NOAA Data Report ERL PMEL-26

FISHERIES-OCEANOGRAPHY COORDINATED INVESTIGATIONS - FIELD OPERATIONS 1989

D. S. Savage

Pacific Marine Environmental Laboratory
Seattle, Washington
February 1990

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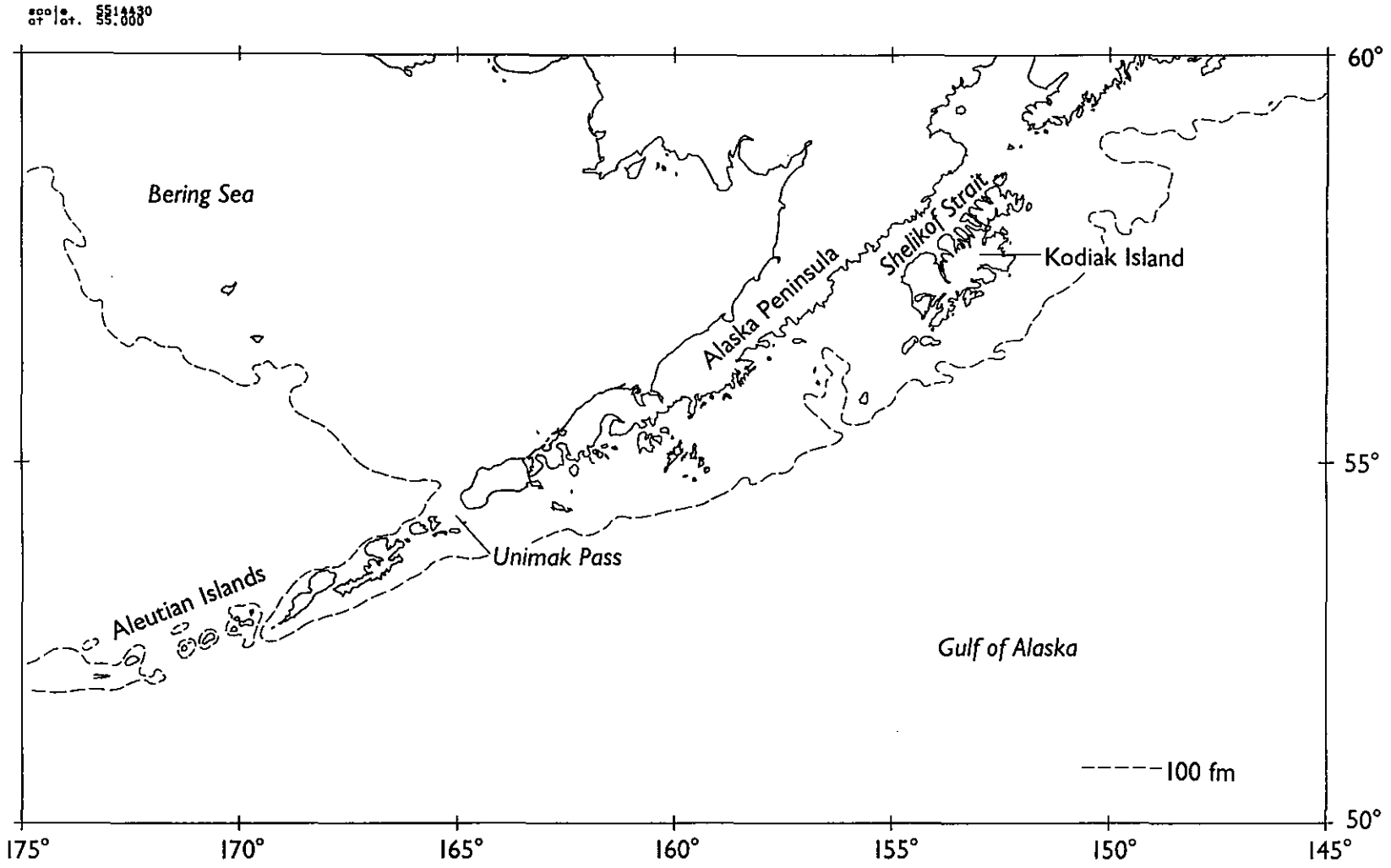

Figure 1. Geographical region of FOCI research.

Fisheries-Oceanography Coordinated Investigations – Field Operations – 1989

D.S. Savage[1]

1. INTRODUCTION

The research cruises described in this report were conducted as an ongoing part of the Fisheries-Oceanography Coordinated Investigations (FOCI), a task undertaken jointly by the Pacific Marine Environmental Laboratory (PMEL) and the Alaska Fisheries Science Center (AFSC). FOCI was initiated in 1986 and has obtained funding for both the physical and biological sciences for the study of fisheries-oceanography in the northern Pacific Ocean. The goal of FOCI is to better understand the physical and biological processes which cause variability in recruitment to commercially valuable fish and shellfish stocks in the Northeast Pacific Ocean and Bering Sea. The present focus is on walleye pollock (*Theragra chalcogramma*) in the western Gulf of Alaska.

This report summarizes the field work conducted under FOCI during FY 1989 (October 1988-September 1989), which was primarily work on pollock recruitment in Shelikof Strait. The objectives of the FY 1989 cruises were to continue time-series observations at sampling sites on the FOCI master grid (Fig. 2), to determine the distribution and abundance of pollock eggs (April) and larvae (May) (Fig. 3, Table 2), and to expand research on specific aspects of regional physical oceanography and biology. The FOCI cruises in FY 1989 included shipboard sampling of plankton, moored instrument deployments and recoveries, drifter studies, and satellite observations of the sea surface.

2. FOCI 89 RESEARCH CRUISES

All of the FOCI research cruises for FY 1989 were conducted aboard the NOAA Ship *Miller Freeman*. A summary of operations for these cruises is given in Table 1. Materials and Methods are listed in Section 3. Cruise summaries are listed in Section 4. Details on moored instruments are listed in Section 5. A drifter summary is listed in Section 6. The four FOCI cruises for FY 1989 are designated 1MF89 through 4MF89. The principal objectives of FOCI 1MF89 were to determine the horizontal patterns of the distribution and abundance of walleye pollock eggs and to locate an area of maximum concentration. The objectives of FOCI 2MF89 were to investigate transport, condition, and survival of pollock eggs and larvae from Shelikof Strait spawning grounds. The objectives of FOCI 3MF89 were to collect concomitant satellite and in situ physical and biological data, to collect data for larval mortality estimates, to

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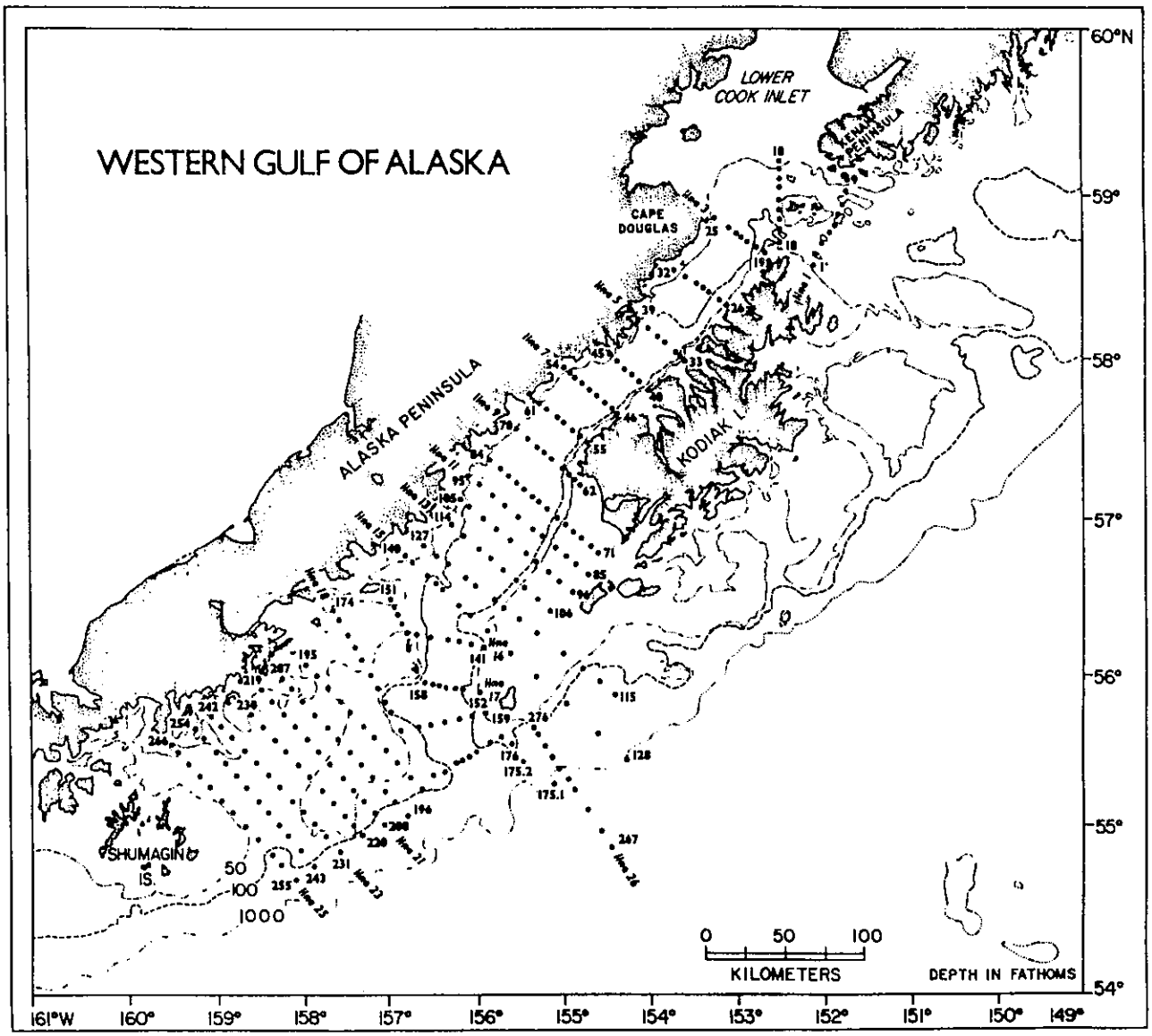

Figure 2. FOCI master station grid.

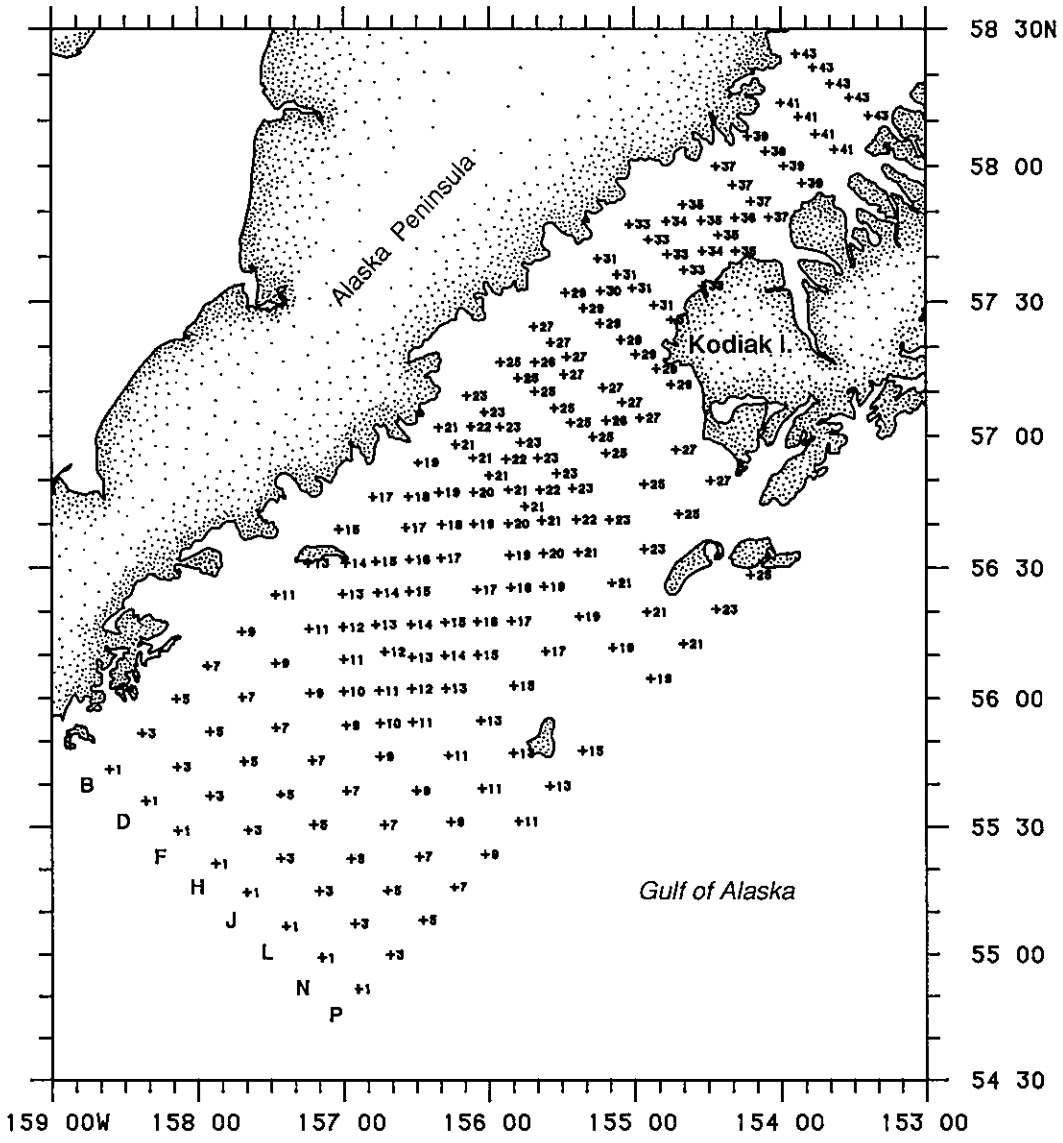

Figure 3. Biological grid for FOCI 1989 field season.

TABLE 1. SUMMARY OF FOCI SAMPLING ACTIVITIES DURING FY 1989

Vessel, Cruise, Dates, FOCI Cruise Name	NUMBER OF STATIONS CTD	B	b	T	CMZ	CNC	MWT	XBT	Other
Miller Freeman, MF-89-03- Leg I, 5-16 April FOCI 1MF89	8	138	7	6			7	9	4 epibenthic sled tows for eggs (0.505 mm mesh)
Miller Freeman, MF-89-03- Leg II, 19 April- 5 May FOCI 2MF89	93	91	6	8	12	5		17	5 mooring recoveries, 12 moor-ing deployments, 6 vertical bongos, 1 met. buoy deployment, 3 sets drifter deployments (5 units)
Miller Freeman, MF-89-04- Leg I, 9-25 May FOCI 3MF89	144	153	16	9	26	47	2	14	1 mooring deployment, 1 buoy deployment, 69 vertical bongos, 25 gear comparison tows, 26 zooplankton (52 samples), 13 vertical plankton samples, 20 hydrocarbon samples 30 Ortner camera tows
Miller Freeman, MF-89-04- Leg II, 28 May- 6 June FOCI 4MF89	24	4		99				20	4 vertical bongos, 2 sets of Loran-C drifter buoy deploy-ments (3 buoys/set), 19 hydrocarbons 8 gear comparisons

CTD=CONDUCTIVITY, TEMPERATURE, DEPTH B=60 CM OBLIQUE BONGO b=20 CM OBLIQUE BONGO
T= 1 M TUCKER TRAWL CMZ=CTD WITH MICROZOOPLANKTON CNC=CTD WITH NUTRIENTS AND CHLOROPHYLL
MWT= MIDWATER TRAWL (ROPE TRAWL OR METHOT) XBT=EXPENDABLE BATHYTHERMOGRAPH

TABLE 2. – 1989 FOCI MASTER GRID FOR LARVAL SURVEYS

Grid Station	Latitude (DDMM.M)	Longitude (DDMM.M)	Grid Station	Latitude (DDMM.M)	Longitude (DDDMM.M)
B1	55 43.4	158 36.5	D13	56 24.0	157 00.4
B3	55 51.8	158 23.0	D15	56 31.5	156 46.8
B5	55 59.8	158 09.0	D17	56 39.2	156 34.5
B7	56 07.4	157 56.0	D19	56 47.2	156 20.8
B9	56 15.3	157 42.0	D21	56 55.0	156 06.8
B11	56 23.8	157 28.0	D23	57 02.0	155 55.5
B13	56 31.1	157 14.5	D25	57 10.0	155 41.0
B15	56 38.8	157 02.0	D27	57 17.8	155 27.8
B17	56 46.2	156 48.0	D29	57 25.2	155 14.0
B19	56 54.0	156 29.5	D31	57 33.0	155 00.8
B21	57 01.9	156 21.0	D33	57 40.5	154 46.5
B23	57 09.0	156 09.4	D35	57 48.0	154 32.8
B25	57 16.6	155 55.2	D37	57 55.8	154 20.0
B27	57 24.5	155 41.5	D39	58 03.2	154 06.5
B29	57 32.0	155 28.4	D41	58 10.8	153 53.0
B31	57 39.6	155 15.0	E33	57 37.0	154 39.8
B33	57 47.2	155 02.0	E35	57 44.8	154 26.0
B35	57 54.8	157 48.0	E37	57 52.2	154 12.5
C33	57 43.8	154 54.2	E39	58 00.0	153 59.0
C35	57 51.5	154 40.2	E41	58 07.0	153 46.0
C37	57 59.9	154 26.8	F1	55 29.0	158 08.3
C39	58 06.5	154 13.8	F3	55 37.2	157 55.0
C41	58 13.8	154 00.2	F5	55 45.2	157 41.0
D1	55 36.0	158 21.5	F7	55 53.1	157 27.9
D3	55 44.0	158 08.5	F9	56 01.2	157 13.8
D5	55 52.2	157 55.0	F11	56 09.0	157 00.0
D7	56 00.2	157 41.8	F13	56 17.0	156 46.8
D9	56 08.1	157 28.0	F15	56 24.6	156 33.0
D11	56 16.0	157 14.2	F17	56 32.2	156 20.0

TABLE 2. – 1989 FOCI MASTER GRID FOR LARVAL SURVEYS – CONTINUED

Grid Station	Latitude (DDMM.M)	Longitude (DDMM.M)	Grid Station	Latitude (DDMM.M)	Longitude (DDDMM.M)
F19	56 40.0	156 06.5	J7	55 38.4	156 58.8
F21	56 47.8	155 52.0	J9	55 46.5	156 45.0
F23	56 55.0	155 39.8	J11	55 54.5	156 31.7
F25	57 03.0	155 26.2	J13	56 02.3	156 18.0
F27	57 10.8	155 12.8	J15	56 10.0	156 04.8
F29	57 18.3	154 59.5	J17	56 17.8	155 50.8
F31	57 26.0	154 45.1	J19	56 25.7	155 37.3
F33	57 33.5	154 32.2	J21	56 33.5	155 23.1
F35	57 41.2	154 18.8	J23	56 40.9	155 10.2
F37	57 48.7	154 05.2	J25	56 49.0	154 56.0
F39	57 56.2	153 51.5	J27	56 56.8	154 43.0
F41	58 03.6	153 38.2	L1	55 06.5	157 23.8
H1	55 21.3	157 52.8	L3	55 14.9	157 10.0
H3	55 29.2	157 39.5	L5	55 22.5	156 57.0
H5	55 37.5	157 26.0	L7	55 30.5	156 43.3
H7	55 45.5	157 12.9	L9	55 38.5	156 30.0
H9	55 53.7	156 59.0	L11	55 46.7	156 17.0
H11	56 01.8	156 45.5	L13	55 54.8	156 03.5
H13	56 09.5	156 32.0	L15	56 02.9	155 49.8
H15	56 17.5	156 18.4	L17	56 10.8	155 36.7
H17	56 25.0	156 05.1	L19	56 18.8	155 22.8
H19	56 32.9	155 51.5	L21	56 26.5	155 09.2
H21	56 40.8	155 38.2	L23	56 34.2	154 56.0
H23	56 48.1	155 25.5	L25	56 42.2	154 42.0
H25	56 56.1	155 11.5	L27	56 49.8	154 29.0
H27	57 04.0	154 57.7	N1	54 59.1	157 09.0
H29	57 11.5	154 45.0	N3	55 07.2	156 55.5
J1	55 14.5	157 40.0	N5	55 15.0	156 42.0
J3	55 22.6	157 26.0	N7	55 23.0	156 29.0
J5	55 30.5	157 12.3	N9	55 31.2	156 16.0

TABLE 2. – 1989 FOCI MASTER GRID FOR LARVAL SURVEYS – CONTINUED

Grid Station	Latitude (DDMM.M)	Longitude (DDMM.M)
N11	55 39.0	156 03.0
N13	55 47.2	155 50.0
N15	55 55.5	155 36.0
N17	56 03.7	155 22.0
N19	56 11.6	155 08.9
N21	56 19.8	154 55.0
P1	54 51.7	156 54.2
P3	54 59.8	156 41.0
P5	55 08.0	156 27.5
P7	55 15.8	156 14.7
P9	55 23.5	156 01.8
P11	55 31.3	155 48.0
P13	55 39.5	155 35.0
P15	55 47.7	155 21.5
P17	55 56.5	155 07.5
P19	56 04.5	154 53.5
P21	56 12.5	154 40.2
P23	56 20.4	154 26.8
P25	56 28.3	154 12.8

ADDENDA (4/20/89) TO TABLE 2. (1989 FOCI MASTER GRID FOR LARVAL SURVEYS)

Grid Station	Latitude (DDMM.M)	Longitude (DDDMM.M)
C21	56 58.0	156 14.0
C23	57 05.3	156 02.0
C25	57 13.0	155 48.0
C27	57 21.0	155 34.5
C29	57 28.5	155 21.0
C31	57 36.0	155 07.0
E21	56 51.0	156 00.0
E23	56 58.5	155 47.0
E25	57 06.2	155 33.0
E27	57 13.8	155 29.0
E29	57 21.5	155 05.5
E31	57 29.2	154 52.0
G21	56 44.0	155 45.2
G23	56 51.5	155 32.0
G25	56 59.7	155 17.0
G27	57 07.5	155 05.0
G29	57 15.0	154 51.0
B43	58 24.5	153 54.0
C43	58 21.5	153 47.0
D43	58 18.0	153 40.0
E43	58 15.0	153 32.0
F43	58 11.0	153 24.0

ADDENDA (5/4/89) TO TABLE 2. (1989 FOCI MASTER GRID FOR LARVAL SURVEYS)

Grid Station	Latitude (DDMM.M)	Longitude (DDDMM.M)	Grid Station	Latitude (DDMM.M)	Longitude (DDDMM.M)
C14	56 31.1	156 59.2	G14	56 17.0	156 32.3
C18	56 46.2	156 33.3	G16	56 24.6	156 19.0
C22	57 02.0	156 07.6	G18	56 32.3	156 06.0
C26	57 16.6	155 41.0	G20	56 40.1	155 52.0
C30	57 32.4	155 13.9	G22	56 47.8	155 39.0
C34	57 47.8	154 47.0	G26	57 03.4	155 11.5
E12	56 16.4	157 00.2	I10	55 54.2	156 45.1
E14	56 24.3	156 46.0	I12	56 02.2	156 32.0
E16	56 31.9	156 33.0	I14	56 09.9	156 18.5
E18	56 39.8	156 19.8	I16	56 17.7	156 05.0
E20	56 47.2	156 06.6	I18	56 25.5	155 51.0
E22	56 54.7	155 53.0	I20	56 33.3	155 37.6
E34	57 41.2	154 32.4	I22	56 41.0	155 24.0
E36	57 48.6	154 19.0			
G10	56 01.6	157 00.0			
G12	56 10.8	156 43.2			

examine the Alaska Coastal Current and nearshore water, to collect CTD data at moorings deployed in April 1989, and to continue with an existing time series of biological and physical data collection. The principal objective for FOCI 4MF89 was to collect data for abundance and mortality estimates of larval pollock resulting from Shelikof Strait spawning.

3. MATERIALS AND METHODS

3.1. Shipboard Sampling

There were four FOCI cruises during FY 1989, all of which conducted sampling in Shelikof Strait aboard the NOAA ship *Miller Freeman.* Table 1 contains a summary of operations for these cruises. The following section describes the materials and methods used for sampling.

3.1.1 Meteorological Surface Observations

Shipboard personnel conducted hourly measurements of surface meteorological variables during all four cruises. Sea-level pressure was determined from an aneroid barometer. Air temperature and wet-bulb temperature were determined from sling psychrometer readings on the port bridge wing, wind speed and direction from a Bendix-Friez aerovane mounted on the masthead, 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, and wave and swell height and direction were made when possible.

3.1.2 CTD

The CTD used by FOCI during the FY 1989 cruises was the PMEL Seabird SBE-9 CTD. Temperature and salinity field correction samples were obtained on most casts, usually near the bottom of the cast. Reversing thermometers were used every third to fifth cast as a check on CTD temperatures. Salinity samples were analyzed on the shipboard Autosal salinometer.

3.1.3 Nutrients and Chlorophyll

Nutrient and chlorophyll samples were obtained during cruises 2MF89 and 3MF89 using 10-L Niskin bottles deployed with a rosette sampler/CTD system and 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. The deepest samples were taken approximately 15 m from the bottom.

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 acetate

filters and frozen. Acetone extraction and fluorometric measurements (Yentsch and Menzel, 1963) were performed after samples were returned from sea.

3.1.4 Plankton

Microzooplankton were sampled during FOCI 2MF89 and 3MF89 using 10-L Niskin bottles with a rosette sampler/CTD system tripped at 0, 10, 20, 30, 40, 50, 60, 70, and 80 m. Water was filtered through 40-μm mesh filter bags that were back-flushed into storage jars with 3% buffered formalin.

During 1MF89, the primary sampling gear for the main egg survey was the 60 cm paired bongo frame with 0.505 mm mesh. The 1 m Tucker trawl with 0.505 mm mesh was used for special egg predation studies for a total of 6 tows. The combined 60 cm bongo (0.333 mm mesh) and 20 cm bongo (0.153 mm mesh) was used as part of an ongoing study on CTD line 8. The 20 cm and 60 cm frames were towed on the same wire approximately 1.5 m apart.

During 2MF89, the primary sampling gear for the main larval survey was the 60 cm paired bongo frame with 0.333 mm mesh nets. Special studies used the 1 m Tucker trawl with a 0.505 mm mesh net. CTD Line 8 was again surveyed with the combined 60 cm (0.333 mm mesh) and 20 cm (0.153 mm mesh) bongos as part of an ongoing study.

Gear tests were done to compare the effectiveness of the 60 cm bongo with 0.333 mm mesh and 0.505 mm mesh and the 1 m Tucker trawl with 0.505 mm mesh.

During 3MF89, the primary gear for the main larval survey was again the 60 cm paired bongo with 0.333 mm mesh nets. The combined 60 cm (0.333 mm mesh) and 20 cm (0.153 mm mesh) was again used on CTD Line 8. The 20 cm (0.153 mm mesh) bongo was also used to collect net zooplankton at 21 other stations. Gear tests were done to compare the effectiveness of the 60 mm bongo with 0.505 mm and 0.333 mm mesh, the 1 m Tucker trawl with 0.505 mm mesh, and the Methot net with 2 × 3 mm mesh. The Methot net caught no pollock larvae and was eliminated from further comparison. The Tucker trawl proved to be the most efficient and was suggested for use on cruise 4MF89.

During 4MF89, the primary gear for the larval survey was the 1 m Tucker trawl with 0.505 mm mesh. Gear tests were again done to compare the effectiveness of the 60 cm bongo (0.505 mm mesh) and the 1 m Tucker trawl (0.505 mm mesh). Two daytime and two nighttime tows were made with each gear type. The Tucker trawl and the bongo caught larvae in the same size range, but the numbers caught were greater in the Tucker trawl.

Standard MARMAP bongo tows (Smith and Richardson, 1977) were made, except that tows were made to near bottom on cruises 1MF89 and 2MF89. On cruises 3MF89 and 4MF89 the tows were taken to only 100 m, provided that the water depth was sufficient. Wire angles, maintained at a constant 45° wire angle, were monitored throughout all tows. On 1MF89, an electronic bathykymograph (BKG) was used initially on the bongo tows, but it failed and was replaced with a mechanical bathykymograph (BKG) calibrated against the CTD system. The

mechanical BKG was used for FOCI 2MF89–4MF89. The BKGs were used to record the depth and trajectory of the tows. The volume filtered by the nets was estimated using a General Oceanics flowmeter mounted inside the mouth of each net. Samples were stored in 3% buffered formalin.

Tucker trawls (Clark, 1969) with 1 m frames and .505 mm mesh nets were used to sample plankton on all four FOCI cruises. Cruise 4MF89 was the only cruise that used the 1 m Tucker for the main larval survey. The Tucker trawl was fished obliquely with a 45° wire angle and was taken to as near bottom as possible on 1MF89 and 2MF89. On cruises 3MF89 and 4MF89 the Tucker trawls were taken to only 100 m, where water depth permitted.

An epibenthic sled (Hopkins, 1973) was used on 1MF89 to sample pollock eggs on or near the bottom. The sled is basically an opening-closing 1 m Tucker trawl mounted on skids. The net is opened and closed by a messenger activated release and is towed at an oblique 45° wire angle. It was designed as a vehicle for towing a plankton net (0.505 mm mesh on 1MF89). Sled tows were performed at four sites.

A total of seven rope trawls were done on 1MF89 to collect stomachs from potential predators of pollock eggs and to obtain walleye pollock eggs from gravid adults for a laboratory study of egg development. Tows were made at depths and locations near Cape Kekurnoi where an echosounder (Simrad 38kHz) showed sign of fish. Methot trawls were conducted during 3MF89 for gear comparison studies comparing the effectiveness of bongos, Tucker trawls, and Methot trawls. The Methot net caught no pollock and was eliminated from further comparison.

The Ortner net-camera, an in situ, silhouette photography, towed sampling system, was used on FOCI 3MF89 to examine the vertical distribution of zooplankton at 30 stations. The camera was towed obliquely on descent to within 20 m of the bottom and was actuated on ascent. Flow, conductivity, temperature, depth and fluorescence were continuously monitored.

3.1.5 Shipboard Current Measurements

On 3MF89, a three-speed backtrack for calibration of the *Miller Freeman* ADCP (Acoustic Doppler Current Profiler) was conducted. An ADCP section was run over moorings M21 to M29. The ADCP data sets will allow calibration of the ship's system and may permit fine scale resolution of the velocity field.

3.1.6 Moored Instruments

Twelve moorings were deployed on 2MF89, including two long-term moorings (#8902 and #8904). Nine moorings were deployed along FOCI CTD line 12 to examine lateral larval drift and one mooring was deployed in Kennedy Entrance to gain an understanding of upstream conditions. Five moorings which were deployed in 1988 were recovered during 2MF89. The PEGGY-2 meteorological buoy was also deployed during FOCI 2MF89. The PEGGY-2 buoy moved shortly after deployment about 3 miles, where it became stationary at the 141 m contour.

During 3MF89, one 600kHz RD ADCP (acoustic doppler current profiler) mooring was deployed. The PEGGY-2 buoy was recovered during 4MF89.

3.1.7 Drifter Studies

During 2MF89 one satellite-tracked drifter and two sets of Loran-C drifters (two drifters per set) were deployed. The original plan with the Loran-C drifters was to deploy three drifters, but one malfunctioned, so two test deployments were made with the remaining two drifters. The satellite-tracked drifter, drogued at 45 m, was deployed at station E23 to track larval movement. On cruise 3MF89, a satellite-tracked buoy was deployed at station D19 in the midst of high numbers of larvae. The trajectory from the buoy was used to help determine the late larval grid for the following cruise. On 4MF89, sets of Loran-C drifters were deployed twice. The first deployment was during the larval survey on May 30–31 near FOCI line 12. The second deployment was on June 6. There were three buoys deployed and recovered per set. Despite intermittent equipment problems, two useful data sets were obtained.

3.2 Other Operations

3.2.1 Satellite Imagery

A search of historical satellite data was conducted during 1986 at the NOAA NESDIS/Satellite Data Services Division (SDSD) in Suitland, MD. Hard copy images and some digital data tapes from this search are stored in the FOCI satellite data archive at PMEL. The tapes contain navigated (i.e., they have the geographic position associated with the image) Advanced Very High Resolution Radiometer (AVHRR) data. There may be problems in acquiring the digital tapes for all of these images since not all data are stored in this format. 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, 1989. 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 based on clear skies over Shelikof Strait and the surrounding area. Similarly, Coastal Zone Color Scanner (CZCS) data were saved for Shelikof Strait.

One of the objectives of FOCI 3MF89 was to collect concomitant satellite and in situ physical and biological data. Because of overcast conditions, satellite images of sea surface temperature were not obtained until 3 hr prior to the end of operations at a location off of Wide Bay. At the same time, biological and physical data were being collected near Wide Bay. This did not provide a definitive study of conditions within an eddy, but did provide concomitant data sets.

3.2.2 METNET

FOCI reduced its METNET (mesoscale meteorological observing network) from five stations at five sites (Ugaiushak, Semidi, Chirikof, Tugidak and Wide Bay) to four stations at two sites (Ugaiushak and Semidi) during July 1988. Repairs and replacements were made prior to redeployment of the stations. Each station received two car batteries linked in parallel for its power supply. The stations were to operate unattended until spring 1989, when a maintenance visit was scheduled.

In August 1988 the pressure sensor at Ugaiushak Island behaved erratically during storm episodes. Later in the fall, three stations began transmitting intermittently and by mid-March all stations had ceased transmitting. Despite these malfunctions, the data was stored in memory and retrieved when the stations were dismantled.

4. SHIP CRUISE SUMMARIES

This section provides a brief summary of objectives and activities for each cruise. A figure showing all sampling stations is provided to depict the general study area of each cruise. Figures and tables are provided with each cruise to depict station locations and sampling activities. Station numbers are assigned each cruise by the Chief Scientist. FOX station numbers refer to FOCI master station numbers, which are shown in Figure 1A. These stations are located on transects which are referred to 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. During the 1989 field season there was also a FOCI master grid for the larval surveys which is shown in Figure 2.

4.1 FOCI 1MF89 5–16 April 1989

Scientific party:	Ann Matarese, Chief Scientist	NOAA/AFSC
	Jay Clark	NOAA/AFSC
	Richard Bates	NOAA/AFSC
	William Rugen	NOAA/AFSC
	Susan Picquelle	NOAA/AFSC
	Mary Yoklavich	NOAA/AFSC
	Bern Megrey	NOAA/AFSC
	Richard Brodeur	NOAA/AFSC

The principal objectives of this cruise, the first in a series of four 1989 FOCI cruises, were to determine the horizontal patterns of the distribution and abundance of walleye pollock eggs and to locate an area of maximum concentration. A total of 28 bongo stations along the Alaska Peninsula between Cape Kuliak and Cape Igvak were completed as part of a "presurvey" (Fig. 4). Egg abundances were found to be high in the Cape Kekurnoi area as well as at the northern end of the survey grid. The main survey consisted of 100 additional bongo stations (Fig. 5).

Special studies on potential predators of walleye pollock eggs were conducted at one site (station G023A) off of Cape Kekurnoi, selected because high egg abundances were found there during the presurvey. Predators were collected there in a total of six (three day/three night) Tucker trawls. A total of 190 invertebrate predators were collected and immediately frozen at –80°C for laboratory analysis.

At the same location, seven rope trawls (four day/three night) were made to collect stomachs from potential vertebrate predators of walleye pollock eggs and to fertilize eggs for a laboratory study of egg development. A total of 175 pollock and 125 eulachon stomachs were preserved for analysis. For each trawl a random subsample of about 200 fish was taken. Sex, length, and stage of maturity were determined on 200 fish for each trawl for a total of 1400 fish. Otoliths were collected from a subsample of 50 females and 50 males, and 447 total were removed. Ovaries were collected from one trawl, 42 preserved and 26 frozen. For several trawls, length comparisons (SL, TL, and FL) were made on a total of 404 fish. Live eggs were fertilized and reared aboard ship at three different temperatures (3°, 5°, and 7°C).

An epibenthic sled was towed four times in the area of high concentration in order to determine the abundance of the eggs found immediately above the bottom in comparison to those in the overlying water column.

A total of seven bongo tows and CTD casts were made on FOX Line 8 as part of an ongoing time series for zooplankton and physical oceanography.

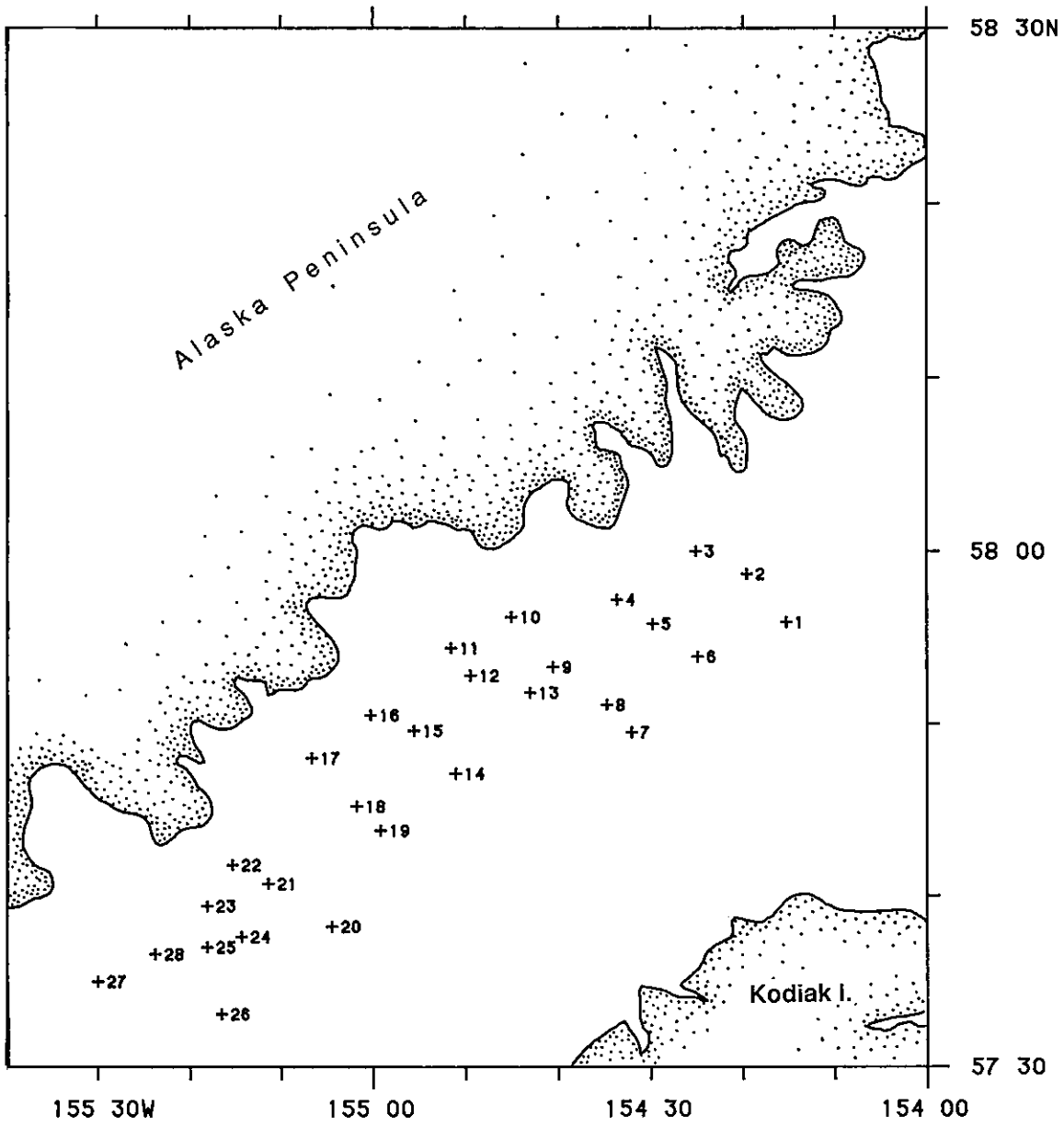

Figure 4. Presurvey bongo stations occupied during 1MF89, 5–16 April 1989.

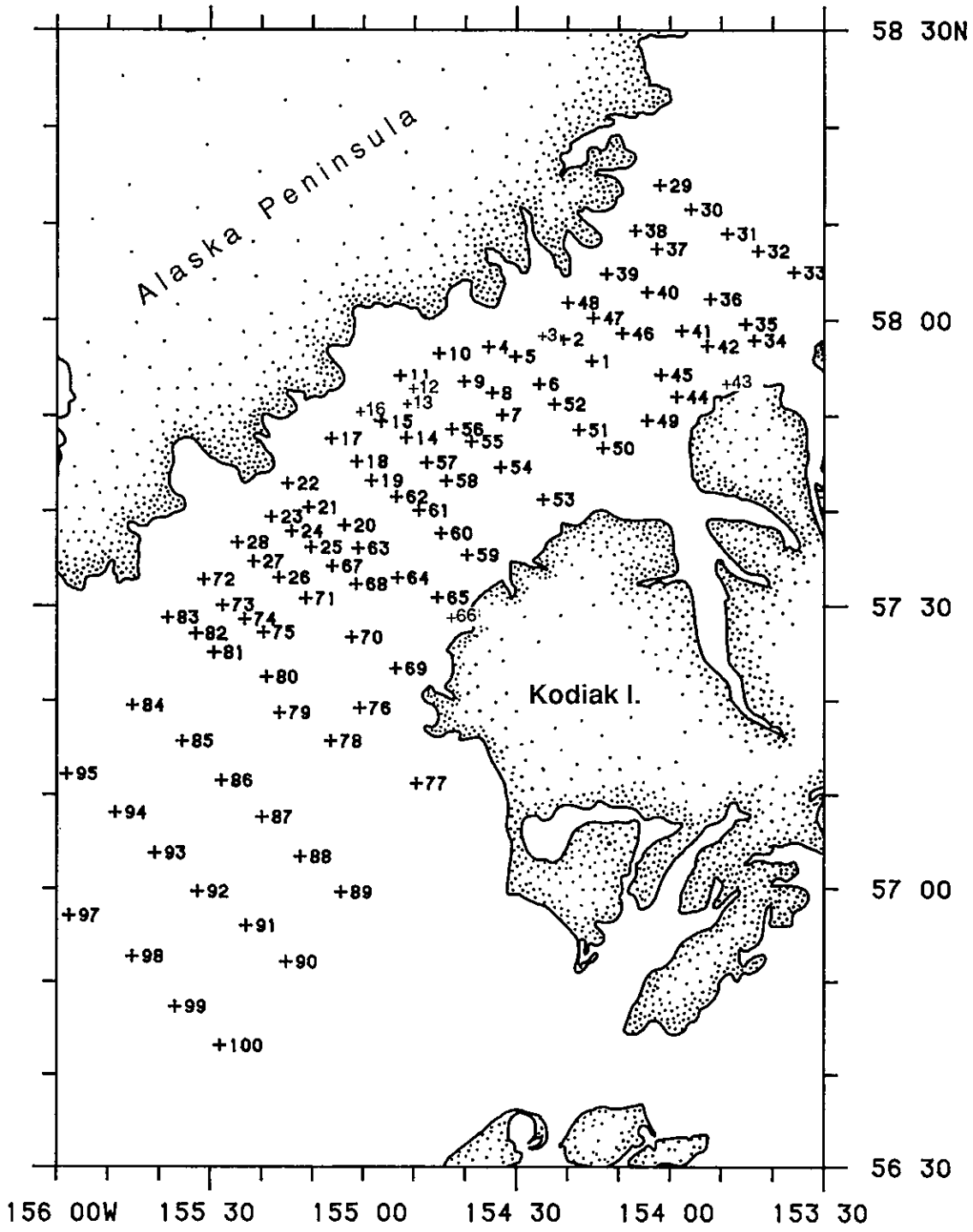

Figure 5. Bongo stations occupied during 1MF89, 5–16 April 1989.

TABLE 3. – OPERATIONS DURING FOCI CRUISE 1MF89, 5–16 APRIL 1989.

B=60 CM BONGO (0.505 MM MESH UNLESS OTHERWISE NOTED)
b=20 CM BONGO (0.153 MM MESH) CTD=CONDUCTIVITY, TEMPERATURE, DEPTH
XBT=EXPENDABLE BATHYTHERMOGRAPH MWT=MIDWATER ROPE TRAWL
SLED=1 M EPIBENTHIC SLED (0.505 MM MESH) T=TUCKER TRAWL (0.505 MM MESH)

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
96	6 Apr.	0621	23		57 56.63	154 06.37	XBT
96	6 Apr.	0746	G001A		57 55.91	154 15.27	B
96	6 Apr.	0851	G002A		57 58.72	154 19.56	B
96	6 Apr.	0957	G003A		58 00.04	154 25.06	B
96	6 Apr.	1058	G004A		57 57.21	154 33.70	B
96	6 Apr.	1149	G005A		57 55.76	154 29.83	B
96	6 Apr.	1239	G006A		57 53.91	154 24.93	B
96	6 Apr.	1339	G007A		57 49.47	154 32.07	B
96	6 Apr.	1435	G008A		57 51.07	154 34.77	B
96	6 Apr.	1522	G009A		57 53.30	154 40.64	B
96	6 Apr.	1726	G010A		57 56.22	154 45.05	B
96	6 Apr.	1841	G011A		57 54.41	154 51.63	B
96	6 Apr.	1922	G012A		57 52.75	154 49.49	B
96	6 Apr.	2012	G013A		57 51.81	154 43.05	B
96	6 Apr.	2123	G014A		57 47.13	154 51.13	B
96	6 Apr.	2215	G015A		57 49.56	154 55.57	B
96	6 Apr.	2301	G016A		57 50.48	155 00.26	B
96	6 Apr.	2353	G017A		57 48.02	155 06.65	B
97	7 Apr.	0043	G018A		57 45.22	155 01.78	B
97	7 Apr.	0128	G019A		57 43.78	154 59.24	B
97	7 Apr.	0202	24		57 41.45	155 01.53	XBT
97	7 Apr.	0229	G020A		57 38.24	155 04.53	B
97	7 Apr.	0327	G021A		57 40.69	155 11.39	B
97	7 Apr.	0414	G022A		57 41.77	155 15.25	B
97	7 Apr.	0506	G023A		57 39.38	155 18.09	B
97	7 Apr.	0557	G024A		57 37.59	155 14.34	B
97	7 Apr.	0643	G025A		57 36.99	155 18.09	B
97	7 Apr.	0748	G026A		57 33.06	155 16.50	B
97	7 Apr.	0840	G027A		57 35.04	155 20.99	B

TABLE 3. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 1MF89, 5–16 APRIL 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
97	7 Apr.	0926	G028A		57 36.61	155 23.81	B
97	7 Apr.	1020	R023A		57 39.49	155 17.96	B
97	7 Apr.	1125	R023B		57 39.48	155 10.00	B
97	7 Apr.	1326	R023C		57 39.44	155 18.23	B
97	7 Apr.	1712	MWT–1		57 38.94	155 17.65	MWT
97	7 Apr.	2048	MWT–2		57 38.43	155 14.52	MWT
97	7 Apr.	2352	MWT–3		57 38.36	155 15.91	MWT
98	8 Apr.	0044	25		57 38.50	155 12.26	XBT
98	8 Apr.	0345	MWT–4		57 38.08	155 13.46	MWT
99	9 Apr.	2031	26		58 02.06	154 06.61	XBT
100	10 Apr.	0029	S23A		57 39.52	155 17.82	T
100	10 Apr.	0154	S23B		57 39.30	155 18.40	T
100	10 Apr.	0248	S23C		57 39.22	155 18.76	T
100	10 Apr.	0624	S23D		57 39.51	155 17.75	T
100	10 Apr.	0714	S23E		57 39.36	155 18.31	T
100	10 Apr.	0827	S23F		57 39.11	155 17.99	T
100	10 Apr.	1026	MWT–5		57 38.28	155 15.51	T
100	10 Apr.	1246	MWT–6		57 38.37	155 16.52	MWT
100	10 Apr.	1654	27		57 39.18	155 18.57	XBT
100	10 Apr.	1716	G023X		57 39.28	155 17.51	SLED
100	10 Apr.	2321	G029B		58 13.97	154 02.00	B
101	11 Apr.	0013	G030A		58 11.46	153 55.89	B
101	11 Apr.	0119	G031B		58 09.02	153 48.80	B
101	11 Apr.	0153	G032B		58 07.20	153 42.94	B
101	11 Apr.	0240	G033B		58 05.04	153 35.90	B
101	11 Apr.	0357	G034B		57 57.88	153 43.59	B
101	11 Apr.	0436	G035B		57 59.58	153 45.31	B
101	11 Apr.	0537	G036B		58 02.16	153 52.10	B
101	11 Apr.	0654	G037B		58 07.41	154 02.57	B
101	11 Apr.	0752	G038B		58 09.29	154 06.81	B
101	11 Apr.	0858	G039B		58 04.75	154 12.42	B
101	11 Apr.	1003	G040B		58 02.94	154 04.47	B
101	11 Apr.	1107	G041B		57 58.94	153 57.72	B
101	11 Apr.	1153	G042B		57 57.25	153 52.65	B
101	11 Apr.	1255	G043B		57 53.63	153 49.34	B
101	11 Apr.	1347	G044B		57 52.01	153 58.66	B

TABLE 3. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 1MF89, 5–16 APRIL 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
101	11 Apr.	1429	G045B		57 54.33	154 01.76	B
101	11 Apr.	1521	G046B		57 58.56	154 09.26	B
101	11 Apr.	1610	G047B		58 00.21	154 14.95	B
101	11 Apr.	1659	G048B		58 01.76	154 20.03	B
101	11 Apr.	1753	G003B		57 58.26	154 25.01	B
101	11 Apr.	1848	G002B		57 58.04	154 20.81	B
101	11 Apr.	1935	G001B		57 55.66	154 15.28	B
101	11 Apr.	2033	28		57 49.70	154 05.07	XBT
101	11 Apr.	2044	G049B		57 49.53	154 04.53	B
101	11 Apr.	2152	G050B		57 46.61	154 13.08	B
101	11 Apr.	2216	G051B		57 48.49	154 17.78	B
101	11 Apr.	2254	G052B		57 51.21	154 22.55	B
101	11 Apr.	2322	G006B		57 53.32	154 25.59	B
102	12 Apr.	0008	G005B		57 56.16	154 30.27	B
102	12 Apr.	0107	G004B		57 57.15	154 35.57	B
102	12 Apr.	0154	G010B		57 56.51	154 45.16	B
102	12 Apr.	0233	G009B		57 53.62	154 40.32	B
102	12 Apr.	0312	G008B		57 52.41	154 34.90	B
102	12 Apr.	0352	G007B		57 50.10	154 32.90	B
102	12 Apr.	0504	G053B		57 41.21	154 24.77	B
102	12 Apr.	0556	G054B		57 44.59	154 33.18	B
102	12 Apr.	0645	G055B		57 47.34	154 38.86	B
102	12 Apr.	0722	G056B		57 48.59	154 42.69	B
102	12 Apr.	0808	G013B		57 51.45	154 51.45	B
102	12 Apr.	0852	G012B		57 52.39	154 50.19	B
102	12 Apr.	0943	G011B		57 54.17	154 52.83	B
102	12 Apr.	1030	G016B		57 50.17	155 00.73	B
102	12 Apr.	1113	G015B		57 49.36	154 56.51	B
102	12 Apr.	1159	G014B		57 47.69	154 51.61	B
102	12 Apr.	1248	G057B		57 45.07	154 47.60	B
102	12 Apr.	1329	G058B		57 43.22	154 43.79	B
102	12 Apr.	1441	G059B		57 35.36	154 39.70	B
102	12 Apr.	1523	G060B		57 37.68	154 44.84	B
102	12 Apr.	1612	G061B		57 40.08	154 49.11	B
102	12 Apr.	1658	G062B		57 41.47	154 53.52	B
102	12 Apr.	1751	G019B		57 43.18	154 58.39	B

TABLE 3. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 1MF89, 5–16 APRIL 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
102	12 Apr.	1840	G018B		57 45.21	155 01.34	B
102	12 Apr.	1936	G017B		57 47.62	155 06.32	B
102	12 Apr.	2038	G022B	61	57 42.89	155 14.89	B (0.333 mm), b
102	12 Apr.	2131	G021B	60	57 40.40	155 10.78	B (0.333 mm), b
102	12 Apr.	2218	G020B	59	57 38.50	155 03.70	B (0.333 mm), b
102	12 Apr.	2248	29		57 36.40	155 01.76	XBT
102	12 Apr.	2258	G063B	58	57 36.09	155 01.01	B (0.333 mm), b
102	12 Apr.	2351	G064B	57	57 33.01	154 53.26	B (0.333 mm), b
103	13 Apr.	0042	G065B	56	57 30.90	154 45.45	B (0.333 mm), b
103	13 Apr.	0126	G066B	55	57 28.85	154 42.38	B (0.333 mm), b
103	13 Apr.	0319	G066B	55	57 28.75	154 42.55	CTD
103	13 Apr.	0453	G065B	56	57 30.90	154 47.52	CTD
103	13 Apr.	0554	G064B	57	57 32.93	154 52.92	CTD
103	13 Apr.	0704	G063B	58	57 36.13	155 00.96	CTD
103	13 Apr.	0848	G020B	59	57 38.52	155 04.30	CTD
103	13 Apr.	0951	G021B	60	57 40.38	155 10.71	CTD
103	13 Apr.	1046	G022B	61	57 42.76	155 14.86	CTD
103	13 Apr.	1216	G023B		57 39.41	155 18.08	B
103	13 Apr.	1302	G024B		57 37.85	155 14.09	B
103	13 Apr.	1345	G025B		57 36.21	155 10.31	B
103	13 Apr.	1426	G067B		57 34.21	155 06.07	B
103	13 Apr.	1507	G068B		57 32.25	155 01.43	B
103	13 Apr.	1626	G069B		57 23.36	154 53.65	B
103	13 Apr.	1728	G070B		57 26.69	155 02.27	B
103	13 Apr.	1821	G071B		57 30.75	155 11.34	B
103	13 Apr.	1912	G026B		57 33.01	155 16.58	B
103	13 Apr.	2001	G027B		57 34.66	155 21.60	B
103	13 Apr.	2048	G028B		57 36.67	155 24.66	B
103	13 Apr.	2144	G072B		57 32.76	155 31.32	B
103	13 Apr.	2228	G073B		57 30.07	155 27.64	B
103	13 Apr.	2314	G074B		57 28.55	155 23.31	B
103	13 Apr.	2356	G075B		57 27.23	155 19.58	B
104	14 Apr.	0032	30		57 24.99	155 14.45	B
104	14 Apr.	0128	G076B		57 19.17	155 00.72	B
104	14 Apr.	0241	G077B		57 11.21	154 49.58	B
104	14 Apr.	0345	G078B		57 15.65	155 06.43	B

TABLE 3. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 1MF89, 5–16 APRIL 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
104	14 Apr.	0441	G079B		57 18.74	155 16.52	B
104	14 Apr.	0526	G080B		57 22.48	155 19.04	B
104	14 Apr.	0619	G081B		57 25.08	155 29.26	B
104	14 Apr.	0701	G082B		57 27.09	155 32.87	B
104	14 Apr.	0619	G081B		57 25.08	155 29.26	B
104	14 Apr.	0701	G082B		57 27.09	155 32.87	B
104	14 Apr.	0745	G083B		57 28.81	155 38.36	B
104	14 Apr.	0900	G084B		57 19.48	155 45.18	B
104	14 Apr.	1003	G085B		57 15.66	155 35.52	B
104	14 Apr.	1102	G086B		57 11.54	155 27.84	B
104	14 Apr.	1203	G087B		57 07.63	155 19.92	B
104	14 Apr.	1302	G088B		57 03.43	155 12.36	B
104	14 Apr.	1359	G089B		56 59.56	155 04.40	B
104	14 Apr.	1509	G090B		56 52.09	155 15.15	B
104	14 Apr.	1605	G091B		56 55.99	155 23.03	B
104	14 Apr.	1701	G092B		56 59.70	155 32.46	B
104	14 Apr.	1758	G093B		57 03.84	155 40.94	B
104	14 Apr.	1855	G094B		57 08.13	155 48.58	B
104	14 Apr.	1953	G095B		57 12.15	155 58.07	B
104	14 Apr.	2110	G096B		57 01.57	156 02.66	B
104	14 Apr.	2206	G097B		56 57.14	155 57.59	B
104	14 Apr.	2243	31		56 55.19	155 52.65	B
104	14 Apr.	2317	G098B		56 52.68	155 45.27	B
105	5 Apr.	0042	G099B		56 47.33	155 36.89	B
105	5 Apr.	0142	G100B		56 43.12	155 28.10	B
105	5 Apr.	0852	MWT-7		57 39.31	155 17.90	MWT
105	5 Apr.	0955	32		57 38.28	155 20.47	XBT
105	5 Apr.	1246	G023X		57 38.47	155 18.63	SLED
105	5 Apr.	1331	33		57 37.81	155 16.27	XBT
105	5 Apr.	1412	G023Z		57 37.49	155 18.69	SLED

4.2 FOCI 2MF89 19 April–5 May 1989

Scientific party:	Judith Gray, Chief Scientist	NOAA/PMEL
	Bill Rugen	NOAA/AFSC
	Annette Brown	NOAA/AFSC
	Jay Clark	NOAA/AFSC
	Carol Dewitt	NOAA/PMEL
	Dave Kachel	NOAA/PMEL
	Bill Parker	NOAA/PMEL
	Marie Schall	NOAA/PMEL
	Debbie Siefert	NOAA/AFSC

The principal objective of FOCI 2MF89 was to investigate transport, condition and survival of pollock eggs and larvae from Shelikof Strait spawning. The two major accomplishments for 2MF89 were the recovery and deployment of moorings for long-term and special studies (Figs. 9 and 10), and the completion of bongo, Tucker trawl, and CTD grids from the Semidi Islands to Kennedy Entrance.

The biological component of 2MF89 consisted of occupying a large grid of stations from northern Shelikof Strait to the Semidi Islands, the occupation of CTD line 8 with both the 60 and 20 cm bongo frames, and microzooplankton, chlorophyll, and nutrient collections. Bongo tows designed to show the horizontal distribution of eggs and larvae were completed at 88 stations for a total of 91 tows. A 60 cm bongo with 0.333 mm mesh was used. Figures 6-8 show the grid with rough estimates of larval abundance. Seven stations were chosen for additional sampling of six live tows, eight Tucker trawls, and seven CTDs. Vertical live tows were done with the bongo net deployed and retrieved at 15 m s^{-1} for RNA/DNA larval condition indices and histology. Predators were collected with a 1 m Tucker trawl. The Tucker trawl was outfitted with 0.505 mm mesh nets. A gear comparison consisting of two tows with a 0.333 bongo net, two tows with a 0.505 bongo net, and two tows with a 0.505 Tucker trawl was conducted at station F23. A satellite-tracked drifter drogued at 45 m was deployed at station E23 to track larval movement. Sixteen bongo tows were conducted on the CTD grid. The quality of the sampling effort was good.

The physical component of 2MF89 consisted of 93 CTD stations which were conducted using the PMEL Seabird CTD. CTDs were located to examine water property differences between areas of high and low larval concentrations, to look at Alaska Coastal Current versus nearshore waters, to calibrate sensors on the moorings, and to continue the long-term, water-properties data set at specific stations. A total of five moorings which were deployed in 1988 were recovered. Twelve moorings were deployed during 2MF89, including two long-term moorings (#2 and #4), nine moorings along FOCI CTD line 12 to examine lateral larval drift, and one mooring in Kennedy entrance to help gain an understanding of upstream conditions. All of these data will help contribute to computer flow modeling and the understanding of larval movement in the region. Weather data was collected next to the Peggy-2 meteorological buoy

and will be used to parameterize atmospheric forcing of the upper ocean in the flow model. Problems with the 600 kHz RD moored Acoustic Doppler Current Profiler precluded the deployment of mooring #30. One of the three Loran-C drifters failed and was sent back to the manufacturer. Two test deployments were made with the remaining two drifters (Figs. 11 and 12).

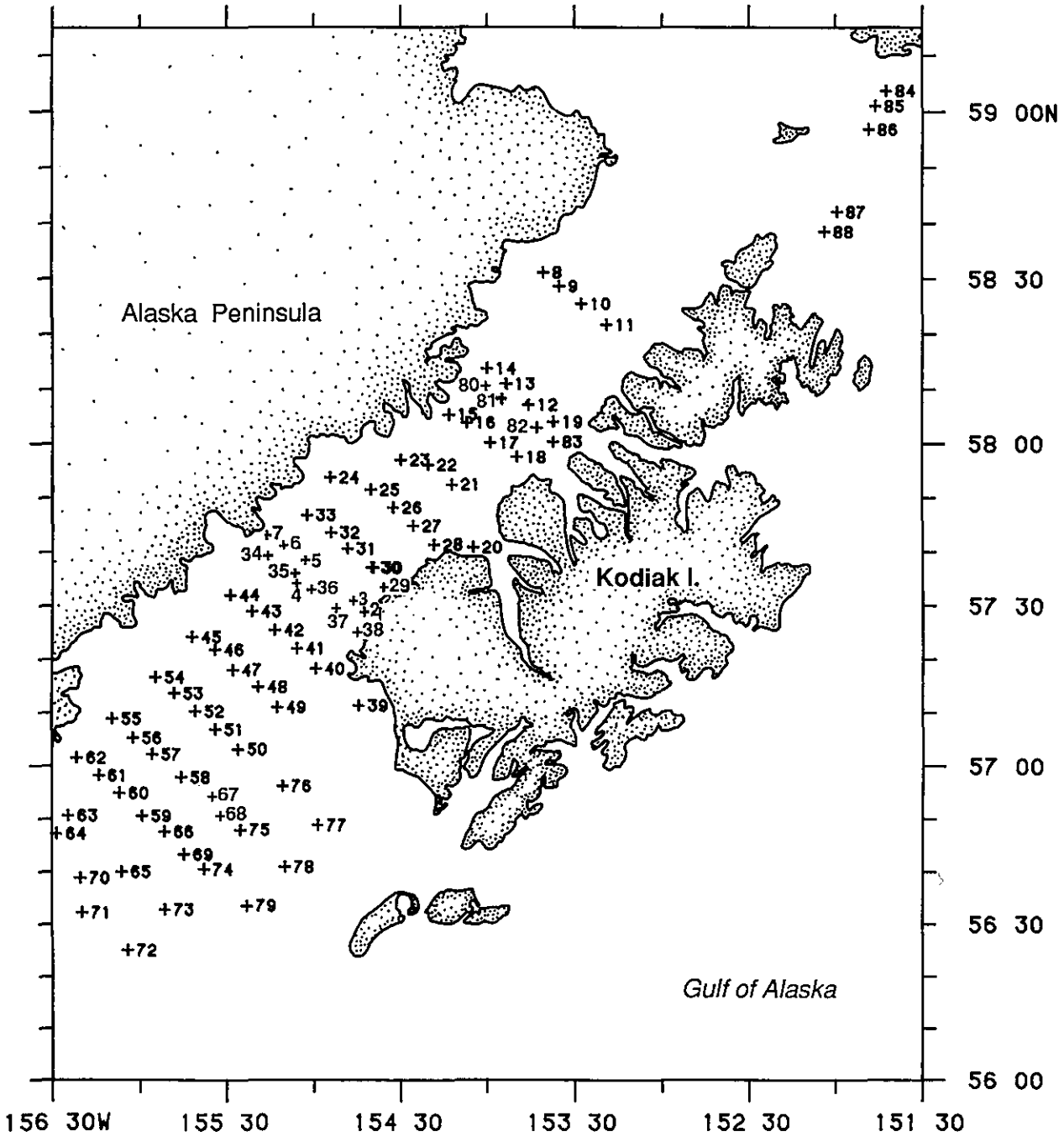

Figure 6. Bongo stations occupied during 2MF89, 19 April–5 May 1989.

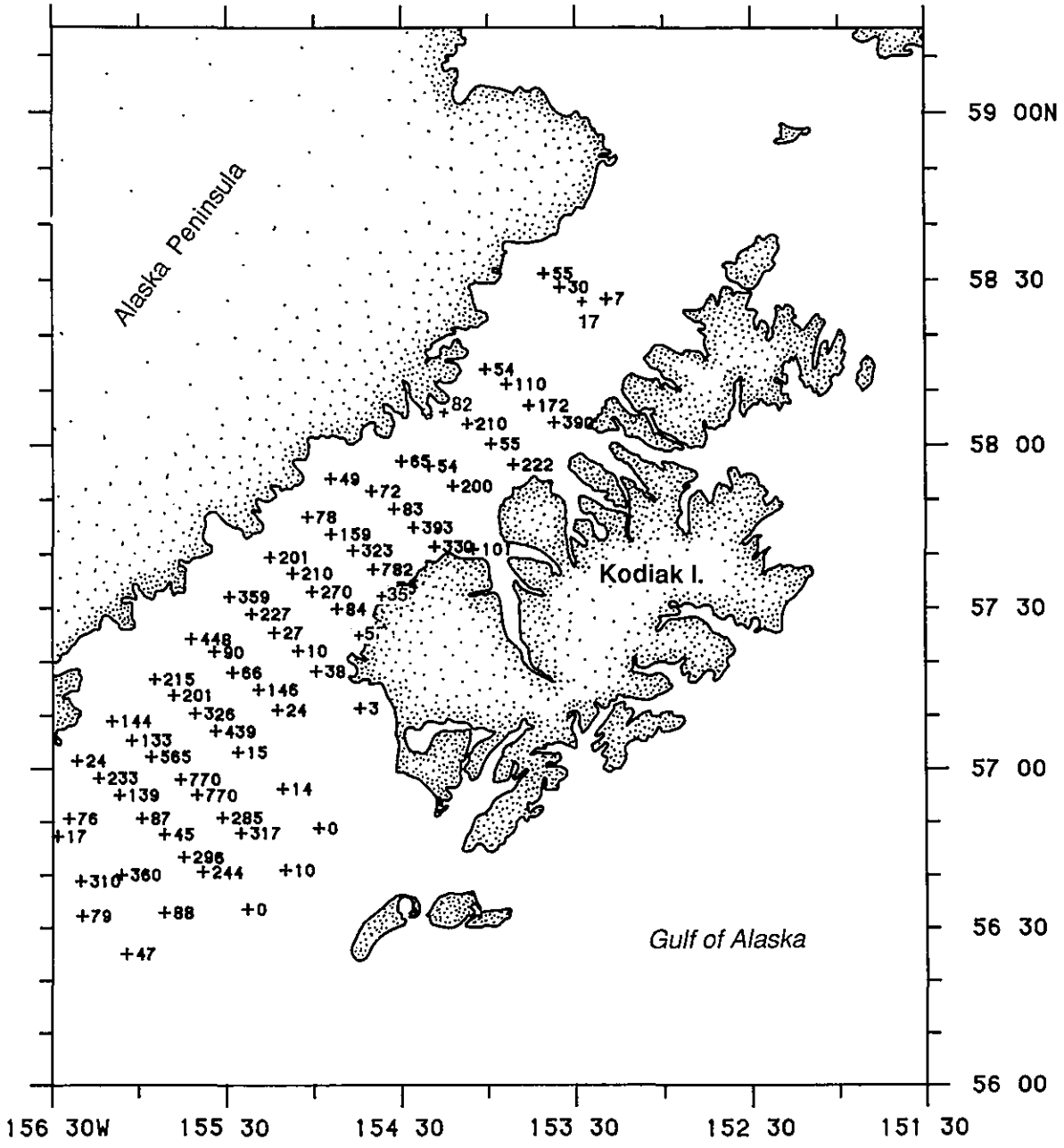

Figure 7. Larval rough counts (total estimated number of larvae caught) at individual bongo stations during 2MF89, 19 April–5 May 1989.

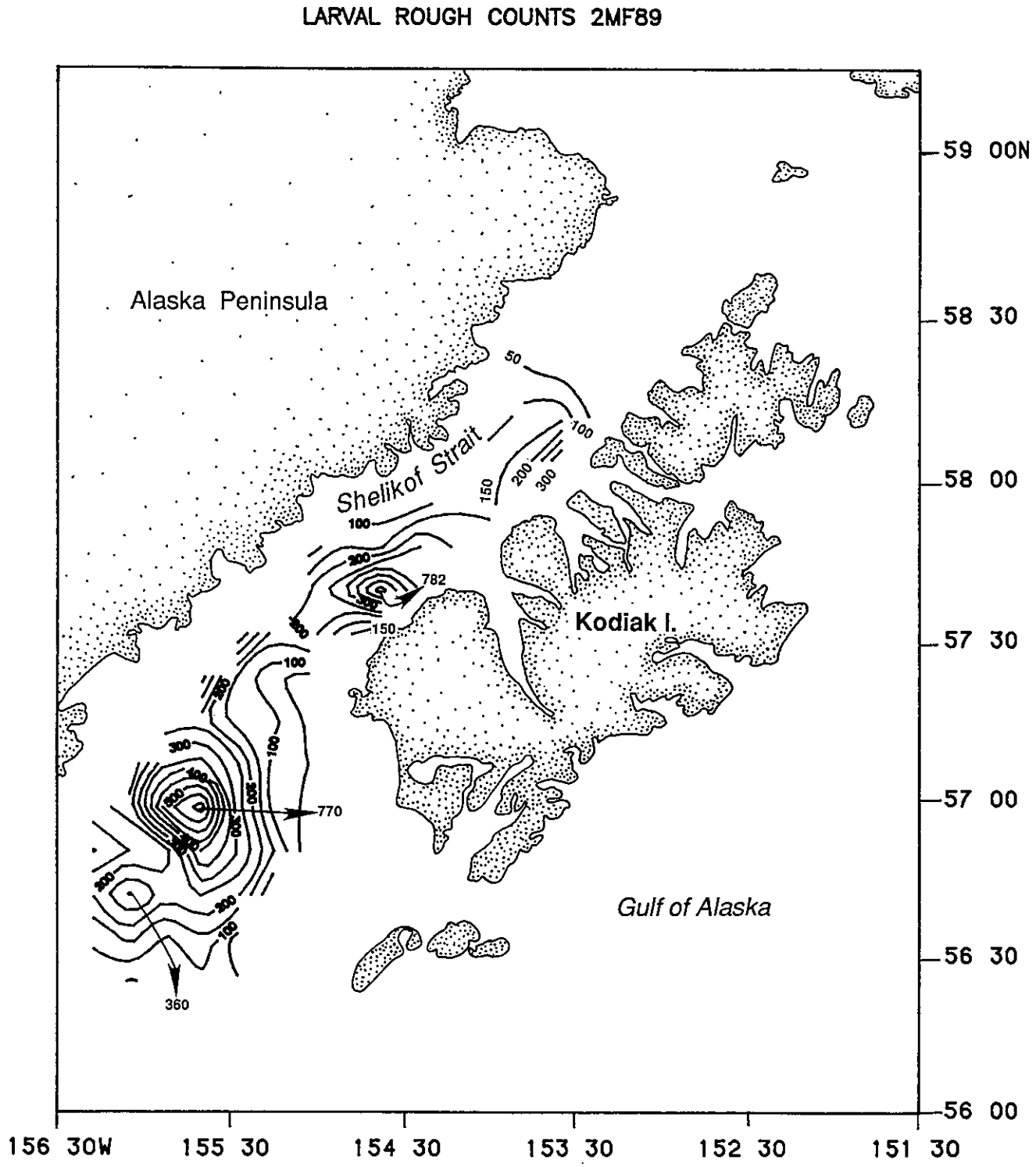

Figure 8. Contours of larval rough counts during 2MF89, 19 April–5 May 1989.

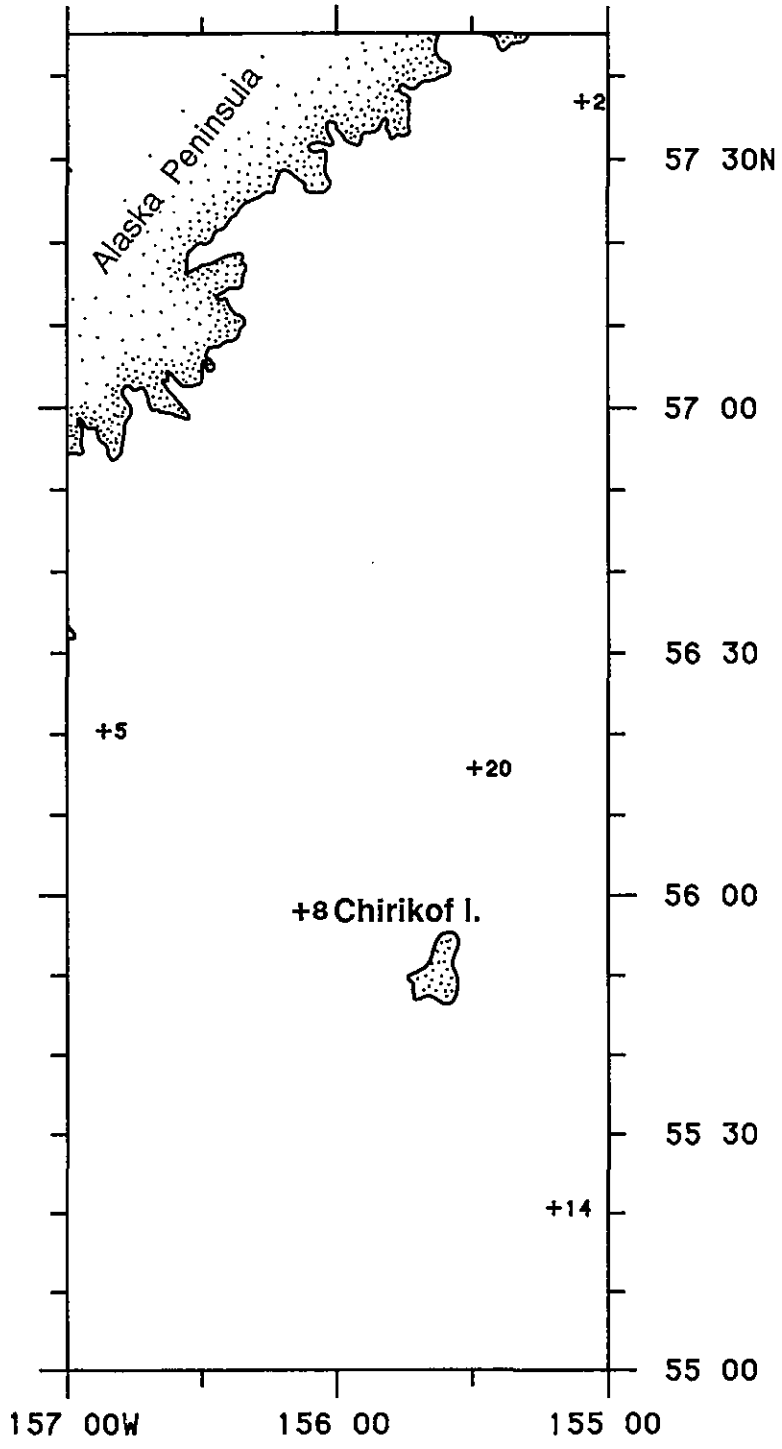

Figure 9. Mooring recovery sites during 2MF89, 19 April–5 May 1989.

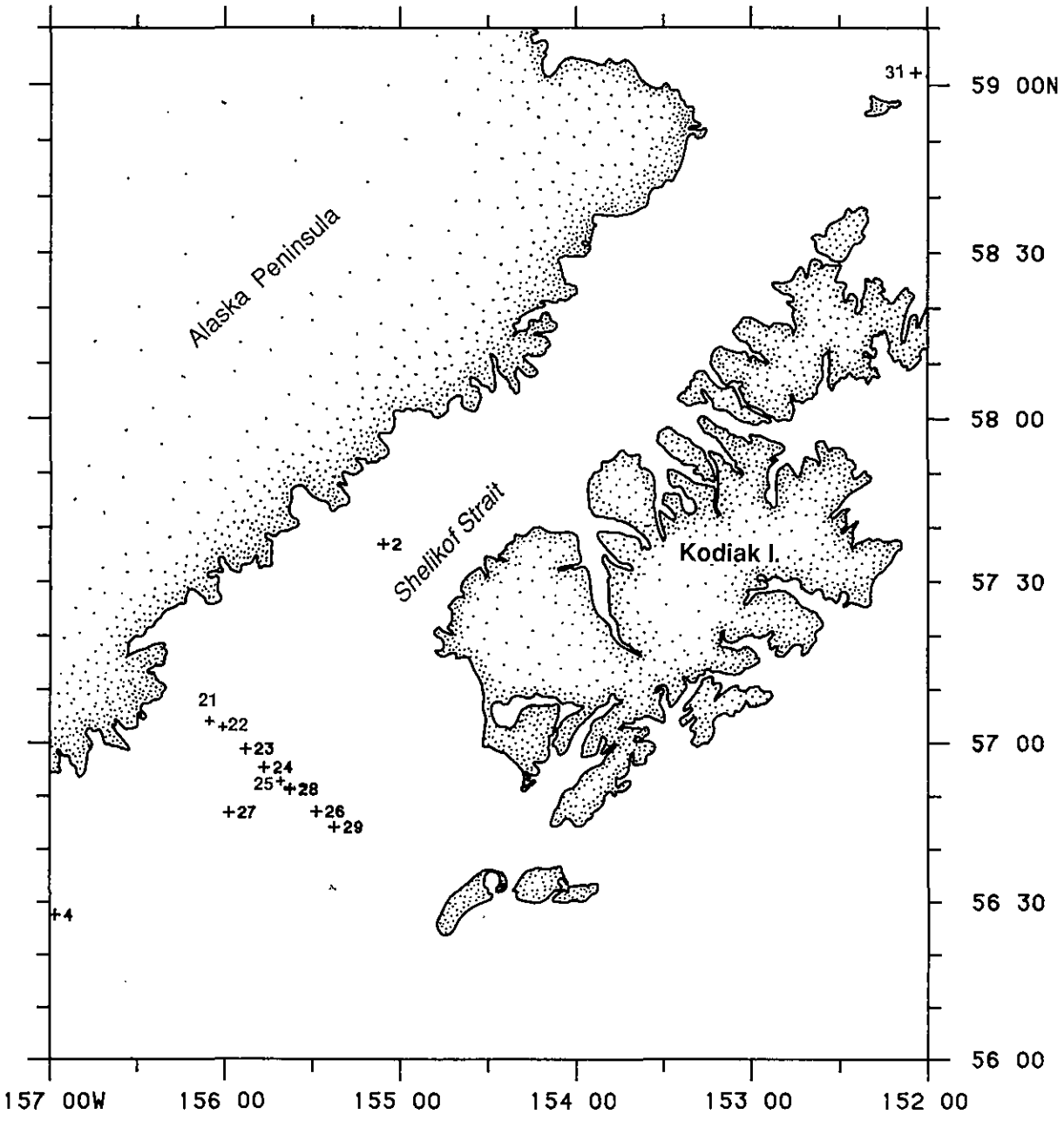

Figure 10. Mooring deployment sites during 2MF89, 19 April–5 May 1989.

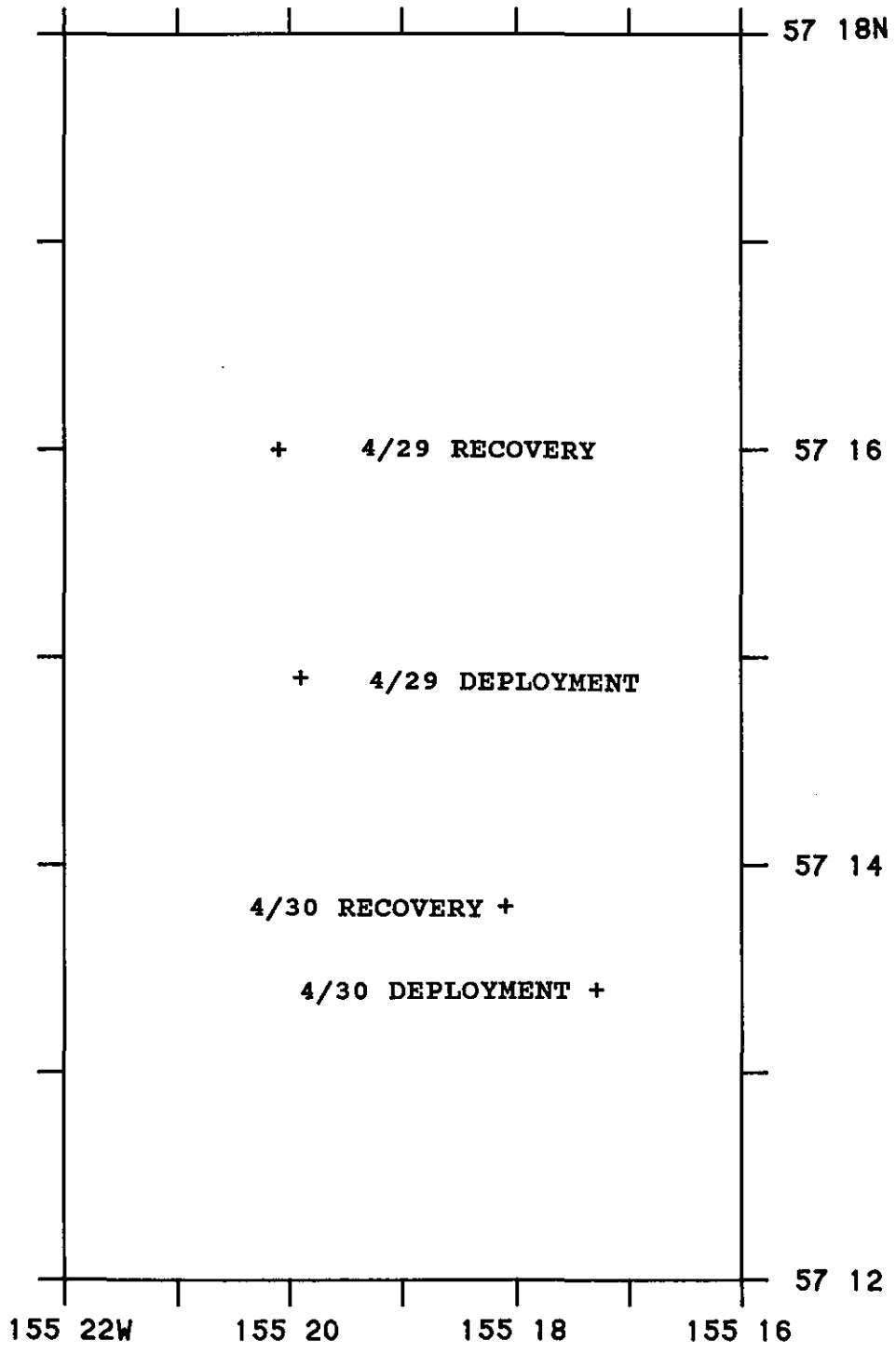

Figure 11. Loran-C drifter deployments on 29 April and recoveries on 30 April during 2MF89.

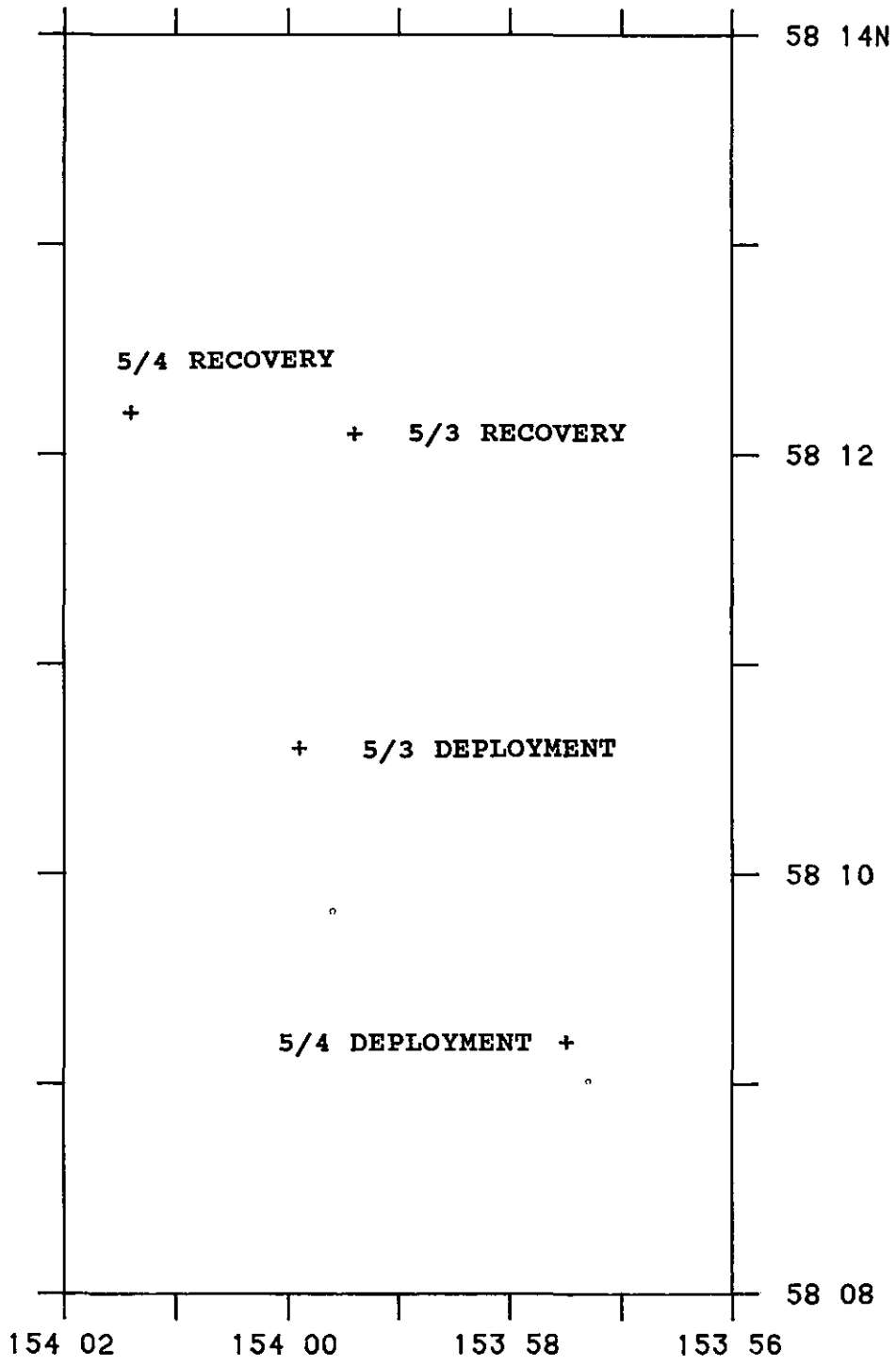

Figure 12. Loran-C drifter deployments on 3 May and recoveries on 4 May during 2MF89.

TABLE 4. – OPERATIONS DURING FOCI CRUISE 2MF89, 19 APRIL – 5 MAY 1989.

FOCI STATION NUMBERS FROM THE MASTER CTD GRID (NUMBERS), MOORING STATIONS (MS) AND THE 1989 BIOLOGICAL GRID (LETTERS AND NUMBERS; CONSECUTIVE BONGO NUMBERS, MULTIPLE OCCUPATIONS MARKED BY A,B, ETC.).

B=60 CM OBLIQUE BONGO (0.505 MM) b=20 CM. BONGO (0.153 MM MESH)
CTD=CONDUCTIVITY, TEMPERATURE, DEPTH NUT=NUTRIENT CAST
CHL=CHLOROPHYLL CAST MZ=MICROZOOPLANKTON CAST VB=VERTICAL BONGO
T=TUCKER TRAWL (0.505 MM MESH) VB=60 CM VERTICAL BONGO (0.505 MM MESH)

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
110	20 Apr.	1836		M14	55 20.84	155 11.27	CTD
110	20 Apr.	2014		M14	55 20.74	155 12.02	Recover Mooring
111	21 Apr.	0421		M8	55 57.37	156 22.74	CTD
111	21 Apr.	0440		M8	55 57.43	156 22.64	Recover Mooring
111	21 Apr.	0726		152	55 54.00	155 59.91	CTD
111	21 Apr.	0838		153	55 55.10	156 11.25	CTD
111	21 Apr.	0931		154	55 55.69	156 15.33	CTD
111	21 Apr.	1012		155	55 56.11	156 21.10	CTD
111	21 Apr.	1053		156	55 56.63	156 25.83	CTD
111	21 Apr.	1143		157	55 57.34	156 31.05	CTD
111	21 Apr.	1230		158	55 58.03	156 37.07	CTD
111	21 Apr.	1544		M5	56 21.55	156 54.76	CTD
111	21 Apr.	1613		M5	56 20.38	156 51.68	Recover Mooring
111	21 Apr.	1745		147	56 17.96	156 47.75	CTD
111	21 Apr.	1833		148	56 21.64	156 52.42	CTD
111	21 Apr.	1921		149	56 24.04	156 54.92	CTD
111	21 Apr.	1957		150	56 26.64	156 57.11	CTD
111	21 Apr.	2056		151	56 30.17	156 59.90	CTD
111	21 Apr.	2222		M4	56 27.61	156 58.27	Deploy Mooring
111	21 Apr.	2236		M4	56 27.80	156 58.00	CTD
112	22 Apr.	0328		M20	56 15.66	155 29.65	CTD
112	22 Apr.	0355		M20	56 15.71	155 29.50	Recover Mooring
112	22 Apr.	0710		99	56 43.44	155 20.54	CTD
112	22 Apr.	0834		100	56 48.94	155 29.27	CTD
112	22 Apr.	1018		101	56 51.45	155 38.15	CTD

TABLE 4.(CONTINUED) – OPERATIONS DURING FOCI CRUISE 2MF89, 19 APRIL – 5 MAY 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
112	22 Apr.	1129		102	56 55.92	155 47.76	CTD
112	22 Apr.	1257		103	56 59.71	155 56.98	CTD
112	22 Apr.	1354		104	57 03.91	156 05.01	CTD
112	22 Apr.	1825		M21	57 03.75	156 05.00	Deploy Mooring
112	22 Apr.	1845		M21	57 03.80	156 05.30	CTD
112	22 Apr.	2204		M22	57 02.83	156 02.34	Deploy Mooring
112	22 Apr.	2225		M22	57 02.90	156 02.53	CTD
113	23 Apr.	0423		Pegg	57 01.20	156 01.60	Deploy met. buoy
113	23 Apr.	0538		M21	57 03.85	156 05.49	CTD
113	23 Apr.	0625		M22	57 02.91	156 02.41	CTD
113	23 Apr.	1111		102	56 55.86	155 48.08	CTD
113	23 Apr.	1238		101	56 51.33	155 37.73	CTD
113	23 Apr.	1311	G001A	101	56 51.29	155 36.94	B
113	23 Apr.	1430		100	56 48.07	155 29.91	CTD
113	23 Apr.	1528		99	56 43.33	155 21.20	CTD
113	23 Apr.	1857		M27	56 46.94	155 58.47	Deploy Mooring
113	23 Apr.	1957		M26	56 46.95	155 28.46	Deploy Mooring
113	23 Apr.	2028	M26/27		56 47.15	155 28.49	CTD
114	24 Apr.	0024		M23	56 58.75	155 52.79	Deploy Mooring
114	24 Apr.	0043		M23	56 58.52	155 52.72	CTD
114	24 Apr.	0342		M24	56 55.32	155 46.43	Deploy Mooring
114	24 Apr.	0415		M24	56 34.77	155 46.04	CTD
114	24 Apr.	0614		M25	56 52.61	155 40.67	Deploy Mooring
114	24 Apr.	0636		M25	56 52.50	155 40.60	CTD
114	24 Apr.	0849		M21	57 03.80	156 04.98	CTD
114	24 Apr.	0922		M22	57 02.89	156 02.63	CTD
114	24 Apr.	1033		M23	56 58.84	155 52.97	CTD
114	24 Apr.	1135		M24	56 55.48	155 46.14	CTD
114	24 Apr.	1242		M25	56 52.94	155 40.92	CTD
114	24 Apr.	1405	M26/27		56 46.99	155 28.60	CTD
114	24 Apr.	1740		M29	56 44.07	155 22.34	Deploy Mooring
114	24 Apr.	1803		M29	56 43.96	155 23.10	CTD
114	24 Apr.	2055		M28	56 51.18	155 37.61	Deploy Mooring
114	24 Apr.	2111		M28	56 51.23	155 37.57	CTD
115	25 Apr.	0238		M2	57 36.69	155 06.23	CTD
115	25 Apr.	0312		M2	57 36.91	155 05.84	Recover Mooring

TABLE 4.(CONTINUED) – OPERATIONS DURING FOCI CRUISE 2MF89, 19 APRIL – 5 MAY 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
115	25 Apr.	0514		M2	57 36.90	155 05.84	Deploy Mooring
115	25 Apr.	0537		M2	57 36.68	155 06.05	CTD
115	25 Apr.	0801		60	57 40.47	155 10.72	CTD (no sled)
116	26 Apr.	0527		55	57 28.56	154 43.02	CTD,MZ,NUT,CHL
116	26 Apr.	0527	G002A	55	57 28.56	154 43.02	B,b
116	26 Apr.	0822		56A	57 30.86	154 46.34	CTD,NUT,CHL
116	26 Apr.	0908		56B	57 30.91	154 46.73	MZ
116	26 Apr.	0942	G003A	56	57 30.98	154 46.13	B,b
116	26 Apr.	1113		57	57 33.11	154 51.83	CTD,MZ
116	26 Apr.	1431		58A	57 36.48	155 05.87	CTD,NUT,CHL
116	26 Apr.	1530		58B	57 36.01	155 04.63	MZ
116	26 Apr.	1544	G004A	58	57 36.14	155 05.08	B,b
116	26 Apr.	1647		59A	57 38.37	155 04.23	CTD(pin misfire)
116	26 Apr.	1723		59B	57 38.33	155 04.23	CTD,MZ
116	26 Apr.	1739	G005A	59	57 38.47	155 04.02	B,b
116	26 Apr.	1837		60A	57 40.65	155 10.26	CTD,NUT,CHL
116	26 Apr.	1926		60B	57 40.61	155 10.13	MZ
116	26 Apr.	1942	G006A	60	57 40.55	155 10.62	B,b
116	26 Apr.	2039		61A	57 42.93	155 15.32	CTD,NUT,CHL
116	26 Apr.	2118		61B	57 42.91	155 15.47	MZ
116	26 Apr.	2147	G007A	61	57 42.66	155 16.24	B,b
117	27 Apr.	0913	G008A	B43	58 31.14	153 40.64	B
117	27 Apr.	1045	G009A	C43	58 28.60	153 35.17	B
117	27 Apr.	1143	G010A	D43	58 25.42	153 27.62	B
117	27 Apr.	1250	G011A	E43	58 21.55	153 19.18	B
117	27 Apr.	1514	G012A	E41	58 07.06	153 45.84	B
117	27 Apr.	1630	G013A	D41	58 10.95	153 53.61	B
117	27 Apr.	1800	G014A	C41	58 13.66	154 00.78	B
117	27 Apr.	1932	G015A	C39	58 05.26	154 13.30	B
117	27 Apr.	2023	G016A	D39	58 03.75	154 07.06	B
117	27 Apr.	2208	G017A	E39	58 00.11	153 58.93	B
117	27 Apr.	2316	G018A	F39	57 56.32	153 51.30	B
118	28 Apr.	0105	G019A	F41	58 03.97	153 37.26	B
118	28 Apr.	0339	G020A	F37	57 40.77	154 04.88	B
118	28 Apr.	0442	G021A	E37	57 52.40	154 12.20	B
118	28 Apr.	0550	G022A	D37	57 56.10	154 20.50	B

TABLE 4.(CONTINUED) – OPERATIONS DURING FOCI CRUISE 2MF89, 19 APRIL – 5 MAY 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
118	28 Apr.	0649	G023A	C37	57 57.00	154 30.00	B
118	28 Apr.	0853	G024A	B35	57 53.83	154 54.35	B
118	28 Apr.	1013	G025A	C35	57 51.48	154 40.37	B
118	28 Apr.	1131	G026A	D35	57 48.19	154 32.57	B
118	28 Apr.	1239	G027A	E35	57 44.84	154 25.88	B
118	28 Apr.	1347	G028A	F35	57 41.30	154 18.59	B
118	28 Apr.	1539	G029A	F33	57 33.65	154 34.67	B
118	28 Apr.	1626	G030A	E33	57 37.13	154 39.58	B
118	28 Apr.	1730		E33	57 36.86	154 39.74	CTD
118	28 Apr.	1835	G031A	D33	57 40.55	154 46.50	B
118	28 Apr.	1944	G032A	C33	57 43.61	154 54.25	B
118	28 Apr.	2051	G033A	B33	57 46.83	155 02.43	B
118	28 Apr.	2220	G034A	B31	57 39.37	155 14.85	B
118	28 Apr.	2328	G035A	C31	57 36.44	155 07.22	B
119	29 Apr.	0038	G036A	D31	57 32.95	155 00.63	B
119	29 Apr.	0203	G037A	E31	57 29.77	154 52.11	B
119	29 Apr.	0312	G038A	F31	57 26.13	154 45.16	B
119	29 Apr.	0537	G039A	H29	57 11.30	154 44.30	B
119	29 Apr.	0711	G040A	F29	57 18.16	154 59.32	B
119	29 Apr.	0822	G041A	E29	57 21.99	155 05.49	B (hit bottom)
119	29 Apr.	0907	G041A	E29	57 21.99	155 05.49	B
119	29 Apr.	1015	G042A	D29	57 25.37	155 13.57	B
119	29 Apr.	1122	G043A	C29	57 28.89	155 21.43	B
119	29 Apr.	1232	G044A	B29	57 32.05	155 28.86	B
119	29 Apr.	1418	G045A	B27	57 24.18	155 41.97	B
119	29 Apr.	1533	G046A	C27	57 21.76	155 34.14	B
119	29 Apr.	1705	G047A	D27	57 18.00	155 27.87	B
119	29 Apr.	1817	G048A	E27	57 14.75	155 19.08	B
119	29 Apr.	1909		E27	57 14.90	155 19.92	Deploy Loran–C #1
119	29 Apr.	1937			57 13.42	155 17.27	Deploy Loran–C #2
119	29 Apr.	2012	G049A	F27	57 10.97	155 12.57	B
119	29 Apr.	2219	G050A	F25	57 03.08	155 26.19	B
119	29 Apr.	2327	G051A	E25	57 06.97	155 33.76	B
120	30 Apr.	0050	G052A	D25	57 10.30	155 40.80	B
120	30 Apr.	0300			57 15.97	155 20.08	Recover Loran–C #1
120	30 Apr.	0345			57 13.80	155 18.07	Recover Loran–C #2

TABLE 4.(CONTINUED) – OPERATIONS DURING FOCI CRUISE 2MF89, 19 APRIL – 5 MAY 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
120	30 Apr.	0535	G053A	C25	57 13.66	155 48.07	B
120	30 Apr.	0539	G054A	B25	57 16.70	155 54.60	B
120	30 Apr.	0824	G055A	B23	57 08.91	156 09.49	B
120	30 Apr.	0921	G056A	C23	57 05.26	156 02.61	B
120	30 Apr.	1026	G057A	D23	57 02.15	155 55.87	B
120	30 Apr.	1151	G058A	E23	56 57.86	155 45.79	B
120	30 Apr.	1332	G059A	E21	56 50.55	155 59.20	B
120	30 Apr.	1446	G060A	D21	56 54.95	156 07.01	B
120	30 Apr.	1540	G061A	C21	56 58.21	156 14.21	B
120	30 Apr.	1648	G062A	B21	57 01.47	156 21.73	B
120	30 Apr.	1839	G063A	C19	56 50.63	156 24.64	B
120	30 Apr.	1930	G064A	D19	56 47.25	156 28.50	B
120	30 Apr.	2100	G065A	F19	56 39.97	156 06.26	B
120	30 Apr.	2150	S065A	F19	56 40.08	156 06.20	VB
120	30 Apr.	2334	G066A	F21	56 47.60	155 51.35	B
121	1 May	0013	G067A	F23	56 54.98	155 40.16	B
121	1 May	0204	S067A	F23	56 55.00	155 39.70	VB
121	1 May	0233		F23	56 55.02	155 39.48	CTD, MZ
121	1 May	0331	S067B	F23	56 54.90	155 39.70	T (Day)
121	1 May	0402	S067C	F23	56 55.20	155 39.08	T (Day)
121	1 May	0456	G068A	G23	56 50.77	155 31.61	B
121	1 May	0645	G069A	G21	56 43.29	155 44.83	B
121	1 May	0739	S069A	G21	56 43.80	155 44.69	VB
121	1 May	0809		G21	56 43.74	155 44.41	CTD, MZ
121	1 May	1036	S067D	F23	56 54.92	155 39.47	T (Night)
121	1 May	1117	S067E	F23	56 54.90	155 39.18	T (Night)
121	1 May	1157	S067F	F23	56 54.64	155 39.77	T (Night)
121	1 May	1515	G070A	F18	56 38.75	156 20.54	B
121	1 May	1700	G071A	F17	56 32.15	156 19.86	B
121	1 May	1836	S072A	H17	56 25.10	156 05.00	VB
121	1 May	1859		H17	56 25.14	156 04.82	CTD
121	1 May	1920	G072A	H17	56 25.01	156 04.54	B
121	1 May	2100	G073A	H19	56 32.77	155 51.45	B
121	1 May	2235	S074A	H21	56 40.75	155 37.88	VB
121	1 May	2304		H21	56 40.71	155 37.88	CTD,MZ
122	2 May	0012	G074B	H21	56 40.46	155 38.29	B (A Hit Bottom)

TABLE 4.(CONTINUED) – OPERATIONS DURING FOCI CRUISE 2MF89, 19 APRIL – 5 MAY 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
122	2 May	0215	C067A	F23	56 54.57	155 39.66	B (0.333 MM MESH)
122	2 May	0256	C067A	F23	56 55.15	155 39.57	B (0.333 MM MESH)
122	2 May	0338	S067G	F23	56 54.91	155 39.44	T (Day)
122	2 May	0411	C067A	F23	56 54.76	155 39.48	T (0.505 MM MESH)
122	2 May	0452	C067A	F23	56 54.92	155 39.59	T (0.505 MM MESH)
122	2 May	0534	C067A	F23	56 54.02	155 39.70	B (0.505 MM MESH)
122	2 May	0621	C067A	F23	56 54.86	155 39.60	B (0.505 MM MESH)
122	2 May	0803	G075A	H23	56 47.92	155 25.25	B
122	2 May	0936	S076A	H25	56 56.10	155 11.39	VB
122	2 May	1001		H25	56 56.28	155 10.88	CTD, MZ
122	2 May	1024	G076A	H25	56 56.18	155 10.86	B
122	2 May	1137	G077A	J25	56 48.79	154 58.62	B
122	2 May	1244	G078A	J23	56 40.93	155 10.10	B
122	2 May	1353	G079A	J21	56 33.50	155 23.10	B
122	2 May	1505		M29	56 44.05	155 22.34	RD Calibration
122	2 May	1738		M29	56 44.15	155 22.29	CTD
122	2 May	1825	M26/27		56 47.18	155 28.20	CTD
122	2 May	1935		M28	56 51.26	155 37.39	CTD
122	2 May	2015		M25	56 52.58	155 40.53	CTD
122	2 May	2105		M24	56 55.16	155 46.24	CTD
122	2 May	2202		M23	56 58.52	155 52.61	CTD
122	2 May	2320	Peggy		56 59.87	156 08.01	Weather
123	3 May	0010		M22	57 02.78	156 02.16	CTD
123	3 May	2333	Peggy		56 59.90	156 07.80	Weather
123	3 May	0127		M21	57 03.66	156 04.74	CTD
123	3 May	0242		E23	56 57.84	155 46.09	Deploy Sat. Drifter
123	3 May	0725		61	57 42.94	155 15.02	CTD
123	3 May	0815		60	57 40.96	155 09.84	CTD
123	3 May	0918		59	57 38.59	155 04.11	CTD
123	3 May	1000		58	57 36.38	155 00.38	CTD
123	3 May	1056		57	57 33.19	154 52.59	CTD
123	3 May	1145		56	57 30.88	154 46.86	CTD
123	3 May	1225		55	57 28.55	154 42.23	CTD
123	3 May	1330	S030B	E33	57 37.07	154 39.92	VB
123	3 May	1349		E33	57 37.20	154 39.86	CTD,MZ
123	3 May	1416	G030B	E33	57 37.10	154 40.07	B

TABLE 4.(CONTINUED) – OPERATIONS DURING FOCI CRUISE 2MF89, 19 APRIL – 5 MAY 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
123	3 May	1835		39	58 12.83	154 06.00	CTD
123	3 May	1923		38	58 10.79	154 00.36	CTD
123	3 May	1943	G080A	38	58 10.82	154 00.71	B
123	3 May	2004			58 10.62	153 59.90	Deploy Loran–C #1
123	3 May	2026			58 09.16	153 57.48	Deploy Loran–C #2
123	3 May	2052		37	58 08.08	153 54.65	CTD
123	3 May	2113	G081A	37	58 08.06	153 54.87	B
123	3 May	2203		36	58 05.39	153 49.12	CTD
123	3 May	2314		35	58 03.10	153 42.82	CTD
123	3 May	2333	G082A	35	58 02.93	153 42.86	B
123	3 May	?					Received FAX Sat. Pic.
124	4 May	0021		34	58 00.50	153 37.37	CTD
124	4 May	0037	G083A	34	58 00.30	153 37.37	B
124	4 May	0124		33	57 59.21	153 34.75	CTD
124	4 May	0331			58 12.05	153 59.38	Retrieve Loran–C #2
124	4 May	0347			58 12.18	154 01.41	Retrieve Loran–C #1
124	4 May	1715		M31	59 02.15	152 04.21	Deploy mooring
124	4 May	1735		M31	59 02.11	152 03.92	CTD
124	4 May	1913		9	59 03.78	151 43.98	CTD
124	4 May	1950	G084A	9	59 03.72	151 42.31	B
124	4 May	2034		8	59 01.09	151 47.06	CTD
124	4 May	2058	G085A	8	59 00.98	151 46.11	B
124	4 May	2150		7	58 57.02	151 48.02	CTD
124	4 May	2213	G086A	7	58 56.82	151 48.58	B
124	4 May	2259		6	58 52.59	151 49.93	CTD
124	4 May	2337		5	58 49.08	151 53.60	CTD
124	4 May	0012		4	58 46.09	151 56.12	CTD
125	5 May	0059		3	58 42.03	151 59.62	CTD
125	5 May	0113	G087A	3	58 42.06	151 59.47	B
125	5 May	0202		2	58 38.45	152 04.25	CTD
125	5 May	0216	G088A	2	58 38.48	152 03.91	B
125	5 May	0257		1	58 34.82	152 06.57	CTD

4.3 FOCI 3MF89 9–25 May 1989

Scientific party:	James Schumacher, Chief Scientist	NOAA/PMEL
	Richard Bates	NOAA/AFSC
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	Shailer Cummings	NOAA/AOML
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	Lew Incze	BLOS
	Nazila Merati	NOAA/AFSC
	Peter Ortner	NOAA/AOML
	Peter Proctor	NOAA/PMEL

The objectives of 3MF89 were to collect concomitant satellite and in situ physical and biological data, collect biological and physical data to estimate mortality of larvae, to examine biological and physical characteristics of Alaska Coastal Current and nearshore water, to collect CTD data at the moorings deployed in April 1989, and to collect biological and physical data to continue existing time series. All objectives except the collection of satellite data were completed successfully. Satellite images of sea surface temperature were not obtained until 3 hr prior to the end of operations due to overcast skies. Both biological and physical data were being collected at a location off Wide Bay during a time period when satellite images were made in the same area. Although this will not provide a definitive study of conditions within an eddy, it will provide concomitant data sets. A biological grid was occupied during the first phase of the cruise (Fig. 13). Bongo tows were conducted between Shelikof Strait proper and the Semidi Islands. Rough counts were made and the resulting distribution is shown in Figures 14 and 15. While occupying this grid, collections of CTD, nutrient, chlorophyll, net zooplankton, and microzooplankton were made on Line 8 (between columns 29 and 33) which continue the long-term time series of sampling. CTD data also were collected along CTD grid lines 16 and 17; estimates of transport from these data will give an indication of larval transport out of the grid. The close proximity between bongo stations (on column 23) and moored instruments (deployed on the previous cruise) was taken advantage of and CTD data was collected near the moorings. This provided data to estimate transport within the grid and to calibrate the moored temperature and conductivity sensors. At this time, operations were also conducted in the vicinity of Peggy and a moored current array was deployed. Upon completion (as determined by bongo tows with rough counts of less than 50 larvae) of the grid, the location for conducting extensive comparisons between the Alaska Coastal Current and nearshore waters was determined. While steaming to this location, a satellite-tracked buoy was deployed at station D19 in the midst of high numbers of larvae. This buoy's trajectory helped to determine the grid occupied during the following cruise, 4MF89.

Intensive operations were conducted during the following week on the section which is parallel to and just southwest of Column 21 of the FOCI 1989 biological grid (Figure 3). There were five stations on the section and diel stations were occupied within the section. The transect

was designed to see if biological and physical conditions differed across the sea valley in a way that might affect the growth and/or predation rates of larval pollock. Conductivity, temperature, fluorescence, underwater light, extracted chlorophylls, microzooplankton, larvae and net zooplankton were measured. Based on conditions sampled during the first transect, a diel station was established near either end of the line. The diel stations were sampled throughout the 24-hour periods to get daily feeding patterns of larvae and to compare feeding and growth (using larval otolith analysis) with food, temperature and other conditions. Sampling of physics and zooplankton every 2 hours will also provide a measure of short-term variability due to water moving past the study sites. Three transects and 2.5 diels were conducted. Observations of naupliar production rates were made at the two diel sites. A 1.2 MHz SONAR and the net camera were used to examine vertical distribution of zooplankton at all stations. During this phase of the cruise a three-speed backtrack for calibration of the ship's ADCP was also conducted.

During the last 2 days of the cruise, extensive gear comparisons were made and both CTD and ADCP data were collected. An L-backtrack was run for ADCP (Acoustic Doppler Current Profiler) calibration, and an ADCP section was run over moorings M21 to M29. The ADCP data sets will allow calibration of the ship's system and may permit fine scale resolution of the velocity field. The gear types were compared to determine the catch efficiency for various sizes of pollock larvae. During two trawls, the Methot net caught no pollock and was eliminated from further comparison. The remaining comparison was among bongo nets with 0.333 and 0.505 mm mesh and a 0.505 mm Tucker trawl. Preliminary results indicated that the Tucker was the most efficient so it was used on the following cruise for the late larval grid.

Several activities not included in the original cruise objectives were accomplished during 3MF89. An objective of the FOCI program during 1989 was to collect simultaneous over-the-water winds and upper ocean currents. This was done by deploying a meteorological buoy (Peggy) (Fig. 16) and attempting to deploy a nearby acoustic current profiler during FOCI 2MF89. The RDI current profiler failed, but was repaired and re-deployed near Peggy during 3MF89.

With guidance from Bob Clark of NMFS/Montlake, plankton samples were collected for possible examination of the impact of the oil spill in Prince William Sound (station locations and times given in Table 5). Mousse was frequently sighted in Shelikof Strait proper, but was rarely seen west of column 29 of the larval grid (Fig. 3). Although frequently seen, the mousse never covered more than 1% of the sea surface. Oil sheen was also seen frequently in the same region.

Calibration of the ship's ADCP, both by backtracking and by collecting observations in the vicinity of the moored current array, the comparison of Methot, Tucker and various size mesh bongo nets, and testing a repaired Loran-C buoy were three more operations that were successfully completed in addition to the original objectives (Fig. 17).

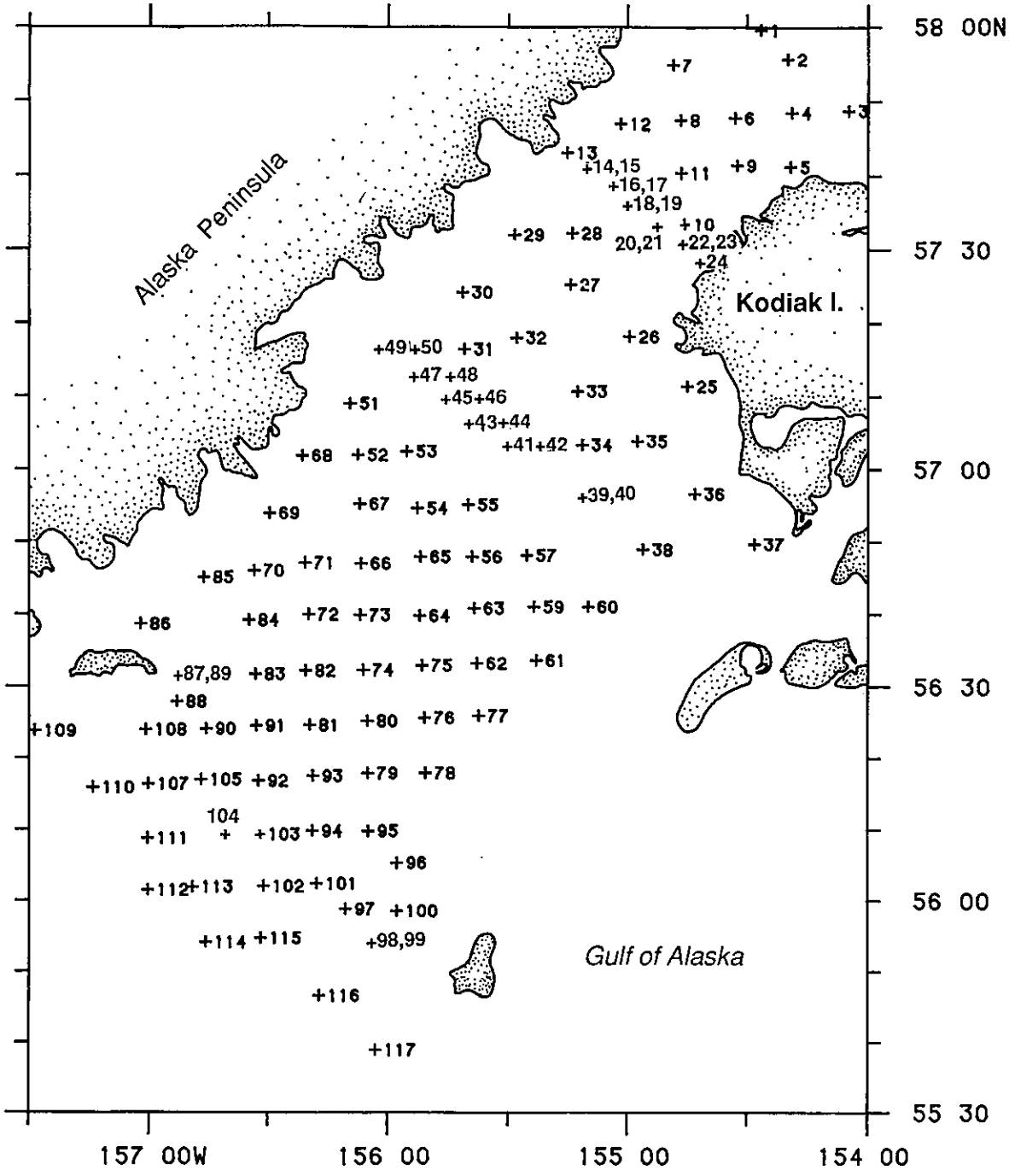

Figure 13. Bongo stations occupied during 3MF89, 9–25 May 1989.

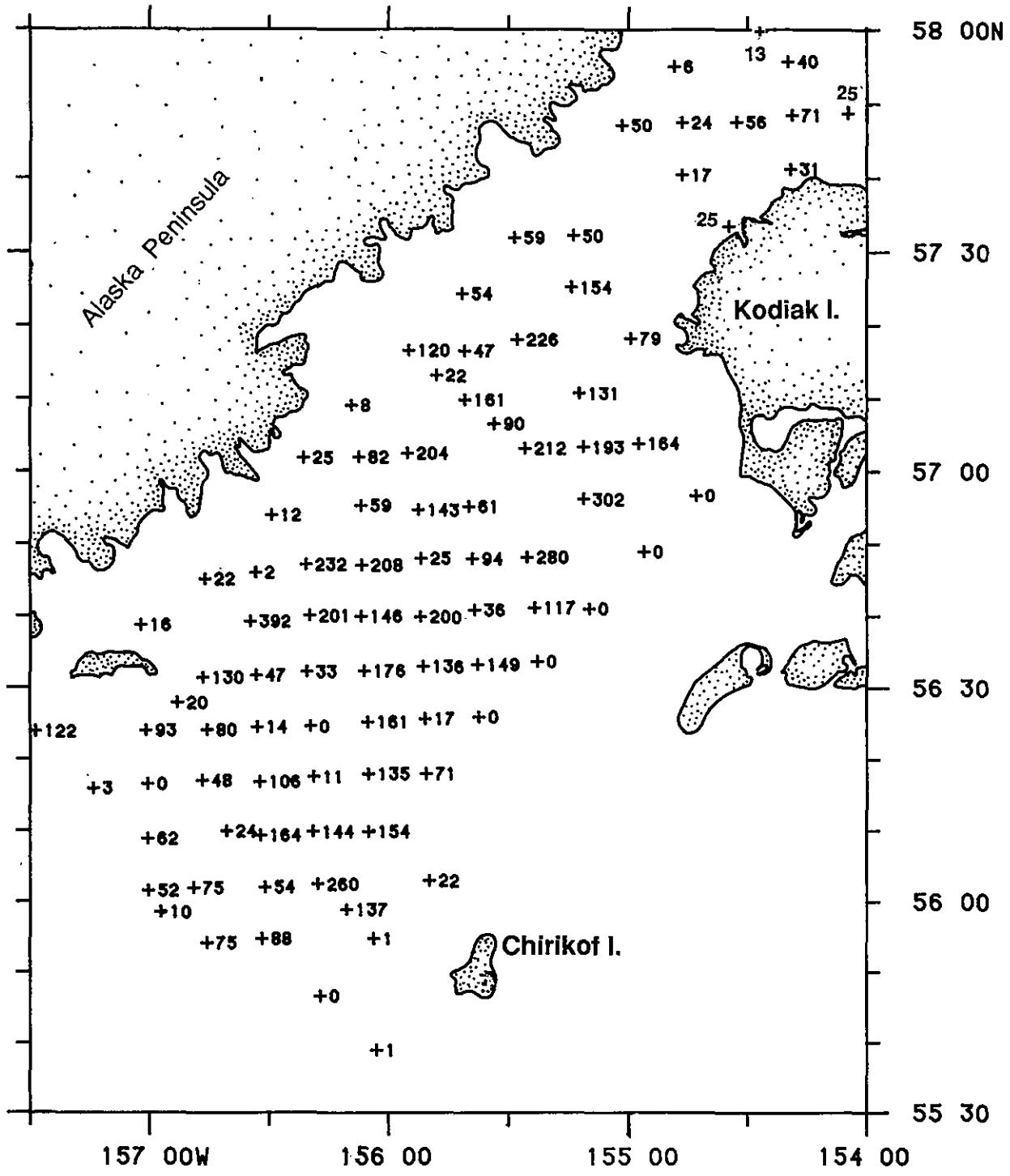

Figure 14. Larval rough counts (total estimated number of larvae caught) at individual bongo stations during 3MF89, 9–25 May 1989.

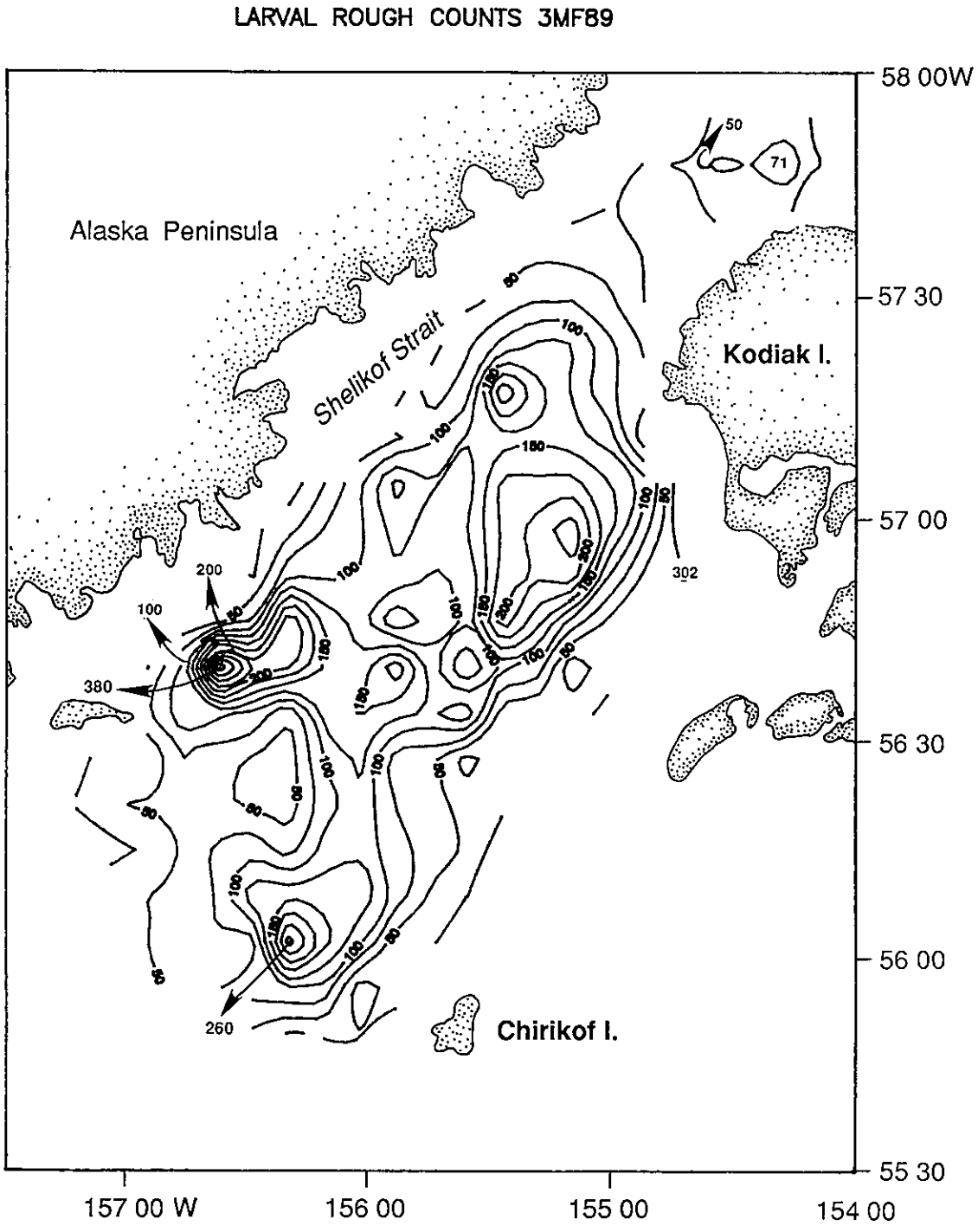

Figure 15. Contours of larval rough counts during 3MF89, 9–25 May 1989.

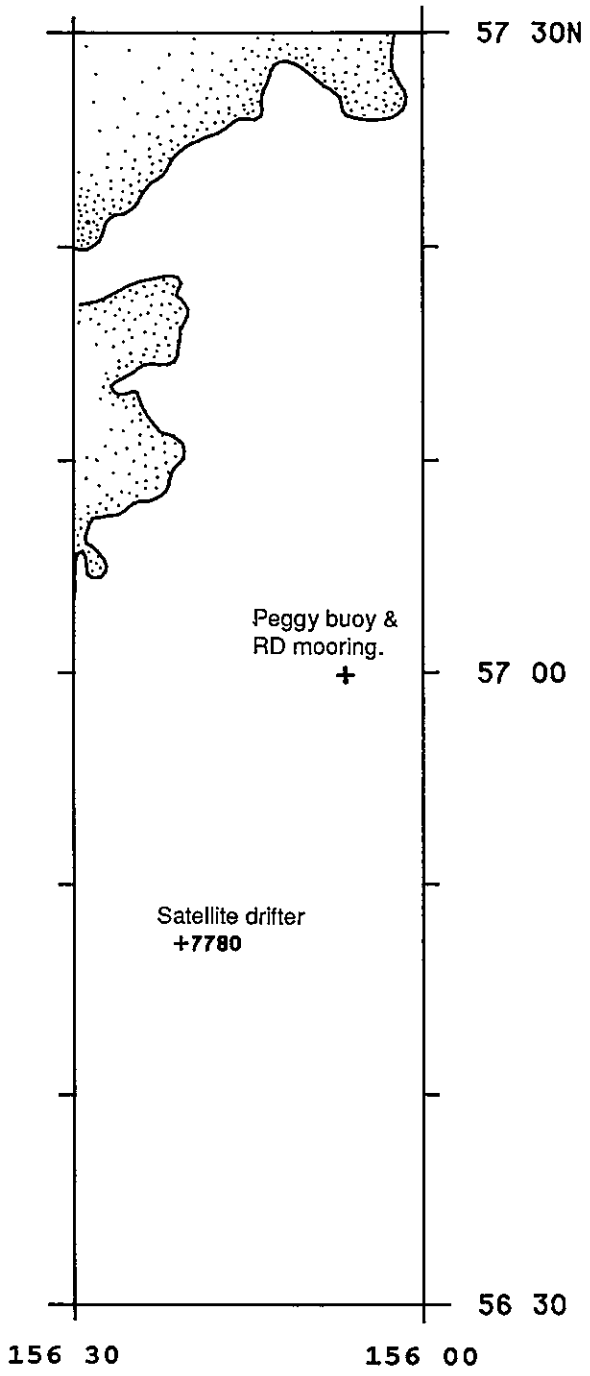

Figure 16. Deployment sites for the Peggy Meteorological Buoy, the RD mooring, and Satellite Drifter #7780 during 3MF89, 9–25 May 1989.

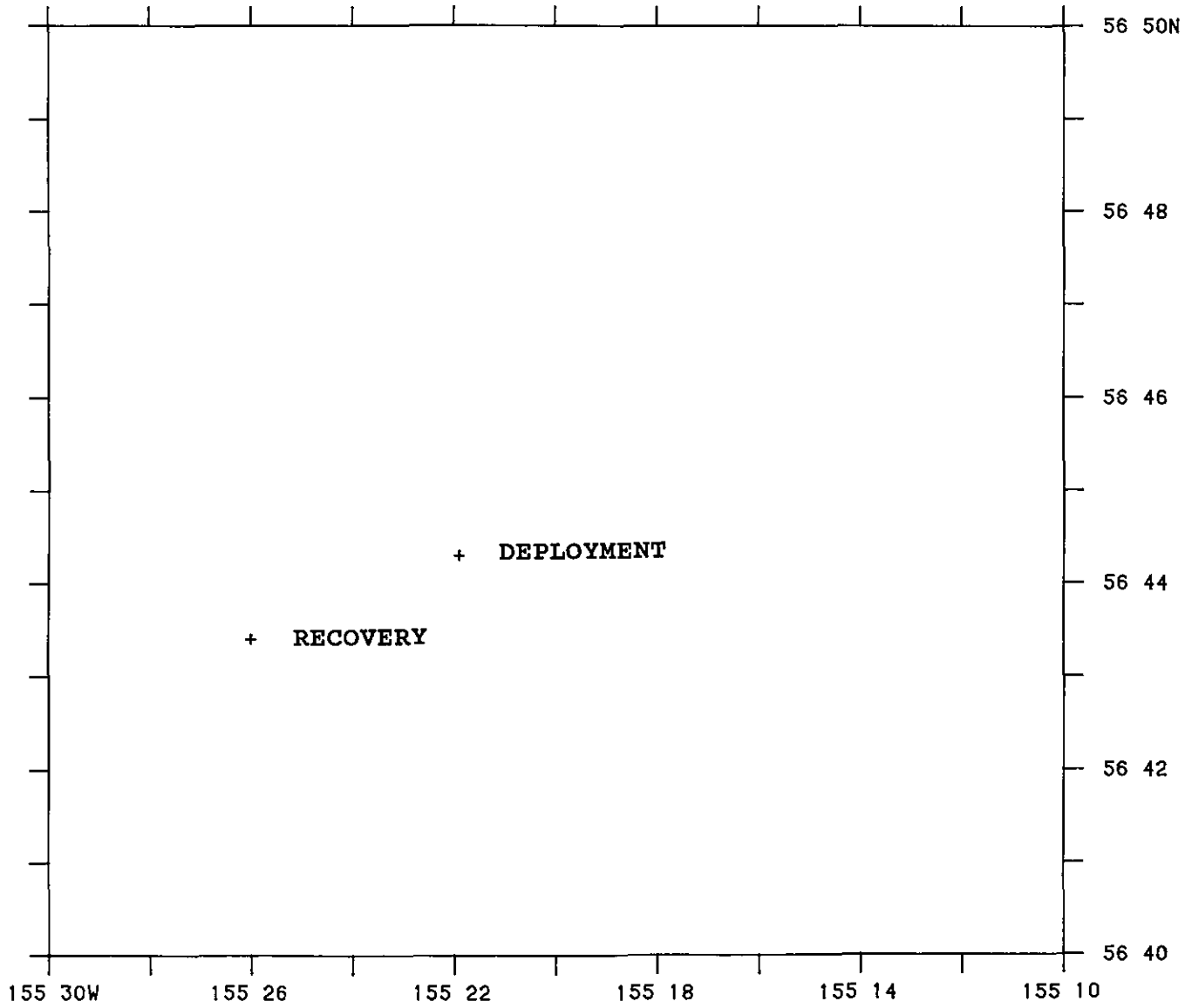

Figure 17. Loran-C drifter deployment on 23 May and recovery on 24 May during 3MF89.

TABLE 5. – OPERATIONS DURING FOCI CRUISE 3MF89, 9–25 MAY 1989.

B=60 CM (0.333 MM MESH) OBLIQUE BONGO TO MAX. DEPTH
Bb=60 CM (0.333 MM) AND 20 CM (0.153 MM) BONGOS TO MAX. DEPTH
SB=BONGO TO 100 M CTD=CONDUCTIVITY, TEMPERATURE, DEPTH
CMZ=CTD WITH MICROZOOPLANKTON T=TUCKER TRAWL (0.505 MM MESH)
CNC=CTD WITH NUTRIENTS AND CHLOROPHYLLS
VB=60 CM VERTICAL BONGO FOR LIVE COLLECTIONS (0.333 MM MESH)
HC=HYDROCARBONS F=FLORISTICS sCTD=CTD TO 100 M
VPS=VERTICAL PLANKTON SAMPLER CC=CAMERA CAST

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
129	9 May	1206	G001A	C37	57 59.77	154 26.64	SB,HC
129	9 May	1256	G002A	D37	57 55.72	154 19.86	SB,HC
129	9 May	1415	G003A	F37	57 48.72	154 04.81	SB,HC
129	9 May	1530	G004A	E36	57 48.48	154 18.89	SB
129	9 May	1633	G005A	F35	57 41.21	154 19.18	SB
129	9 May	1758	G006A	D35	57 47.60	154 32.93	SB
129	9 May	1824	G006A	D35	57 47.42	154 33.08	sCTD (09MAY1812.DAT)
129	9 May	1853	G006B	D35	57 47.75	154 33.02	SB
129	9 May	2017	G007A	B35	57 54.95	154 48.56	SB
129	9 May	2130	G008A	C34	57 47.48	154 46.66	SB
129	9 May	2251	G009A	E34	57 41.41	154 32.51	SB
129	9 May	2315	G009A	E34	57 41.33	154 32.42	sCTD (09MAY2258.DAT)
129	9 May	2339	G009A	E34	57 41.58	154 32.54	VPS
130	10 May	0031	G009A	E34	57 42.13	154 32.79	CC
130	10 May	0148	G010A	F33	57 33.54	154 34.96	sCTD (50 M; 10MAY0138.DAT)
130	10 May	0201	G010A	F33	57 33.49	154 34.80	SB (80 M)
130	10 May	0310	G011A	D33	57 40.40	154 46.59	SB
130	10 May	0435	G012A	B33	57 47.20	155 02.03	sCTD (10MAY0420.DAT)
130	10 May	0454	G012A	B33	57 47.05	155 01.80	B
130	10 May	0615	G013A	61	57 43.02	155 15.62	CNC
130	10 May	0651	G013A	61	57 43.11	155 15.75	CMZ (10MAY0633.DAT)
130	10 May	0712	G013A	61	57 43.10	155 15.83	Bb
130	10 May	0755	G013B	61	57 43.13	155 15.53	Bb
130	10 May	0853	G014A/5A	60	57 41.05	155 09.94	CNC (10MAY0839.DAT)
130	10 May	0935	G014A/5A	60	57 41.08	155 09.73	CMZ (10MAY0919.1MA)
130	10 May	1010	G014A/5A	60	57 41.03	155 09.73	CMZ (rep. 20 m MZ; no file)
130	10 May	1030	G014A	60	57 40.99	155 10.29	Bb

TABLE 5. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 3MF89, 9–25 MAY 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
130	10 May	1112	G015A	60	57 40.98	155 10.08	SB
130	10 May	1208	G016A/7A	59	57 38.53	155 04.05	CTD (10MAY1149.DAT)
130	10 May	1236	G016A	59	57 38.60	155 03.71	B
130	10 May	1314	G017A	59	57 38.27	155 03.94	SB
130	10 May	1358	No bongo	M2	57 36.81	155 05.84	CTD (10MAY1340.DAT)
130	10 May	1445	G018A/9A	58	57 36.34	155 00.48	CNC (10MAY1430.DAT)
130	10 May	1523	G018A/9A	58	57 36.46	155 00.78	CMZ (10MAY1504.DAT)
130	10 May	1545	G018A	58	57 36.19	155 01.02	Bb
130	10 May	1620	G019A	58	57 36.28	155 00.64	SB
130	10 May	1726	G020A/1A	57	57 33.13	154 52.64	CTD (10MAY1710.DAT)
130	10 May	1754	G020A	57	57 32.84	154 52.55	Bb
130	10 May	1825	G021A	57	57 33.02	154 52.20	SB
130	10 May	1916	G022A/3A	56	57 30.93	154 47.30	CNC (10MAY1904.DAT)
130	10 May	2004	G022A/3A	56	57 31.03	154 47.40	CMZ (10MAY1957.DAT)
130	10 May	2023	G022A/3A	56	57 30.92	154 47.12	Bb (problems)
130	10 May	2101	G022A/3A	56	57 31.03	154 47.00	Bb
130	10 May	2142	G022A/3A	56	57 30.93	154 47.02	SB
130	10 May	2230	G024A	55	57 28.52	154 41.97	CNC,MZ(50 M;10MAY2214.DAT)
130	10 May	2250	G024A	55	57 28.63	154 42.02	Bb
131	11 May	0110	G025A	H29	57 11.40	154 44.96	SB (90 M WIRE OUT)
131	11 May	0225	G026A	F29	57 18.21	154 59.47	SB, HC
131	11 May	0348	G027A	D29	57 25.21	155 14.36	SB, HC
131	11 May	0416	G027A	D29	57 25.15	155 13.97	sCTD (11 MAY0408.DAT)
131	11 May	0513	G028A	C30	57 32.23	155 13.98	SB
131	11 May	0623	G029A	B29	57 31.87	155 28.67	SB, HC
131	11 May	0649	G029A	B29	57 31.98	155 28.61	sCTD (11MAY0642.DAT)
131	11 May	0805	G030A	B27	57 24.25	155 41.49	SB
131	11 May	0927	G031A	C26	57 16.53	155 40.96	SB
131	11 May	1035	G032A	D27	57 17.97	155 28.07	SB
131	11 May	1202	G033A	F27	57 10.73	155 12.59	SB
131	11 May	1306	G034A	G26	57 03.28	155 11.43	SB
131	11 May	1410	G035A	H27	57 03.81	154 57.49	SB
131	11 May	1528	G036A	J27	56 56.64	154 43.06	SB (54 m wire out)
131	11 May	1637	G037A	L27	56 49.71	154 29.08	SB
131	11 May	1900	G038A	J25	56 48.91	154 56.10	SB
131	11 May	2023	G039A	H25	56 56.10	155 11.43	SB

TABLE 5. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 3MF89, 9–25 MAY 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
131	11 May	2052	G039A	H25	56 56.30	155 11.35	sCTD (11MAY2042.DAT)
131	11 May	2112	G040A	H25	56 56.15	155 11.36	Bb
131	11 May	2239	G041A	F25	57 03.06	155 26.01	SB
131	11 May	2310	G041A	F25	57 02.94	155 26.71	sCTD (11MAY2259.DAT)
131	11 May	2346	G042A	F25	57 03.35	155 25.86	Bb
132	12 May	0100	G043A	E25	57 06.54	155 33.58	SB
132	12 May	0133	G043A	E25	57 06.79	155 33.65	sCTD (12MAY0122.DAT)
132	12 May	0157	G044A	E25	57 06.68	155 33.38	B
132	12 May	0301	G045A	D25	57 09.78	155 40.96	SB
132	12 May	0327	G045A	D25	57 10.03	155 40.87	sCTD (12MAY0317.DAT)
132	12 May	0346	G046A	D25	57 09.83	155 40.76	B
132	12 May	0452	G047A	C25	57 13.11	155 48.05	SB
132	12 May	0518	G047A	C25	57 13.28	155 48.14	sCTD (12MAY0509.DAT)
132	12 May	0537	G048A	C25	57 13.03	155 48.19	B
132	12 May	0639	G049A	B25	57 16.48	155 54.98	SB
132	12 May	0705	G049A	B25	57 16.68	155 55.21	sCTD (12MAY0655.DAT)
132	12 May	0732	G050A	B25	57 16.75	155 54.88	B
132	12 May	0906	G051A	B23	57 08.95	156 09.36	SB
132	12 May	1010	G052A	C22	57 01.99	156 07.93	CTD (12MAY0953.DAT)
132	12 May	1023	G052A	C22	57 01.92	156 07.36	SB
132	12 May	1105	No bongo	M #21	57 03.77	156 04.42	CTD (12MAY1055.DAT)
132	12 May	1130	No bongo	M #22	57 02.72	156 02.46	CTD (12MAY1122.DAT)
132	12 May	1222	G053A	D23	57 02.40	155 55.30	SB
132	12 May	1315	No bongo	M #23	56 58.85	155 52.61	CTD (12MAY1259.DAT)
132	12 May	1407	G054A	E22	56 54.62	155 52.62	SB
132	12 May	1500	No bongo	PEG.	56 59.86	156 07.93	Mark on Peggy buoy
132	12 May	1641	No bongo	RD	56 59.77	156 05.75	Deployed 600 KHz RD ADCP
132	12 May	1920	No bongo	M #24	56 55.24	155 46.18	CTD (12MAY1904.DAT)
132	12 May	2003	G055A	F23	56 55.08	155 39.87	SB
132	12 May	2057	No bongo	M #25	56 52.30	155 40.30	CTD (12MAY2035.DAT)
132	12 May	2133	No bongo	M #28	56 50.98	155 37.54	CTD (12MAY2119.DAT)
132	12 May	2217	G056A	G22	56 47.92	155 38.87	SB
132	12 May	2323	G057A	H23	56 48.10	155 25.39	SB
133	13 May	0016	No bongo	M26/2	56 46.98	155 28.32	CTD (13MAY0000.DAT)
133	13 May	0106	G058A	M #29	56 44.15	155 22.18	CTD (13MAY0051.DAT)
133	13 May	0124	G058A	M #29	56 44.13	155 22.32	Vertical bongo (50 m wire out)

TABLE 5. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 3MF89, 9–25 MAY 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
133	13 May	0159	G059A	I22	56 41.05	155 23.64	SB
133	13 May	0308	G060A	J23	56 40.96	155 09.92	SB (90 m wire out)
133	13 May	0435	G061A	J21	56 33.62	155 23.00	SB,HC
133	13 May	0545	G062A	I20	56 33.18	155 37.65	SB
133	13 May	0613	G062A	I20	56 33.33	155 37.54	sCTD (13MAY0603.DAT)
133	13 May	0711	G063A	H21	56 40.75	155 38.35	SB
133	13 May	0827	G064A	G20	56 39.79	155 51.95	SB
133	13 May	0856	G064A	G20	56 39.73	155 51.95	sCTD (13MAY0843.DAT)
133	13 May	1008	G065A	F21	56 47.88	155 51.82	SB,HC
133	13 May	1127	G066A	E20	56 47.03	156 06.55	SB
133	13 May	1240	G067A	D21	56 55.16	156 06.85	SB
133	13 May	1313	G067A	D21	56 55.02	156 06.81	sCTD (13MAY1301.DAT)
133	13 May	1433	G068A	B21	57 01.84	156 21.30	SB,HC
133	13 May	1636	No bongo	PEG.	56 59.86	156 08.00	Mark on Peggy buoy
133	13 May	1802	G069A	B19	56 53.87	156 29.48	SB
133	13 May	1906	G070A	C18	56 46.04	156 33.36	SB
133	13 May	2010	G071A	D19	56 47.12	156 20.61	SB
133	13 May	2117	G072A	E18	56 39.98	156 19.72	SB
133	13 May	2238	G073A	F19	56 39.86	156 06.80	SB
133	13 May	2304	G073A	F19	56 40.16	156 06.82	sCTD (13MAY2257.DAT)
134	14 May	0009	G074A	G18	56 32.31	156 06.11	SB
134	14 May	0121	G075A	H19	56 32.91	155 51.44	SB
134	14 May	0231	G076A	I18	56 25.62	155 50.83	SB
134	14 May	0342	G077A	J19	56 25.91	155 37.33	SB
134	14 May	0512	G078A	J17	56 17.88	155 50.63	SB
134	14 May	0622	G079A	I16	56 17.85	156 04.97	SB
134	14 May	0737	G080A	H17	56 25.15	156 05.11	SB
134	14 May	0812	G080A	H17	56 25.11	156 05.08	sCTD (14MAY0758.DAT)
134	14 May	0917	G081A	G16	56 24.55	156 19.49	SB
134	14 May	1030	G082A	F17	56 32.20	156 20.52	SB
134	14 May	1133	G083A	E16	56 31.70	156 33.20	SB
134	14 May	1158	G083A	E16	56 31.67	156 33.21	sCTD (14MAY1149.DAT)
134	14 May	1301	G084A	D17	56 39.24	156 34.82	SB
134	14 May	1322	G084A	D17	56 39.16	156 34.61	sCTD (14MAY1309.DAT)
134	14 May	1448	G085A	B17	56 45.09	156 46.16	SB
134	14 May	1615	G086A	B15	56 38.73	157 02.23	SB,HC

TABLE 5. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 3MF89, 9–25 MAY 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
134	14 May	1750	G087A	D15	56 31.37	156 46.72	SB
134	14 May	1839	G088A	C14	56 27.85	156 53.13	SB
134	14 May	1952	G089A	D15	56 31.42	156 46.55	SB,HC
134	14 May	2051	G090A	E14	56 24.07	156 45.69	SB
134	14 May	2200	G091A	F15	56 24.48	156 33.03	SB,HC
134	14 May	2309	G092A	G14	56 16.84	156 32.35	SB
135	15 May	0018	G093A	H15	56 17.45	156 18.73	SB
135	15 May	0124	G094A	I14	56 09.80	156 18.79	SB
135	15 May	0232	G095A	J15	56 09.80	156 04.90	SB,HC
135	15 May	0337	G096A	K15	56 02.90	155 49.80	SB
135	15 May	0527	G097A	K13	55 58.79	156 10.50	SB
135	15 May	0621	G098A	L13	55 54.81	156 03.39	SB
135	15 May	0651	G099A	L13	55 54.71	156 03.77	SB (repeat)
135	15 May	0759	G100A	L14	55 58.53	156 57.33	SB (100 m wire out)
135	15 May	1053	G101A	J13	56 02.39	156 17.69	SB
135	15 May	1220	G102A	I12	56 02.02	156 31.10	SB
135	15 May	1333	G103A	H13	56 09.33	156 32.20	SB
135	15 May	1428	G104A	G12	56 09.91	156 40.72	SB
135	15 May	1450	G104A	G12	56 09.99	156 40.93	CTD (15MAY1436.DAT)
135	15 May	1619	G105A	F13	56 17.00	156 46.97	SB
135	15 May	1746	G106A	E12	56 16.52	157 00.52	SB
135	15 May	1817	G107A	E12	56 16.41	157 00.29	SB
135	15 May	1942	G108A	D13	56 24.01	157 00.86	SB
135	15 May	2209	G109A	B11	56 23.83	157 28.63	SB
135	15 May	2343	G110A	D11	56 15.94	157 14.06	SB,HC
136	16 May	0011	G110A	D11	56 15.84	157 13.85	CTD (16MAY0002.DAT)
136	16 May	0135	G111A	F11	56 08.78	157 00.43	SB
136	16 May	0241	G112A	G10	56 01.54	157 00.26	SB
136	16 May	0337	G113A	H11	56 01.89	156 49.14	SB,HC
136	16 May	0449	G114A	I10	55 54.09	156 45.71	SB
136	16 May	0609	G115A	J11	55 54.65	156 31.77	SB,HC
136	16 May	0801	G116A	L11	55 46.62	156 17.05	SB
136	16 May	0941	G117A	N11	55 38.88	156 03.04	SB
136	16 May	1234	No bongo	152	55 53.71	155 59.93	CTD (16MAY1219.DAT)
136	16 May	1354	No bongo	153	55 54.74	156 10.85	CTD (16MAY1341.DAT)
136	16 May	1443	No bongo	154	55 55.27	156 14.73	CTD (16MAY1432.DAT)

TABLE 5. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 3MF89, 9–25 MAY 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
136	16 May	1534	No bongo	155	55 55.85	156 20.73	CTD (16MAY1520.DAT)
136	16 May	1629	No bongo	156	55 56.45	156 25.91	CTD (16MAY1610.DAT)
136	16 May	1721	No bongo	157	55 57.37	156 30.77	CTD (16MAY1710.DAT)
136	16 May	1816	No bongo	158	55 58.07	156 37.78	CTD (16MAY1800.DAT)
136	16 May	2130	No bongo	147	56 17.90	156 48.05	CTD (16MAY2113.DAT)
136	16 May	2227	No bongo	148	56 21.58	156 51.75	CTD (16MAY2210.DAT)
136	16 May	2312	No bongo	149	56 24.06	156 54.91	CTD (16MAY2301.DAT)
137	17 May	0003	No bongo	M4	56 27.53	156 58.18	CTD (16MAY2355.DAT)
137	17 May	0041	No bongo	151	56 30.08	157 00.14	CTD (16MAY0032.DAT)
137	17 May	0332	No bongo, CTD		56 47.19	156 20.81	Deployed sat. buoy #7780
137	17 May	0450	PEG.		56 59.83	156 07.91	Mark on Peggy buoy
137	17 May	0526	No bongo	M21	57 03.79	156 04.87	CTD (17MAY0511.DAT)
137	17 May	0600	No bongo	M22	57 02.77	156 02.01	CTD (17MAY0547.DAT)
137	17 May	0702	No bongo	M23	56 58.58	155 52.68	CTD (17MAY0646.DAT)
137	17 May	0758	No bongo	M24	56 55.10	155 46.39	CTD (17MAY0741.DAT)
137	17 May	0854	No bongo	M25	56 52.54	155 40.51	CTD (17MAY0838.DAT)
137	17 May	0932	No bongo	M28	56 51.16	155 37.82	CTD (17MAY0921.DAT)
137	17 May	1037	No bongo	M26/2	56 47.04	155 28.50	CTD (17MAY1018.DAT)
137	17 May	1130	G118A	M29	56 43.98	155 22.25	CTD (17MAY1115.DAT)
137	17 May	1153	G118A	M29	56 43.73	155 22.03	Bongo (shrink. exp.), HC
137	17 May	1243	G119A	M29TO	56 40.10	155 29.13	Bongo (for shrink. exp.)
137	17 May	1306	G120A	M29TO	56 39.72	155 28.75	Bongo (for shrink. exp.)
137	17 May	1356	G121A	5	56 36.82	155 36.68	Bongo (for shrink. exp.)
137	17 May	1551	G122A	Z64	56 37.14	155 36.56	CNC (17MAY1536.DAT)
137	17 May	1625	G122A	Z64	56 36.86	155 36.95	CMZ (17MAY1618.DAT)
137	17 May	1650	G122A	Z64	56 37.23	155 36.16	VPS
137	17 May	1719	G122A	Z64	56 37.01	155 36.78	Bb
137	17 May	1841	G123A	Z65	56 42.19	155 47.43	CNC (17MAY1818.DAT)
137	17 May	1919	G123A	Z65	56 42.72	155 45.69	VPS
137	17 May	1959	G123A	Z65	56 42.06	155 48.12	CMZ (17MAY1935.DAT)
137	17 May	2019	G123A	Z65	56 42.03	155 47.60	SB
137	17 May	2148	G124A	Z66	56 47.35	155 59.29	CNC (17MAY2129.DAT)
137	17 May	2220	G124A	Z66	56 47.42	155 58.74	VPS
137	17 May	2248	G124A	Z66	56 47.39	155 59.43	CMZ (17MAY2236.DAT)
137	17 May	2310	G124A	Z66	56 47.35	155 59.20	SB
138	18 May	0025	G125A	Z67	56 52.86	156 09.92	CNC (18MAY0010.DAT)

TABLE 5. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 3MF89, 9–25 MAY 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
138	18 May	0114	G125A	Z67	56 53.02	156 09.97	VPS
138	18 May	0120	G125A	Z67	56 53.09	156 09.93	VPS
138	18 May	0131	G125A	Z67	56 53.21	156 09.90	VPS
138	18 May	0146	G125A	Z67	56 52.86	156 09.98	CMZ (18MAY0135.DAT)
138	18 May	0202	G125A	Z67	56 52.75	156 09.88	SB
138	18 May	0316	G126A	Z68	56 57.89	156 20.91	CNC (18MAY0304.DAT)
138	18 May	0335	G126A	Z68	56 58.15	156 20.82	VPS
138	18 May	0400	G126A	Z68	56 57.80	156 21.08	CMZ (18MAY0345.DAT)
138	18 May	0412	G126A	Z68	56 57.82	156 21.28	SB
138	18 May	0539	D001		56 55.08	156 16.17	Bongo for Nazi
138	18 May	0632	D001		56 55.14	156 16.18	Bongo for Nazi
138	18 May	0702	D001		56 55.51	156 15.59	Bongo for Nazi
138	18 May	0746	G127A	Z69	56 55.13	156 16.04	CTD (18MAY0728.DAT)
138	18 May	0807	G127A	Z69	56 55.33	156 15.73	Vertical bongo (70 m), HC
138	18 May	0939	G128A	Z70	56 55.33	156 16.20	CC10 (18MAY0925.DAT)
138	18 May	1013	G128A	Z70	56 55.52	156 15.76	Vertical bongo (60 m)
138	18 May	1126		Z70	56 56.07	156 16.05	CC
138	18 May	1209	G129A	Z71	56 55.31	156 15.71	CTD (18MAY1158.DAT)
138	18 May	1226	G129A	Z71	56 55.33	156 15.77	Vertical bongo (60 m)
138	18 May	1238	G130A	Z71	56 55.36	156 15.58	Vertical bongo (60 m)
138	18 May	1425	G131A	Z72	56 55.39	156 15.61	CTD (18MAY1410.DAT)
138	18 May	1450	G131A	Z72	56 55.35	156 15.78	Vertical bongo (60 m)
138	18 May	1500	G132A	Z72	56 55.40	156 15.49	Vertical bongo (60 m)
138	18 May	1519		Z73	56 55.29	156 15.65	CC10 (18MAY1506.DAT)
138	18 May	1642		Z73	56 55.44	156 16.10	CC
138	18 May	1730		Z73	56 55.18	156 16.06	Vertical bongo
138	18 May	1747		Z74	56 55.25	156 15.60	CTD (18MAY1734.DAT)
138	18 May	1805		Z74	56 55.28	156 15.78	Vertical bongo
138	18 May	1823		Z74	56 55.11	156 15.94	Bb
138	18 May	1912		Z74	56 55.36	156 15.57	Vertical bongo
138	18 May	2007		Z75	56 55.39	156 16.40	CTD (18MAY1950.DAT)
138	18 May	2024		Z75	56 55.42	156 16.02	Vertical bongo
138	18 May	2140		Z76	56 55.28	156 15.98	CMZ,C10 (18MAY2125.DAT)
138	18 May	2203		Z76	56 55.20	156 16.24	Vertical bongo
138	18 May	2242		Z76	56 55.42	156 15.96	CC
138	18 May	2329		Z76	56 55.18	156 16.23	B

TABLE 5. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 3MF89, 9–25 MAY 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
139	19 May	0012		Z77	56 55.35	156 15.95	CMZ (18MAY2356.DAT)
139	19 May	0031		Z77	56 55.33	156 15.88	Vertical bongo
139	19 May	0208		Z78	56 55.31	156 15.85	CTD (19MAY0157.DAT)
139	19 May	0232		Z78	56 55.28	156 15.84	Vertical bongo
139	19 May	0352		Z79	56 55.26	156 16.09	CC10 (19MAY0342.DAT)
139	19 May	0407		Z79	56 55.37	156 15.94	Vertical bongo
139	19 May	0447		Z79	56 55.38	156 15.97	CC
139	19 May	0540		Z80	56 55.21	156 16.18	CTD (19MAY0527.DAT)
139	19 May	0559		Z80	56 55.31	156 15.94	Vertical bongo
139	19 May	0739		Z81	56 55.33	156 15.84	CTD (19MAY0724.DAT)
139	19 May	0755		Z81	56 55.37	156 15.44	Vertical bongo
139	19 May	0825		Z81	56 55.27	156 15.90	SB
139	19 May	0910		Z81	56 55.29	156 15.70	Vertical bongo
139	19 May	0944		Z82	56 55.30	156 15.81	CNC10 (19MAY0931.DAT)
139	19 May	1010		Z82	56 55.34	156 15.83	Vertical bongo
139	19 May	1043		Z82	56 55.70	156 16.30	CC (doors failed to open)
139	19 May	1124		Z83	56 55.44	156 16.18	CTD (19MAY1109.DAT)
139	19 May	1138		Z83	56 55.45	156 16.18	Vertical bongo
139	19 May	1204			56 55.05	156 16.39	ADCP RDI Calibration Backtrack
139	19 May	1605		Z84	56 58.37	156 19.39	CC10 (19MAY1529.DAT)
139	19 May	1655		Z84	56 58.19	156 20.40	CC
139	19 May	1727		Z84	56 57.95	156 21.22	B
139	19 May	1748		Z84	56 57.96	156 21.27	Vertical bongo, HC
139	19 May	1858		Z85	56 53.36	156 11.00	CC10 (19MAY1827.DAT)
139	19 May	1938		Z85	56 52.88	156 10.06	CC
139	19 May	2019		Z85	56 52.97	156 09.97	SB
139	19 May	2138		Z86	56 48.07	155 59.93	CTD
139	19 May	2215		Z86	56 47.77	155 59.27	CC
139	19 May	2243		Z86	56 47.41	155 58.90	SB
139	19 May	2313		Z86	56 47.48	155 59.00	Vertical bongo, HC
140	20 May	0052		Z87	56 42.28	155 49.14	CTD (20MAY0039.DAT)
140	20 May	0131		Z87	56 42.18	155 48.13	CC
140	20 May	0205		Z87	56 42.06	155 47.48	SB
140	20 May	0311		Z88	56 37.15	155 38.12	CTD (20MAY0252.DAT)
140	20 May	0355		Z88	56 37.06	155 37.36	CC
140	20 May	0432		Z88	56 36.87	155 36.95	Bb

TABLE 5. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 3MF89, 9–25 MAY 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
140	20 May	0539		Z88	56 37.14	155 37.71	CC
140	20 May	0743		Z89	56 43.64	155 49.95	CTD (20MAY0728.DAT)
140	20 May	0811		Z89	56 43.66	155 50.15	Vertical bongo
140	20 May	0856		Z89	56 43.73	155 49.38	Vertical bongo
140	20 May	0943		Z90	56 43.50	155 50.20	CTD (20MAY0928.DAT)
140	20 May	0958		Z90	56 43.50	155 50.12	Vertical bongo
140	20 May	1117		Z90	56 43.05	155 50.05	CC
140	20 May	1200		Z91	56 43.34	155 50.25	CTD (20MAY1145.DAT)
140	20 May	1218		Z91	56 43.50	155 50.47	Vertical bongo
140	20 May	1302		Z91	56 43.44	155 50.27	Vertical bongo
140	20 May	1405			56 43.55	155 50.29	Vertical bongo
140	20 May	1427		Z92	56 43.41	155 50.19	CTD (20 MAY1408.DAT)
140	20 May	1451		Z92	56 43.37	155 50.19	Vertical bongo
140	20 May	1522		Z93	56 43.38	155 51.26	CTD (20MAY1507.DAT)
140	20 May	1614		Z93	56 43.59	155 50.01	CC
140	20 May	1640		Z93	56 43.23	155 50.02	Vertical bongo
140	20 May	1705		Z93	56 43.43	155 50.24	Vertical bongo
140	20 May	1728		Z94	56 43.52	155 50.26	CTD (20MAY1709.DAT)
140	20 May	1750		Z94	56 43.50	155 50.11	Vertical bongo
140	20 May	1809		Z94	56 43.28	155 50.48	Bb
140	20 May	1906		Z94	56 43.53	155 50.20	Vertical bongo
140	20 May	2013		Z95	56 43.45	155 50.25	CTD (20MAY1955.DAT)
140	20 May	2032		Z95	56 43.54	155 50.38	Vertical bongo
140	20 May	2101		Z95	56 43.51	155 50.42	Vertical bongo
140	20 May	2144		Z96	56 43.38	155 50.07	CTD (20MAY2126.DAT)
140	20 May	2207		Z96	56 43.52	155 49.39	Vertical bongo
140	20 May	2243		Z96	56 43.38	155 50.48	CC
141	21 May	0011		Z97	56 43.53	155 50.23	CTD (20MAY2359.DAT)
141	21 May	0033		Z97	56 43.47	155 50.29	Vertical bongo (60 m wire out)
141	21 May	0212		Z98	56 43.57	155 50.14	CTD (21MAY0159.DAT)
141	21 May	0230		Z98	56 43.49	155 50.30	Vertical bongo (60 m wire out)
141	21 May	0401		Z99	56 43.54	155 50.12	CTD (21MAY0349.DAT)
141	21 May	0423		Z99	56 43.73	155 49.84	Vertical bongo
141	21 May	0458		Z99	56 43.77	155 50.99	CC
141	21 May	0541		Z100	56 43.40	155 50.35	CTD (21MAY0528.DAT)
141	21 May	0559		Z100	56 43.57	155 50.02	Vertical bongo

TABLE 5. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 3MF89, 9–25 MAY 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
141	21 May	0641		Z100	56 43.36	155 50.34	Vertical bongo
141	21 May	0744		Z101	56 43.72	155 49.84	CTD (21MAY0725.DAT)
141	21 May	0810		Z101	56 43.53	155 50.34	Vertical bongo
141	21 May	0909		Z101	56 43.52	155 50.07	SB
141	21 May	1003		Z101	56 43.55	155 50.34	SB
141	21 May	1025		Z102	56 43.54	155 50.07	CTD (21MAY1012.DAT)
141	21 May	1106		Z102	56 43.94	155 50.62	CC
141	21 May	1211		Z103	56 43.60	155 50.22	CTD (21MAY1156.DAT)
141	21 May	1228		Z103	56 43.69	155 49.94	Vertical bongo
141	21 May	1540		Z104	56 37.80	155 36.22	CTD (21MAY1520.DAT)
141	21 May	1638		Z104	56 37.25	155 35.87	CC
141	21 May	1713		Z104	56 36.86	155 36.70	CMZ (21MAY1659.DAT)
141	21 May	1729		Z104	56 36.73	155 37.02	Bb
141	21 May	1845		Z105	56 41.51	155 46.97	CNCF (21MAY1828.DAT)
141	21 May	1926		Z105	56 41.72	155 47.14	CC
141	21 May	2002		Z105	56 42.41	155 46.91	CMZF (21MAY1943.DAT)
141	21 May	2026		Z105	56 42.24	155 47.65	SB
141	21 May	2147		Z106	56 46.81	155 59.10	CNC (21MAY2130.DAT)
141	21 May	2233		Z106	56 47.23	155 58.44	CC
141	21 May	2303		Z106	56 47.52	155 59.08	CMZ (21MAY2245.DAT)
141	21 May	2326		Z106	56 47.49	155 58.96	SB
142	22 May	0046		Z107	56 52.35	156 08.31	CNCF (22MAY0035.DAT)
142	22 May	0130		Z107	56 52.37	156 09.30	CC
142	22 May	0200		Z107	56 52.82	156 09.76	CMZ (22MAY0148.DAT)
142	22 May	0219		Z107	56 52.72	156 10.15	SB
142	22 May	0333		Z108	56 58.18	156 19.34	CNC (22MAY0326.DAT)
142	22 May	0408		Z108	56 57.94	156 19.98	CC
142	22 May	0430		Z108B	56 57.22	156 20.68	CMZ (22MAY0422.DAT)
142	22 May	0442		Z108	56 57.74	156 20.75	Bb
142	22 May	0738		Z109	56 43.63	155 49.93	CTD (22MAY0707.DAT)
142	22 May	0803		Z109	56 43.57	155 50.20	SB
142	22 May	0903		Z109	56 43.47	155 49.67	Vertical bongo (60 m wire out)
142	22 May	0941		Z110	56 43.76	155 50.03	CTD (22MAY0927.DAT)
142	22 May	1003		Z110	56 43.52	155 50.34	Vertical bongo (60 m wire out)
142	22 May	1036		Z110	56 43.52	155 49.41	CC
142	22 May	1125		Z110	56 43.59	155 50.11	Vertical bongo (60 m wire out)

TABLE 5. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 3MF89, 9–25 MAY 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
142	22 May	1209		Z111	56 43.42	155 50.40	CTD (22MAY1156.DAT)
142	22 May	1226		Z111	56 43.47	155 50.40	Vertical bongo (60 m wire out)
142	22 May	1348		Z111	56 43.50	155 50.35	Vertical bongo (60 m wire out)
142	22 May	1427		Z112	56 43.40	155 50.30	CTD (22MAY1410.DAT)
142	22 May	1445		Z112	56 43.46	155 50.52	Vertical bongo (60 m wire out)
142	22 May	1522		Z113	56 43.30	155 50.27	CTD (22MAY1510.DAT)
142	22 May	1539		Z113	56 43.20	155 49.91	Vertical bongo (60 m wire out)
142	22 May	1616		Z113	56 43.47	155 49.35	CC
142	22 May	1643		Z113	56 43.56	155 50.42	Vertical bongo
142	22 May	1713		Z114	56 43.34	155 50.07	CTD (22MAY1658.DAT)
142	22 May	1805		Z114	56 43.42	155 50.45	Vertical bongo
142	22 May	1822		Z114	56 43.39	155 50.72	Bb
142	22 May	2013		Z115	56 43.82	155 50.23	CTD (22MAY1945.DAT)
142	22 May	2045		Z115A	56 43.73	155 50.28	Vertical bongo
142	22 May	2115		Z115A	56 43.54	155 50.49	Vertical bongo
142	22 May	2144		Z116	56 43.64	155 50.20	CTD (22MAY2124.DAT)
142	22 May	2203		Z116A	56 43.70	155 49.94	Vertical bongo
142	22 May	2235		Z116	56 43.71	155 49.62	CC
142	22 May	2348		Z117	56 43.47	155 50.31	Vertical bongo
143	23 May	0010		Z117	56 43.58	155 50.18	CTD (22MAY2356.DAT)
143	23 May	0105		Z117A	56 43.44	155 50.28	Vertical bongo
143	23 May	0203		Z118	56 43.47	155 50.37	Vertical bongo
143	23 May	0224		Z118	56 43.42	155 50.18	CTD (23MAY0211.DAT)
143	23 May	0357		Z119	56 43.59	155 50.19	CTD (23MAY0342.DAT)
143	23 May	0424		Z119	56 43.53	155 50.07	Vertical bongo
143	23 May	0458		Z119	56 43.01	155 50.24	CC
143	23 May	0524	C001A		56 43.65	155 50.24	Tucker
143	23 May	0548	C001A		56 43.62	155 50.19	Tucker
143	23 May	0626	C001A		56 43.68	155 50.39	Methot
143	23 May	0653	C001A		56 43.75	155 50.50	Methot
143	23 May	0908		PEG.	56 59.94	156 07.69	Mark on Peggy buoy
143	23 May	0948		M21	57 03.89	156 05.05	CTD (23MAY0938.DAT)
143	23 May	1016		M21	57 04.00	156 04.52	VPS
143	23 May	1058		M22	57 02.97	156 02.41	CTD (23MAY1042.DAT)
143	23 May	1125		M22	57 03.26	156 01.79	VPS
143	23 May	1236		M23	56 58.65	155 52.76	CTD (23MAY1218.DAT)

TABLE 5. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 3MF89, 9–25 MAY 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
143	23 May	1300		M23	56 58.66	155 52.68	VPS
143	23 May	1358		M24	56 55.25	155 46.48	CTD (23MAY1341.DAT)
143	23 May	1423		M24	56 55.11	155 46.39	VPS
143	23 May	1517		M25	56 52.47	155 40.59	CTD (23MAY1458.DAT)
143	23 May	1545		M25	56 52.22	155 40.32	VPS
143	23 May	1626		M28	56 51.17	155 37.45	CTD (23MAY1610.DAT)
143	23 May	1648		M28	56 50.97	155 37.07	VPS
143	23 May	1751		M26/2	56 46.86	155 28.53	CTD (23MAY1733.DAT)
143	23 May	1814		M26/2	56 46.60	155 28.25	VPS
143	23 May	1912		M29	56 44.14	155 22.29	CTD (23MAY1856.DAT)
143	23 May	1932		M29	56 43.96	155 21.97	VPS
143	23 May	2012	C002A		56 44.33	155 22.06	Tucker
143	23 May	2045		BUOY	56 44.34	155 21.90	Deployed Loran-C drifter buoy
143	23 May	2102	C002A		56 44.34	155 22.58	Tucker
143	23 May	2150	C002A		56 44.02	155 22.86	Tucker
143	23 May	2217	C002A		56 44.08	155 22.98	Tucker
143	23 May	2257	C002A		56 44.37	155 22.79	Bongo 0.333 mm
143	23 May	2331	C002A		56 44.40	155 23.00	Bongo 0.333 mm
144	24 May	0005	C002A		56 44.36	155 23.05	Bongo 0.333 mm
144	24 May	0101	C002A		56 44.26	155 23.95	Bongo 0.333 mm
144	24 May	0153	C002A		56 44.08	155 24.65	Bongo 0.505 mm
144	24 May	0226	C002A		56 43.94	155 25.16	Bongo 0.505 mm
144	24 May	0257	C002A		56 43.78	155 25.39	Bongo 0.505 mm
144	24 May	0322	C002A		56 43.64	155 25.64	Bongo 0.505 mm
144	24 May	0358		BUOY	56 43.42	155 26.02	Recovered Loran-C drifter buoy
144	24 May	0419		RDI	56 43.74	155 25.29	Began RDI "L" Transect
144	24 May	0553		RDI	56 42.11	155 27.36	Completed RDI "L" Transect
144	24 May	0728	C003A		56 43.63	155 26.17	Bongo 0.505 mm
144	24 May	0759	C003A		56 43.48	155 26.59	Bongo 0.505 mm
144	24 May	0829	C003A		56 43.53	155 26.44	Bongo 0.505 mm
144	24 May	0900	C003A		56 43.44	155 26.31	Bongo 0.333 mm
144	24 May	0946	C003A		56 43.35	155 26.70	Bongo 0.333 mm
144	24 May	1019	C003A		56 43.47	155 26.45	Bongo 0.333 mm
144	24 May	1052	C003A		56 43.58	155 26.53	Tucker
144	24 May	1117	C003A		56 43.54	155 26.27	Tucker
144	24 May	1145	C003A		56 43.44	155 26.24	Tucker

TABLE 5. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 3MF89, 9–25 MAY 1989.

GMT Date JD		GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
144	24 May	1231		RDI	56 44.11	155 22.41	Began RDI Transect
144	24 May	1623		RDI	56 03.21	156 06.77	Completed RDI "L" Transect
144	24 May	1648		M21	56 03.67	156 04.95	CTD (24MAY1625.DAT)
144	24 May	1722		M22	56 02.63	156 02.12	CTD (24MAY1705.DAT)
144	24 May	1822		M23	56 58.73	155 53.05	CTD (24MAY1805.DAT)
144	24 May	1923		M24	56 55.13	155 46.50	CTD (24MAY1902.DAT)
144	24 May	2010		M25	56 52.63	155 40.79	CTD (24MAY1954.DAT)
144	24 May	2048		M28	56 51.10	155 37.69	CTD (24MAY2032.DAT)
144	24 May	2148		M26/2	56 46.78	155 28.94	CTD (24MAY2137.DAT)
144	24 May	2234		M29	56 44.02	155 22.31	CTD (24MAY2222.DAT)

4.4 FOCI 4MF89 28 May–June 6, 1989

Scientific party:	Sarah Hinckley, Chief Scientist	NOAA/AFSC
	Dave Kachel	NOAA/PMEL
	Art Kendall	NOAA/AFSC
	Nazila Merati	NOAA/AFSC
	Tim Mulligan	NOAA/AFSC, UW/FRI
	Dave Savage	NOAA/AFSC
	Mary Yoklavich	NOAA/AFSC

4MF89, the last FOCI cruise of the FY 1989 field season, was conducted aboard the NOAA Ship *Miller Freeman* from May 28 to June 6, 1989. The main objective of this cruise was to conduct the third larval survey (of the FOCI 1989 field season) of the area between Shelikof Strait and the Semidi Islands. The purpose of these surveys is to estimate abundance and mortality rates of larval pollock resulting from the Shelikof Strait spawning, to collect biological specimens for growth and nutrition studies, and to collect concomitant physical oceanographic data.

The larval survey of the region from FOCI line 8 to west of the Semidi Islands (larval grid lines 6 through 31, Fig. 3) was successfully completed (Fig. 18). A 1 m Tucker trawl was chosen as the primary gear based on the results of FOCI 2MF89 and 3MF89 gear comparison tests. This trawl was used at each station. Rough counts of pollock larvae were made at each station. The resulting distribution is shown in Figures 19 and 20. Biological samples for age and growth studies, studies of nutritional condition and shrinkage were collected. Plankton samples for hydrocarbon analysis were collected at 19 stations. During the occupation of this grid, CTD casts were done at FOCI line 8, and line 12 (moorings 21–29). Opportunistic CTD and XBT casts were made at stations where frozen samples (for RNA/DNA analysis) were taken. Positions of the two satellite-tracked drifters (#80 and #81) were obtained several times during the cruise, and compared with the larval distribution.

A set of eight gear comparison tows was made at one station (K12). This set consisted of two nighttime and two daytime Tucker trawls (0.505 mm mesh) and two nighttime and two daytime bongo tows (0.505 mm mesh).

The Loran-C drifter buoys (3) were deployed twice during this cruise, once on May 30–31 near FOCI line 12 during the larval survey, and again on June 6, after the PEGGY buoy was retrieved. Despite intermittent problems, two useful data sets were obtained.

The weather buoy, Peggy 2, was retrieved after the completion of the larval grid, as information was received that it was again drifting.

Because of the loss of approximately 12 hours due to weather, there was not enough time for the planned midwater trawling.

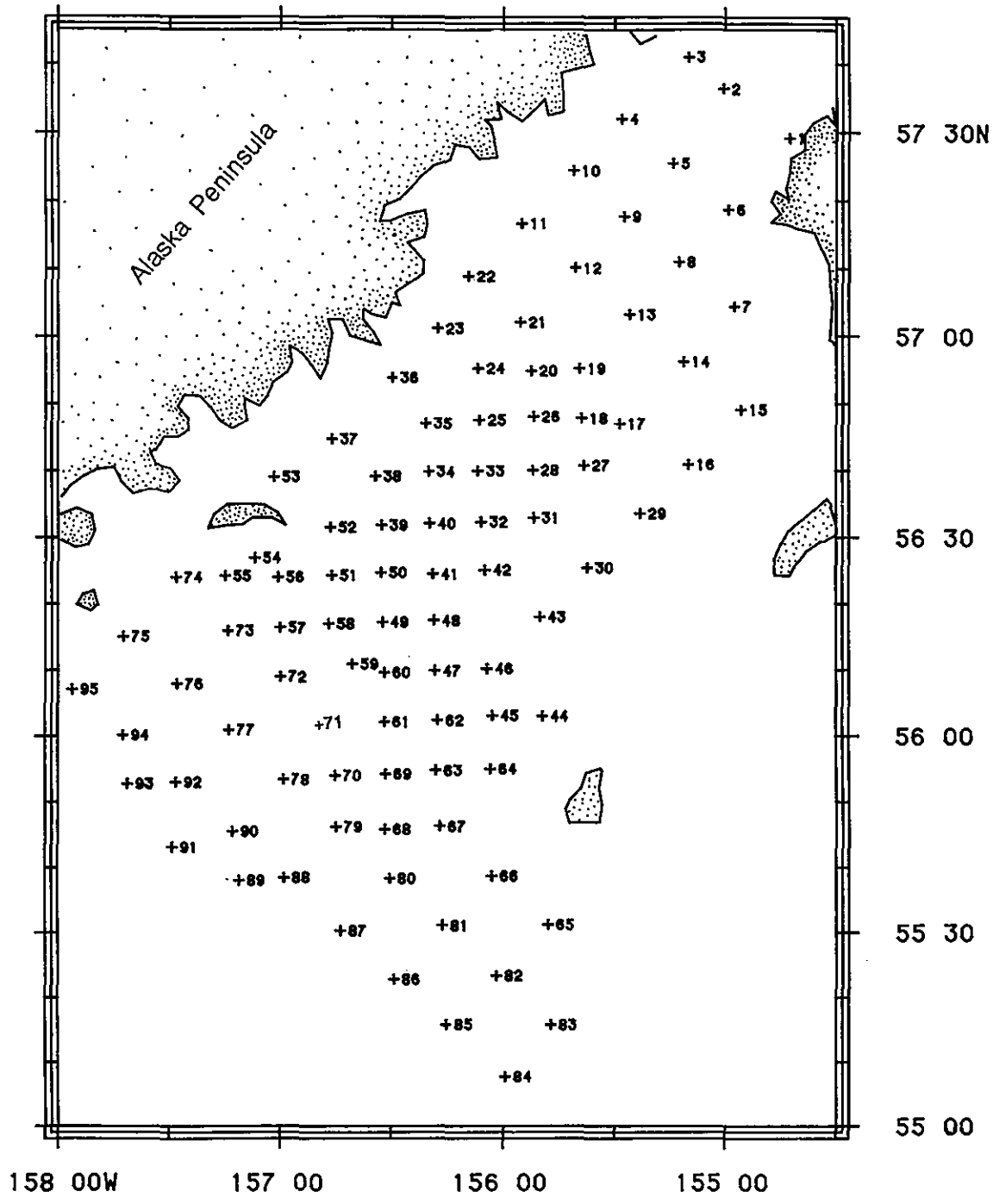

Figure 18. Tucker trawl stations occupied during 4MF89, 28 May–6 June 1989.

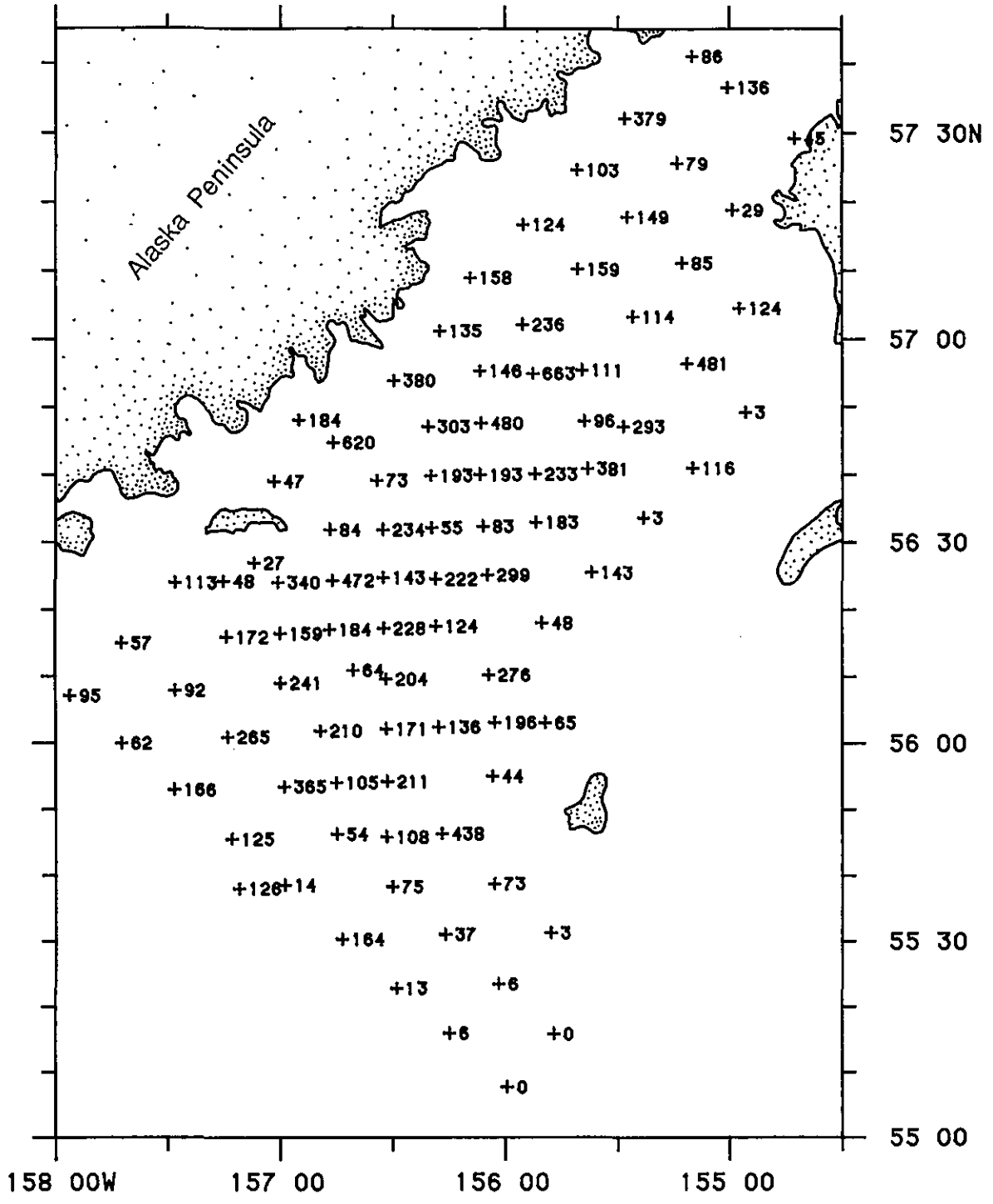

Figure 19. Larval rough counts (total estimated number of larvae caught) at individual Tucker trawl stations during 4MF89, 28 May–6 June 1989.

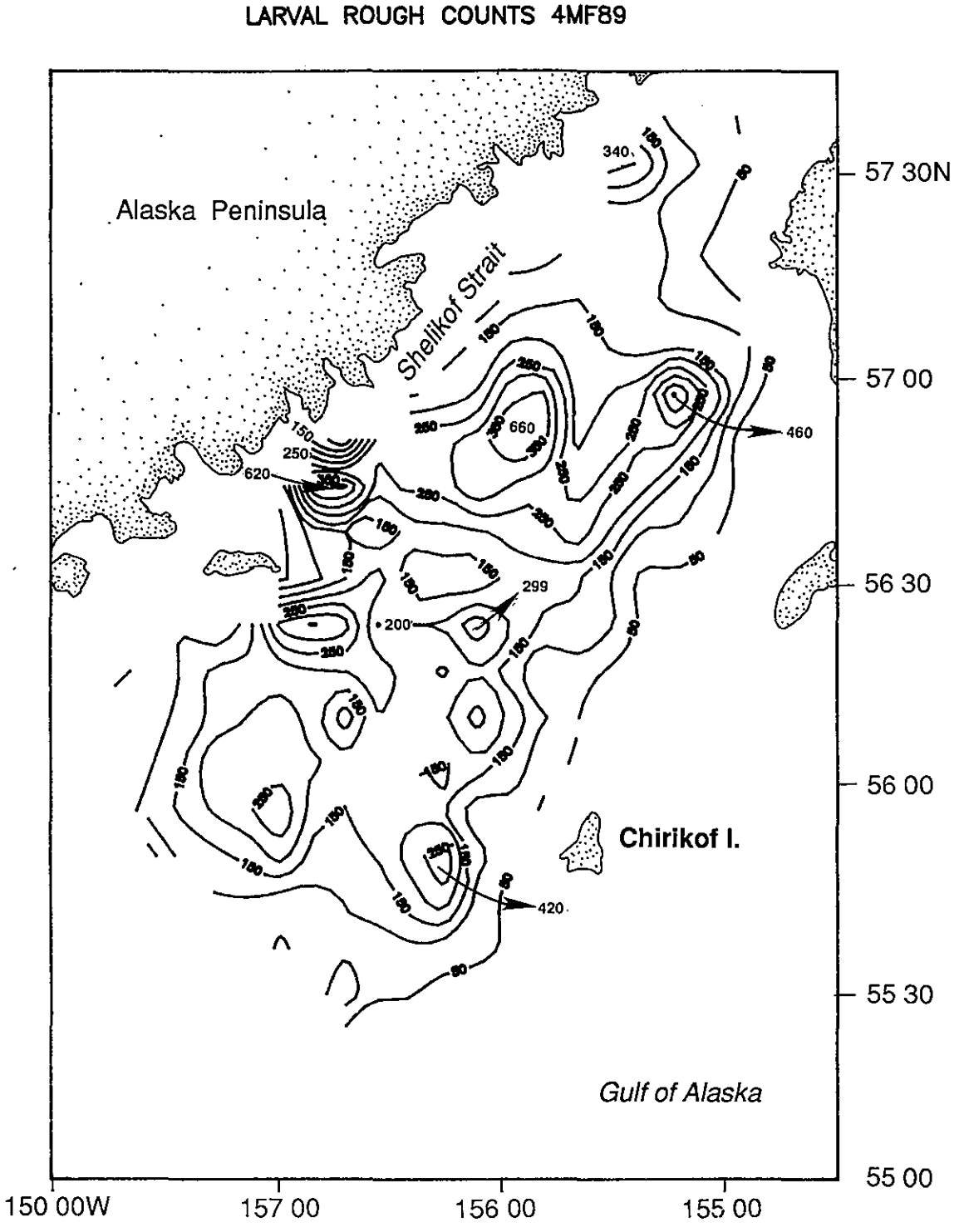

Figure 20. Contours of larval rough counts during 4MF89, 28 May–6 June 1989.

TABLE 6. – OPERATIONS DURING FOCI CRUISE 4MF89, 28 MAY – 6 JUNE 1989.

B=60 CM OBLIQUE BONGO (0.505 MM. MESH UNLESS OTHERWISE NOTED)
TUCKER=TUCKER TRAWL (0.505 MM MESH) CTD=CONDUCTIVITY,TEMPERATURE,DEPTH
XBT=EXPENDABLE BATHYTHERMOGRAPH LORAN-C= RETRIEVABLE L.C. DRIFTERS
LIVE BONGO=60 CM BONGO (0.505 MM. MESH) FISHED VERTICALLY

GMT Date JD	GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
149 29 May	1541	G001A	F31	57 29.20	154 42.75	Tucker
149 29 May	1612		55	57 29.35	154 42.43	CTD
149 29 May	1653		56	57 30.90	154 46.79	CTD
149 29 May	1743		57	57 33.04	154 52.55	CTD
149 29 May	1827	G002A	D31	57 36.45	155 00.62	Tucker
149 29 May	1854		58	57 36.32	155 00.86	CTD
149 29 May	1938		59	57 38.44	155 04.17	CTD
149 29 May	2021	G003A	B31	57 41.04	155 10.04	Tucker
149 29 May	2051		60	57 40.89	155 09.54	CTD
149 29 May	2119			57 41.60	155 12.09	SEAS XBT
149 29 May	2151		61	57 42.91	155 15.52	CTD
149 29 May	2325	G004A	B29	57 32.01	155 28.34	Tucker
150 30 May	0058	G005A	D29	57 25.53	155 14.21	Tucker
150 30 May	0230	G006A	F29	57 18.67	154 59.15	Tucker
150 30 May	0419	G007A	H27	57 04.37	154 57.49	Tucker
150 30 May	0452		H27	57 04.31	154 57.54	CTD
150 30 May	0609	G008A	F27	57 10.98	155 12.70	Tucker
150 30 May	0715			57 16.32	155 24.43	SEAS XBT
150 30 May	0739	G009A	D27	57 17.71	155 27.49	Tucker
150 30 May	0805		D27	57 17.61	155 26.91	CTD
150 30 May	0921	G010A	B27	57 24.45	155 41.14	Tucker
150 30 May	1044	G011A	B25	57 16.55	155 55.25	Tucker
150 30 May	1208	G012A	D25	57 10.06	155 40.79	Tucker
150 30 May	1235		D25	57 10.03	155 40.97	CTD
150 30 May	1357	G013A	F25	57 03.22	155 26.01	Tucker
150 30 May	1422		F25	57 03.07	155 26.22	CTD
150 30 May	1537	G014A	H25	56 56.25	155 11.36	Tucker,XBT
150 30 May	1613			56 52.72	155 10.92	SEAS XBT
150 30 May	1723	G015A	J25	56 49.06	154 55.91	Tucker
150 30 May	1845	G016A	J23	56 40.89	155 09.93	Tucker
150 30 May	1908		J23	56 40.87	155 10.30	CTD

TABLE 6. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 4MF89, 28 MAY – 6 JUNE 1989.

GMT Date JD	GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
150 30 May	2008		M29	56 44.25	155 22.42	CTD
150 30 May	2057	G017A	H23	56 47.04	155 28.61	Tucker
150 30 May	2124	Moor. 27/27–H23		56 46.72	155 28.46	CTD
150 30 May	2220	G018A	G22	56 47.82	155 39.12	Tucker
150 30 May	2309	Mooring 28		56 51.05	155 38.03	CTD
150 30 May	2327	Mooring 28		56 50.81	155 38.33	Deploy Loran–C #3
150 30 May	2355	Mooring 25		56 52.57	155 40.63	CTD
150 30 May	0017	Mooring 25		56 52.48	155 41.07	Deploy Loran–C #2
151 31 May	0037			56 52.70	155 37.17	Deploy Loran–C #1
151 31 May	0114	G019A	F23	56 55.25	155 39.65	Tucker
151 31 May	0209	Mooring 24		56 55.40	155 46.41	CTD
151 31 May	0249	G020A	E22	56 54.83	155 52.74	Tucker
151 31 May	0335	Mooring 23		56 59.01	155 52.70	CTD
151 31 May	0418			56 55.52	155 44.13	SEAS XBT
151 31 May	0505			56 50.98	155 37.50	Retrieve Loran–C #1
151 31 May	0539			56 50.48	155 40.49	Retrieve Loran–C #3
151 31 May	1042	G021A	D23	57 01.96	155 55.48	Tucker
151 31 May	1133	Mooring 22		57 02.60	156 02.74	CTD
151 31 May	1210	Mooring 21		57 03.73	156 05.34	CTD
151 31 May	1258	G022A	B23	57 08.84	156 09.44	Tucker,XBT
151 31 May	1316			57 08.84	156 10.04	SEAS XBT
151 31 May	1414	G023A	B21	57 01.07	156 17.48	Tucker
151 31 May	1552	G024A	D21	56 55.22	156 06.81	Tucker
151 31 May	1711	G025A	E20	56 47.50	156 06.51	Tucker
151 31 May	1734		E20	56 47.69	156 06.32	CTD
151 31 May	1834	G026A	F21	56 47.95	155 52.14	Tucker
151 31 May	2010	G027A	H21	56 40.84	155 38.33	Tucker
151 31 May	2155			56 40.08	155 52.44	Retrieve Loran–C #2
151 31 May	2221	G028A	G20	56 39.99	155 52.20	Tucker
152 1 June	0009			56 33.60	155 23.54	
152 1 June	0017	G029A	J21	56 33.59	155 23.22	Tucker,XBT
152 1 June	0130	G030A	J19	56 25.48	155 37.28	Tucker
152 1 June	0148			56 25.18	155 37.36	SEAS XBT
152 1 June	0257	G031A	H19	56 32.87	155 51.96	Tucker
152 1 June	0413	G032A	G18	56 32.30	156 05.96	Tucker
152 1 June	0519	G033A	F19	56 39.92	156 06.81	Tucker,XBT

TABLE 6. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 4MF89, 28 MAY – 6 JUNE 1989.

GMT Date JD	GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
152 1 June	0540			56 40.12	156 06.78	SEAS XBT
152 1 June	0630	G034A	E18	56 39.83	156 19.92	Tucker
152 1 June	0739	G035A	D19	56 47.02	156 20.61	Tucker
152 1 June	0856	G036A	B19	56 53.80	156 29.78	Tucker
152 1 June	0913			56 53.54	156 29.63	SEAS XBT
152 1 June	1046	G037A	B17	56 44.73	156 45.96	Tucker,XBT
152 1 June	1101		B17	56 44.33	156 46.24	SEAS XBT
152 1 June	1156	G038A	D17	56 39.12	156 34.33	Tucker
152 1 June	1206		D17	56 38.91	156 34.02	SEAS XBT
152 1 June	1300	G039A	E16	56 31.79	156 32.74	Tucker
152 1 June	1400	G040A	F17	56 32.10	156 19.72	Tucker
152 1 June	1506	G041A	G16	56 24.51	156 18.71	Tucker
152 1 June	1605	G042A	H17	56 25.10	156 04.90	Tucker
152 1 June	1730	G043A	J17	56 17.99	155 50.33	Tucker
152 1 June	1924	G044A	L15	56 03.01	155 49.50	Tucker
152 1 June	2035	G045A	K14	56 03.10	156 02.88	Tucker
152 1 June	2143	G046A	J15	56 10.17	156 04.53	Tucker
152 1 June	2202		J15	56 10.43	156 04.16	SEAS XBT
152 1 June	2220		J15	56 09.94	156 04.79	CTD
152 1 June	2329	G047A	I14	56 09.89	156 18.26	Tucker
153 2 June	0043	G048A	H15	56 17.53	156 18.47	Tucker
153 2 June	0105		H15	56 17.77	156 18.83	SEAS XBT
153 2 June	0155	G049A	G14	56 17.15	156 32.44	Tucker
153 2 June	0305	G050A	F15	56 24.66	156 32.73	Tucker
153 2 June	0409	G051A	E14	56 24.30	156 45.95	Tucker
153 2 June	0520	G052A	D15	56 31.81	156 46.75	Tucker #1
153 2 June	0546	G052A	D15	56 31.46	156 46.51	Tucker #2
153 2 June	0714	G053A	B15	56 39.01	157 01.68	Tucker
153 2 June	1003	G054A	B13	56 26.87	157 07.05	Tucker
153 2 June	1057	G055A	C12	56 24.22	157 14.89	Tucker
154 3 June	0108	G056A	D13	56 24.02	157 00.52	Tucker
154 3 June	0220	G057A	E12	56 16.41	156 59.96	Tucker
154 3 June	0332	G058A	F13	56 17.02	156 46.86	Tucker,XBT
154 3 June	0349			56 16.99	156 46.53	SEAS XBT
154 3 June	0455	G059A	G12	56 10.88	156 40.63	Tucker
154 3 June	0556	G060A	H13	56 09.57	156 31.86	Tucker

TABLE 6. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 4MF89, 28 MAY – 6 JUNE 1989.

GMT Date JD	GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
154 3 June	0658			56 03.16	156 31.85	SEAS XBT
154 3 June	0714	G061A	I12	56 02.13	156 31.76	Tucker
154 3 June	0832	G062A	J13	56 02.35	156 17.83	Tucker
154 3 June	1013	G063A	K12	55 54.76	156 17.86	Tucker
154 3 June	1041		K12	55 54.79	156 17.41	SEAS XBT
154 3 June	1046		K12	55 54.79	156 17.47	CTD
154 3 June	1109	C001A1	K12	55 54.76	156 17.61	Tucker
154 3 June	1138		K12	55 54.61	156 18.13	Tucker–aborted
154 3 June	1159	C001A2	K12	55 54.63	156 17.79	Bongo
154 3 June	1222	C001A3	K12	55 54.70	156 17.83	Bongo
154 3 June	1308		K12	55 54.58	156 18.02	Live bongo #1
154 3 June	1354		K12	55 54.33	156 18.11	Live bongo #2
154 3 June	1421		K12	55 54.55	156 17.92	Live bongo #3
154 3 June	1440	C001A4	K12	55 54.42	156 17.72	Bongo
154 3 June	1534	C001A5	K12	55 54.47	156 17.78	Bongo
154 3 June	1613	C001A6	K12	55 54.49	156 17.92	Tucker
154 3 June	1644	C001A7	K12	55 54.38	156 17.78	Tucker
154 3 June	1813	G064A	L13	55 54.99	156 03.54	Tucker
154 3 June	2148	G065A	P11	55 31.15	155 48.02	Tucker
154 3 June	2342	G066A	N11	55 38.74	156 02.95	Tucker
155 4 June	0208	G067A	L11	55 46.27	156 16.91	Tucker
155 4 June	0313	G068A	K10	55 45.75	156 31.68	Tucker
155 4 June	0431	G069A	J11	55 54.20	156 31.50	Tucker
155 4 June	0447		J11	55 53.81	156 31.24	SEAS XBT
155 4 June	0549	G070A	I10	55 53.96	156 45.10	Tucker
155 4 June	0701	G071A	H11	56 01.84	156 49.44	Tucker
155 4 June	0816	G072A	F11	56 08.95	156 59.97	Tucker
155 4 June	0937	G073A	D11	56 15.94	157 14.19	Tucker
155 4 June	1134	G074A	B11	56 23.98	157 27.76	Tucker
155 4 June	1301	G075A	B9	56 14.97	157 42.30	Tucker
155 4 June	1416	G076A	D9	56 07.88	157 27.95	Tucker
155 4 June	1532	G077A	F9	56 00.93	157 13.95	Tucker
155 4 June	1658	G078A	H9	55 53.43	156 59.07	Tucker
155 4 June	1822	G079A	J9	55 46.20	156 44.91	Tucker
155 4 June	1952	G080A	L9	55 38.28	156 30.22	Tucker
155 4 June	2128	G081A	N9	55 31.06	156 16.11	Tucker

TABLE 6. (CONTINUED) – OPERATIONS DURING FOCI CRUISE 4MF89, 28 MAY – 6 JUNE 1989.

GMT Date JD	GMT	Sta. No.	FOCI Sta. No.	Lat. N. (dd mm.mm)	Long. W. (ddd mm.mm)	Operations
155 4 June	2307	G082A	P9	55 23.42	156 01.89	Tucker
156 5 June	0040	G083A	R9	55 15.78	155 47.24	Tucker
156 5 June	0211	G084A	R7	55 07.72	155 59.47	Tucker
156 5 June	0237		R7	55 08.12	156 01.23	SEAS XBT
156 5 June	0357	G085A	P7	55 15.93	156 14.95	Tucker
156 5 June	0528	G086A	N7	55 22.76	156 29.18	Tucker
156 5 June	0703	G087A	L7	55 30.25	156 43.58	Tucker
156 5 June	0838	G088A	J7	55 38.45	156 58.80	Tucker
156 5 June	0937	G089A	I6	55 38.03	157 10.96	Tucker,XBT
156 5 June	0950		I6	55 37.92	157 11.00	SEAS XBT
156 5 June	1043	G090A	H7	55 45.54	157 12.85	Tucker
156 5 June	1158	G091A	G6	55 43.14	157 29.04	Tucker
156 5 June	1321	G092A	F7	55 52.98	157 28.23	Tucker
156 5 June	1333		F7	55 52.66	157 28.49	SEAS XBT
156 5 June	1425	G093A	E6	55 52.70	157 41.20	Tucker
156 5 June	1540	G094A	D7	56 00.07	157 42.43	Tucker
156 5 June	1703	G095A	B7	56 07.11	157 56.23	Tucker
157 6 June	0204	PEGGY		56 48.97	156 30.22	Buoy Recovery
157 6 June	0339			56 48.48	159 29.61	Deploy Loran-C #1
157 6 June	0357			56 46.57	156 27.88	Deploy Loran-C #2
157 6 June	0422			56 48.21	156 25.87	Deploy Loran-C #3
157 6 June	0442	C002A-1		56 47.76	156 26.47	Tucker
157 6 June	1257			56 46.76	156 27.39	Retrieve Loran-C #1
157 6 June	1328			56 49.42	156 24.25	Retrieve Loran-C #2
157 6 June	1403			56 45.58	156 25.00	Retrieve Loran-C #3
157 6 June	1627			56 45.59	155 51.25	CTD (BKG Cal.)
157 6 June	1800			56 45.98	155 33.10	SEAS XBT

5. ACKNOWLEDGMENTS

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