

NOAA Ship MILLER FREEMAN R-223
Commander Robert J. Pawlowski, NOAA
Commanding Officer

CRUISE REPORT
Eastern Bering Sea
and Shelikof Strait
MF94-08 (FOCI 8MF94)

Leg 1
16 - 23 September, 1994
Richard Brodeur
Chief Scientist
NOAA Alaska Fisheries Science Center (AFSC)

Leg 2
23 - 29 September, 1994
William Parker
Chief Scientist
NOAA Pacific Marine Environmental Lab. (PMEL)

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1.0 Introduction

Fisheries Oceanography Coordinated Investigations (FOCI) is a joint effort by scientists at PMEL and AFSC to understand the biological and physical processes which cause variability of recruitment to commercially valuable fish and shellfish stocks in Alaskan waters. The FOCI program is presently studying the effects of the biotic and abiotic environment on the early life stages of walleye pollock spawned in the Bering Sea and Shelikof Strait. There are two aspects to the study: the acquisition and analysis of time-series data, and specific research topics to be covered on a cruise-by-cruise basis. This cruise represented a joint effort of FOCI and investigators from other laboratories to examine the geographic distribution of juvenile pollock in relation to oceanographic features around the Pribilof Islands. This report represents the summary of only the FOCI objectives.

The objectives of this cruise were:

- (1) to continue acquisition of long-term biological and physical time series;
- (2) to conduct a juvenile walleye pollock survey around the Pribilof Islands and collect biological data on pollock;
- (3) to collect adult pollock and other fish predators to investigate vertebrate predation on pollock juveniles;
- (4) to collect information on acoustic backscattering and target strength measurements with a 38 kHz system;
- (5) to recover four moorings containing physical and biological sensors;
- (6) to conduct gear comparison experiments;
- (7) to map surface distribution of phytoplankton pigments.

2.0 Operations

LEG 1

Proceeded from Dutch Harbor on September 16 and did acoustic survey and marine mammal survey on the way to the Pribilof Islands. Rendezvous with R/V Surveyor on September 17 south of St. Paul Island. Transferred scientists and equipment to Surveyor and proceeded to Middle Front Transect (Fig. 1). At each station CTD casts were made and chlorophylls, nutrients, and microzooplankton were collected at selected stations and then conducted a 38 kHz acoustic transect along the CTD line following the Surveyor. Two successful bottom trawls, an IKMT/MPS trawl and an anchovy trawl were completed on this transect.

On 19 September, began CTD transect of inner shelf Front A on north side of St. Paul Island and followed with a daytime acoustic transect (Fig. 1). Strong scattering layers were observed throughout the transect at several depths. Three anchovy trawls caught almost exclusively age-0 pollock and jellyfish. A bottom trawl before dusk caught relatively few large predators. The acoustic transect was repeated during night and was followed by two anchovy trawls, a Methot and neuston net tow.

Proceeded to inner shelf Front B south of St. Paul Island and repeated the CTD transect and day and night acoustic transects with the Surveyor (Fig. 1). Strong acoustic signals were observed again along this transect but rough sea conditions and the presence of much crab fishing gear precluded making a full set of trawls along this transect. Three anchovy trawls were made during the day and one anchovy and Methot trawl were made at night. Both ships moved to inner shelf Front D north of St. George Island (Fig. 1) and conducted the CTD transect and the day acoustic transect only. The Miller Freeman made one tow each with the neuston net, Methot trawl, anchovy trawl and the bottom trawl.

The last joint operations involved an acoustic transect on the inner shelf front south of St. George to the head of the Pribilof Canyon (Fig. 1). A concentrated school was located at the shelf break in about 230 m of water during the transect but it could not be located again for sampling. Both an anchovy and bottom trawl were made at the shelf edge. The anchovy trawl caught some age-0 pollock but mostly jellyfish and the bottom trawl caught mainly Pacific Ocean perch. We returned up on the shelf and began sampling an area which showed distinct layering of acoustic targets. We sampled this layer over a diel period using anchovy and bottom trawls and a low-light video camera attached to the CTD rosette to look at diel differences in vertical distribution and aggregation patterns and predation.

LEG 2

Departed St Paul, English Bay on September 24 in route to the Peggy Mooring location. Completed one neuston tow during transit. Recorded a CTD and ADCP backtrack L before Peggy recovery on the 24th. Started transit to Shelikof Strait with a neuston tow taken during transit. In Shelikof Strait, we recovered six subsurface moorings and three surface moorings (M-2 had broken from its anchor two days before recovery). CTD casts were completed prior to each mooring recovery. The Gore Point CTD line (7 stations) was also completed on this leg. One neuston tow was done and an ARGOS Drifting buoy was deployed during the CTD line. In the attempt to recover F-9436, the acoustic release failed to function when the release command was transmitted. After defining the mooring location, a drag cable was deployed and circled the mooring. The mooring and all equipment was recovered by using this technique. A search for two moorings (F-9401, F-9403) that were reported as lost was conducted with no positive results and the Miller Freeman arrived in Kodiak on September 29.

3.0 Summary

Frontal structure was observed in the CTD sections done jointly with the Surveyor along all transects. Large concentrations of echosign were observed on all transects, particularly those north of St. Paul and St. George Islands and in the Middle Shelf Domain. Trawls through the depths of maximum echosign caught mainly age-0 pollock (mostly 35-85 mm) and large gelatinous zooplankton. At the diel station, age-0 pollock underwent a distinct diel vertical migration and were found near the bottom during the day and in midwater and near-surface waters at night. Many potential predators were collected in the bottom trawls, including adult pollock, arrowtooth flounder, Pacific cod and Pacific halibut, and preliminary at-sea examination of stomach contents revealed some predation on age-0 pollock.

4.0 Personnel

| | | |
|-----------------|--------------------|-----------|
| Richard Brodeur | NOAA/AFSC | 9/16-9/23 |
| Matt Wilson | NOAA/AFSC | 9/16-9/23 |
| Morgan Busby | NOAA/AFSC | 9/16-9/23 |
| Rex Phillips | NOAA/AFSC | 9/16-9/23 |
| Dave Kachel | NOAA/PMEL | 9/16-9/23 |
| Leslie Lawrence | NOAA/PMEL | 9/16-9/23 |
| William Percy | Oregon State Univ. | 9/16-9/23 |
| Frank Morado | NOAA/AFSC | 9/16-9/23 |
| Beth Sinclair | NOAA/NMML | 9/16-9/23 |
| Geoff Lang | NOAA/AFSC | 9/16-9/23 |
| William Parker | NOAA/PMEL | 9/23-9/30 |
| Carol Dewitt | NOAA/PMEL | 9/23-9/30 |
| Rick Miller | NOAA/PMEL | 9/16-9/30 |
| Judy Oetting | Teacher at Sea | 9/16-9/30 |
| Jeff Napp | NOAA/AFSC | 9/16-9/17 |
| Lisa Britt | NOAA/AFSC | 9/16-9/17 |
| Roger Hewitt | NOAA/SWFSC | 9/16-9/17 |
| David Demer | Scripps Inst. | 9/16-9/17 |
| Jim Overland | NOAA/PMEL | 9/16-9/17 |

5.0 Cruise Statistics

| | |
|--------------------------------------|------|
| CTD Casts | 33 |
| § Chlorophyll Samples Taken | 212 |
| § Microzooplankton Collections | 68 |
| § Nutrient Collections | 52 |
| § IKMT/MPS Collections | 5 |
| § Neuston Collections | 4 |
| Anchovy Trawls | 20 |
| Bottom Trawls | 8 |
| Camera Deployments | 4 |
| § Predator Stomach Samples Collected | 418 |
| § Pathology Collections | 1000 |
| Marine Mammal Prey Collections | 50 |

| | |
|------------------------------|------|
| Immunoassay Collections | 40 |
| Nautical Miles Surveyed | 1125 |
| Expendable bathythermographs | 6 |
| Moorings Recovered | 10 |
| ARGOS Drifter Buoy | 1 |

6.0 Acknowledgements:

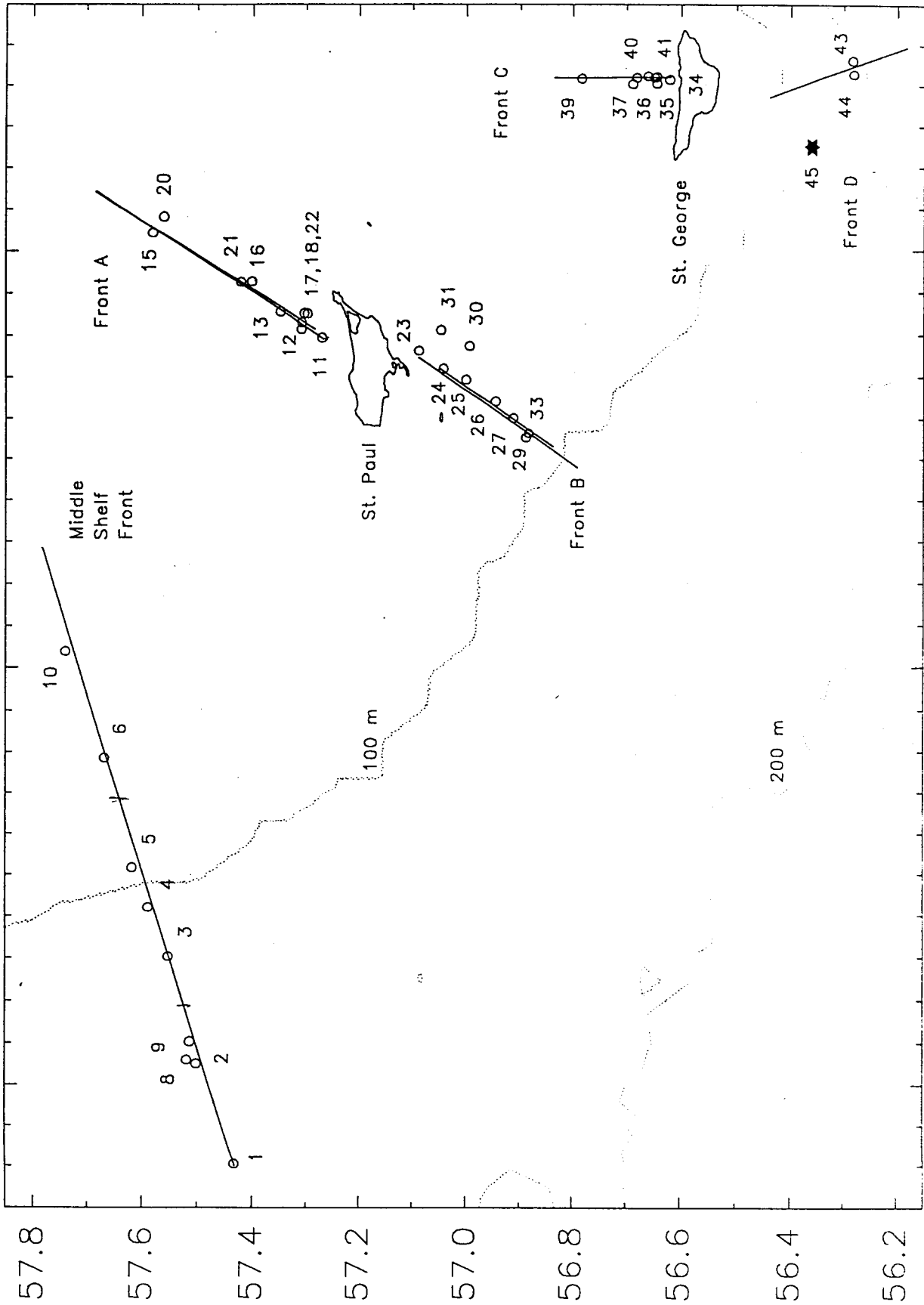
We would like to thank the C.O. Robert Pawlowski and the officers and crew of the MILLER FREEMAN for their cooperation and assistance in meeting all the cruise objectives and much more. Special thanks to Micheal Lemon, Field Operations Officer, Dennis Seems, the Executive Officer, Chief Survey Tech Bill Floering and Assistant Survey Tech Phillip White for the long hours and extra effort they gave us. We also appreciate the skill and hard work shown by Rick Pietrusiak and the deck crew in keeping us on a tight fishing schedule under sometimes adverse conditions.

Table 1. MF 94-08 Cruise Summary.

| STA | HAUL | DAY | | START | | START | | DEPTH (M) | | OPERATION |
|-----|------|-------|------------|-------|-------|-------|-------|-----------|--------|------------------------|
| | | (ADT) | TIME (ADT) | DD | MM | DD | MM | MAX. | BOTTOM | |
| 1 | 1 | 17 | 22:49 | 57 | 25.97 | 172 | 11.62 | 102 | 112 | CTDB 01 |
| 1 | 2 | 17 | 23:58 | 57 | 24.61 | 172 | 10.75 | 110 | 110 | Bottom Trawl 1 |
| 2 | 1 | 18 | 1:35 | 57 | 30.08 | 171 | 56.91 | 99 | 107 | CTD 02 |
| 3 | 1 | 18 | 2:41 | 57 | 33.14 | 171 | 41.76 | 95 | 103 | CTDB 03 |
| 4 | 1 | 18 | 3:36 | 57 | 35.30 | 171 | 34.76 | 92 | 101 | CTD 04 |
| 5 | 1 | 18 | 4:15 | 57 | 37.01 | 171 | 28.97 | 91 | 94 | CTDB 05 |
| 6 | 1 | 18 | 5:23 | 57 | 40.08 | 171 | 12.84 | 84 | 94 | CTD 06 |
| 7 | 1 | 18 | 7:24 | 57 | 46.98 | 170 | 42.97 | 81 | 81 | Transect 1 Start |
| | | 18 | 12:38 | 57 | 25.90 | 172 | 12.02 | 107 | 107 | Transect 1 End |
| 8 | 1 | 18 | 14:30 | 57 | 31.10 | 171 | 56.42 | 0 | 108 | IKMT/MPS 1, Fail |
| 8 | 2 | 18 | 16:05 | 57 | 31.88 | 171 | 56.33 | 102 | 107 | IKMT/MPS 2, Net 1 |
| 8 | 2 | 18 | 16:39 | 57 | 32.44 | 171 | 55.66 | 98 | 107 | IKMT/MPS 2, Net 2 |
| 8 | 2 | 18 | 16:49 | 57 | 32.93 | 171 | 55.86 | 71 | 107 | IKMT/MPS 2, Net 3 |
| 8 | 2 | 18 | 16:59 | 57 | 33.36 | 171 | 54.47 | 29 | 108 | IKMT/MPS 2, Net 4 |
| 8 | 2 | 18 | 17:09 | 57 | 33.61 | 171 | 54.15 | 12 | 108 | IKMT/MPS 2, Net 5 |
| 9 | 1 | 18 | 18:14 | 57 | 30.79 | 171 | 53.81 | 106 | 109 | Bottom Trawl 2 |
| 9 | 2 | 18 | 23:09 | 57 | 37.51 | 171 | 29.42 | 62 | 100 | Anchovy Trawl 01, Fail |
| 10 | 1 | 19 | 2:50 | 57 | 44.37 | 170 | 57.65 | 50 | 87 | Anchovy Trawl 02 |
| 11 | 1 | 19 | 7:34 | 57 | 16.19 | 170 | 12.22 | 28 | 35 | CTDB 07 |
| 12 | 1 | 19 | 8:14 | 57 | 18.49 | 170 | 10.11 | 44 | 50 | CTDB 08 |
| 13 | 1 | 19 | 8:51 | 57 | 20.96 | 170 | 8.62 | 52 | 57 | CTD 09 |
| 14 | 1 | 19 | 10:13 | 57 | 16.02 | 170 | 12.45 | 33 | 33 | Transect 2 Start |
| | | 19 | 13:09 | 57 | 41.01 | 169 | 51.51 | 70 | 70 | Transect 2 End |
| 15 | 1 | 19 | 14:18 | 57 | 34.88 | 169 | 57.42 | 52 | 71 | Anchovy Trawl 03. Poor |
| 16 | 1 | 19 | 16:13 | 57 | 24.09 | 170 | 4.29 | 34 | 61 | Anchovy Trawl 04 |
| 17 | 1 | 19 | 17:59 | 57 | 18.25 | 170 | 8.81 | 25 | 49 | Anchovy Trawl 05 |
| 18 | 1 | 19 | 19:58 | 57 | 17.80 | 170 | 8.90 | 42 | 45 | Bottom Trawl 3 |
| 19 | 1 | 19 | 21:30 | 57 | 17.04 | 170 | 11.02 | 40 | 40 | Transect 3 Start |
| | | 20 | 0:18 | 57 | 41.02 | 169 | 51.67 | 71 | 71 | Transect 3 End |
| 20 | 1 | 20 | 1:24 | 57 | 33.66 | 169 | 55.10 | 42 | 71 | Anchovy Trawl 06 |
| 20 | 2 | 20 | 2:47 | 57 | 33.88 | 169 | 54.84 | 53 | 72 | Method Trawl |
| 21 | 1 | 20 | 5:05 | 57 | 25.34 | 170 | 4.38 | 40 | 63 | Anchovy Trawl 07 |
| 22 | 1 | 20 | 6:58 | 57 | 18.56 | 170 | 11.07 | 38 | 52 | Anchovy Trawl 08 |
| 23 | 1 | 20 | 9:54 | 57 | 5.28 | 170 | 14.14 | 25 | 29 | CTDB 10 |
| 24 | 1 | 20 | 10:58 | 57 | 2.58 | 170 | 16.74 | 47 | 56 | CTDB 11 |
| 25 | 1 | 20 | 11:56 | 56 | 59.98 | 170 | 18.37 | 58 | 64 | CTD 12 |
| 26 | 1 | 20 | 12:30 | 56 | 56.77 | 170 | 21.55 | 75 | 85 | CTDB 13 |
| 27 | 1 | 20 | 13:18 | 56 | 54.77 | 170 | 23.94 | 88 | 93 | CTD 14 |
| 28 | 1 | 20 | 15:09 | 57 | 5.30 | 170 | 15.22 | 34 | 34 | Transect 4 Start |
| | | 19 | 17:03 | 56 | 47.45 | 170 | 31.17 | 105 | 105 | Transect 4 End |
| 29 | 1 | 20 | 17:54 | 56 | 53.05 | 170 | 26.22 | 54 | 98 | Anchovy Trawl 09 |
| 30 | 1 | 20 | 20:44 | 56 | 59.62 | 170 | 13.41 | 35 | 69 | Anchovy Trawl 10 |
| 31 | 1 | 20 | 22:24 | 57 | 2.81 | 170 | 11.21 | 50 | 64 | Method Trawl |
| 32 | 1 | 20 | 23:30 | 57 | 2.92 | 170 | 16.76 | 52 | 52 | Transect 5 Start |
| | | 21 | 1:00 | 56 | 50.21 | 170 | 28.21 | 101 | 101 | Transect 5 End |
| 33 | 1 | 21 | 2:29 | 56 | 53.34 | 170 | 26.81 | 48 | 97 | Anchovy Trawl 11 |
| 34 | 1 | 21 | 6:22 | 56 | 37.26 | 169 | 35.14 | 43 | 51 | CTDB 15 |
| 35 | 1 | 21 | 7:05 | 56 | 38.68 | 169 | 34.75 | 68 | 76 | CTDB 16 |
| 35 | 1 | 21 | 7:45 | 56 | 38.88 | 169 | 34.87 | 0 | 76 | Neuston Net |
| 36 | 1 | 21 | 8:40 | 56 | 39.68 | 169 | 34.68 | 71 | 76 | CTD 17 |
| 37 | 1 | 21 | 9:11 | 56 | 40.93 | 169 | 34.83 | 72 | 79 | CTDB 18 |
| 38 | 1 | 21 | 9:49 | 56 | 37.19 | 169 | 34.78 | 52 | 52 | Transect 6 Start |
| | | 21 | 11:07 | 56 | 50.08 | 169 | 34.92 | 68 | 68 | Transect 6 End |
| 39 | 1 | 21 | 12:12 | 56 | 47.01 | 169 | 35.00 | 48 | 72 | Anchovy Trawl 12 |
| 40 | 1 | 21 | 13:56 | 56 | 41.32 | 169 | 35.75 | 75 | 79 | Bottom Trawl 4 |

Table 1. MF 94-08 Cruise Summary.

| STA | HAUL | DAY | | START | | START | | DEPTH (M) | | OPERATION |
|-----|------|-------|-------|-------|-------|-------|-------|-----------|--------|------------------|
| | | (ADT) | (ADT) | DD | MM | DD | MM | MAX. | BOTTOM | |
| 41 | 1 | 21 | 15:20 | 56 | 38.69 | 169 | 35.68 | 50 | 75 | Methot Trawl |
| 42 | 1 | 21 | 18:34 | 56 | 26.43 | 169 | 37.66 | 94 | 94 | Transect 7 Start |
| | | 21 | 20:09 | 56 | 10.95 | 169 | 30.29 | 478 | 478 | Transect 7 End |
| 43 | 1 | 21 | 21:52 | 56 | 16.94 | 169 | 34.30 | 180 | 205 | Anchovy Trawl 13 |
| 44 | 1 | 21 | 23:58 | 56 | 17.03 | 169 | 32.20 | 211 | 221 | CTD 19 |
| 44 | 2 | 22 | 2:55 | 56 | 16.11 | 169 | 38.35 | 197 | 200 | Bottom Trawl 5 |
| 45 | 1 | 22 | 6:25 | 56 | 21.64 | 169 | 44.87 | 30 | 118 | Anchovy Trawl 14 |
| 45 | 2 | 22 | 8:00 | 56 | 22.08 | 169 | 44.88 | 110 | 115 | CTD 20 |
| 45 | 3 | 22 | 9:56 | 56 | 23.92 | 169 | 45.53 | 30 | 104 | Anchovy Trawl 15 |
| 45 | 4 | 22 | 11:33 | 56 | 24.59 | 169 | 45.35 | 98 | 100 | Bottom Trawl 6 |
| 45 | 5 | 22 | 14:00 | 56 | 24.69 | 169 | 44.85 | 93 | 99 | CTD 21 |
| 45 | 6 | 22 | 15:44 | 56 | 26.07 | 169 | 45.54 | 56 | 94 | Anchovy Trawl 16 |
| 45 | 7 | 22 | 17:44 | 56 | 24.18 | 169 | 44.57 | 42 | 103 | Anchovy Trawl 17 |
| 45 | 8 | 22 | 18:44 | 56 | 23.69 | 169 | 44.62 | 99 | 103 | CTD 22 |
| 45 | 9 | 22 | 19:46 | 56 | 24.74 | 169 | 44.33 | 97 | 101 | Bottom Trawl 7 |
| 45 | 10 | 22 | 22:22 | 56 | 24.58 | 169 | 45.82 | 42 | 100 | Anchovy Trawl 18 |
| 45 | 11 | 23 | 0:13 | 56 | 24.35 | 169 | 43.32 | 25 | 104 | Anchovy Trawl 19 |
| 45 | 12 | 23 | 1:41 | 56 | 25.09 | 169 | 43.09 | 28 | 96 | Anchovy Trawl 20 |
| 45 | 13 | 23 | 3:00 | 56 | 25.65 | 169 | 42.95 | 92 | 95 | Bottom Trawl 8 |



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Fig. 1. Location of the acoustic transects (solid lines), haul and CTD positions (circles) and diel survey (star) conducted during MF94-08. See Table 1 for the operations conducted at each location.