



UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL MARINE FISHERIES SERVICE  
Northwest and Alaska Fisheries Center  
Resource Assessment and Conservation  
Engineering Division  
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December 6, 1988

## CRUISE RESULTS

### Charter Vessel Pelagos Cruise No. PE 88-1

Eastern Bering Sea Shelf/Slope  
Echo Integrator Midwater Trawl Survey  
of Pelagic Walleye Pollock

## CRUISE PERIOD, AREA, AND SCHEDULE

Northwest and Alaska Fisheries Center (NAFAC) personnel conducted an echo integrator/midwater trawl (EIMWT) survey of pelagic walleye pollock (Theragra chalcogramma) in the waters of the eastern Bering Sea shelf and slope on board the chartered fishing vessel Pelagos during June, July, and August 1988. The demersal component of the shelf and slope pollock stocks was also surveyed by NAFAC personnel during this period and results are reported elsewhere. The combined results of the pelagic and demersal surveys will constitute the fourth in a series of triennial comprehensive assessments of pollock in this region.

During the cruise, the outer continental shelf and upper slope (50-250 fm) was surveyed. In some areas, transect lines continued into shallower (30 fm) waters. The area surveyed extended from Unimak Pass to northwest of St. Matthew Island (Fig. 1). The cruise schedule was as follows:

|            |  |
|------------|--|
| June 17-18 | Acoustic system loaded on <u>Pelagos</u> in Kodiak |
| June 19-20 | Standard target calibration in Malina Bay          |
| June 21-22 | Transit to start of survey                         |



|                  |  |
|------------------|--|
| June 23-July 11  | Survey Leg I--Unimak Pass to the Pribilof Islands                  |
| July 12          | Transit to Makushin Bay  |
| July 13-14       | Standard target calibration in Makushin Bay                        |
| July 15-16       | Cruise break in Dutch Harbor                                       |
| July 17-18       | Transit to resume survey   |
| July 19-28       | Survey Leg II--Pribilof Islands to northwest of St. Matthew Island |
| July 29-August 2 | Break for emergency vessel repairs                                 |
| August 3-13      | Intercalibration with Japanese vessel                              |
| August 14        | Transit  |
| August 15        | End survey in Dutch Harbor   |

#### OBJECTIVES

The Pelagos cruise was conducted as part of a comprehensive multi-vessel survey of the groundfish resources of the eastern Bering Sea shelf and slope. Since pollock are semi-demersal in distribution, the on-bottom portion of the stock is assessed by means of demersal trawls and the off-bottom component is surveyed by EIMWT techniques. The EIMWT survey conducted on board the Pelagos was designed to collect echo integrator and midwater trawl data for the estimation of distribution, biomass, and biological composition of midwater pollock in the survey area; to conduct standard target calibrations of the equipment; and to conduct an intercalibration experiment to facilitate comparisons between NWAFC hydroacoustic data and results of hydroacoustic surveys conducted by the Fisheries Agency of Japan on board the chartered fishery trawler Seiju Maru No. 28.

#### ACOUSTIC EQUIPMENT AND TRAWL GEAR

The hydroacoustic system used during this cruise was an echo integration and target strength measurement system operating at 38 kHz. The transducer was mounted in a dead weight body that was towed behind the vessel at a depth of approximately 12 fathoms at speeds of 9 to 11 knots. The complete acoustic system was calibrated in Puget Sound using the University of Washington calibration barge before and after the survey. During the survey, standard target field calibrations were

conducted on three occasions. Standard target calibration involves anchoring the vessel stern and aft, suspending a copper sphere with known acoustic properties beneath the transducer, and collecting data on the performance of the instruments.

Trawl sampling for adult fish was conducted with a modified midwater rope trawl #864 from NET Systems, Inc.<sup>1</sup> This net has rope wings, an intermediate with stretch mesh sizes ranging from 64 inches at the mouth to 5 inches at the posterior end, and a cod end of 3 1/2 inch stretch mesh fitted with a 1 1/4 inch liner. When towed with 5 m<sup>2</sup> midwater trawl doors, the net has an approximate wingspread of 40-50 m and an approximate vertical opening of 30-40 m. Juvenile fish were sampled with a Marinovich midwater trawl using the same 5 m<sup>2</sup> doors. The trawl is square, with headrope, footrope, and breastline lengths of 30 ft and mesh sizes ranging from 3 inches forward to 1 1/4 inches in the cod end. The cod end was fitted with a 3/8-inch knotless web liner. The approximate vertical mouth opening of the net was 4 m.

#### SURVEY METHODS

The survey was conducted 24 hours per day along a systematic grid of parallel track lines spaced at 20 nm intervals (Fig. 1). The basic survey covered the area between the 50 and 250 fm isobaths but transect lines were extended into deeper or shallower water if fish sign was encountered at the ends of the transect lines. The transducer was towed at depths between 11 and 16 fm at speeds of 9 to 12 knots, depending on weather conditions. Density estimates from the echo integration system were output every minute for up to 400 one-meter thick depth strata.

Rope trawl hauls were made to collect biological information in selected areas where echo sign occurred. For each trawl haul, the total catch weight and the number of each species of finfish caught was determined. Data for the determination of sex, length, and age composition were collected. Marinovich trawls were used to sample age 0 pollock. Estimates of the numbers of each species caught were made and total weights of jellyfish caught were also recorded.

Conductivity-Temperature-Depth (CTD) casts, using an SBE 19 Seacat Profiler from Sea-Bird Electronics, Inc., were conducted at each trawl location and at additional selected sites throughout the survey area.

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<sup>1</sup> Reference to trade names or commercial firms does not imply endorsement by the National Marine Fisheries Service (NMFS), NOAA.

## RESULTS

Approximately 5,100 nm of transect line were surveyed during the study. Twenty-five rope trawl hauls and ten Marinovich hauls were carried out (Table 1). Pollock predominated in all the catches. Catch information is presented in Table 2. The following biological measurements were collected: 6,619 length samples, 1,519 age structures, 1,095 individual fish weights, and 1,412 maturity samples. Forty-one CTD casts were made.

Midwater aggregations of pollock were encountered throughout the survey area. The depth of adult fish generally occurred in 60-100 fm of water and age 0 fish were observed in shallower (60-50 fm) water. The densest distributions of fish were observed in the northwestern portion of the survey area, especially to the west of St. Matthew Island.

A preliminary, unweighted, length frequency histogram for the rope trawl catches of pollock is presented in Figure 2.

### SCIENTIFIC PERSONNEL

#### Leg 1

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|                 |                               |
|-----------------|-------------------------------|
| William Karp    | Chief Scientist, NWAFC        |
| Neal Williamson | Statistician, NWAFC           |
| Daniel Twohig   | Electronics Technician, NWAFC |
| John Garrison   | Electronics Technician, NWAFC |
| Jan McCrory     | Biological Technician, NWAFC  |
| Sharon Lind     | Fishery Biologist, NWAFC      |

#### Leg 2

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|                  |                               |
|------------------|-------------------------------|
| Edmund Nunnallee | Chief Scientist, NWAFC        |
| Daniel Twohig    | Electronics Technician, NWAFC |
| Douglas Smith    | Fishery Biologist, NWAFC      |
| Scott Leopold    | Biological Technician, NWAFC  |
| Sharon Lind      | Fishery Biologist, NWAFC      |

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Table 1.--Midwater trawl haul and catch information for 1988 summer hydroacoustic/midwater trawl survey of eastern Bering Sea shelf and slope.

| Haul No. | Date 1988 | Trawl type | Start Pos. |           | Time of day (local) | Depth (fm) Gear/Bottom | Temp. (°C) surface/Gear | Duration (hr.) | Catch (lbs)     |                  |             |                   |               |
|----------|-----------|------------|------------|-----------|---------------------|------------------------|-------------------------|----------------|-----------------|------------------|-------------|-------------------|---------------|
|          |           |            | Lat. (N)   | Long. (W) |                     |                        |                         |                | Pollock (age 0) | Pollock (>age 0) | Pacific cod | Jellyfish unident | Other species |
| 1        | 6/23      | R          | 55°05'     | 164°45'   | 2025                | 30/50                  | 6.8/5.3                 | 1.30           |                 | 36.0             |             | 3000.0            | 0.3           |
| 2        | 6/25      | M          | 56°06'     | 163°07'   | 1615                | 11/45                  | 7.6 /7.1                | 0.42           | 0.1             |                  |             | 250.0             |               |
| 3        | 6/25      | M          | 56°06'     | 163°05'   | 1857                | 22/45                  | 7.6/2.8                 | 0.58           | 0.4             |                  |             | 40.0              |               |
| 4        | 6/26      | R          | 54°56'     | 166°01'   | 1031                | 65/75                  | 7.0/ -                  | 0.82           |                 | 3344.0           | 10.0        |                   | 36.0          |
| 5        | 6/27      | R          | 55°51'     | 165°47'   | 0015                | 55/61                  | 7.4/4.2                 | 0.50           |                 | 4428.9           | 60.1        | 10.0              | 1.0           |
| 6        | 6/29      | M          | 56°56'     | 165°05'   | 1115                | 23/38                  | 7.1/1.3                 | 0.42           | 0.1             |                  |             | 5.0               |               |
| 7        | 6/29      | R          | 56°09'     | 167°08'   | 2141                | 65/69                  | 7.3/ -                  | 0.28           |                 | 3078.1           |             | 21.9              |               |
| 8        | 6/30      | R          | 56°10'     | 167°05'   | 0507                | 61/69                  | 7.3/ -                  | 0.08           |                 | 2432.0           |             | 10.0              | 7.0           |
| 9        | 6/30      | R          | 55°54'     | 168°49'   | 1700                | 90/94                  | 7.5/3.7                 | 0.40           |                 | 59.0             |             | 5.0               | 0.1           |
| 10       | 7/1       | R          | 56°32'     | 168°19'   | 2255                | 52/64                  | 7.8/3.5                 | 0.05           |                 | 726.0            |             | 79.0              |               |
| 11       | 7/2       | R          | 56°40'     | 167°59'   | 1532                | 40/55                  | 7.6/2.8                 | 0.18           |                 | 288.0            |             | 391.0             |               |
| 12       | 7/2       | M          | 56°40'     | 168°01'   | 1642                | 37/55                  | 7.6/2.6                 | 0.27           | 0.1             | 21.0             |             | 81.0              |               |
| 13       | 7/2       | M          | 56°40'     | 168°00'   | 1745                | 20/55                  | 7.6/4.1                 | 0.50           | 0.2             | 5.0              |             | 60.0              |               |
| 14       | 7/4       | R          | 57°43'     | 167°21'   | 1825                | 25/35                  | 6.9/0.7                 | 0.18           |                 |                  |             | 13.0              | 1.0           |
| 15       | 7/4       | M          | 57°42'     | 167°24'   | 1914                | 18/35                  | 6.9/0.9                 | 0.32           | 0.1             |                  |             | 15.0              | 1.8           |
| 16       | 7/5       | R          | 56°38'     | 171°23'   | 1554                | 63/65                  | 7.3/3.9                 | 0.58           |                 | 1346.0           |             | 26.0              |               |
| 17       | 7/6       | R          | 57°00'     | 171°34'   | 1456                | 56/59                  | 7.8/3.6                 | 0.08           |                 | 1702.0           | 4.0         | 66.0              |               |
| 18       | 7/6       | R          | 57°00'     | 171°35'   | 1558                | 25/60                  | 7.8/4.8                 | 0.53           |                 |                  |             | 500.0             |               |

M = Marinovich  
R = Rope Trawl

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Table 1.--Continued.

| Haul No. | Date 1988 | Trawl type | Start Pos. |           | Time of day (local) | Depth (fm) Gear/Bottom | Temp. (°C) surface/Gear | Duration (hr.) | Catch (lbs)     |                  |             |                   |               |
|----------|-----------|------------|------------|-----------|---------------------|------------------------|-------------------------|----------------|-----------------|------------------|-------------|-------------------|---------------|
|          |           |            | Lat. (N)   | Long. (W) |                     |                        |                         |                | Pollock (age 0) | Pallock (>age 0) | Pacific cod | Jellyfish unident | Other species |
| 19       | 7/7       | R          | 57°14'     | 171°59'   | 2240                | 57/59                  | 7.5/3.4                 | 0.07           |                 | 655.0            |             | 25.0              |               |
| 20       | 7/8       | R          | 57°14'     | 173°02'   | 1248                | 61/63                  | 7.8/3.2                 | 0.93           |                 | 887.0            |             | 29.0              | 1.0           |
| 21       | 7/8       | R          | 57°46'     | 171°31'   | 2131                | 51/53                  | 8.3/1.9                 | 0.12           |                 | 1349.0           | 11.5        | 29.0              |               |
| 22       | 7/8       | M          | 57°46'     | 171°32'   | 2249                | 35/53                  | 8.3/2.3                 | 0.37           | 0.2             |                  |             | 27.0              | 0.3           |
| 23       | 7/10      | R          | 58°05'     | 173°10'   | 0848                | 57/58                  | 8.2/2.3                 | 1.00           |                 | 914.0            |             | 3.0               |               |
| 24       | 7/10      | M          | 58°54'     | 170°50'   | 2024                | 15/41                  | 7.3/2.6                 | 0.57           |                 |                  |             |                   |               |
| 25       | 7/11      | R          | 58°33'     | 172°57'   | 0718                | 57/60                  | 8.0/1.8                 | 0.17           |                 | 2991.6           |             | 2.8               | 5.6           |
| 26       | 7/20      | R          | 59°03'     | 173°42'   | 0950                | 61/63                  | 7.5/1.7                 | 0.12           |                 | 2528.0           |             | 11.5              | 1.8           |
| 27       | 7/20      | M          | 59°04'     | 173°38'   | 1105                | 12/61                  | 7.5/7.2                 | 0.30           | 0.2             | 22.0             |             | 15.0              | 3.0           |
| 28       | 7/21      | R          | 59°16'     | 174°17'   | 0915                | 59/64                  | 7.8/-                   | 0.08           |                 | 2614.0           |             | 2.0               |               |
| 29       | 7/21      | R          | 58°50'     | 175°29'   | 1555                | 61/71                  | 8.4/2.5                 | 0.72           |                 | 6760.0           |             | 13.3              |               |
| 30       | 7/23      | R          | 59°29'     | 176°01'   | 0840                | 65/74                  | 8.4/2.2                 | 0.05           |                 | 4986.4           |             | 1.0               |               |
| 31       | 7/23      | M          | 59°28'     | 176°02'   | 0930                | 05/73                  | 8.4/8.2                 | 0.42           | 0.1             |                  |             | 21.5              |               |
| 32       | 7/26      | R          | 60°13'     | 176°13'   | 0800                | 65/70                  | 7.5/1.6                 | 0.13           |                 | 2220.6           |             | 2.0               |               |
| 33       | 7/27      | R          | 60°38'     | 176°17'   | 0810                | 54/65                  | 7.1/1.0                 | 0.37           |                 | 2930.9           |             |                   |               |
| 34       | 7/27      | R          | 60°43'     | 177°16'   | 2100                | 64/74                  | 7.5/1.5                 | 0.03           |                 | 6660.0           |             |                   |               |
| 35       | 7/28      | R          | 61°00'     | 177°38'   | 1515                | 68/73                  | 8.4/1.4                 | 0.18           |                 | 3406.8           |             |                   |               |

Table 2.--Frequency of occurrence and total weight of catches during 1988 summer hydroacoustic/  
midwater trawl survey of eastern Bering Sea shelf and slope.

| Species (common name) | Frequency of Capture |            | Total<br>catch (lbs) | Scientific name                 |
|-----------------------|----------------------|------------|----------------------|---------------------------------|
|                       | Marinovich net       | Rope trawl |                      |                                 |
| Pollock (adult)       | 3                    | 23         | 56391.3              | <u>Theragra chalcogramma</u>    |
| Pollock (juvenile)    | 9                    |            | 1.5                  |                                 |
| Jellyfish (unident)   | 10                   | 21         | 4755.0               |                                 |
| Pacific herring       |                      | 6          | 26.7                 | <u>Clupea harengus pallasii</u> |
| Salmon, (coho)        |                      | 1          | 20.0                 | <u>Oncorhynchus kisutch</u>     |
| Pacific cod           |                      | 4          | 85.6                 | <u>Gadus macrocephalus</u>      |
| Eulachon              |                      | 2          | 7.1                  | <u>Thaleichthys pacificus</u>   |
| Flatfish unid.        | 2                    |            | 2.5                  |                                 |
| Euphausiid unid.      | 1                    |            | 0.1                  |                                 |
| Roundfish unid.       | 1                    |            | 0.1                  |                                 |
| Flatfish (juvenile)   | 1                    |            | 0.1                  |                                 |
| Smooth lumpsucker     |                      | 1          | 1.0                  | <u>Aptocyclus ventricosus</u>   |
| Sand lance            | 1                    |            | 0.1                  | <u>Ammodytes hexapterus</u>     |
| Sturgeon poacher      | 1                    |            | 0.1                  | <u>Agonus acipenserinus</u>     |
| Rock sole             |                      | 1          | 1.0                  | <u>Lepidopsetta bilineata</u>   |

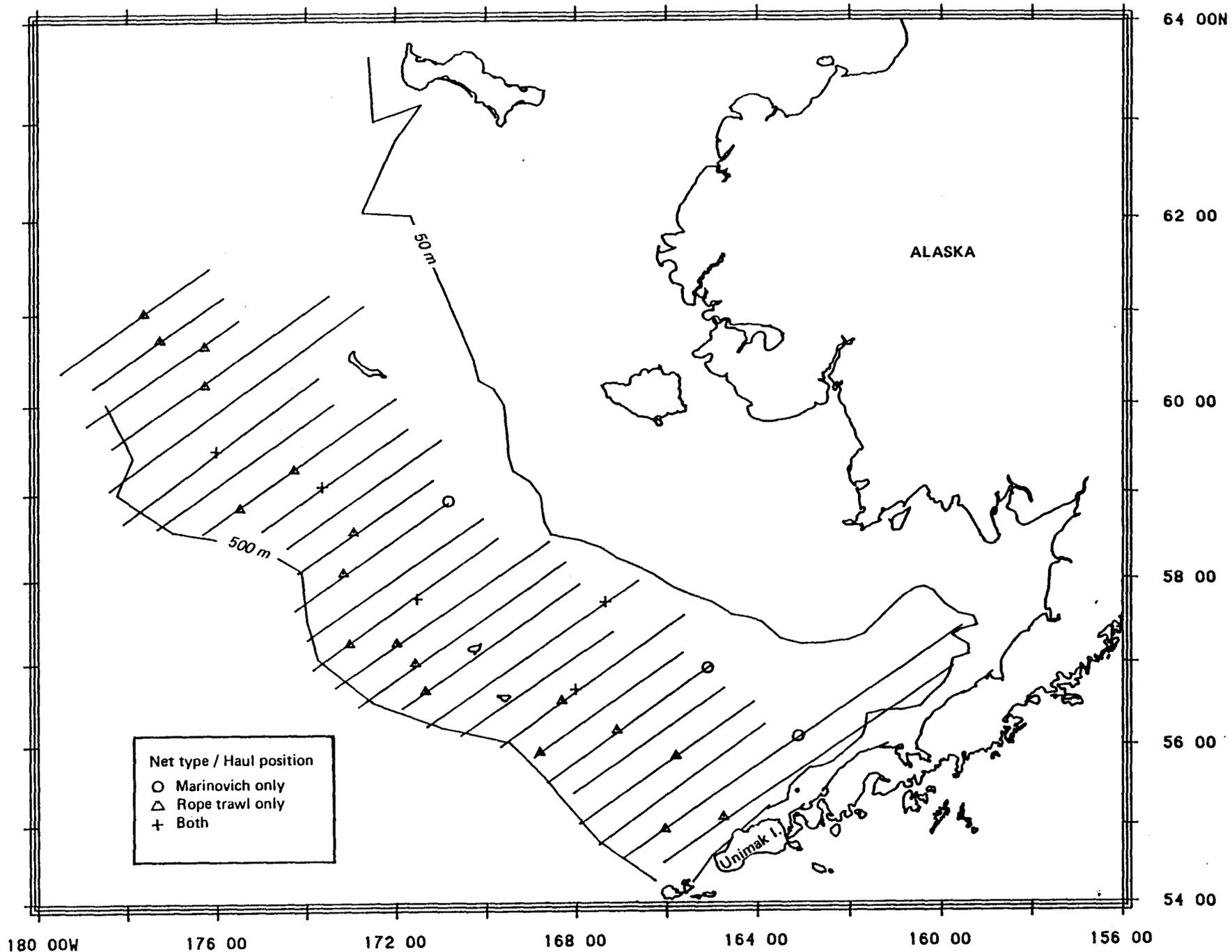


Fig. 1.--Transect lines surveyed during Summer 1988 echo integration/midwater trawl survey of adult walleye pollock on the eastern Bering Sea shelf and slope. Net type used at each haul position also indicated.

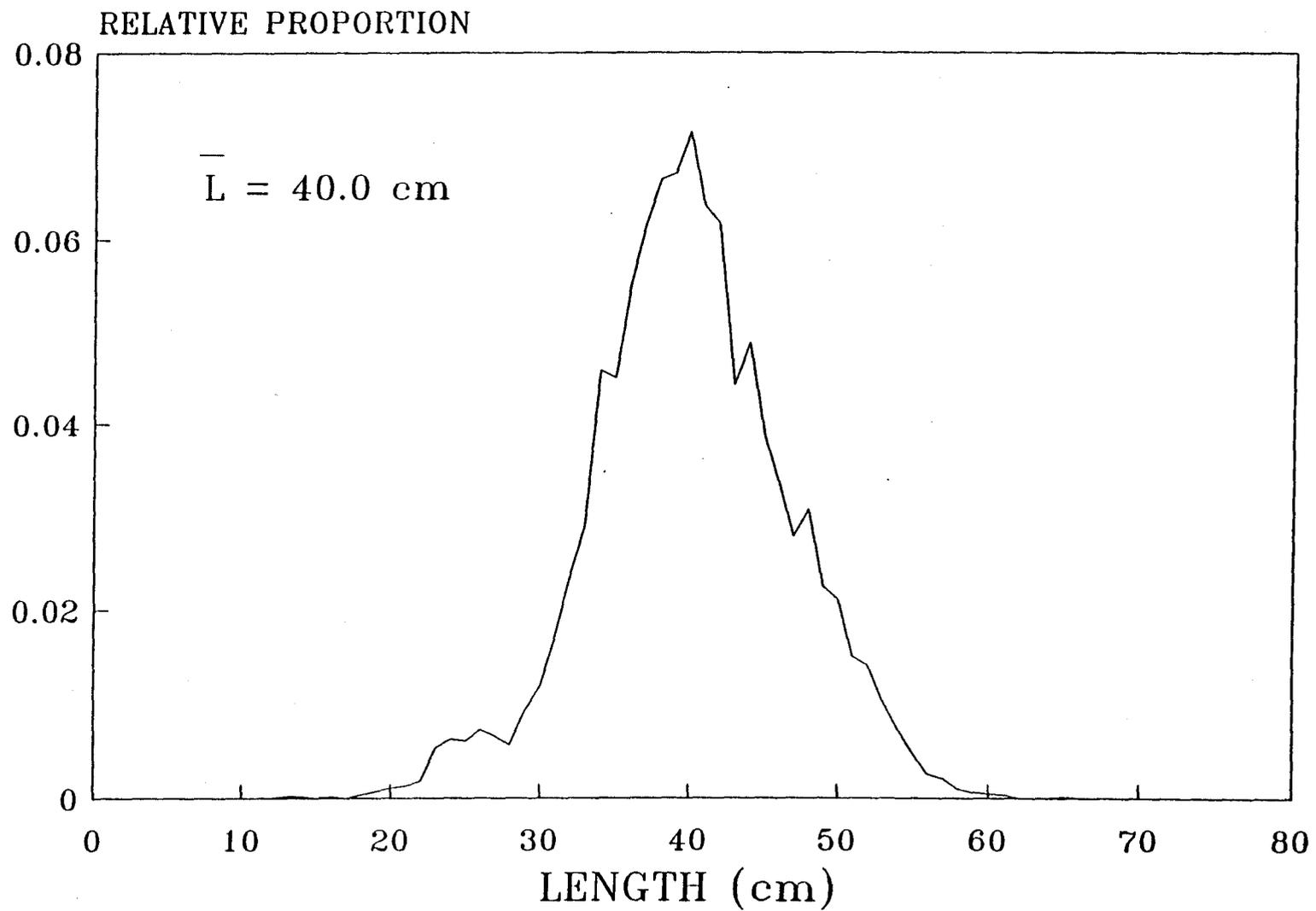


Fig. 2.--Preliminary, unweighted length distribution from midwater trawls conducted during Summer, 1988 survey of eastern Bering Sea shelf and slope pelagic pollock.