 39.12	CTD, N, Chl, B, b, Camera transect (to 56 34.32, 156 32.67; T, C and fluoro-meter only)
		1925	81	56 33.93	156 32.81	CTD, N, Chl
		2035	82	56 33.37	156 33.91	CTD
		2106	83	56 32.43	156 35.04	CTD
		2140	84	56 31.51	156 36.24	CTD
		2218	85	56 30.52	156 37.67	CTD
		2248	86	56 29.87	156 39.10	CTD

TABLE 4. (cont.)

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
PHASE IV: CTD Grid (Upper Strait) and Plankton Collections						
146	26 May	0242	87 (105)	57 07.43	156 11.91	CTD, ExB
		0341	88 (104)	57 03.95	156 05.03	CTD, ExB
		0452	89 (103)	56 59.86	155 56.96	CTD, ExB
Check on PEGGY transmission with satellite uplink sensor; no response. Sea state too rough to replace antenna.						
		0600	90 (102)	56 55.85	155 47.91	CTD, ExB
		0724	91 (101)	56 51.46	155 37.93	CTD
		0822	92 (100)	56 47.90	155 30.47	CTD
		0922	93 (99)	56 43.43	155 21.66	CTD
		1032	94 (88)	56 49.0	155 07.42	CTD
		1120	95 (89)	56 53.22	155 15.08	CTD
		1213	96 (90)	56 56.88	155 25.46	CTD
		1315	97 (91)	57 00.79	155 33.34	CTD
		1427	98 (92)	57 04.89	155 42.64	CTD
		1532	99 (93)	57 08.83	155 51.17	CTD
		1641	100 (94)	57 12.95	156 00.21	CTD
		1742	101 (95)	57 15.92	156 06.96	CTD
		1856	102 (84)	57 20.88	155 51.43	CTD
		2002	103 (82)	57 15.52	155 40.35	CTD
		2109	104 (80)	57 10.55	155 28.51	CTD
		2211	105 (78)	57 05.53	155 17.94	CTD
		2318	106 (76)	57 00.03	155 07.31	CTD
PHASE V: Return to Diel Site for Special Collections (Larval Biology/Zooplankton Feeding)						
147	27 May	0835-2102	107	56 33.87	155 33.60	ExB (17)
		2230	108	56 33.68	156 33.19	CTD, N, B, CAM
		0007	109	56 33.36	156 33.99	CAM, ExB
148	28 May	0210-0507	110	56 33.28	156 33.72	ExB (7)
		0610-1347	111	56 29.99	156 40.02	ExB (8)
Return to PEGGY buoy @ 56 59.85, 155 57.17 @ 1749 GMT; replace antenna; still no satellite signal detected.						

3.4 RIBS-87-II

Scientific Party: Andrew T. Roach, PMEL, Chief Scientist
Carol DeWitt, PMEL
David Kachel, PMEL

This cruise had three objectives: 1) occupy the FOCI CTD line 8 in Shelikof Strait, 2) deploy moorings in Unimak, Amukta, and Amchitka Passes in the Aleutian Islands, and 3) occupy lines of CTDs in the Bering Sea in the vicinity of the date line.

CTDs at line 8 in Shelikof Strait continued the long-term sampling of water properties at these stations. The moorings were designed to monitor exchange of water between the Gulf of Alaska and Bering Sea through three of the larger passes through the Aleutian Islands. CTDs in the Bering Sea (Figure 6), together with those of RIBS-87-I, will elucidate regional circulation and water properties.

Table 5 lists stations and activities accomplished during RIBS-87-II including 57 CTDs, 10 Tucker trawls, 6 nutrient stations, and 3 mooring deployments.

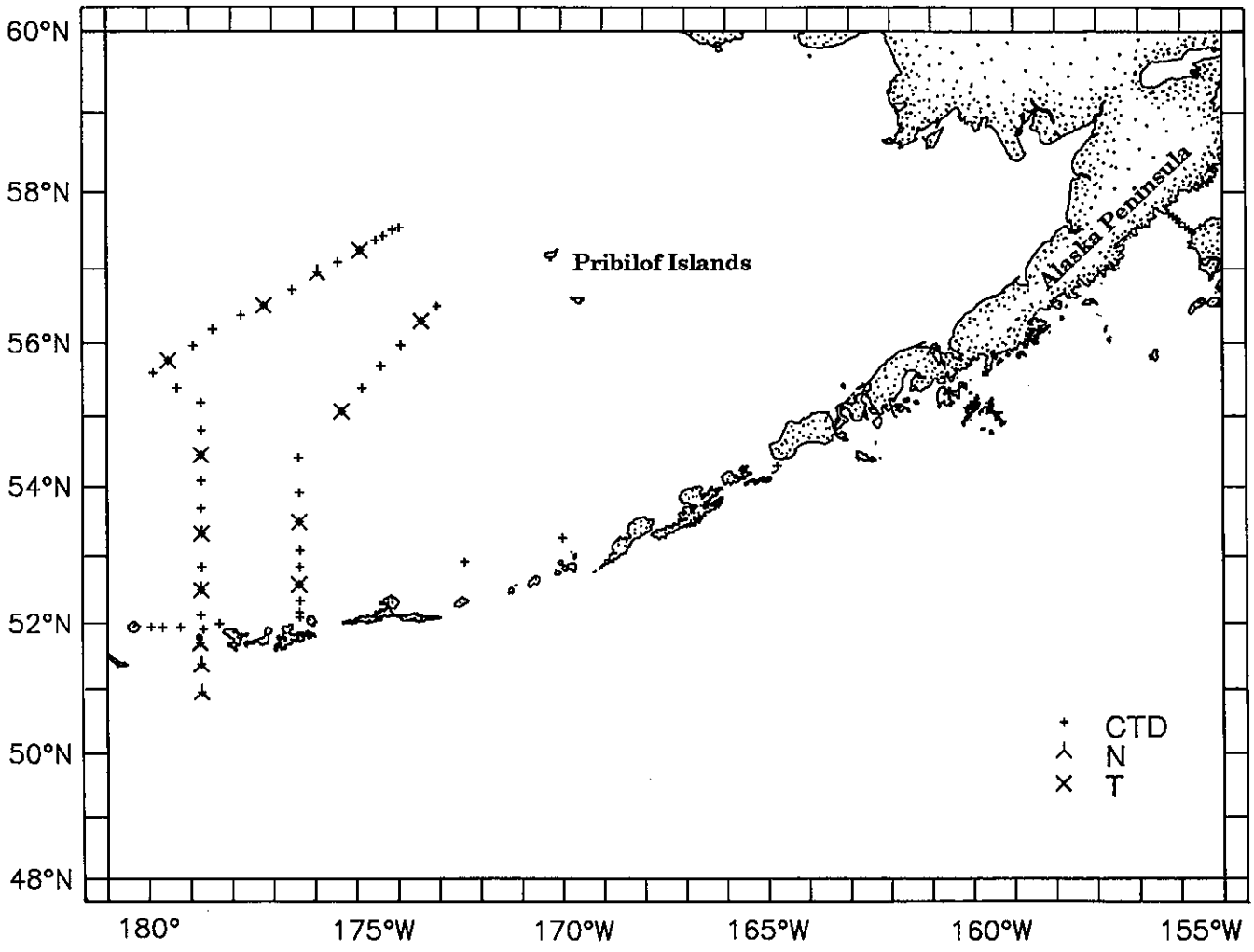

Figure 6. RIBS-87-II (MF-87-07) sampling stations.

TABLE 5. Station locations, times, and activities during RIBS-87-II (MF-87-07). See Table 1 for abbreviations.

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
154	3 Jun	0828	1 (055)	57 28.42	154 42.86	CTD
		0911	2 (056)	57 31.03	154 46.92	CTD
		0952	3 (057)	57 33.25	154 52.41	CTD
		1042	4 (058)	57 36.38	155 00.54	CTD
		1127	5 (059)	57 38.48	155 04.23	CTD
		1216	6 (060)	57 40.89	155 10.00	CTD
		1307	7 (061)	57 43.10	155 15.41	CTD
155	4 Jun	2302	8 (UNI)	54 17.82	164 45.98	CTD
158	7 Jun	0450	9 (093)	51 56.89	–179 56.60	CTD
		0708	10 (095)	51 56.72	–179 40.06	CTD
		0944	11 (097)	51 56.76	–179 14.91	CTD
		1359	12 (099)	51 54.56	–178 41.89	CTD
		1635	13 (101)	51 59.85	–178 18.40	CTD
159	8 Jun	0422	14 (075)	50 57.37	–178 44.24	CTD,N
		0900	15 (076)	51 22.97	–178 44.67	CTD,N
		1319	16 (077)	51 42.21	–178 46.41	CTD,N
		1637	17 (078)	52 07.67	–178 45.12	CTD
		1938	18 (079)	52 30.07	–178 44.88	CTD,N,T
		2342	19 (080)	52 50.41	–178 43.78	CTD
160	9 Jun	0334	20 (081)	53 19.71	–178 44.26	CTD,N,T
		0751	21 (082)	53 41.91	–178 44.67	CTD
		1100	22 (083)	54 05.28	–178 44.49	CTD
		1359	23 (084)	54 27.17	–178 44.61	CTD,T
		1708	24 (085)	54 48.10	–178 44.23	CTD
		2001	25 (086)	55 11.25	–178 45.03	CTD
		2340	26 (087)	55 23.55	–179 19.52	CTD
161	10 Jun	0302	27 (088)	55 36.13	–179 52.92	CTD
		0618	28 (089)	55 46.12	179 31.54	CTD,T
		1034	29 (090)	55 58.37	178 55.69	CTD
		1341	30 (091)	56 11.53	178 27.00	CTD
		1707	31 (092)	56 22.81	177 46.02	CTD
		2021	32 (068)	56 30.58	177 12.95	CTD,T
162	11 Jun	0039	33 (067)	56 43.39	176 31.65	CTD
		0432	34 (066)	56 57.02	175 54.94	CTD,N
		0800	35 (065)	57 04.97	175 25.06	CTD
		1106	36 (064)	57 14.28	174 52.94	CTD,T
		1402	37 (063)	57 22.55	174 30.77	CTD
		1601	38 (062)	57 25.65	174 20.01	CTD
		1801	39 (061)	57 30.28	174 06.88	CTD
		1920	40 (060)	57 32.12	173 57.27	CTD
163	12 Jun	0132	41 (058)	56 30.10	173 02.17	CTD
		0422	42 (056)	56 17.91	173 25.49	CTD,T
		0800	43 (055)	55 58.40	173 54.96	CTD
		1050	44 (054)	55 41.49	174 24.93	CTD
		1353	44 (054)	55 41.09	174 23.21	CTD

TABLE 5. (cont.)

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
		1714	45 (053)	55 22.96	174 50.96	CTD
		2045	46 (052)	55 03.95	175 20.36	CTD,T
164	13 Jun	0301	47 (009)	54 24.74	176 22.90	CTD
		0644	48 (008)	53 54.77	176 22.16	CTD
		0953	49 (007)	53 29.90	176 22.10	CTD,T
		1327	50 (006)	53 04.90	176 21.74	CTD
		1559	51 (005)	52 50.33	176 21.95	CTD
		2116	52 (004)	52 34.81	176 22.60	CTD,T
165	14 Jun	0017	53 (003)	52 20.14	176 21.67	CTD
		0216	54 (002)	52 09.98	176 22.46	CTD
		0405	55 (001)	52 05.52	176 21.97	CTD
		1647	56 (015)	52 54.37	172 23.08	CTD
166	15 Jun	0037	57 (025)	53 15.55	170 00.67	CTD

3.5 FOCI-87-III

Scientific Party: Sarah Hinckley, NWAFC, Chief Scientist
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Thomas Jackson, PMEL
Gregory Green, Envirosphere
Gary Carter, Envirosphere

FOCI-87-III was conducted from 16 June to 3 July, 1987 from the NOAA ship *Miller Freeman*. This cruise was the first leg of a two-part survey with the following objectives: (1) examine the distribution and biology of late-larval and early juvenile pollock between Kodiak Island and Unimak Pass; (2) collect information on zooplankton distribution and abundance; (3) collect temperature and salinity (CTD) data; and (4) recover 12 and deploy 4 current moorings.

The Methot trawl (a frame trawl with a modified IK [Isaacs-Kidd] depressor, 2.5 meter square steel frame, and 2×3 mm oval mesh net), proved effective in catching late larvae and early juveniles ranging in size from 10.9 to 41.5 mm standard length. A total of 76 Methot tows were completed during FOCI-87-III, including 4 short tows for live samples, and one set of three replicate tows. The net was deployed off the stern in an oblique or stepped manner. All pollock were sorted out from the Methot samples onboard, and were preserved for ageing and growth studies and stomach content analysis. In addition, fifteen 60-cm and three 20-cm bongo tows, eight Tucker trawls, and 30 CTDs were completed. Weather permitted only five current meter moorings to be recovered and three to be deployed. Figure 7 show the locations of stations, Table 6 provides an operations summary.

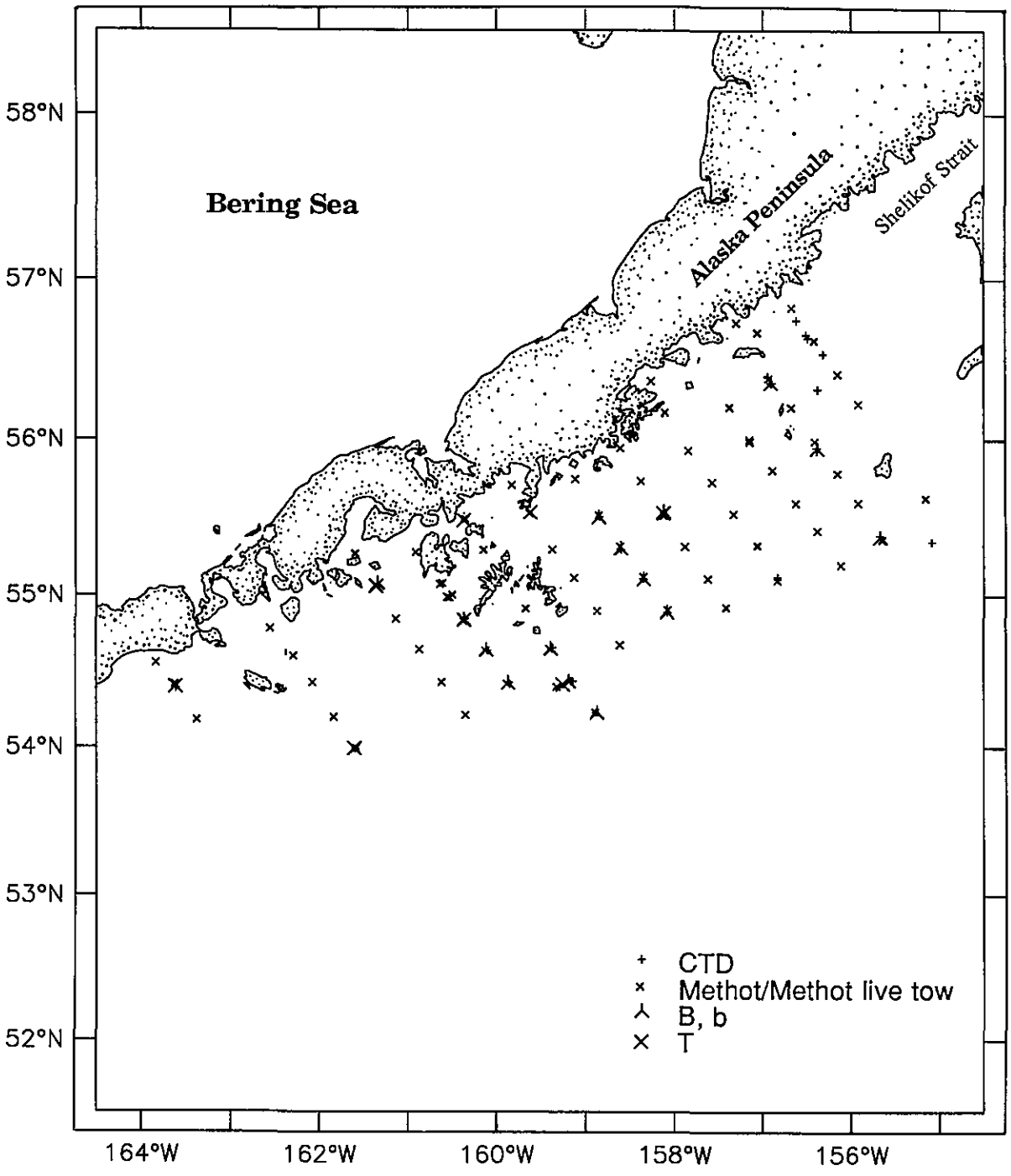

Figure 7. FOCI-87-III (MF-87-08) sampling stations.

TABLE 6. Station locations, times, and sampling activities during FOCI-87-III (MF-87-08). See Table 1 or footnotes for abbreviations.

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
169	18 Jun	1700	G001A	54 33.5	163 50.0	Methot
		1839	G002A	54 23.4	163 36.6	CTD
		1913	G002A	54 24.1	163 36.9	T
		1945	G002A	54 24.9	163 37.4	Methot
		2218	G003A	54 10.9	163 22.7	Methot
170	19 Jun	0426	G004A	53 59.4	161 35.4	CTD
		0445	G004A	53 59.6	161 35.9	T
		0602	G004A	53 59.6	161 35.0	Methot
		0752	G005A	54 12.0	161 50.0	Methot
		0934	G006A	54 25.7	162 04.3	Methot
		1104	G007A	54 36.2	162 17.2	Methot
		1409	G008A	54 46.9	162 33.1	Methot
		1933	G009A	55 16.2	161 35.7	Methot
		2250	G010A	55 03.8	161 21.2	Methot
		2311	G010A	55 03.7	161 21.5	T
171	20 Jun	0014	G010A	55 04.9	161 20.4	B
		0210	G011A	54 50.9	161 07.6	Methot
		0356	G012A	54 38.9	160 51.8	Methot
		0536	G013A	54 26.0	160 36.8	Methot
		0723	G014A	54 12.9	160 20.7	Methot
		1005	G015A	54 25.8	159 51.6	CTD
		1025	G015A	54 25.9	159 52.0	B
		1050	G015A	54 25.3	159 52.9	Methot
		1246	G016A	54 38.4	160 06.0	CTD
		1301	G016A	54 38.9	160 06.7	B
		1320	G016A	54 38.5	160 07.2	Methot
		1459	G017A	54 51.0	160 21.0	CTD
		1530	G017A	54 50.8	160 21.6	B
		1548	G017A	54 50.5	160 21.6	T
		1612	G017A	54 50.0	160 22.0	Methot
		1748	G017B	55 00.3	160 30.0	Methot
		1816	L017A	54 59.2	160 32.0	Methot – Live tow
		1841	L017B	54 59.5	160 33.5	Methot – Live tow
		2021	G018A	55 04.8	160 36.5	Methot
		2057	L018A	55 04.4	160 38.2	Methot – Live tow
172	21 Jun	0110	G019A	55 16.8	160 54.6	Methot
		0431	G020A	55 29.5	160 21.0	Methot
		0522	L020A	55 29.5	160 22.0	Methot – Live tow
		0618	G020A	55 29.1	160 22.1	T
		0756	G021A	55 17.7	160 08.7	Methot
		1135	G022A	54 55.0	159 40.6	Methot
		1504	G023A	54 39.6	159 22.2	CTD

[1] ACM = acoustic current meter.

TABLE 6. (cont.)

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
		1517	G023A	54 39.3	159 23.2	B
		1532	G023A	54 39.1	159 24.1	Methot
		1748	G024A	54 26.4	159 09.6	CTD
		1836	G024A	54 26.4	159 08.4	CTD
		1902	G024A	54 26.4	159 09.6	CTD
		1924	G024A	54 26.3	159 11.1	B
		2038	G024A	54 25.1	159 15.3	T
		2139	G024A	54 24.1	159 19.4	Methot
173	22 Jun	0012	G025A	54 13.8	158 53.4	CTD
		0051	G025A	54 14.0	158 52.5	B
		0150	G025A	54 13.9	158 53.7	Methot
		0500	G026A	54 40.6	158 37.1	Methot
		0653	G027A	54 54.0	158 52.9	Methot
		0827	G028A	55 06.9	159 07.8	Methot
		0956	G029A	55 17.9	159 22.5	Methot
		1144	G030A	55 31.8	159 38.0	Methot
		1224	G030A	55 32.3	159 37.4	T
		1352	G031A	55 42.7	159 49.8	Methot
		1704	G032A	55 45.0	159 06.9	Methot
		1903	G033A	55 30.6	158 51.0	CTD
		1922	G033A	55 30.5	158 51.3	B
		1950	G033A	55 31.1	158 51.5	Methot
		2144	G034A	55 18.0	158 36.6	CTD
		2209	G034A	55 18.5	158 36.5	B
		2251	G034A	55 19.1	158 37.1	Methot
174	23 Jun	0038	G035A	55 06.6	158 21.6	CTD
		0057	G035A	55 06.5	158 21.3	B
		0133	G035A	55 07.3	158 21.5	Methot
		0326	G036A	54 53.4	158 05.4	CTD
		0342	G036A	54 53.7	158 05.5	B
		0408	G036A	54 54.5	158 05.1	Methot
		0632	G037A	54 55.5	157 25.1	Methot
		0805	G038A	55 06.7	157 37.5	Methot
		0939	G039A	55 19.0	157 52.9	Methot
		1114	G040A	55 31.0	158 07.7	Methot
		1201	G040A	55 32.0	158 07.7	T
		1228	G040A	55 32.6	158 07.5	B
		1411	G041A	55 44.3	158 23.1	Methot
		1558	G042A	55 56.8	158 37.0	Methot
		2137	G043A	56 22.2	158 16.2	Methot
176	25 Jun	0356	G044A	56 10.4	158 06.7	Methot
		0556	G045A	55 55.9	157 50.6	Methot
		0744	G046A	55 43.9	157 34.4	Methot
		0932	G047A	55 31.7	157 19.9	Methot
		1117	G048A	55 19.6	157 03.7	Methot
		1310	G049A	55 07.2	156 49.8	CTD

TABLE 6. (cont.)

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
		1337	G049A	55 06.6	156 49.8	CTD
		1405	G049A	55 06.1	156 50.0	Methot
		1707	G050A	55 12.0	156 07.2	Methot
		1912	G051A	55 25.2	156 23.1	Methot
		2039	G052A	55 35.9	156 37.6	Methot
		2221	G053A	55 48.5	156 53.3	Methot
		2358	G054A	56 00.1	157 08.9	Methot
177	26 Jun	0139	G055A	56 12.4	157 22.5	Methot
		0758	G057A	56 44.0	157 17.8	Methot
		0914	G058A	56 40.4	157 03.5	Methot
		1120	G059A	56 24.0	156 56.4	CTD
		1202	G059A	56 23.2	156 56.1	Methot
		1330	G060A	56 12.3	156 40.7	Methot
		1510	G061A	55 59.4	156 24.9	Methot
		1644	G061A	55 55.8	156 23.4	CTD
		1829	G062A	55 47.3	156 09.4	Methot
		2051	G063A	55 36.0	155 55.1	Methot
		2339	G064A	55 23.4	155 40.8	CTD
178	27 Jun	0008	G064A	55 22.9	155 40.2	B, b
		0110	G064A	55 21.8	155 39.0	Methot
		1623	ACM	56 19.2	156 22.8	CTD
		2133	CM5	56 21.6	156 54.6	CTD
179	28 Jun	0252	CM18	56 32.4	156 19.2	CTD
		0408	CM17	56 38.4	156 29.4	CTD
		0506	CM16	56 39.6	156 30.6	CTD
		0717	CM15	56 45.0	156 37.2	CTD
		0810	G071A	56 49.6	156 40.4	Methot
		0955	G070A	56 37.4	156 25.2	Methot
		1138	G069A	56 24.9	156 09.3	Methot
		1318	G068A	56 13.6	155 55.1	Methot
181	30 Jun	1712	G059B	56 21.6	156 54.4	B, b
		2306	G059B (CM5)	56 21.6	156 54.0	CTD
182	1 Jul	0225	G061B (CM8)	55 57.0	156 23.4	CTD
		0246	G061B	55 56.8	156 23.0	B, b
		0533	S054A (1)	55 59.4	157 08.8	Methot (replicate #1)
		0601	S054A (2)	55 59.4	157 08.8	Methot (replicate #2)
		0628	S054A (3)	55 59.3	157 08.8	Methot (replicate #3)
		1231	G065A	55 37.8	155 09.6	Methot
183	2 Jul	0418	CM8	55 57.0	156 23.4	CTD
		1021	CM14	55 21.0	155 05.4	CTD
184	3 Jul	0039	CM14	55 20.4	155 12.6	CTD

3.6 FOCI-87-IV

Scientific Party: Kevin Bailey, NWAFC, Chief Scientist
Jay Clark, NWAFC
Bill Rugen, NWAFC
P. Ferraro, NWAFC
Gregory Green, Envirosphere
B. Hanson, Envirosphere
Carol DeWitt, PMEL
Bill Parker, PMEL

FOCI-87-IV was conducted from 6-16 July, 1987 from the NOAA ship *Miller Freeman.* This cruise was the second leg of a two-part survey with the following objectives: (1) examine the distribution and biology of late-larval and early juvenile pollock between Kodiak Island and Unimak Pass; (2) collect information on zooplankton distribution and abundance; (3) collect temperature and salinity (CTD) data; and (4) recover 12 and deploy 4 current meter moorings.

The Methot trawl (a frame trawl with a modified IK [(Isaacs-Kidd)] depressor, 2.5 meter square steel frame, and 2×3 mm oval mesh net), proved effective in catching late larvae and early juveniles ranging in size from 10.9 to 41.5 mm standard length. A total of 92 Methot tows were completed during FOCI-87-IV, including one vertical and one depth series. During a standard tow, the net was deployed off the stern in an oblique or stepped manner. All pollock were sorted out from the Methot samples onboard, and were preserved for ageing and growth studies and stomach content analysis. In addition, four 60-cm bongo tows, three Tucker trawls, and twelve CTDs were completed. The remaining seven current meter moorings were recovered and one was deployed. Figure 8 shows the locations of stations; Table 7 provides an operations summary.

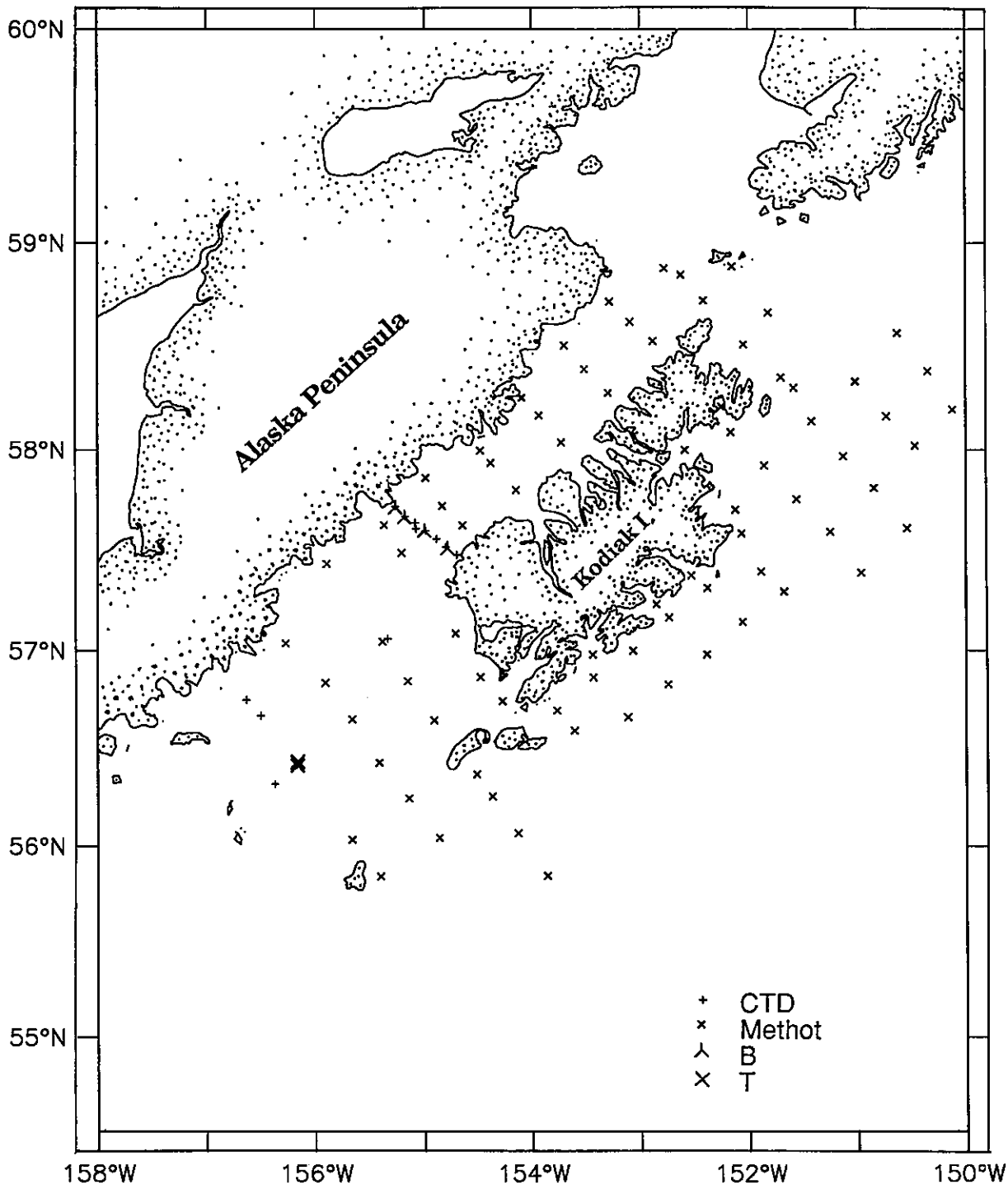

Figure 8. FOCI-87-IV (MF-87-08) sampling stations.

TABLE 7. Station locations, times, and sampling activities during FOCI-87-IV (MF-87-08). See Table 1 or footnotes for abbreviations.

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
188	7 July	1356	CM2	57 36.6	155 04.8	CTD
		1937	G088A	57 29.4	155 12.7	Methot
189	8 July	0107	CM19	57 03.6	155 20.4	CTD
		0140	G084A	57 02.7	155 23.2	Methot
		0805	G073A	56 50.2	155 54.6	Methot
		0624	G072A	57 02.2	156 16.2	Methot
		1108	CM16	56 40.2	156 30.0	CTD
		1207	CM15	56 45.0	156 37.8	CTD
		2001	G067A	56 02.0	155 39.9	Methot
190	9 July	0052	ACM[1]	56 19.2	156 22.2	CTD
		0158-1809	D069A-0	56 25.0	156 09.0	Methot (vertical series)
		1554	D069L	56 25.8	156 09.9	T
		1642	D069M	56 24.9	156 09.8	T
		1729	D069N	56 26.2	156 09.6	T
		2224	G066A	55 50.6	155 24.4	Methot
191	10 July	0034	G077A	56 02.6	154 51.8	Methot
		0345	G078A	55 50.8	153 51.5	Methot
		0538	G079A	56 04.0	154 08.0	Methot
		0706	G080A	56 15.4	154 22.3	Methot
		0826	G081A	56 22.2	154 31.1	Methot
		1056	G076A	56 14.8	155 08.7	Methot
		1500	G092A	56 44.6	154 16.8	Methot
		2040	G091A	56 52.0	154 28.9	Methot
		2216	G090A	57 05.2	154 42.8	Methot
192	11 July	0143	G083A	56 50.7	155 09.4	Methot
		0314	G082A	56 38.8	154 54.8	Methot
		0520	G075A	56 25.8	155 25.0	Methot
		0653	G074A	56 39.1	155 39.9	Methot
		1112	G086A	57 26.1	155 53.8	Methot
		1310	G087A	57 37.7	155 22.4	Methot
		1430	(61)	57 43.2	155 16.2	CTD
		1601	(60)	57 40.2	155 10.8	CTD
		1431	F061A	57 43.0	155 16.2	B
		1615	F060A	57 40.1	155 11.2	B
		1723	(59)	57 38.4	155 05.4	CTD
		1816	(58)	57 36.0	154 59.4	CTD
		1827	F058A	57 36.1	155 00.1	B
		1936	(57)	57 33.6	154 53.4	CTD
		2023	(56)	57 31.2	154 48.0	CTD
		2209	(55)	57 28.8	154 42.0	CTD
		2123	F056A	57 30.9	154 47.3	B
		2310	G093A	57 37.7	154 38.8	Methot

[1] ACM = acoustic current meter.

TABLE 7. (cont.)

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
193	12 July	0119	G094A	57 43.4	154 50.2	Methot
		0139	G095A	57 51.7	154 59.4	Methot
		0334	G096A	57 59.8	154 28.9	Methot
		0424	G097A	57 56.1	154 23.2	Methot
		0547	G098A	57 48.1	154 09.0	Methot
		0800	G099A	58 02.2	153 43.6	Methot
		0918	G100A	58 10.1	153 56.0	Methot
		1027	G101A	58 15.3	154 05.7	Methot
		1250	G104A	58 16.7	153 17.6	Methot
		1406	G103A	58 23.6	153 30.8	Methot
		1515	G102A	58 30.5	153 41.8	Methot
194	13 July	0013	G107A	58 43.2	153 16.9	Methot
		0119	G106A	58 37.4	153 05.6	Methot
		0231	G105A	58 31.8	152 53.0	Methot
		0459	G108A	58 52.8	152 46.8	Methot
		0559	G109A	58 50.9	152 37.6	Methot
		0738	G110A	58 53.3	152 09.1	Methot
		0859	G111A	58 43.5	152 25.1	Methot
		1121	G129A	58 40.0	151 49.0	Methot
		1230	G112A	58 30.8	152 02.8	Methot
		1350	G113A	58 21.2	151 42.1	Methot
		1451	G113B	58 18.2	151 35.0	Methot
		1606	G114A	58 08.4	151 25.2	Methot
		1751	G130A	58 20.0	151 00.9	Methot
		1941	G131A	58 34.1	150 37.9	Methot
		2155	G132A	58 23.0	150 21.0	Methot
195	14 July	0037	G133A	58 11.8	150 07.3	Methot
		0204	G134A	58 01.2	150 28.2	Methot
		0324	G135A	58 09.9	150 43.9	Methot
		0510	G115A	57 58.1	151 07.6	Methot
		0621	G116A	57 48.7	150 50.8	Methot
		0745	G117A	57 36.8	150 32.6	Methot
		0944	G118A	57 23.5	150 57.8	Methot
		1119	G119A	57 35.7	151 15.0	Methot
		1241	G120A	57 45.4	151 33.6	Methot
		1408	G121A	57 55.4	151 51.4	Methot
		1539	G122A	58 05.2	152 10.0	Methot
		1645	G123A	58 12.7	152 15.2	Methot
		1848	G124A	58 00.0	152 35.5	Methot
		2123	G125A	57 42.3	152 07.5	Methot
		2236	G126A	57 35.3	152 04.0	Methot
196	15 July	0002	G127A	57 23.9	151 53.1	Methot
		0150	G136A	57 19.0	152 23.2	Methot
		0254	G128A	57 22.7	152 31.9	Methot
		0442	G138A	57 14.0	152 51.2	Methot
		0522	G137A	57 10.1	152 44.3	Methot

TABLE 7. (cont.)

JD	GMT Date	GMT Time	Sta. No. (FOCI No.)	Lat. N (dd mm.mm)	Long. W (ddd mm.mm)	Activities and Comments
		0700	G139A	57 00.0	153 04.2	Methot
		0840	G141A	56 58.8	153 26.2	Methot
		0932	G140A	56 51.9	153 26.0	Methot
		1104	G142A	56 41.8	153 46.1	Methot
		1200	G143A	56 35.7	153 36.4	Methot
		1422	G144A	56 39.8	153 07.0	Methot
		1603	G145A	56 49.8	152 44.8	Methot
		1735	G146A	56 58.9	152 23.5	Methot
		1914	G147A	57 08.7	152 03.6	Methot
		2058	G148A	57 17.8	151 40.5	Methot
	15-16 July	2329-0046	D119A-B	57 35.0	151 15.0	Methot (vertical series)

4. MOORED INSTRUMENTS SUMMARY

Fifteen moored instrument arrays were deployed (Table 8) in 1987 for the following studies: (1) continuation of long-term time series at mooring stations 2, 5, 8, and 14; (2) lateral variability of the Alaska Coastal Current (ACC) at stations 15-19; (3) relationship between winds and surface currents at PEGGY; and (4) exchange of water between the Gulf of Alaska and Bering Sea through three Aleutian Island passes at BG-701, 702, and 703. Exact mooring locations are given in Table 8. Approximate locations can be seen in Figure 2, FOCI master station grid.

Moorings recovered (Table 9) were conducted in July and included the four long-term moorings and the five moorings for lateral variability of the ACC.

TABLE 8. 1987 Mooring deployments.

Station	Location (N,W)	Water depth (M)	Loran rates	Deployment Yr/JD	Deployment Time (GMT)	# of Meters	Pressure Gauge
8615	56 44.91 156 37.32	139	X18701.1 Y32958.1 Z44721.0	86/292	0452	2	1
8616	56 40.19 156 30.05	192	X18703.2 Y32966.3 Z44678.4	86/292	0332	4	1
8617	56 38.60 156 28.97	207	X18678.9 Y32971.5 Z44673.2	86/292	0006	4	1
8618	56 32.63 156 19.40	225	X18673.4 Y32980.3 Z44618.6	86/291	2151	5	1
8619	57 02.43 155 21.80	262	X18724.0 Y32741.9 Z44205.7	86/292	1815	4	0
PEGGY[1] (MET[2])	57 00.05 155 57.85	243	Y32814.8 Z44443.2	87/103	0726	0	0
PEGGY (ACM[3])	56 20.14 156 23.20	242	Y33042.1 Z44662.4	87/103	1817	4	0
PEGGY (ADCP#2)	56 19.88 156 23.05	252	Y33042.9 Z44661.8	87/103	2118	1	0
BG-701	54 18.33 164 46.19	81	X18199.2 Y34595.7 Z47866.8	87/155	2205	2	0
BG-702	52 24.40 171 28.10	433	X16558.4 Y35137.9 Z49284.5	87/156	2245	3	0

[1] PEGGY = station consisting of MET, ACM, and ADCP moorings.
[2] MET = meteorological buoy.
[3] ACM = acoustic current meter.

TABLE 8. (cont.)

Station	Location (N,W)	Water depth (M)	Loran rates	Deployment Yr/JD	Deployment Time (GMT)	# of Meters	Pressure Gauge
BG-703	51 46.09 179 30.67	1189	X13756.1 Y34798.1 Z49939.2	87/157	0220	4	0
8702	57 36.91 155 05.75	258	X18734.4 Y32550.1 Z44099.0	87/188	1832	5	1
8705	56 21.65 156 54.38	127	X18670.4 Y33095.4 Z44860.8	87/181	2246	3	1
8708	55 57.01 156 22.25	223	X18643.6 Y33139.2 Z44705.9	87/182	0352	5	1
8714	55 20.79 155 12.00	1185	Y33144.8 Z44384.3	87/184	0001	5	0

TABLE 9. 1987 Mooring recoveries.

Station	Location (N,W)	Water depth (M)	Recovery Yr/JD	Time (GMT)	# of Meters	Pressure Gauge
8602	57 36.55 155 04.02	259	87/188	1533	5 (2 lost)	1 (lost)
8605	56 21.61 156 54.79	126	87/189	2135	3	1
8608	55 56.89 156 23.18	225	87/182	2327	5 (2 lost)	1
8614	55 21.36 155 04.45	1322	87/183	1632	3 (1 lost)	1
8615	56 45.99 156 37.29	139	87/189	1335	2	1
8616	56 41.72 156 28.81	192	87/189	1540	4	1
8617	56 36.77 156 30.07	207	87/179	2214	4	1
8618	56 29.85 156 21.54	225	87/179	1924	5	1 (lost)
8619	57 03.90 155 20.80	262	87/189	2255	4	0
PEGGY (MET)	56 58.53 155 57.34		87/189	0452	0	0
PEGGY (ACM)	56 19.94 156 23.04	247	87/189	2358	4	0
PEGGY (ADCP#2)	56 19.43 156 22.95	243	87/178	1834	1	0

5. REMOTE WEATHER STATION SUMMARY

This year saw the continuation of the effort to measure local winds south of Shelikof Strait that was begun in late FY 1986. There were five automated, satellite-transmitting weather stations maintained at Wide Bay, Ugaiushak Island, Chowiet Island in the Semidis, Chirikof Island, and Tugidak Island. Figure 9 is a map showing these locations; Table 10 gives specific details about them. A sixth station was installed in the Semidis halfway through the year to augment data return from that site. The weather stations were off-the-shelf equipment manufactured by the Handar Corporation and proved inadequate for the environment in their initial design. As a consequence, data return during the first half of 1987 was poor. To insure a near-continuous time series at Ugaiushak Island (which has been instrumented since 1985), an older, field-proven Synergetics weather station replaced the non-functioning station in December 1986. The Wide Bay and Chirikof Island stations were damaged by animals. Full details of station maintenance during the year are offered in the chronology below. Figure 10 presents the periods of data return from all six stations at the five sites.

METNET Chronology

1986 Oct 11 **Ugaiushak** RH and temp fail after a period of intermittency.

1986 Nov 27 **Wide Bay** ceases operation due to low power supply.

1986 Dec 18 Galasso, Proctor replace **Ugaiushak Island** Handar station (which had blown over) with Synergetics equipment @ 1130 AST. Synergetics 3400 modules: 3401A – 2384A000214, 3241A – 2884A00209, 3489A – 0683A00159, 3452A – 2186A00335. R.M. Young 05103 wind monitor (1126), YSI 44212 thermistor (8604), AIR DB-3A digital barometer (0310 8605211011). SAFT battery pack in marine plywood box. 3 m tower. Station elevation from hand-held altimeter is 27 m. First data 3522246. Note: Wind speed threshhold of 2.3 m/s.

1986 Dec 18 **Ugaiushak** temp fails.

1986 Dec 19 **Chirikof** station dies due to low power.

1987 Jan 27 **Tugidak** transmissions become intermittent.

1987 Feb 4 **Semidi** tower blows over and winds fail.

1987 Feb 14 **Tugidak** transmissions become regular.

1987 Mar 16 DeWitt, Proctor make maintenance visit to **Wide Bay** @ 2200 GMT. Anchored tower, changed DCP to 1022, Setra pressure transducer to 107966 (both ex-Ugaiushak). No RAM dump. Repaired or replaced bear damage to battery box, cable, antenna (1726) and cable. Replaced wind cross-arm, replaced wind direction with 809, replaced temp/RH filter and radiation shield.

1987 Mar 17	DeWitt, Proctor made maintenance visit to **Chirikof Island** @ 2100 GMT. Anchored tower, changed DCP to 1021, Setra pressure sensor to 107970 (both ex-Wide Bay). No RAM dump. Replaced batteries and cable with those from Wide Bay. Replaced wind speed with 845. Temp/RH removed.
1987 Mar 18	**Chirikof** wind speed and RH fail.
1987 Mar 18	DeWitt, Proctor visit **Tugidak Island** @ 2100 GMT. Anchored tower. RAM dump, replaced two batteries, temp/Rh removed.
1987 Mar 21	**Chirikof** wind speed returns.
1987 Mar 21	**Wide Bay** wind speed goes intermittent.
1987 Mar 23	DeWitt, Proctor make maintenance visit to **Semidi Island** @ 2200 GMT. Tower had fallen over; erected (see Proctor, 1989) and anchored new tower. RAM dump. Replace wind speed with 840, reshape antenna, remove temp/RH.
1987 Mar 23	DeWitt, Proctor install Handar station **Semidi 2** about 13 m west of first station @ 2200 GMT. Handar DCP (1025), Setra 270B pressure transducer (107971), Handar wind speed (745), Handar wind direction (794), Handar air temp/RH (718) with new radiation shield, Handar directional antenna (1686). Wind cross arm apparently misaligned as Semidi 2 wind directions agree with Semidi wind directions which are known to be in error (Proctor, 1989).
1987 Mar 25	**Chirikof** temp fails.
1987 Jun 15	**Semidi 2** RH fails.
1987 Jun 25	**Wide Bay** RH intermittent.
1987 Aug 16	**Chirikof** station dies.
1987 Sep 23	**Semidi 2** wind speed fails.
1987 Sep 27	GOES dial-up problems for several days.

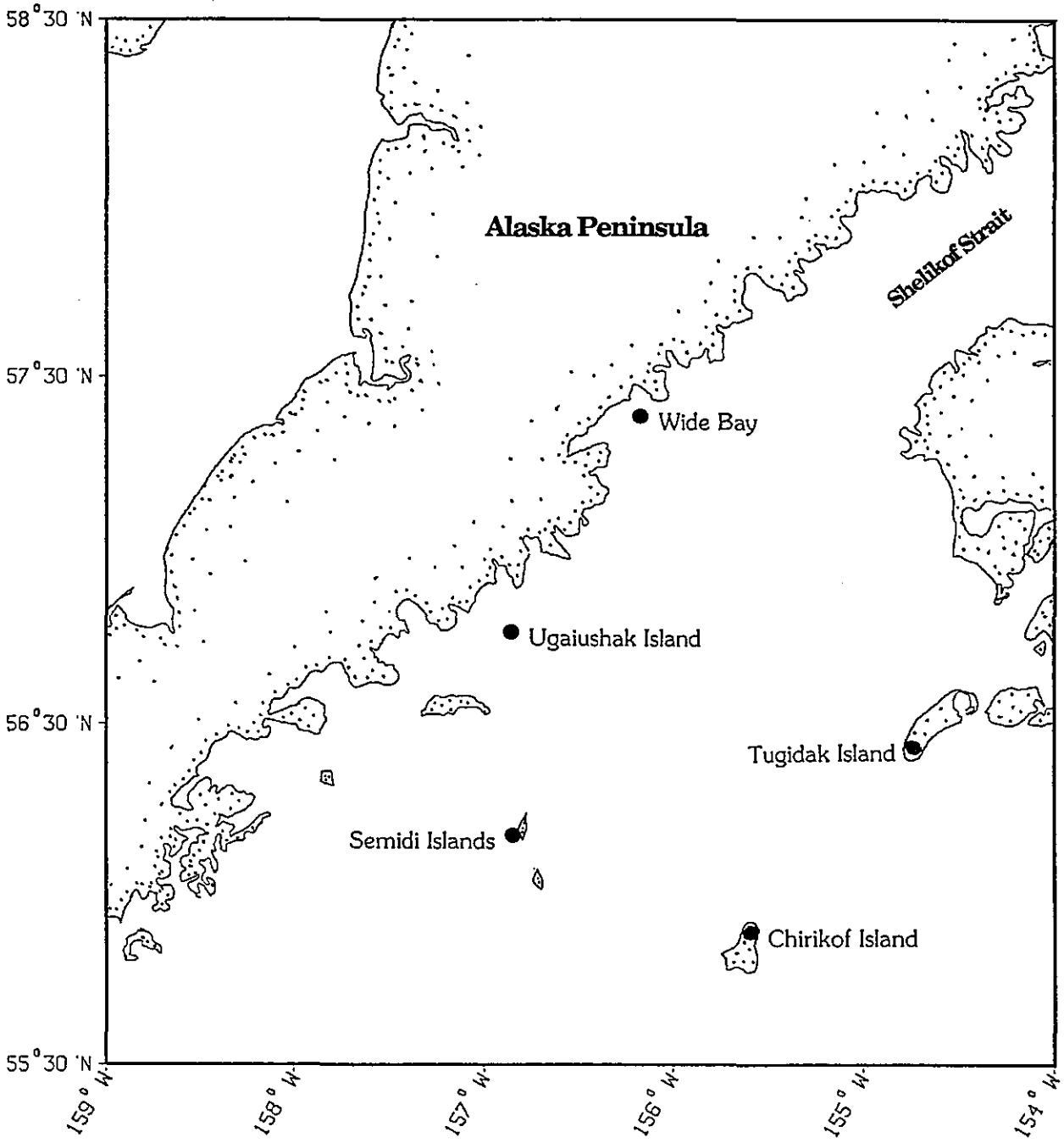

Figure 9. METNET site locations.

TABLE 10. METNET Site Information.

Station	Position (deg & min)	Elevation (m)
Wide Bay	57 25.0N, 156 10.9W	20.6
Ugaiushak Island	56 47.6N, 156 51.1W	27.9
Semidi Island	56 03.9N, 156 41.8W	67.0
Tugidak Island	56 25.6N, 154 42.6W	39.8
Chirikof Island	55 54.6N, 155 34.1W	35.2

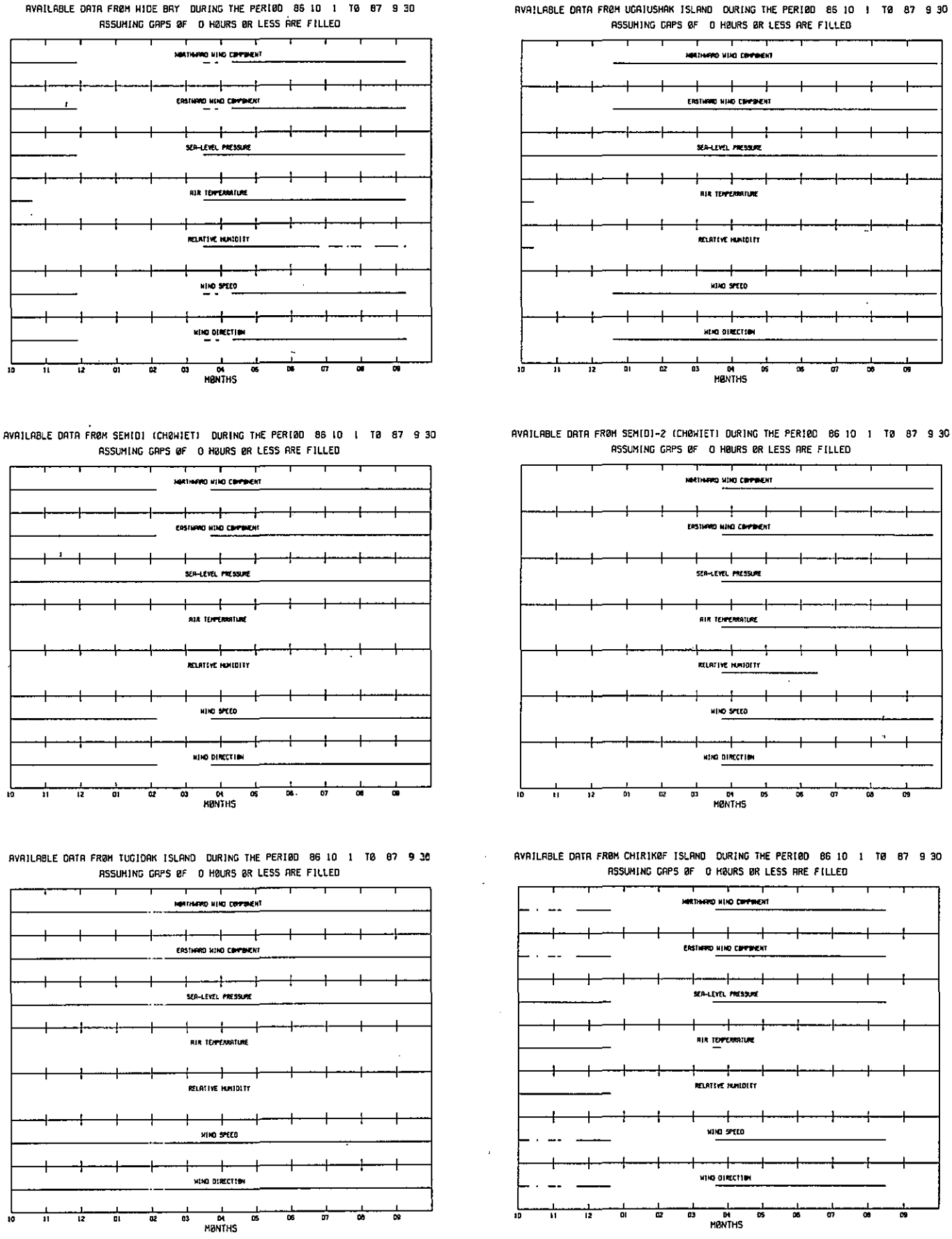

Figure 10. METNET station data return periods.

6. DRIFTER SUMMARY

During the 1987 field season, 21 satellite-tracked drifting buoys were deployed – 18 drogued at 40 meters and 3 drogued at 200 meters. The drifters were deployed at various dates, times and locations along line 8 to gather statistics on the trajectories of water parcels originating in the vicinity of this large pollock spawning location. Table 11 shows dates and drogue depths for each drifter.

TABLE 11. Time periods and locations of drifter buoys released during 1987 FOCI field operations. An X gives the buoy location, where S is Shelikof Strait, A is the Alaska Stream, and B is the Bering Sea. All buoys were released in Shelikof Strait.

Buoy Number	Start Date	End Date	Length (Days)	Location S A B	Drogue Depth (m)
7228	4/03/87	4/03/87	0	X	200
7224	4/12/87	9/10/87	151	X	200
7225	4/12/87	7/29/87	108	X X	40
7226	4/12/87	8/15/87	125	X X	40
7227	4/12/87	8/15/87	125	X	40
7229	4/12/87	4/14/87	2	X	40
7230	4/12/87	6/10/87	59	X	40
7235	4/12/87	4/13/87	1	X	40
7236	4/12/87	8/11/87	121	X	40
7237	4/12/87	8/11/87	121	X X	40
7238	4/16/87	4/16/87	0	X	200
7220	5/20/87	6/18/87	29	X	40
7221	5/20/87	6/29/87	40	X	40
7223	5/20/87	5/20/87	0	X	40
7233	5/20/87	9/17/87	121	X X X	40
7239	5/20/87	5/31/87	11	X	40
7240	5/20/87	10/20/87	153	X	40
7241	5/20/87	9/26/87	129	X X	40
7242	5/20/87	8/08/87	80	X	40
7243	5/20/87	8/21/87	93	X X	40
7244	5/20/87	6/02/87	13	X	40

7. SATELLITE IMAGE SUMMARY

A search for imagery during the 1987 field season was conducted at the NOAA/NESDIS Satellite Data Services Division (SDSD) in Suitland, MD. A total of 48 local-area-coverage (LAC) or High Resolution Picture Transmission (HRPT) images were selected. Tapes of the images were ordered and will be processed and archived at PMEL during FY 1988. Additionally, 58 Gilmore Creek (GIL) format images were obtained from the Gilmore Creek, AK receiving station. These are 8-bit data tapes, as opposed to the LAC and HRPT data tapes which contain 10-bit data. These tapes will also be processed and archived during FY 1988. Imagery was selected on the basis of clear skies over Shelikof Strait and the surrounding area. The time period searched included February to May, 1987 for the Gilmore data and mid-March to May for the SDSD data. A list of all of the data selected from both sources can be found in Table 12. An example of the processed 10-bit data can be seen in Figure 11.

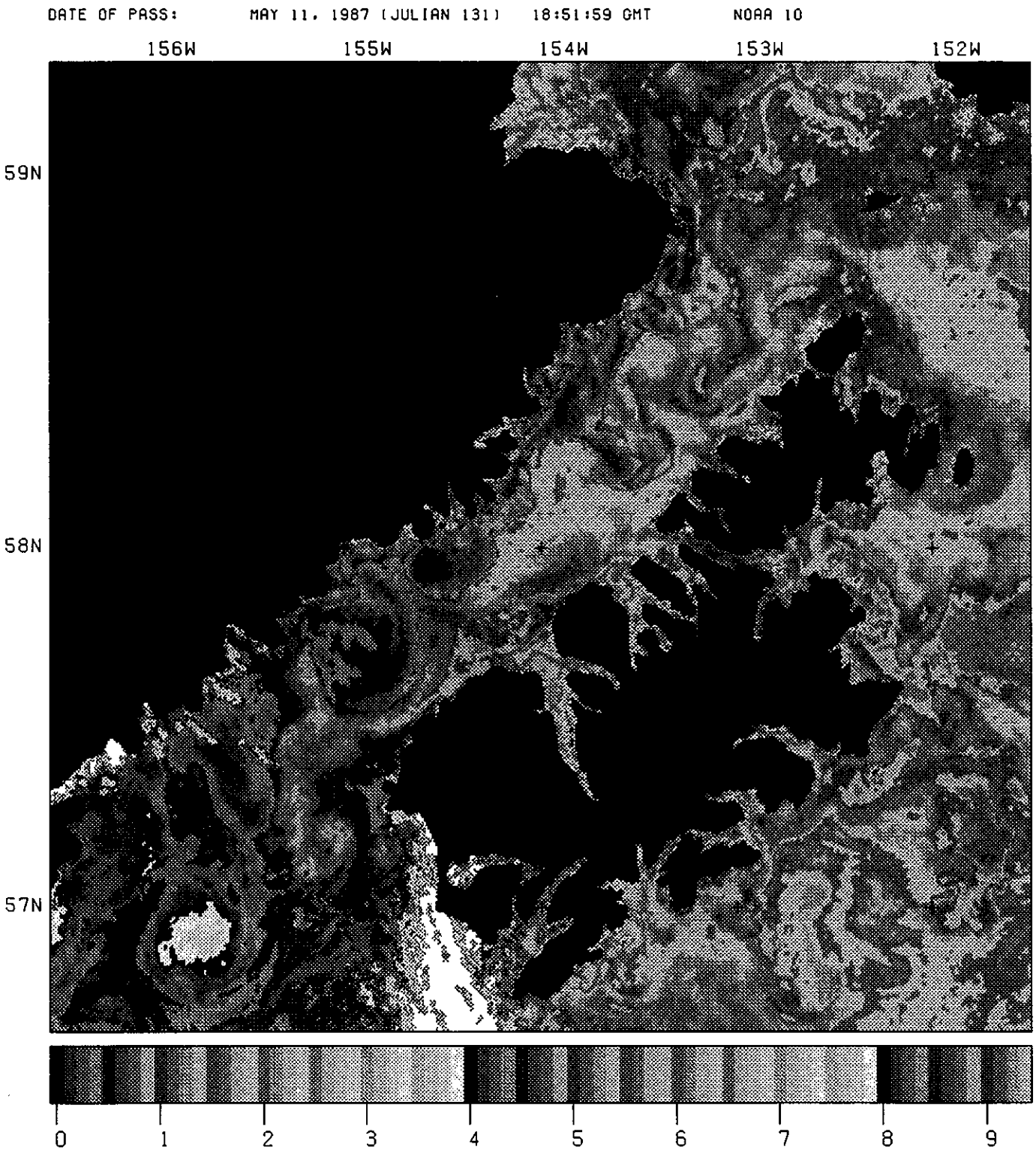

Figure 11. Satellite image sample.

TABLE 12. Tapes processed and images produced for the five study areas.

	JD	Date	Orbit #	Type of tape[1]	Time
1987	043	2/12	10/2098	GIL	05:13:33
	056	2/25	9/11350	GIL	00:55:37
			10/2283	GIL	05:31:59
			9/11358	GIL	14:44:01
			10/2291	GIL	19:14:39
	057	2/26	9/11364	GIL	00:44:14
			10/2297	GIL	05:09:37
			9/11372	GIL	14:33:12
			10/2305	GIL	18:52:55
	058	2/27	9/11378	GIL	00:33:21
			10/2311	GIL	04:48:21
			9/11386	GIL	14:22:23
			10/2319	GIL	18:31:08
	059	2/28	9/11392	GIL	00:22:54
			10/2325	GIL	04:26:11
			9/11400	GIL	14:11:37
			10/2333	GIL	18:09:30
	060	3/1	9/11406	GIL	00:12:05
			10/2339	GIL	04:03:53
			10/2340	GIL	05:44:30
			10/2347	GIL	17:47:46
			10/2348	GIL	19:28:17
	061	3/2	9/11420	GIL	00:00:43
			10/2354	GIL	05:22:42
			9/11428	GIL	13:49:55
			10/2362	GIL	19:06:28
			9/11434	GIL	23:49:06
	062	3/3	10/2368	GIL	05:01:44
	063	3/4	9/11449	GIL	01:20:03
	091	4/1	9/11857	SDSD	23:29:25
	092	4/2	9/11858	SDSD	01:10:19
	094	4/4	9/11894	SDSD	14:44:15

[1] GIL = Gilmore Creek 8-bit data.
SDSD = NOAA/NESDIS Satellite Data Service Division 10-bit data.

TABLE 12. (cont.)

JD	Date	Orbit #	Type of tape[1]	Time
095	4/5	9/11900	SDSD	00:37:44
		9/11900	GIL	00:37:10
		10/2845	SDSD	18:35:35
097	4/7	9/11928	SDSD	00:16:08
098	4/8	10/2888	SDSD	19:10:30
099	4/9	10/2902	SDSD	18:48:51
		9/11970	SDSD	23:43:49
			GIL	23:41:53
100	4/10	9/11971	SDSD	01:24:54
		9/11971	GIL	01:24:14
		9/11978	GIL	13:32:24
		10/2916	SDSD	18:27:07
		10/2916	GIL	18:20:04
101	4/11	9/11985	SDSD	01:14:00
		10/2922	GIL	04:14:24
		9/11992	GIL	13:21:27
		9/11993	GIL	15:02:34
		10/2930	SDSD	18:01:59
		10/2930	GIL	17:58:14
102	4/12	9/11999	SDSD	01:01:53
		9/11999	GIL	01:01:53
		10/2936	GIL	03:52:17
		10/2937	GIL	05:33:36
		9/12007	GIL	14:51:40
103	4/13	9/12013	SDSD	00:51:23
106	4/16	10/3001	SDSD	17:53:59
107	4/17	9/12069	SDSD	00:08:51
		10/3016	SDSD	19:11:59
		9/12083	SDSD	23:57:03
110	4/20	9/12112	SDSD	01:17:01
		10/3058	SDSD	18:06:59
		10/3058	GIL	18:03:13

TABLE 12. (cont.)

JD	Date	Orbit #	Type of tape[1]	Time
111	4/21	9/12126	SDSD	01:06:16
		9/12126	GIL	01:06:18
		10/3064	GIL	03:57:30
114	4/24	10/3115	SDSD	18:21:59
115	4/25	9/12182	SDSD	00:23:19
		9/12182	GIL	00:23:19
117	4/27	9/12218	SDSD	13:53:59
		10/3158	SDSD	18:54:59
122	5/2	9/12281	SDSD	00:48:33
123	5/3	9/12295	SDSD	00:37:23
124	5/4	9/12309	SDSD	00:26:59
125	5/5	9/12323	SDSD	00:00:00
126	5/6	9/12337	SDSD	00:04:30
127	5/7	10/3300	SDSD	18:41:59
131	5/11	10/3357	SDSD	18:51:59
		10/3357	GIL	18:48:25
132	5/12	9/12422	GIL	00:41:26
		10/3371	SDSD	18:33:00
133	5/13	10/3385	GIL	18:04:17
134	5/14	9/12450	SDSD	00:19:54
		9/12450	GIL	00:19:51
		10/3391	GIL	03:58:44
		10/3392	GIL	05:40:18
		9/12458	GIL	14:08:31
136	5/16	10/3428	SDSD	18:46:14
		9/12492	SDSD	23:47:33
137	5/17	9/12493	SDSD	01:28:40
144	5/24	9/12591	SDSD	00:12:43
145	5/25	9/12605	SDSD	00:01:57

TABLE 12. (cont.)

JD	Date	Orbit #	Type of tape[1]	Time
147	5/27	9/12634	SDSD	01:21:24
148	5/28	9/12648	SDSD	01:10:31
149	5/29	9/12662	SDSD	00:59:39
		10/3613	SDSD	19:04:14
150	5/30	9/12676	SDSD	00:48:48
		10/3619	SDSD	04:53:13
151	5/31	9/12690	SDSD	00:38:10

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