



UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL MARINE FISHERIES SERVICE  
Alaska Fisheries Science Center  
Resource Assessment and Conservation Engineering Division  
7600 Sand Point Way Northeast  
BIN C15700, Building 4  
Seattle, Washington 98115-0070

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F/AKC1:Sd

## PRELIMINARY CRUISE RESULTS

### NOAA SHIP MILLER FREEMAN, CRUISE NO. 95-05 ECHO INTEGRATION-TRAWL SURVEY OF WALLEYE POLLOCK ON THE EASTERN BERING SEA SHELF AND SLOPE

#### CRUISE PERIOD, AREA, AND SCHEDULE

Scientists from the Alaska Fisheries Science Center (AFSC) conducted an echo integration-trawl (EIT) survey of walleye pollock (Theragra chalcogramma) aboard the NOAA ship Miller Freeman from April 1-14, 1995. The cruise began at sea after fishing operations for cruise MF95-04 were completed, and ended in Dutch Harbor, Alaska. The survey area covered the eastern Bering Sea (EBS) shelf and slope from the Alaska Peninsula in the southeast to west of the Pribilof Islands.

The itinerary for the NOAA ship Miller Freeman follows (dates are local):

- Apr 1            Transit to survey start near Amak Island (Scientists embarked March 29 in Kodiak, Alaska, during cruise MF95-04.)
- Apr 2-9        Pass 1 EIT survey of EBS shelf and slope
- Apr 9-10      Transit back to Unimak Pass area
- Apr 10-13     Pass 2 EIT survey of EBS shelf at Unimak Pass and north of Unimak Island
- Apr 13        Transit to Unalaska Island; sphere calibration in Anderson Bay
- Apr 14        Disembark scientific personnel in Dutch Harbor; end of cruise

#### OBJECTIVES

The principal objective of the cruise was to collect echo-integration data and midwater and demersal trawl data necessary to determine the distribution, biomass, and biological composition of walleye pollock in the survey area.

Secondary objectives were to:



1. collect walleye pollock target strength data for use in scaling echo-integration data to estimates of absolute abundance;
2. calibrate two centerboard-mounted acoustic systems using standard sphere techniques;
3. collect and preserve stomachs from pollock and Pacific cod (Gadus macrocephalus) for food habits studies (contact: Patricia Livingston, AFSC);
4. collect mature pollock ovaries to assess interannual variations in fecundity (contact: Bern Megrey, AFSC);
5. spawn mature pollock from the southeastern Bering Sea shelf and then culture fertilized eggs for laboratory experiments on larval growth rates and metabolism (contact: Gail Theilacker, AFSC);
6. collect adult pollock for observer training program (contact: Sheryl Corey, AFSC); and
7. collect physical oceanographic data including temperature and salinity profiles at selected sites, plus continuous monitoring of sea surface parameters (e.g., temperature, salinity, light level, and productivity) and water current profiles.

#### VESSEL, ACOUSTIC EQUIPMENT, AND TRAWL GEAR

The NOAA ship Miller Freeman is a 65.5-m (216-foot) stern trawler equipped for fisheries and oceanographic research. Two Simrad<sup>1</sup> split-beam transducers, one operating at 38 kHz and the other at 120 kHz, were mounted on the bottom of the vessel's centerboard. With the centerboard fully extended, the transducers were 9 m below the water surface. System electronics were housed in a portable laboratory mounted on the vessel's weather deck. Acoustic data were collected at both frequencies with a quantitative echosounding system (Simrad EK500). Data from the Simrad EK500 echo sounder/receiver were stored and processed using Simrad BI500 echo-integration and target-strength data analysis software on a SUN workstation.

Midwater echosign was sampled using a modified Northern Gold 1200 midwater rope trawl (NET Systems, Inc.). The trawl was constructed with ropes in the forward section and stretch mesh sizes ranging from 163 cm (64 in) immediately behind the rope section to 8.9 cm (3.5 in) in the codend. It was fished in a bridleless configuration and fitted with a 3.2-cm (1.25-in) mesh codend liner. Headrope

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

and footrope lengths were 94.5 m (310 ft) and 50 m (164 ft), respectively, and breastlines measured 79.4 m (260.5 ft). The headrope length was measured between the points of attachment at the breastline. The footrope length was measured between the points where tom weights were attached. The net was fished with 1.8-m X 2.7-m (6-ft X 9-ft) steel V-doors [1,000 kg (2,200 lb)], and 227-kg (500-lb) tom weights on each side. Vertical net opening, depth, and temperature were monitored with a Furuno wireless netsounder system attached to the headrope.

Fish on and near bottom were sampled with an 83/112 bottom trawl without roller gear. Net mesh sizes ranged from 10.2 cm (4 in) forward and 8.9 cm (3.5 in) in the codend, to 3.2 cm (1.25 in) in the codend liner. Headrope and footrope lengths were 25.6 and 34.1 m (83.9 and 111.9 ft), respectively, and the breastlines measured 3.4 and 3.2 m (11.3 and 10.5 ft). The 83/112 demersal trawl was fished with the same steel V-doors that were used with the rope trawl. The Furuno netsounder system monitored trawl mouth opening, depth, and temperature.

Age-1 fish and euphausiids in midwater were targeted with a Marinovich trawl. Meshes in the Marinovich trawl measured 7.6 cm (3.0 in) forward, 3.2 cm (1.3 in) in the codend, and 0.32 cm (1/8 in) in the codend liner. Headrope and footrope lengths were each 9.1 m (30 ft). The Marinovich trawl was also fished with the same steel V-doors used with the rope trawl. Again, the Furuno netsounder system monitored the trawl mouth opening, depth, and temperature.

Tow depth profiles for all trawls were obtained by attaching a microBT (small, retrievable temperature profiler) to the net. Water temperature and salinity profile data were collected at trawl and calibration sites with a Seabird CTD system. Additional temperature profile data were obtained by launching expendable bathythermographs (XBTs). Sea surface oceanographic data and environmental data were collected using the NOAA ship Miller Freeman's Scientific Collection System (SCS). Ocean current profile data were provided by the vessel's acoustic doppler current profiler system whose transducer is mounted in the centerboard.

#### SURVEY METHODS

The EIT survey of the EBS shelf and slope consisted of parallel, north-south transects that were spaced either 25 nmi or 12.5 nmi apart. A first pass (Fig. 1) started northeast of Unimak Island and proceeded west along the shelf to an area west of the Pribilof Islands. A second pass (Fig. 2) was conducted at Unimak Pass and north of Unimak Island. The southern extent of transects extending off the shelf was near the 1,000-m bottom depth contour. Northern extents were limited by the winter ice pack. A large portion of the area planned to be surveyed during the

cruise had to be omitted because the ice edge was unusually far south. Trackline mileage (including transit and mileage for haul operations) totaled approximately 2,800 nmi.

Standard survey operations occurred 24 hours per day. Favorable weather conditions permitted an average vessel speed of between 12 and 13 knots while running transects. Both acoustic systems (38 kHz and 120 kHz) collected echo-integration data and split-beam target strength data concurrently. Collection of target strength data required suitable conditions (e.g., low fish density, monospecific aggregation, and calm seas) and involved passing repeatedly (at speeds of less than 4 kts) over an aggregation of pollock, then collecting biological data from hauls conducted just prior to and just after collection of acoustic data. Target strength data will be interpreted together with historical target strength information, then used to scale echo-integration values from the 38 kHz transducer to provide estimates of pollock density (numbers/m<sup>2</sup>). Echo-integration data from the 120 kHz acoustic system will be used to assess abundance and distribution of euphausiids and other prey items of pollock.

Midwater and demersal trawl hauls were made at selected locations (Fig. 3) to identify echosign and to provide biological samples. The average trawling speed for all gear types (except Marinovich trawls) was about 3 knots; trawling speed for Marinovich trawls was about 2 knots. The vertical net opening for the midwater rope trawl averaged about 20 m and ranged from 16-24 m. The net opening for the Marinovich midwater trawl was 2-4 m. The 83/112 mouth opening was 2 m. Standard catch sorting and biological sampling procedures were used to provide weight and number by species for each haul. Pollock were further sampled to determine sex, fork length (FL), body weight, age, maturity, and mature or spent ovary weight. An electronic scale was used to determine all weights taken from individual pollock specimens. Fork lengths of adult and juvenile pollock were measured to the nearest cm and recorded with a Polycorder measuring device (a combination of bar code reader and hand-held computer), then downloaded into a personal computer. When collected, pollock and Pacific cod stomachs were preserved in a 10% formalin solution. Mature pollock ovaries for the fecundity study were preserved in Gilson's solution.

## PRELIMINARY RESULTS

### Standard sphere calibrations

Standard sphere calibrations were conducted on four separate occasions before and during the cruise (Table 1). Both the 38 kHz and 120 kHz acoustic systems were calibrated each time. For calibration, the NOAA Ship Miller Freeman was anchored fore and aft in 74-110 m of water. Acoustic properties of two copper spheres suspended below the transducer were measured. Split-beam target strength and echo-integration data collected with the

Simrad EK500 system described acoustic system gain parameters and transducer beam pattern characteristics. No significant differences in gain parameters or transducer beam pattern characteristics for the 38 kHz system were observed among any of the four calibrations. For the 120 kHz system, SV gain dropped 1 db and TS gain dropped 0.8 db between the first and third calibrations, then remained unchanged between the third and fourth calibrations. Collection parameters for MF95-05 were derived from the third and fourth calibrations.

### EIT survey

The greatest densities of pollock were observed in Unimak Pass and north of Unimak Island during pass 1 and pass 2 (Figs. 1 and 2). Most aggregations were within 50 m of bottom. Relatively little echosign was observed west of 167° W. It is of interest to note that pollock were observed right up to the ice edge along most transects.

Biological data were collected and specimen and tissue samples were preserved from 21 midwater (18 rope and 3 Marinovich) and 4 bottom trawl hauls. Trawl station and catch data from all hauls are summarized in Table 2. Oceanographic data were collected from 14 CTD casts (Fig. 4, Table 3), 11 XBT casts (Fig. 4, Table 4), and 23 microBT casts (Table 5).

Walleye pollock was the most abundant fish species captured by all three gear types (Tables 6, 7, and 8), and together with jellyfish accounted for greater than 99% of midwater rope trawl catch composition. Two successful Marinovich trawls were made. One caught only euphausiids while the other caught essentially just pollock. Bottom trawl catch composition was more diverse than off-bottom catch compositions. Pacific cod accounted for nearly a third of the catch by weight, but pollock (at 50%) still comprised the largest single portion of the catch by both weight and numbers. Types of biological data and numbers of samples and measurements collected from pollock and Pacific cod by all trawl types are listed in Table 9.

Walleye pollock captured in trawls ranged in length from 26 cm to 79 cm. Raw length measurements were summed into unweighted length frequency distributions (Fig. 5). Male pollock caught in midwater rope trawl hauls averaged 43.1 cm long; females averaged 46.3 cm. Pollock caught in bottom trawl hauls were larger than pollock caught in midwater rope trawls. Males averaged 46.8 cm and females averaged 53.2 cm. Sex ratios differed markedly from 0.5 for some hauls (range = 0.2-0.8), but an examination of sex ratio versus gear depth, bottom depth, and depth of gear off bottom revealed no apparent trend.

Maturity-length compositions for both sexes of pollock are shown in Fig. 6. East of 168° W, more female pollock were in a spent condition than a mature condition (Fig. 7). West of 168° W the opposite was true. This would suggest that the population near

Unimak Pass (i.e., east of 168° W) spawned sooner in the year than did the population located near the Pribilof Islands. Gonado-somatic indices (gonad weight/total body weight) for mature, prespawning pollock females east and west of 168° W (Fig. 8) suggested a weak, positive association with length. Mean GSI values for the two areas were not significantly different.

#### Target strength data collection

Target strength data were collected and hauls were made north of Unimak Pass on the early morning (local time) of April 12 (hauls 21, 22, and 23) and the night (local time) of April 12-13 (hauls 24 and 25). Catch compositions were very monospecific. Hauls 21 and 22 were at least 99% pollock, and hauls 24 and 25 were just under 95% pollock. One Marinovich trawl (haul 23), conducted to sample smaller organisms in the water column, captured a small quantity of euphausiids. Pollock caught in hauls 21 and 22 were from a unimodal size distribution, averaging about 47 cm and ranging from 38 to 62 cm long. Pollock from hauls 24 and 25 were smaller, averaging 41 cm and ranging from 32 cm to 61 cm. Their size distribution was also unimodal.

## SCIENTIFIC PERSONNEL

<u>Name</u>	<u>Sex/ Nationality</u>	<u>Position</u>	<u>Organization</u>
Neal Williamson	M/USA	Chief Scientist	AFSC
Daniel Twohig	M/USA	Instrument Chief	AFSC
Steve de Blois	M/USA	Fish. Biologist	AFSC
Mike Guttormsen	M/USA	Fish. Biologist	AFSC
Larry Haaga	M/USA	Biol. Tech.	AFSC
Chris Johnston	M/USA	Biol. Lab. Tech.	AFSC
Denise McKelvey	F/USA	Fish. Biologist	AFSC
Steve Pyrczak	M/USA	Computer Spec.	AFSC
Mikhail Stepanenko	M/Russia	Fish. Biologist	TINRO

AFSC - Alaska Fisheries Science Center, Seattle, Washington

TINRO - Pacific Research Institute of Fisheries and Oceanography  
Vladivostok, Russia

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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 Northeast, Building 4, BIN C15700,  
Seattle, Washington 98115-0070. Telephone (206) 526-4170.

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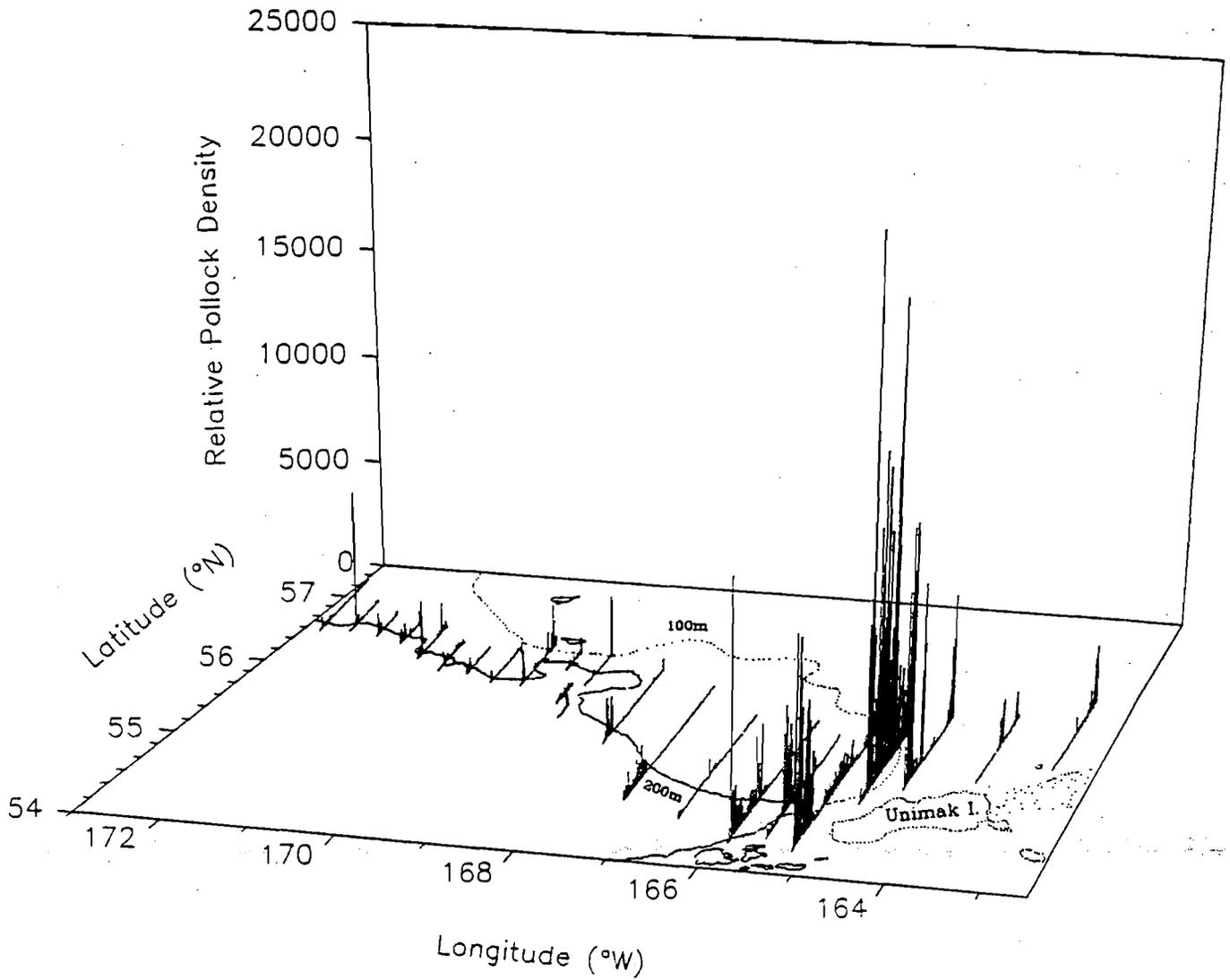


Figure 1. Relative pollock density along trackline from pass 1 of the winter 1995 echo integration-trawl survey of the eastern Bering Sea shelf and slope, MF95-05.

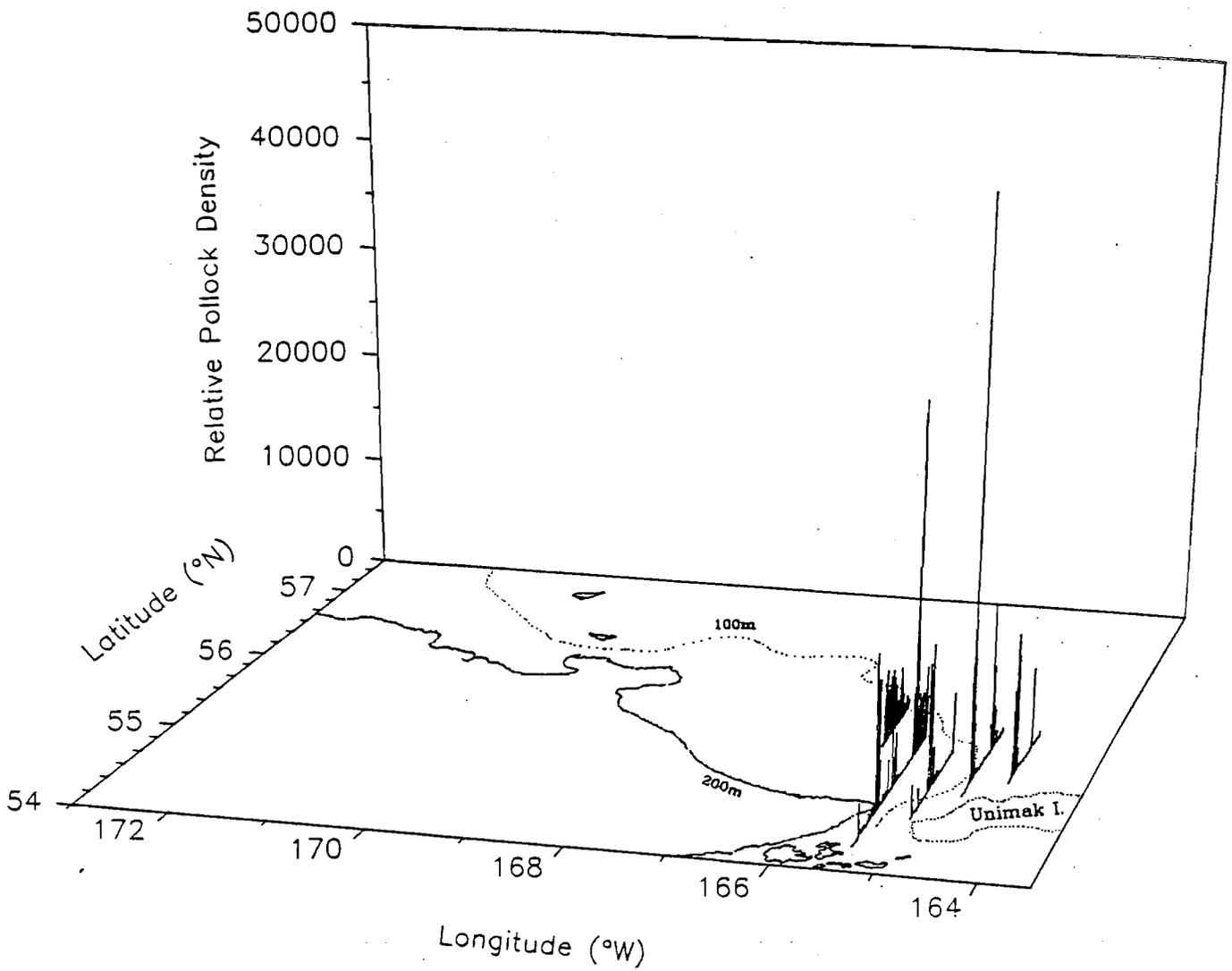


Figure 2. Relative pollock density along trackline from pass 2 of the winter 1995 echo integration-trawl survey of the eastern Bering Sea shelf and slope, MF95-05.

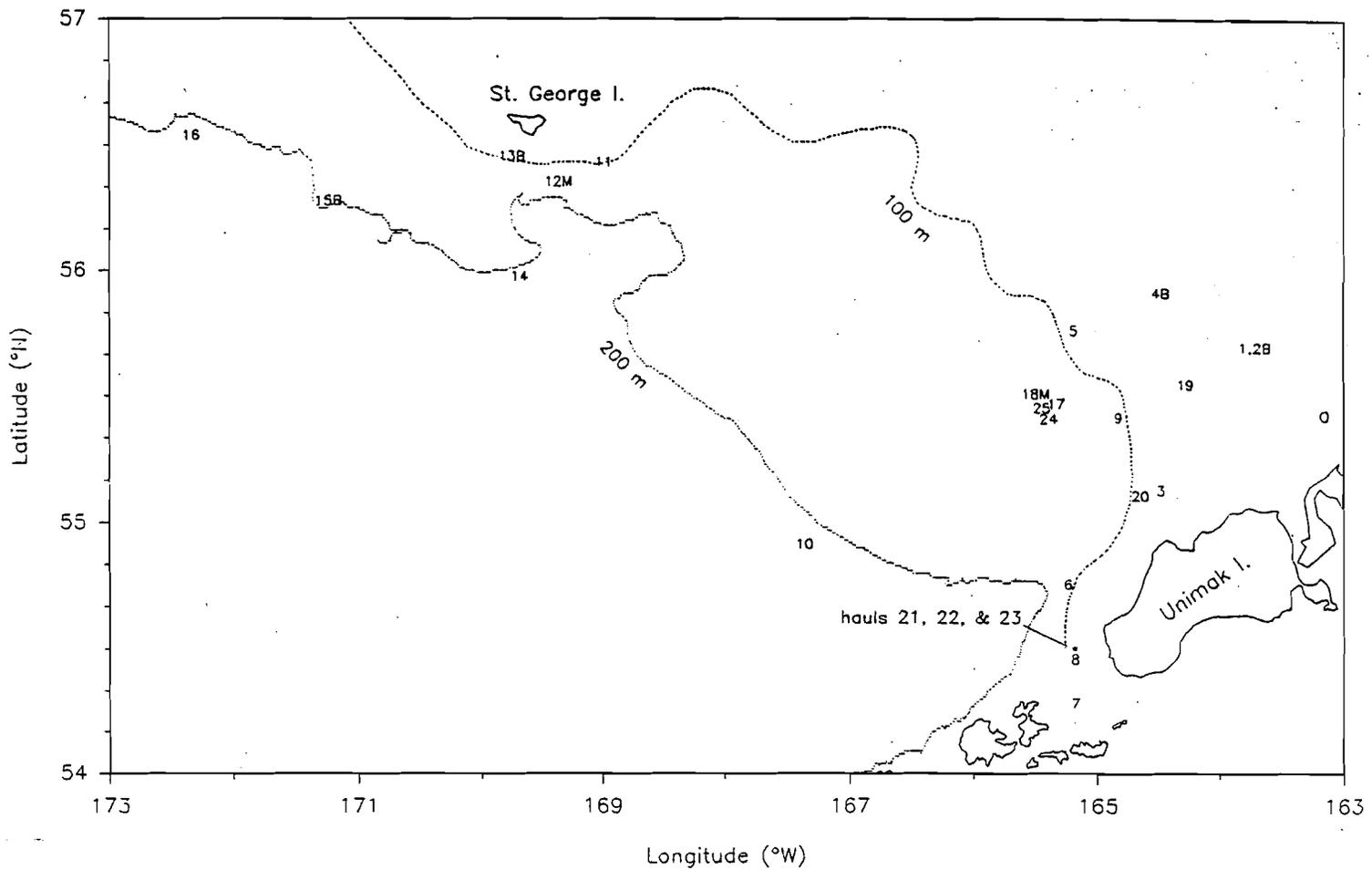


Figure 3. Trawl haul locations during the winter 1995 pollock echo integration-trawl survey of the eastern Bering Sea shelf and slope, MF95-05. Numbers and numbers followed by "B" or "M" represent midwater rope, 83/112 bottom, or Marinovich rope trawls, respectively.

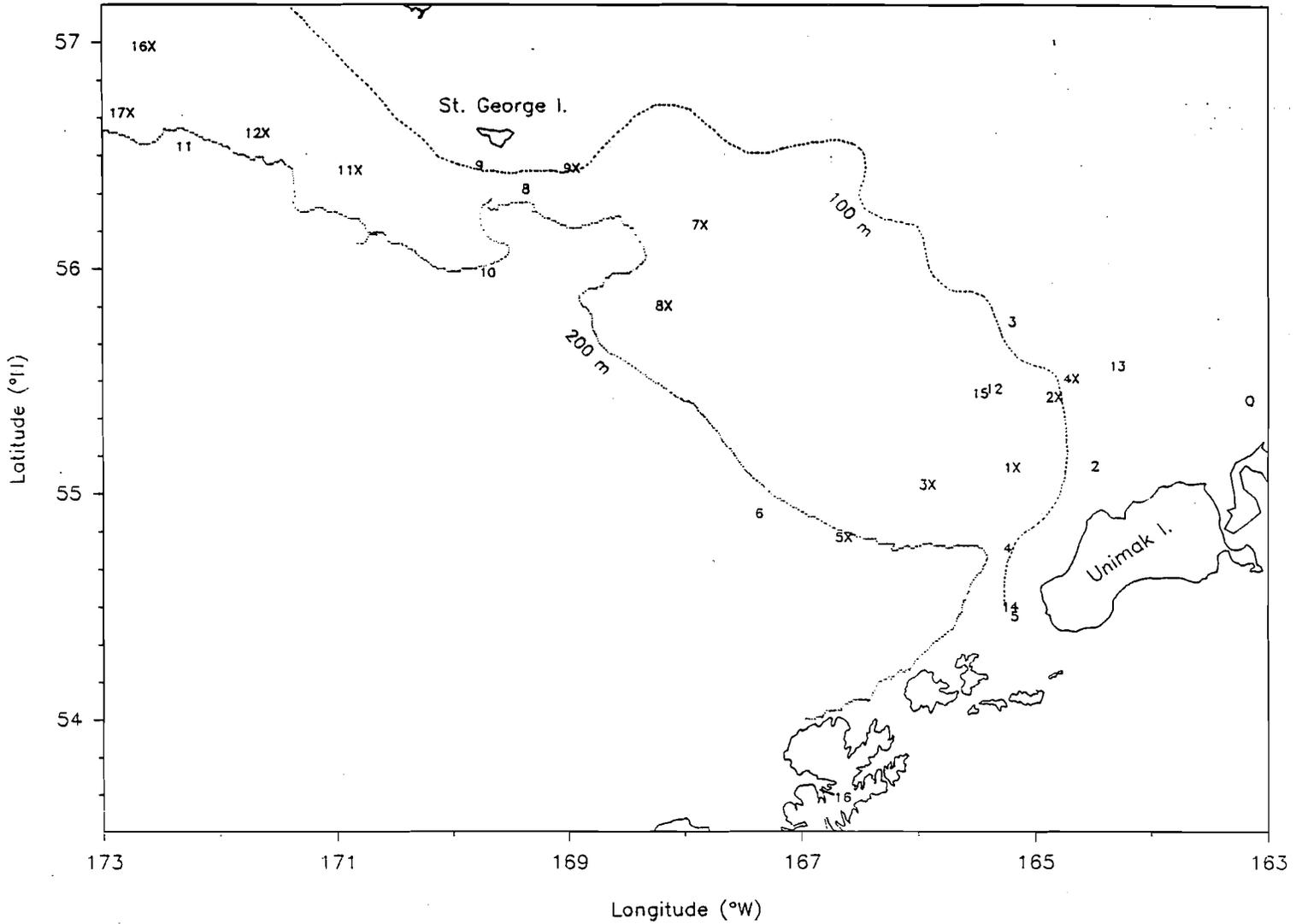


Figure 4. Locations of CTD and XBT casts taken during the winter 1995 pollock echo integration-trawl survey of the eastern Bering Sea shelf and slope, MF95-05. Numbers and numbers followed by "X" represent CTD and XBT casts, respectively.

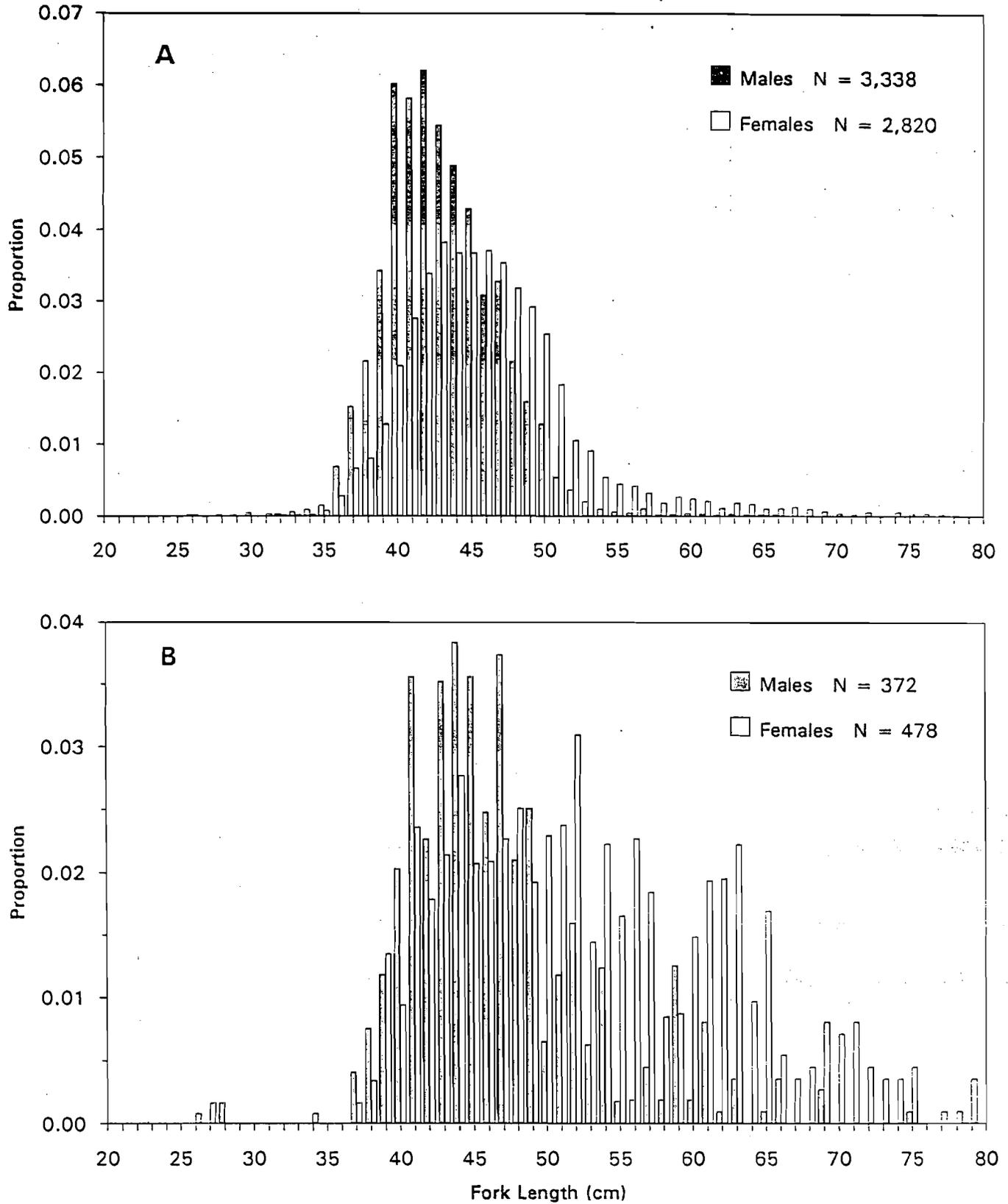


Figure 5. Pollock size compositions from A) 18 midwater rope and B) 3 bottom trawl hauls made during the winter 1995 pollock echo integration-trawl survey of the eastern Bering Sea shelf and slope, MF95-05. N is the total number of males and females measured.

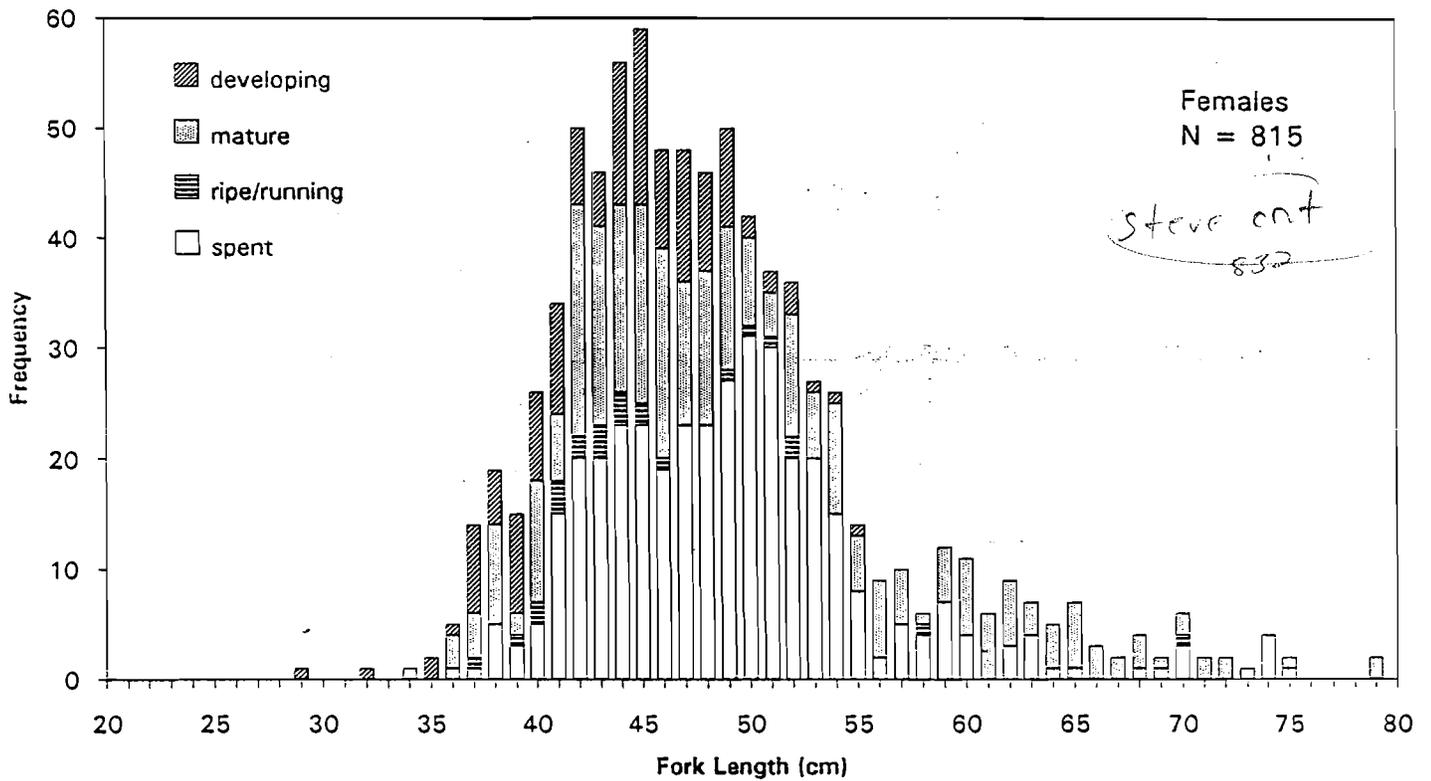
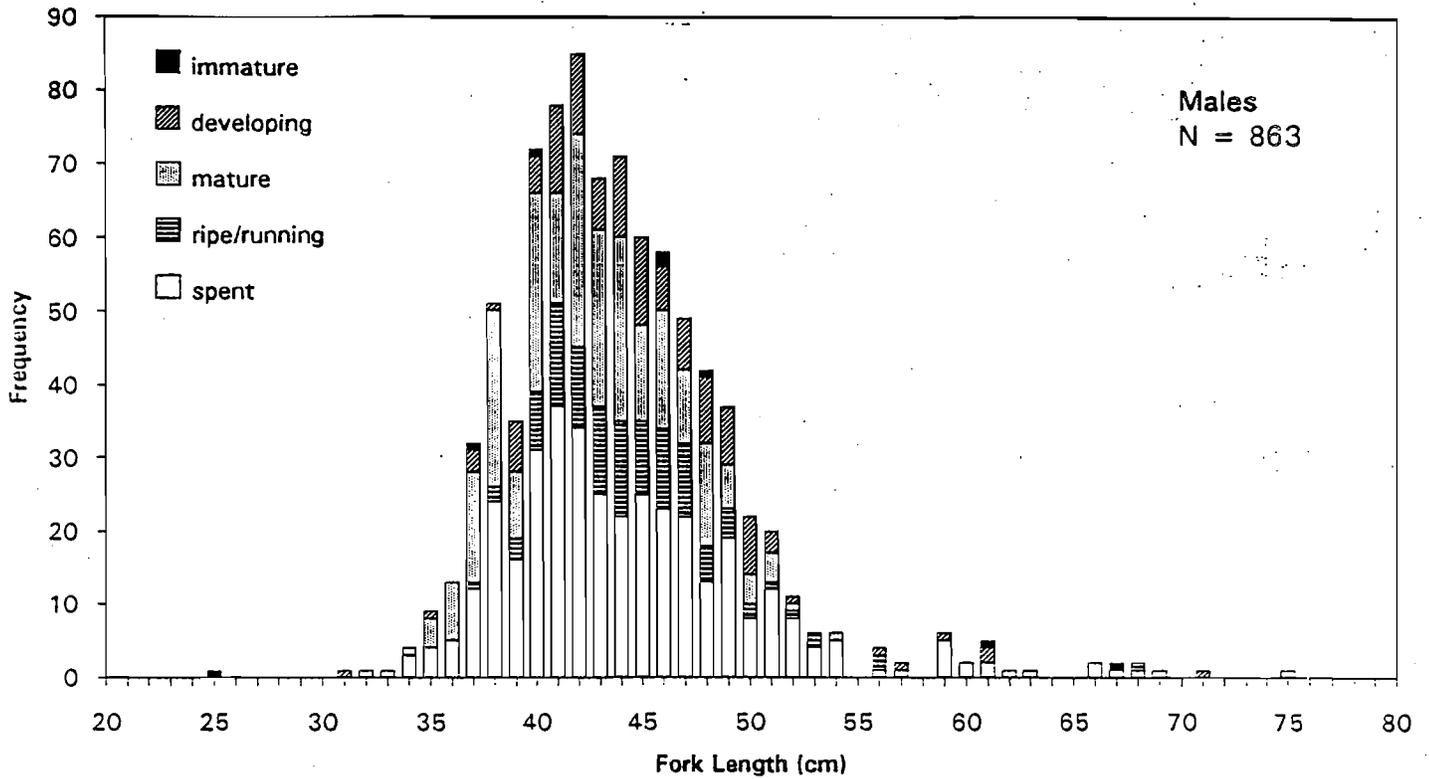


Figure 6. Maturity-length compositions for male and female pollock taken during the winter 1995 echo integration-trawl survey of the eastern Bering Sea shelf and slope, MF95-05.

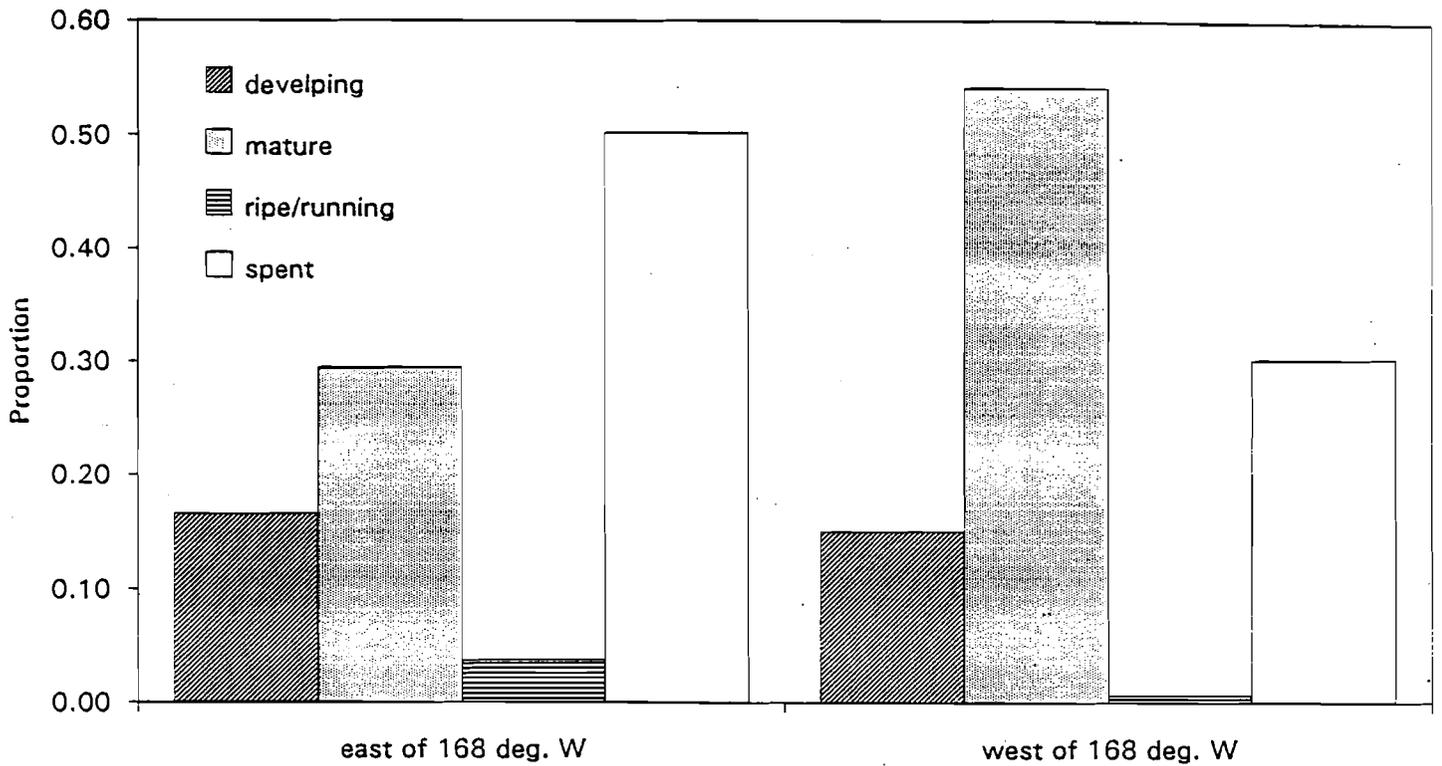


Figure 7. Maturity compositions of random samples of female pollock from east (N = 614) and west (N = 146) of 168 deg. W during the winter 1995 echo integration-trawl survey of the eastern Bering Sea shelf and slope, MF95-05.

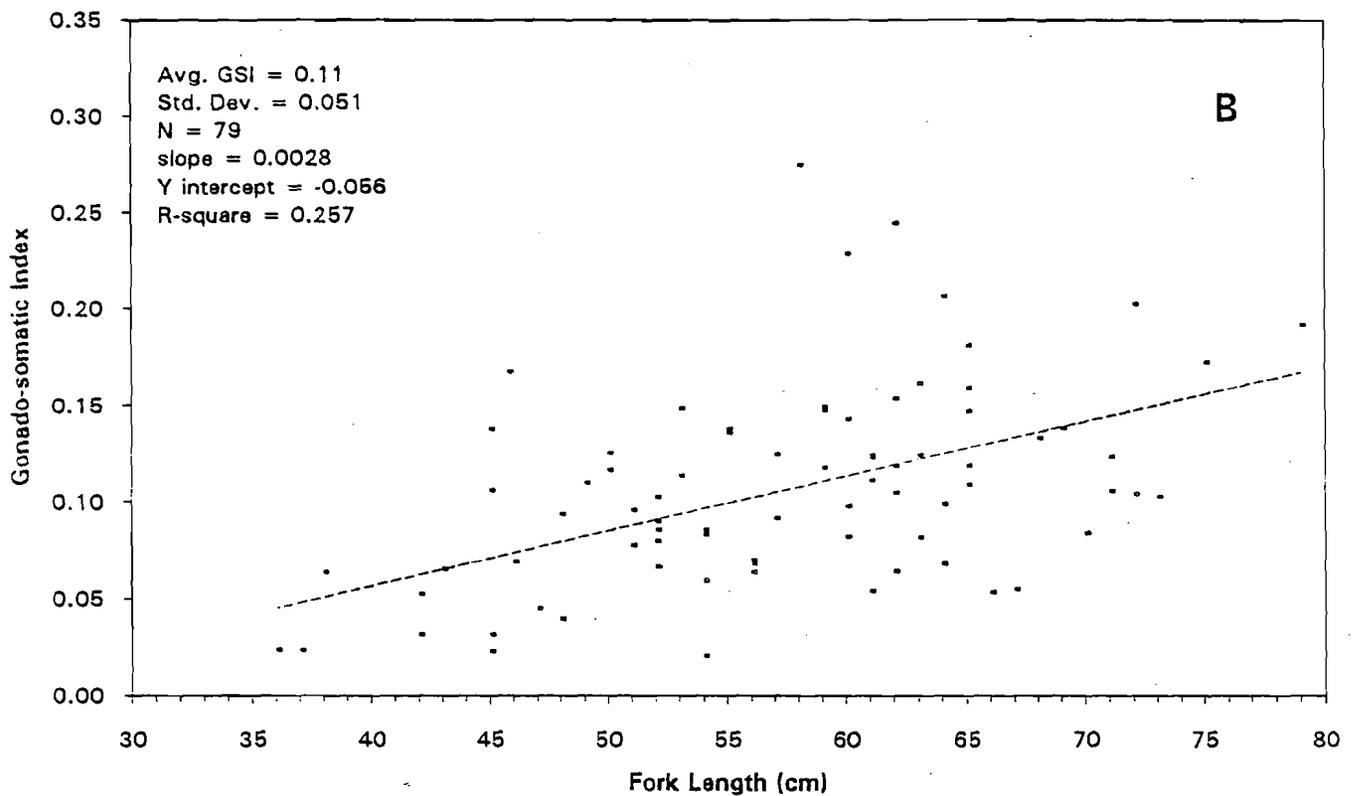
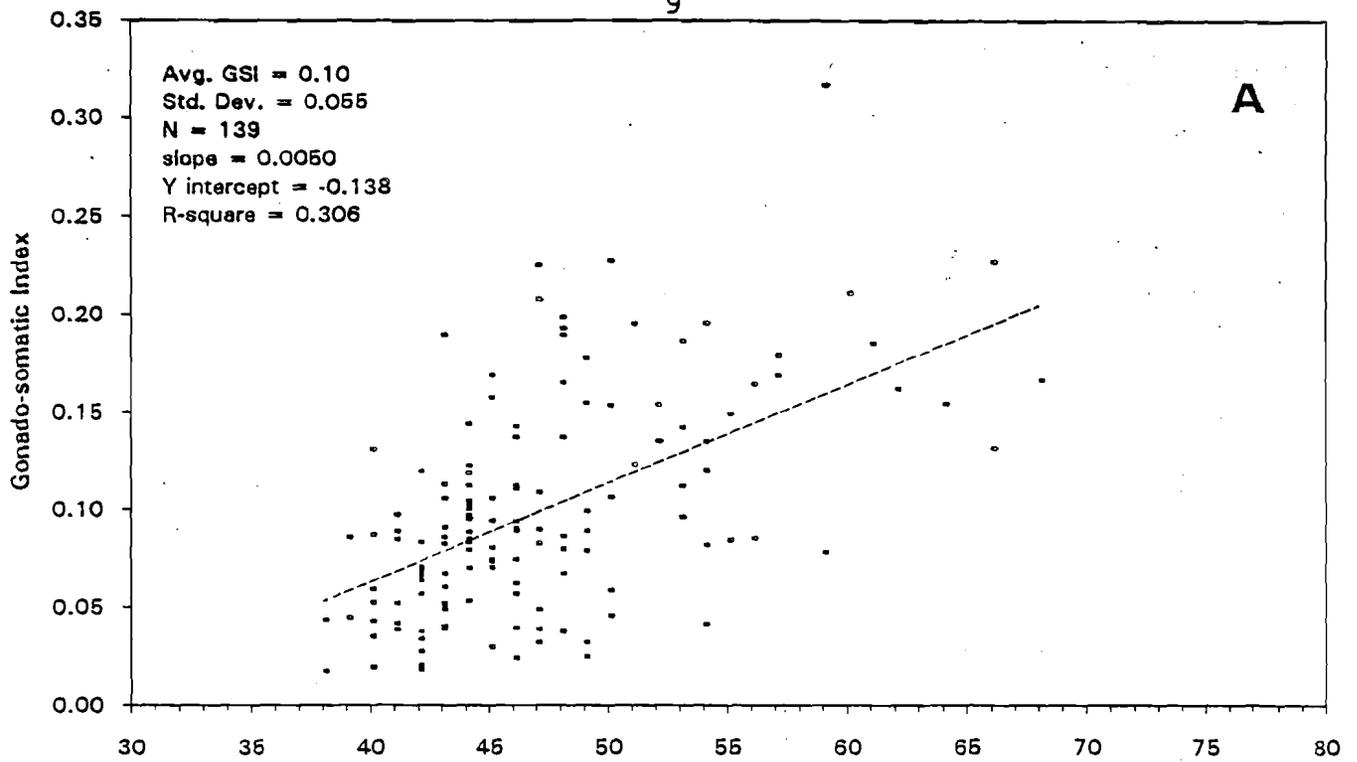


Figure 8. Pollock gonado-somatic indices plotted as a function of length for mature (pre-spawning) females from A) 11 hauls east and B) 2 hauls west of 168 deg. W during the winter 1995 echo integration-trawl survey of the eastern Bering Sea shelf and slope, MF95-05.

Table 1. Summary of sphere calibrations conducted before and during the winter 1995 pollock echo integration-trawl survey of the eastern Bering Sea shelf and slope, MF95-05.

Date	Location	Freq (kHz)	Water Temp (deg. C)		Sphere Range from Transducer (m)	TS Gain (db)	SV Gain (db)	3db Beam Width (deg.)	Angle Offset	
			at Transducer*	at Sphere					Along	Athwart
26 Jan	Port Susan	38	8.4	9.1	23.9	27.3	27.1	7.13	-0.10	-0.06
		120	8.4	9.0	19.5	24.9	25.1	8.81	-0.62	-0.14
13 Feb	Ugak Bay	38	3.7	3.5	26.7	27.3	27.1	7.16	-0.12	-0.05
		120	3.7	3.5	21.9	24.5	24.5	8.81	-0.73	-0.04
8 Mar	Skan Bay	38	3.0	3.0	26.7	27.3	27.1	7.13	-0.14	-0.05
		120	3.0	3.0	22.2	24.1	24.1	9.29	-0.85	-0.40
13 Apr	Anderson Bay	38	2.9	2.8	26.2	27.3	27.1	7.14	-0.09	-0.06
		120	2.9	2.8	21.4	24.1	24.1	9.36	-0.54	-0.72

\* The transducer was located approximately 9 m below the water surface.

Note: Gain and beam pattern terms are defined in the "Operator Manual for Simrad EK500 Scientific Echo Sounder (1993)" available from Simrad Subsea A/S, Standpromenaden 50, P.O. Box 111 N-3191 Horten, Norway.

Table 2. Summary of trawl stations and catch data from the winter 1995 pollock echo integration-trawl survey of the eastern Bering Sea shelf and slope, MF95-05.

Haul No.	Gear Type*	Date (1995)	Time (GMT)	Start Position		Depth (m)		Temp. (deg. C)		Catch	
				Latitude (N)	Longitude (W)	Gear	Bottom	Gear	Surface	Pollock (kg/no)	Other (kg)
1	R	3 Apr	1108-1118	55 41.47	163 43.57	82	95	1.2	0.4	1,450.4/1,961	912.6
2	B	3 Apr	1252-1258	55 41.67	163 43.40	95	95	2.9	0.4	1,625.4/2,096	619.6
3	R	3 Apr	1947-1956	55 07.30	164 28.76	70	71	1.0	1.0	2,764.4/4,059	4,945.4
4	B	4 Apr	0222-0227	55 54.51	164 29.03	95	95	1.1	0.9	1,487.5/1,882	598.5
5	R	4 Apr	0600-0605	55 45.57	165 11.77	91	105	2.5	-0.2	961.3/1,615	467.7
6	R	4 Apr	1320-1330	54 45.16	165 14.21	116	139	2.9	1.3	729.1/1,092	80.5
7	R	4 Apr	1801-1814	54 16.96	165 10.51	120	152	2.5	2.4	818.7/1,138	10.3
8	R	4 Apr	2021-2024	54 27.50	165 10.65	110	143	1.9	1.5	3,162.0/4,210	12.6
9	R	5 Apr	0500-0506	55 24.58	164 49.82	96	107	3.0	1.1	3,270.2/6,173	71.8
10	R	6 Apr	1512-1532	54 54.76	167 21.68	133	347	3.6	2.3	207.1/359	0.7
11	R	7 Apr	1629-1647	56 25.64	168 59.20	103	114	3.5	2.3	604.6/691	17.4
12	M	7 Apr	2343-2353	56 21.11	169 21.81	127	135	3.6	0.7	--/--	1.1
13	B	8 Apr	0253-0256	56 27.04	169 45.24	91	91	0.3	-0.4	125.9/94	257.0
14	R	8 Apr	0804-0829	55 58.47	169 41.44	454	604	3.7	1.9	102.5/203	5.1
15	B	9 Apr	0150-0220	56 16.57	171 14.24	148	148	3.3	1.7	0.3/25	1,769.8
16	R	9 Apr	2145-2202	56 32.11	172 20.69	288	794	2.4	2.4	296.6/590	2.2
17	R	10 Apr	2251-2253	55 27.91	165 19.95	107	114	2.2	0.4	2,017.9/3,421	45.6
18	M	11 Apr	0202-0232	55 30.26	165 29.87	110	116	3.4	0.4	2.0/4	75.4
19	R	11 Apr	0908-0938	55 32.49	164 16.89	84	97	2.3	0.9	1,328.2/2,017	1,882.8
20	R	11 Apr	1645-1653	55 06.03	164 38.90	64	78	1.7	1.1	832.2/1,453	478.5
21	R	12 Apr	0942-0950	54 30.11	165 12.88	60	170	1.6	1.5	1,207.4/1,606	11.9
22	R	12 Apr	1349-1401	54 30.22	165 13.65	65	172	1.6	1.5	667.9/915	1.9
23	M	12 Apr	1701-1721	54 30.03	165 12.73	109	166	2.0	1.5	9.3/12	0.2
24	R	12 Apr	2337-2340	55 24.31	165 23.69	108	115	2.9	-0.3	622.9/1,214	41.1
25	R	13 Apr	0901-0909	55 26.91	165 26.92	75	116	1.5	0.5	420.5/982	23.5

\* R=midwater rope trawl, B=83/112 bottom trawl, M=Marinovich trawl

Table 3. Summary of CTD casts conducted during the winter 1995 pollock echo integration-trawl survey of the eastern Bering Sea shelf and slope, MF95-05.

Cast	Haul	Date (1995)	Time (GMT)	Position		Depth (m)		Transect	Unit *
				Latitude (N)	Longitude (W)	CTD cast	Bottom		
1			***	bad cast -- CTD malfunctioned		***			SN 647
2	3	3 Apr	2124	55 07.26	164 28.69	63	71	3.0	SN 94
3	5	4 Apr	0650	55 45.77	165 11.17	90	105	3.1	SN 94
4	6	4 Apr	1414	54 45.40	165 13.97	121	137	4.0	SN 94
5	8	4 Apr	2128	54 27.39	165 10.35	132	139	4.0	SN 94 & 647
6	10	6 Apr	1637	54 54.67	167 21.74	326	350	7.0	SN 647
7			***	bad cast -- CTD malfunctioned		***			SN 647
8	12	7 Apr	2202	56 20.89	169 21.74	124	137	9.5	SN 94
9	13	8 Apr	0425	56 27.11	169 45.96	78	91	10.0	SN 94
10	14	8 Apr	0953	56 58.73	169 41.83	566	676	10.0	SN 94
11	16	9 Apr	2022	56 32.15	172 17.94	299	810	14.0	SN 94 & 647
12	17,18	11 Apr	0007	55 27.82	165 20.41	99	114	--	SN 647
13	19	11 Apr	1046	55 34.04	164 16.57	87	97	15.0	SN 647
14	21,22,23	12 Apr	1046	54 29.92	165 12.78	152	172	18.0	SN 647
15	25	13 Apr	1015	55 26.59	165 27.55	106	116	18.0	SN 647
16	--	14 Apr	0629	53 39.43	166 50.80	102	107	Anderson Bay	SN 647

\* pressure sensor range is 1,000 PSIA for SN 647 and 2,000 PSIA for SN 94

Table 4. Summary of XBT casts conducted during the winter 1995 pollock echo integration-trawl survey of the eastern Bering Sea shelf and slope, MF95-05

Drop	Probe	Haul	Date (1995)	Time (GMT)	Position		Bottom Depth (m)	Transect
					Latitude (N)	Longitude (W)		
1	T-6	--	4 Apr	1023	55 06.77	165 11.47	115	4.0
2	T-6	9	5 Apr	0525	55 25.56	164 49.77	106	3.5
3	T-6	--	5 Apr	2106	55 02.32	165 55.00	134	5.0
4	T-6	--	6 Apr	0433	55 30.40	166 40.51	136	6.0
5	T-6	--	6 Apr	0828	54 48.38	166 38.00	150	6.0
6	T-6			*** bad probe ***				
7	T-6	--	7 Apr	0038	56 11.49	167 52.03	133	7.1
8	T-6	--	7 Apr	0423	55 49.98	168 10.62	138	8.0
9	T-6			*** bad probe ***				
10	T-4			*** bad probe ***				
11	T-4	--	8 Apr	2027	56 25.79	170 53.00	125	11.6
12	T-4	--	9 Apr	0452	56 35.69	171 40.30	128	12.5
*	T-4			*** bad probe ***				
*	T-4			*** bad probe ***				
*	T-4			*** bad probe ***				
13	T-4	--	9 Apr	1233	56 58.68	172 38.63	125	13.6
14	T-4	--	9 Apr	1713	56 41.16	172 49.85	134	14.0

\* These drops were not assigned numbers.  
Maximum depth for T-4 and T-6 probes is 460 m.

Table 5. Summary of MBT casts conducted during the winter 1995 pollock echo integration-trawl survey of the eastern Bering Sea shelf and slope, MF95-05.

Drop	Date (1995)	Time (GMT)	Position		Depth (m)		Transect	Trawl Type*	Unit Serial No.
			Latitude (N)	Longitude (W)	MBT Cast	Bottom			
1	3 Apr	1052-1128	55 41.47	163 43.57	69	95	2.0	R	4992
2	3 Apr	1247-1302	55 41.67	163 43.40	92	95	2.0	B	5109
3	3 Apr	1922-2010	55 07.30	164 28.76	55	71	3.0	R	4992
4	4 Apr	0216-0231	55 54.51	164 29.03	92	95	3.0	B	5109
5	4 Apr	0549-0616	55 45.57	165 11.77	73	105	3.1	R	5109
6	4 Apr	1310-1339	54 45.16	165 14.21	99	139	4.0	R	4992
7	4 Apr	1742-1833	54 16.96	165 10.51	108	152	4.0	R	5109
8	4 Apr	2017-2038	54 27.50	165 10.65	104	143	4.0	R	5109
9	5 Apr	0446-0517	54 24.58	164 49.82	80	107	3.5	R	5109
10			*** bad drop -- cast failed		***				5109
11	7 Apr	1610-1659	56 25.64	168 59.20	87	114	9.0	R	5109
12	7 Apr	2331-2357	56 21.11	169 21.81	130	135	9.5	M	4992
13	8 Apr	0251-0305	56 27.04	169 45.24	88	91	10.0	B	5109
14	8 Apr	0747-0843	55 58.47	169 41.44	453	604	10.0	R	5109
15	9 Apr	0143-0209	56 16.57	171 14.24	151	148	12.0	B	5109
16	9 Apr	2111-2213	56 32.11	172 20.69	295	794	14.0	R	5109
17	10 Apr	2231-2308	55 27.91	165 19.95	90	114	--	R	5109
18	11 Apr	0152-0244	55 30.26	165 29.87	112	116	--	M	5109
19	11 Apr	0856-0953	55 32.49	164 16.89	70	97	15.0	R	4992
20	11 Apr	1636-1713	55 06.03	164 38.90	52	78	16.0	R	4992
21			*** bad drop -- cast failed		***				4992
22	12 Apr	1337-1413	54 30.22	165 13.65	50	172	18.0	R	5109
23	12 Apr	1656-1725	54 30.03	165 12.73	128	166	18.0	M	5109
24	12 Apr	2324-2354	55 24.31	165 23.69	89	115	18.0	R	5109
25	13 Apr	0848-0919	55 26.91	165 26.92	58	116	18.0	R	5109

\* R = midwater rope trawl, B = 83/112 bottom trawl, M = Marinovich trawl

Table 6. Summary of catch by species in 18 midwater rope trawls during the winter 1995 pollock echo integration-trawl survey of the eastern Bering Sea shelf and slope, MF95-05.

Common Name	Scientific Name	Weight (kg)	Percent	Numbers
Walleye Pollock	<i>Theragra chalcogramma</i>	21,463.7	70.4	33,699
Jellyfish Unidentified	Scyphozoa	8,882.5	29.1	--
Pacific Cod	<i>Gadus macrocephalus</i>	93.0	0.3	22
Smooth Lumpsucker	<i>Aptocyclus ventricosus</i>	21.6	0.1	10
Flathead Sole	<i>Hippoglossoides elassodon</i>	11.4	<0.1	42
Pacific Lamprey	<i>Lampetra tridentata</i>	1.6	<0.1	3
Lanternfish Unidentified	Myctophidae	0.9	<0.1	193
Eulachon	<i>Thaleichthys pacificus</i>	0.2	<0.1	7
Squid Unidentified	Teuthoidea	0.2	<0.1	10
Northern Smoothtongue	<i>Leuroglossus schmidti</i>	0.2	<0.1	43
2 Remaining Species		<0.1	<0.1	--
Totals		30,475.3	100.0	

Table 7. Summary of catch by species in 2 Marinovich rope trawls during the winter 1995 pollock echo integration-trawl survey of the eastern Bering Sea shelf and slope, MF95-05. Catch data from haul no. 18 were excluded because fishing performance was unsatisfactory after the trawl had hit bottom.

Common Name	Scientific Name	Weight (kg)	Percent	Numbers
Walleye Pollock	<i>Theragra chalcogramma</i>	9.3	87.7	12
Euphausiid Unidentified	Euphausiacea	1.1	10.4	21,534
Jellyfish Unidentified	Scyphozoa	0.2	1.9	--
Salps Unidentified	Thaliacea	<0.1	<0.1	--
Totals		10.6	100.0	

Table 8. Summary of catch by species in 4 bottom trawls during the winter 1995 pollock echo integration-trawl survey of the eastern Bering Sea shelf and slope, MF95-05.

Common Name	Scientific Name	Weight (kg)	Percent	Numbers
Walleye Pollock	<i>Theragra chalcogramma</i>	3,239.1	50.0	4,097
Pacific Cod	<i>Gadus macrocephalus</i>	2,089.7	32.2	1,182
Rock Sole	<i>Pleuronectes bilineatus</i>	428.7	6.6	1,514
Jellyfish Unidentified	Scyphozoa	182.9	2.8	--
Pacific Halibut	<i>Hippoglossus stenolepis</i>	115.4	1.8	32
Arrowtooth Flounder	<i>Atheresthes stomias</i>	91.6	1.4	89
Flathead Sole	<i>Hippoglossoides elassodon</i>	83.6	1.3	208
Bairdi Tanner Crab	<i>Chionoecetes bairdi</i>	40.8	0.6	167
Basketstarfish Unidentified	<i>Gorgonocephalus sp.</i>	25.8	0.4	210
Red Irish Lord	<i>Hemilepidotus hemilepidotus</i>	25.3	0.4	51
Alaska Skate	<i>Bathyrāja parmifera</i>	23.8	0.4	6
Empty Snail Shells	Gastropoda	23.3	0.4	102
Purple-Orange Starfish	<i>Asterias amurensis</i>	22.1	0.3	246
Snail Unidentified	Gastropoda	20.4	0.3	199
Hermit Crab Unidentified	Paguridae	20.2	0.3	253
Northern Rockfish	<i>Sebastes polyspinis</i>	14.6	0.2	18
Yellowfin Sole	<i>Pleuronectes asper</i>	13.2	0.2	28
Searcher	<i>Bathymaster signatus</i>	7.0	0.1	18
Sponge Unidentified	Porifera	6.1	0.1	--
Opilio Tanner Crab	<i>Chionoecetes opilio</i>	2.0	<0.1	11
Smooth Lumpsucker	<i>Aptocyclus ventricosus</i>	1.5	<0.1	2
Sea Anemone Unidentified	Actiniaria	1.5	<0.1	11
Pacific Ocean Perch	<i>Sebastes alutus</i>	1.4	<0.1	3
14 Remaining Species		3.9	0.1	43
Totals		6,483.9	100.0	

Table 9. Summary of biological samples and measurements collected during the winter 1995 pollock echo integration-trawl survey of the eastern Bering Sea shelf and slope, MF95-05.

Haul	Length	Maturity	Otoliths	Fish Weight	Ovary Weight	Pollock Stomachs	Pacific Cod Stomachs	Fecundity Samples*	Pollock Spawned	Pollock Frozen	Russia **
1	351	89	89	89	19	12	-	3	-	-	-
2	407	65	65	65	34	3	20	1	-	-	-
3	311	83	83	83	36	17	-	5	-	-	-
4	274	87	87	87	34	6	20	4	-	-	-
5	346	84	84	84	6	-	-	-	X	-	50
6	535	95	95	95	31	3	-	3	-	-	-
7	297	84	84	84	37	12	-	1	-	-	-
8	345	87	87	87	31	20	-	3	X	-	50
9	309	72	72	72	28	20	1	1	-	adults, 20 kg	-
10	359	64	64	64	24	2	-	-	-	-	-
11	381	71	71	71	40	5	2	8	-	-	50
12	-	-	-	-	-	-	-	-	-	-	-
13	94	94	94	94	63	19	-	24	-	-	-
14	203	77	77	77	7	1	-	-	-	-	-
15	25	-	-	-	-	-	20	-	-	age 0 juvs	-
16	296	61	61	61	11	8	-	-	-	-	50
17	351	111	50	50	23	1	3	1	-	adults, 23kg	50
18	4	-	-	-	-	4	-	-	-	-	-
19	312	103	31	103	63	20	-	2	-	-	-
20	374	126	14	14	4	9	-	2	-	-	-
21	334	97	7	7	4	27	-	-	-	-	-
22	404	7	7	7	5	2	-	-	-	-	-
23	12	-	-	-	-	-	-	-	-	-	-
24	319	45	45	45	12	20	-	-	-	adults, 30 kg	-
25	331	75	75	75	15	6	-	3	-	-	-
<b>Total</b>	<b>6,974</b>	<b>1,677</b>	<b>1,342</b>	<b>1,414</b>	<b>527</b>	<b>217</b>	<b>66</b>	<b>61</b>			<b>250</b>

Note -- Length includes samples from random length frequency only

\* Fecundity samples include weights of liver, ovary, and whole body without stomach contents, plus otolith samples, maturity, and sex determination.

\*\* Russian samples include scales, stomach scans, maturities, and fork lengths