

**Preliminary echo integration-trawl survey results for walleye pollock (*Theragra chalcogramma*) on the southeastern Bering Sea shelf and southeastern Aleutian Basin in February and March, 2002**

by Taina Honkalehto, Dale Hanson, Denise McKelvey, and Neal Williamson

**INTRODUCTION**

Scientists from the Midwater Assessment and Conservation Engineering (MACE) Program of the Alaska Fisheries Science Center conduct research surveys of Bering Sea walleye pollock (*Theragra chalcogramma*) to estimate pollock distribution and abundance. Preliminary cruise results presented here are from the echo integration-trawl (EIT) survey carried out between February 18 and March 11, 2002 on the southeastern Bering Sea shelf and in the southeastern Aleutian Basin near Bogoslof Island. The primary cruise objective for the Bering Sea shelf section was to assess abundance and distribution of pollock inhabiting the eastern portion of the Steller sea lion Conservation Area (SCA) east of 168°W. The primary objective of the Bogoslof portion was to assess the abundance and distribution of pre-spawning pollock in the southeastern Aleutian Basin. This report summarizes observed pollock distribution, relative abundance, size composition, sex ratio and maturity information. Biomass estimates, acoustic system and intership calibration results, oceanography, and other cruise results will be reported in a subsequent document.

**METHODS**

Itinerary

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|--------|---|
| 18 Feb | Embark scientists in Dutch Harbor, Alaska. Calibration of acoustic systems in Captains Bay, Alaska. |
| 19 Feb | Intership calibration of the NOAA ship <i>Miller Freeman</i> with Japan Fisheries                   |

|              |   |
|--------------|---|
|              | Agency ship <i>Kaiyo Maru</i> in the Islands of Four Mountains area (Samalga Pass).   |
| 20 Feb-1 Mar | Transit to Bering Sea shelf. Retrieval of 2 temperature sensor moorings in Bristol Bay. EIT survey of the southeastern Bering Sea shelf (transects 98-114).               |
| 1 Mar        | Exchange scientists and obtain fuel in Dutch Harbor.  |
| 1-10 Mar     | EIT survey of the southeastern Bering Sea shelf (transects 115-122) and southeastern Aleutian Basin (transects 199-220). Calibration of acoustic systems in Captains Bay. |
| 11 Mar       | Inport Dutch Harbor.  |

### Acoustic Equipment

Acoustic data were collected with a Simrad EK 500<sup>1</sup> quantitative echo-sounding system on the NOAA ship *Miller Freeman*, a 66-m stern trawler equipped for fisheries and oceanographic research. Two split-beam transducers (38 kHz and 120 kHz) were mounted on the bottom of the vessel's centerboard extending 9 m below the water surface. Data from the echo sounder were processed using Simrad BI500 echo integration and target strength analysis software on a SUN workstation. Results presented here are based on the 38 kHz data. We also collected acoustic data on 38 and 120 kHz frequencies with a new acoustic system (Simrad EK60 echosounder and Sonardata Echolog and Echoview post-processing software) run in parallel to the main acoustic system for testing.

### Trawl Gear and Oceanographic Equipment

Two different trawl nets were used to sample observed echosign. Midwater and near-bottom echosign was sampled using an Aleutian Wing 30/26 Trawl (midwater trawl). On or near bottom echosign was sampled with a poly nor'eastern bottom trawl with roller gear. Vertical net opening and depth were monitored with either a WESMAR third wire netsounder system or a Furuno netsounder system. Both nets were fished with 5 m<sup>2</sup> Fishbuster trawl doors.

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<sup>1</sup> Reference to trade names or commercial firms does not constitute U.S. Government endorsement.

Physical oceanographic data collected during the cruise included temperature/depth profiles obtained with a Sea-Bird Electronics temperature-depth probe (SBE-39) attached to the trawl headrope and conductivity-temperature-depth (CTD) observations collected with a Sea-Bird CTD system at calibration sites and other selected locations. Sea surface temperature, salinity, and other environmental data were collected using the *Miller Freeman's* Scientific Computing System (SCS). Ocean current profile data were obtained using the vessel's centerboard-mounted acoustic Doppler current profiler system operating continuously in water-profiling mode.

### Survey Design

The survey design consisted of 25 north-south transects spaced 8 nmi apart covering a 13,000 nmi<sup>2</sup> area on the Bering Sea shelf, and 22 north-south transects spaced 5 nmi apart covering a 3,000 nmi<sup>2</sup> area in the southeast Aleutian Basin (Fig. 1). Echo integration and trawl data were collected 24 hours a day. Acoustic system settings used during the collection were based on results from acoustic system calibrations and on experience from prior surveys. Trawl hauls were conducted to identify echosign and to provide biological samples. Pollock were sampled to determine sex, fork length, body weight, age, maturity, and ovary weight of selected females. Fork lengths were measured to the nearest cm (i.e., a fish measuring between 49.5 cm and 50.5 cm was recorded as 50 cm). Maturity was determined by visual inspection and categorized as immature, developing, pre-spawning, spawning, or post-spawning.

### Data Analysis

Acoustic data were collected between 14 m from the surface (5 m below the centerboard-mounted transducer) and 0.5 m off the bottom, unless the bottom exceeded 1000 m, the lower limit of data collection. Echosign data identified as pollock were stored in a relational database.

## PRELIMINARY RESULTS

### Biological sampling

Biological data and specimens were collected from 38 trawl hauls (Table 1, Fig. 1): 27 using the midwater trawl; 11 using the bottom trawl. All bottom trawl hauls were made on the southeastern Bering Sea shelf; four were fished on bottom, and 7 were hauls where the bottom trawl was slightly off bottom or in midwater. Biological samples for several additional research projects, including prey studies and genetics, were also collected.

### Bering Sea Shelf

Pollock were observed on all transects (Fig. 2a). They were most abundant north of the Alaska peninsula and Aleutian Island chain between Amak Island and the west edge of Unimak Pass (transects 101-111). The highest pollock concentrations were observed on or near-bottom in waters adjacent to Amak Island at about the 50 to 60 m isobaths, and north of the center of Unimak Island between about the 95 and 110 m isobaths. Pollock were usually off bottom and not as densely aggregated at night as during the day. South of 55°N and west of 165°W (just north of Unimak Pass) pollock aggregations appeared to be more pelagic. West of Akutan Island, pollock were observed near bottom on the slope in deeper water (between the 200 and 500 m isobaths) close to the Aleutian Island chain. Pollock were at very low densities or absent between about 166°W and 167°W except for one patch of juveniles (approximately age 2) observed between the north ends of transects 115 and 116. Between 167°W and 168°W, along the 200 m isobath and inshore to 150 m, pollock occasionally formed isolated 1 to 2 nmi patches of dense pelagic schools which also turned out to be mainly juveniles of about age 2 years. Comparing and contrasting pollock distribution in 2002 (Fig. 2a) to that in 2001 (Fig. 2b), shows that in 2002 the easternmost transects had lower densities of fish than the easternmost transects in the 2001 survey, and transects north of the center of Unimak Island had higher densities in 2002 than in 2001.

Twenty seven trawl hauls were conducted in the southeastern shelf area (hauls 1 to 26, and 38). Fork lengths ranged from 18 to 66 cm. Length data from trawl hauls 3, 8, 16, and 24 (Fig. 3, and see Fig. 1) illustrate the range of pollock sizes encountered on the shelf. Pollock modal lengths decreased from 49 cm in the east along the Aleutian Island chain to 23 cm in the western part of the shelf survey area (Fig. 4). Catch sex ratios for all hauls and fish sizes ranged from 23 to 78% male (Fig. 5). Among pollock larger than 29 cm fork length (approximately age 3 and older), 66% of the females and 51% of the males were pre-spawning (Fig. 6a). Twenty seven percent of females and 23% of males were developing. One percent of females and about 20% of males were actively spawning. For pollock 29 cm and smaller (approximately ages 1 and 2, sexes combined), 13% were immature and 87% were developing. Female pollock were estimated to be 50% mature at 41 cm (Fig. 6c).

#### Bogoslof Area

The geographic distribution of pollock in the Bogoslof/Aleutian Basin area (Fig. 2a) was similar to that observed in 2001 (Fig. 2b). Most pollock were observed along the north slopes of the Aleutian Island chain, either at the northeast end of Umnak Island, or between the west end of Umnak and the Islands of Four Mountains, just north of Samalga Pass. In 2002 there appeared to be more pollock in the Umnak Island aggregation than in 2001.

In the Bogoslof area, pollock sampled in trawl hauls (haul numbers 27 to 37) had fork lengths that ranged from 23 to 70 cm. Length compositions were bimodal; 47 to 52 cm modes were dominant in the region at the northeast corner of Umnak Island (Fig. 3 haul 29, Fig. 4), while 56 to 60 cm modes were dominant in the Island of Four Mountains area (Fig. 3 haul 32, Fig. 4). In one trawl haul sample of an aggregation north of the center of Unalaska Island (transect 200, haul 27) pollock had a narrow length range (30 to 46 cm) and a length mode of 40 cm. Catch sex ratios among all hauls ranged from 13 to 69% male (Fig. 5). Eighty-four percent of the female and 40% of the male pollock were in pre-spawning condition (Fig. 6b). Pollock of both sexes that were in a developing maturity stage were mainly from haul 27 on transect 200. Three percent of females and about 46% of males were actively spawning.

## SCIENTIFIC PERSONNEL

| <u>Name</u>      | <u>Sex/Nationality</u> | <u>Position</u>     | <u>Organization</u> |
|------------------|------------------------|---------------------|---------------------|
| Taina Honkalehto | F/USA                  | Chief Scientist     | MACE                |
| Neal Williamson  | M/USA                  | Fish. Biologist     | MACE (2/18-3/1)     |
| John Horne       | M/USA                  | Fish. Biologist     | MACE (3/1-3/11)     |
| Denise McKelvey  | F/USA                  | Fish. Biologist     | MACE                |
| Mike Brown       | M/USA                  | Computer Specialist | MACE (2/18-3/1)     |
| Steve Porter     | M/USA                  | Fish. Biologist     | FOCI (3/1-3/11)     |
| William Floering | M/USA                  | Fish. Biologist     | MACE                |
| Hyun-Su Jo       | M/Korea                | Fish. Biologist     | NFRDI (3/1-311)     |

### Abbreviations:

MACE - Midwater Assessment and Conservation Engineering Program, Alaska Fisheries Science Center, Seattle, WA

FOCI - Fisheries Oceanographic Coordinated Investigations, AFSC, Seattle, WA

NFRDI – National Fisheries Research and Development Institute, Pusan, Republic of Korea

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For further information, contact Dr. Gary Stauffer, Director, Resource Assessment and Conservation Engineering Division, Alaska Fisheries Science Center, National Marine Fisheries Service, 7600 Sand Point Way NE., BIN C15700, Building 4, Seattle, WA 98115-0070. Telephone (206) 526-4170.

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