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**National Oceanic and Atmospheric Administration**  
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**PRELIMINARY CRUISE RESULTS**  
**NOAA SHIP MILLER FREEMAN**  
**CRUISE NO. 95-04**

**COMBINED ECHO INTEGRATION-TRAWL SURVEY**  
**AND FOCI RESEARCH EFFORT OF WALLEYE POLLOCK IN SHELIKOF STRAIT**

**CRUISE PERIOD, AREA, AND SCHEDULE**

Scientists from the Alaska Fisheries Science Center (AFSC) and the Pacific Marine Environmental Laboratory (PMEL) conducted an echo integration-trawl (EIT) survey (Acoustics Group) and recruitment study [Fisheries-Oceanography Coordinated Investigations (FOCI) Group] directed at walleye pollock (*Theragra chalcogramma*) in the Shelikof Strait area, Gulf of Alaska. The research was conducted aboard the NOAA ship Miller Freeman from March 15 to April 1, 1995, for a total of 16 sea days. Areas of operation included the Shumagin Islands and Shelikof Strait areas. The cruise began in Dutch Harbor. During the latter portion of the cruise, a generator failure suspended trawling operations until the vessel was repaired in Kodiak. Changes in the scientific party were also made in Kodiak. The cruise ended when the vessel passed through Unimak Pass to begin work in the Bering Sea during MF95-05.

The itinerary for the Miller Freeman was as follows:

March 15	Embark scientists in Dutch Harbor
March 16	Conduct one bongo tow in the Shumagin Islands. Cancel planned trawl hauls on spawning pollock aggregations due to bad weather--proceed to Shelikof Strait
March 18-24	Conduct EIT survey of Shelikof Strait area
March 24	Occupy FOCI Line 8 stations
March 24-26	Resume EIT survey of Shelikof Strait area



March 26-27      Suspend trawl operations because of generator failure; complete echo integration portion of EIT survey; transit to Kodiak

March 28-29      Arrive Kodiak for generator repair; exchange portion of scientific party

March 30           Depart Kodiak

March 31-  
April 1            Complete trawl portion of EIT survey; transit to Bering Sea

### OBJECTIVES

The primary objectives of the cruise were to:

1. collect echo-integrator data and midwater and bottom trawl data necessary to determine the distribution, biomass, and biological composition of walleye pollock in the areas of operations;
2. collect various meteorological and physical oceanographic data including vertical profiles of temperature and salinity at selected sites, and continuous monitoring of near-surface currents, temperature, salinity, light levels, etc;
3. collect stomach samples from pollock and other fish species which are considered potential predators of pollock;
4. continue acquisition of long-term biological and physical time series;
5. collect age-0 pollock samples for diet and physiological condition studies;
6. spawn mature pollock and rear the eggs for larval studies in Seattle, Washington, and Newport, Oregon; and
7. collect mature pollock ovaries for fecundity studies.

### VESSEL, ACOUSTIC EQUIPMENT, AND TRAWL GEAR

The survey was conducted on board the NOAA ship Miller Freeman, a 66-m (216-ft) stern trawler equipped for fisheries and oceanographic research. Acoustic data were collected with a quantitative echo-sounding system (Simrad EK500<sup>1</sup>). The Simrad 38

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

and 120 kHz split-beam transducers were mounted on the bottom of the vessel's centerboard. Results presented in this document are based on 38 kHz data. 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. Data from the Simrad EK500 echo sounder/receiver were stored and processed using the Simrad BI500 echo-integration and target-strength data collection and analysis software on a SUN workstation.

Midwater echosign was sampled using a modified Northern Gold 864 midwater rope trawl (NET Systems, Inc., Bainbridge Island, Washington). 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 was fitted with a 3.2-cm (1.25-in) mesh codend liner. Length of the headrope was 94.5 m (310 ft) when measured between the attachment points at the breastline. Length of the footrope was 50 m (164 ft) when measured between the tom weight attachment points. The breastlines measured 79.4 m (260.5 ft). 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 at depth were monitored with a Furuno wireless net sounder system attached to the headrope of the trawl.

Fish on and near bottom were sampled with a polyethylene Nor'eastern high-opening bottom trawl equipped with roller gear. The trawl was constructed with stretch mesh sizes that ranged from 13 cm (5 in) in the forward portion of the net to 8.9 cm (3.5 in) in the codend. It was fitted with a nylon codend liner with a mesh size of 3.2 cm (1.25 in). The 27.2-m (89.1-ft) headrope held 21 floats [30 cm (12 in) diameter]. A 24.7-m (81-ft) chain fishing line was attached to the 24.9-m (81.6-ft) footrope which was constructed of 1-cm (0.4-in) 6 x 19 wire rope wrapped with polypropylene rope. The 24.2-m (79.5-ft) roller gear was constructed with 36-cm (14-in) rubber bobbins spaced 1.5-2.1 m (5-7 ft) apart. A solid string of 10-cm (4-in) rubber disks separated some of the bobbins in the center section of the roller gear. Two 5.9-m (19.5-ft) wire rope extensions with 10-cm (4-in) and 20-cm (8-in) rubber disks were used to span the two lower flying wing sections and were attached to the roller gear. The roller gear was attached to the fishing line using chain toggles [2.9 kg (6.5 lb) each] which were comprised of five links and one ring. The trawl was rigged with triple 54.9-m (180-ft) galvanized wire rope dandyines. 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)]. Vertical net opening, depth, and temperature at depth were monitored with a Furuno wireless net sounder system attached to the headrope of the trawl.

Vertical profile measurements of water temperature and salinity were collected at most trawl stations using a Seabird CTD (conductivity/temperature/depth) system. Temperature profile data were also collected by attaching micro bathythermographs (MBT) to most trawls. At several sites expendable bathythermographs (XBT) were used. The acoustic Doppler current profiler was slaved to the EK500 and operated continuously throughout the cruise in the water profiling mode.

#### SURVEY METHODS

An echo integration-trawl survey was conducted in the Shelikof Strait area to assess the distribution, abundance, and biological characteristics of pollock. (The "Shelikof Strait area" refers to Shelikof Strait and the area surveyed between Middle Cape and Chirikof Island.) Survey transects were oriented parallel to one another. Transects were spaced about 14 km (7.5 nmi) apart except along the western side of the Strait, where 7 km (3.75 nmi) spacing was used (Fig. 1). Greater sampling effort was allocated to the western side of the Strait since it has historically contained most of the pollock spawning biomass. Transects generally did not extend into waters less than about 75 m in depth.

Survey operations were conducted 24 hours a day. Vessel speed averaged about 11 kts while conducting transects, although it varied between 5 and 13.5 kts depending upon weather conditions. Survey operations were scheduled to begin near Chirikof Island but severe weather required skipping transect lines between Chirikof Island and Middle Cape, which were instead completed at the end of the survey.

The acoustic system was used to collect echo-integration and in situ target-strength data during survey operations. Estimates of absolute pollock abundance will be derived from the former data after they are appropriately scaled.

Midwater and bottom trawl hauls were made at selected locations to identify echosign and provide biological samples. Average trawling speed was about 3 kts. The vertical net opening for the midwater rope trawl averaged about 23 m (range 19-30 m). The Poly Nor'eastern trawl's vertical mouth opening was about 5 m (range 4-6 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), age, maturity, and body and ovary weights. An electronic scale was used to determine all weights taken from individual pollock specimens. Fish lengths were usually taken with a Polycorder measuring device (a combination of a bar code reader and a hand held computer). Stomachs were collected from pollock, Pacific

cod, and Arrowtooth flounder and were preserved in 10% formalin. Fecundity samples were removed from mature females and preserved in Gilson's solution. Adult pollock were successfully spawned, and the fertilized eggs were transported to Seattle and Newport, where various studies utilizing pollock eggs and larvae are conducted.

### PRELIMINARY RESULTS

A zig-zag trackline pattern was run near Unimak Pass after departing Dutch Harbor to locate trawlable aggregations of spawning pollock to collect eggs and milt for rearing experiments. No fishable echosign was found. One bongo net tow was conducted in the Shumagin Islands area. Eggs were caught in the tow, suggesting that spawning had recently occurred. Bad weather, however, forced the cancellation of planned trawl hauls on spawning pollock aggregations.

The survey then proceeded to Shelikof Strait, where acoustic data were collected between March 15-27 and comprised about 2,232 km (1,205 nmi) of tracklines (Fig. 1). Nineteen trawl hauls were conducted from March 15-26 (Table 1). A generator breakdown on March 26 suspended trawling operations through the completion of the survey track line on March 27. After repairs were made in Kodiak, six additional trawl hauls were conducted during March 31-April 1 in the southern strait area.

A distributional plot of acoustic backscattering attributed primarily to pollock greater than age 1 is presented in Fig. 2. (Acoustic backscatter collected completely south of Middle Cape has not yet been differentiated between adult pollock and age 1 pollock.) The densest adult pollock aggregations were broadly distributed near Capes Kekurnoi and Kuliak along the west side of the Strait (Fig. 1), where historically the greatest densities of pollock have been observed during surveys conducted in March. Most fish were detected within 50-100 m of the bottom. Age 1 pollock echosign was often detectable in a well-defined, mid-water layer about 150-200 m below the surface from Uyak Bay to the southern limits of the surveyed area near Chirikof Island (Fig. 3).

Pollock was the dominant fish species captured in midwater trawl hauls, comprising 89.5% by weight and 82.0% by numbers of the total catch (Table 2). Eulachon (Thaleichthys pacificus) was the next most common species caught and was primarily associated with tows where the dominant catch by numbers were age 1 pollock. Pollock ranked first in numbers and weight among fishes captured in bottom trawl hauls, comprising 95.5% and 90.9%, respectively (Table 3). Arrowtooth flounder (Atheresthes stomias) was the next most common species caught in bottom trawl hauls.

Biological data were collected at 22 midwater and 3 bottom trawl locations (Tables 1 and 4, Fig. 1). In 15 of the 22 midwater tows, the numbers of age 1 pollock exceeded the catch of older pollock, including all 9 tows conducted south of Middle Cape (Table 1). Age 1 pollock were the dominate catch by weight in 5 tows. Tows made near Cape Kuliak (Hauls 6-10) caught mostly adult pollock, while tows conducted elsewhere caught varying amounts of age 1 (9-15 cm), age 2 (17-30 cm), and older pollock (31-65 cm) (Fig. 4). The size composition of pollock caught in the 3 bottom trawl hauls was similar to nearby mid-water tows, with modal lengths around 48 cm FL and few age-1 pollock.

A total of 2,735 pollock were sampled for maturity from the demersal and midwater catches during the survey. No females less than 31 cm FL or males less than 32 cm FL were mature (Fig. 5). The mean gonadosomatic index (GSI), defined as the ratio of gonad weight to total body weight for mature females, was 0.15 (Fig. 6). The highest numbers of spawning females were observed in the vicinity of Cape Kuliak, where 35% of the adult females were judged to be in spawning condition. Outside of this area, only 5% of the adult females were judged to be in spawning condition.

A total of 10 successful CTD casts, 19 MBT casts, and 4 XBT casts were made during the Acoustics Group's operations (Tables 5-7, Fig. 7). FOCI line 8 time series stations were occupied on March 24, but because of time and weather constraints, only five of eight sites were sampled.

## SCIENTIFIC PERSONNEL

<u>Name</u>	<u>Sex/ Nationality</u>	<u>Position</u>	<u>Organization</u>
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Table 1. Summary of trawl stations and catch data from the Shelikof Strait area during the 1995 echo integration-trawl survey MF95-04.

Haul No.	Date (1995)	Gear type*	Time (GMT)	Start Position		Depth (m)		Temp (deg C)		> = Age 2 pollock		Age 1 pollock		Other	
				Lat. (deg. N)	Long. (deg. W)	Gear	Bottom	Gear	Surface	kg	nos	kg	nos	kg	nos
1	18 Mar	R	1604-1606	57 28.72	155 02.41	162	233	5.2	2.3	19.4	52	44.3	4,377	0.7	34
2	19 Mar	R	0505-0512	57 44.08	155 06.06	252	296	4.7	2.7	454.2	511	1.3	113	5.8	235
3	19 Mar	B	0820-0825	57 38.94	155 12.45	288	288	4.8	2.7	1,031.0	949	0.1	8	369.0	789
4	19 Mar	R	1129-1139	57 33.80	154 54.89	168	230	5.0	3.0	24.2	220	42.1	3,944	6.0	101
5	19 Mar	R	1910-1925	57 47.40	154 53.59	258	282	5.1	1.5	259.2	344	9.4	1,014	31.9	992
6	20 Mar	R	1019-1027	57 56.82	154 16.40	194	219	4.4	2.7	933.4	1,125	0.0	0	5.8	55
7	20 Mar	R	1145-1146	57 58.43	154 20.69	241	274	4.8	2.8	1,543.8	1,679	0.0	0	156.9	18
8	20 Mar	B	1424-1427	58 01.71	154 18.73	269	269	3.1	1.3	3,728.0	3,165	0.0	0	36.2	9
9	20 Mar	B	1923-1928	58 07.95	154 08.28	272	272	3.1	1.4	4,150.1	3,928	0.0	0	13.2	4
10	23 Mar	R	0140-0143	58 14.90	154 00.92	239	256	3.2	1.9	463.7	470	0.0	6	3.3	5
11	23 Mar	R	1044-1054	57 54.87	153 50.95	180	199	4.5	3.0	121.8	653	1.1	132	31.1	1,689
12	23 Mar	R	1434-1440	57 51.96	154 21.08	186	217	5.5	3.3	148.9	510	44.1	3,955	74.9	2,554
13	23 Mar	R	1918-1933	57 41.74	154 27.71	143	209	5.2	3.1	17.7	227	142.2	2,781	24.8	1,187
14	24 Mar	R	0034-0049	57 40.06	154 46.54	195	222	5.0	3.2	2,116.3	2,632	2.3	243	44.6	631
15	24 Mar	R	0548-0549	57 27.61	155 12.18	200	248	5.2	2.9	104.0	362	110.6	9,390	13.0	578
16	24 Mar	R	0936-0937	57 32.63	155 26.64	266	312	5.2	2.9	223.4	375	15.7	1,490	20.6	868
17	25 Mar	R	1019-1024	57 05.41	155 16.83	209	250	5.2	2.7	82.0	219	17.9	1,842	20.1	60
18	25 Mar	R	2043-2057	56 57.14	155 14.42	181	237	5.1	2.5	17.4	64	34.4	2,576	0.3	24
19	26 Mar	R	0431-0451	56 51.91	155 34.62	257	277	5.1	2.4	380.1	1,366	22.7	2,280	120.4	477
20	31 Mar	R	1540-1556	57 13.95	155 27.92	214	262	5.2	2.9	708.6	1,046	171.9	17,466	415.5	4,243
21	31 Mar	R	2052-2102	56 35.30	155 58.65	265	278	4.8	2.6	579.6	1,140	100.7	10,604	64.7	1,461
22	1 Apr	R	0114-0124	56 14.21	156 07.34	209	246	5.0	2.9	63.2	196	145.1	15,591	16.7	605
23	1 Apr	R	0405-0414	56 22.20	156 03.44	211	237	4.9	3.0	625.4	2,076	196.6	20,065	53.4	1,612
24	1 Apr	R	0920-0945	55 41.91	156 17.26	170	254	3.6	3.0	65.1	84	33.8	3,585	16.2	1,032
25	1 Apr	R	1115-1140	55 44.14	156 18.98	231	253	5.2	3.2	299.6	506	85.8	9,374	107.0	9,270

\* R = midwater rope trawl, B = poly Nor'eastern bottom trawl

Table 2. Summary of catch by species in 22 midwater trawls fished in the Shelikof Strait area during the 1995 pollock echo integration-trawl survey MF95-04.

Common name	Scientific name	Weight (kg)	Percent	Numbers	Percent
Walleye pollock	<i>Theragra chalcogramma</i>	10,473.3	89.5%	126,685	82.0%
Eulachon	<i>Thaleichthys pacificus</i>	541.5	4.6%	25,681	16.6%
Salmon Shark	<i>Lamna ditropis</i>	300.0	2.6%	1	<0.1%
Pacific Sleeper Shark	<i>Somniosus pacificus</i>	249.8	2.1%	2	<0.1%
Arrowtooth Flounder	<i>Atheresthes stomias</i>	34.8	0.3%	32	<0.1%
Pacific Cod	<i>Gadus macrocephalus</i>	26.5	0.2%	7	<0.1%
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>	22.0	0.2%	15	<0.1%
Pacific Sleeper Shark	<i>Somniosus pacificus</i>	19.0	0.2%	1	<0.1%
Squid Unidentified	Teuthoidea	14.3	0.1%	764	0.5%
Smooth Lump sucker	<i>Aptocyclus ventricosus</i>	11.0	0.1%	9	<0.1%
Shrimp Unidentified	Natantia	4.9	<0.1%	1,099	0.7%
Red Squid	<i>Berryteuthis magister</i>	2.5	<0.1%	3	<0.1%
Longnose Skate	<i>Raja rhina</i>	2.2	<0.1%	1	<0.1%
Rock Sole	<i>Lepidopsetta bilineata</i>	1.3	<0.1%	2	<0.1%
Rougeye Rockfish	<i>Sebastes aleutianus</i>	1.2	<0.1%	1	<0.1%
Jellyfish Unidentified	Scyphozoa	1.1	<0.1%	3	<0.1%
Northern Smoothtongue	<i>Leuroglossus schmidti</i>	0.4	<0.1%	24	<0.1%
Flathead Sole	<i>Hippoglossoides elassodon</i>	0.4	<0.1%	2	<0.1%
Salps unidentified	Thaliacea	0.3	<0.1%	34	<0.1%
Sidestripe Shrimp	<i>Pandalopsis dispar</i>	0.3	<0.1%	31	<0.1%
Pacific Herring	<i>Clupea pallasii</i>	0.1	<0.1%	3	<0.1%
Lanternfish	Myctophidae	<0.1	<0.1%	13	<0.1%
Capelin	<i>Mallotus villosus</i>	<0.1	<0.1%	2	<0.1%
Comb Jelly Unidentified	Ctenophora	<0.1	<0.1%	1	<0.1%
Total		11,707.0		154,416	

Table 3. Summary of catch by species in 3 bottom trawls from the Shelikof Strait area during the 1995 pollock echo integration-trawl survey MF95-04.

Common name	Scientific name	Weight (kg)	Percent	Numbers	Percent
Walleye pollock	<i>Theragra chalcogramma</i>	8,909.2	95.5%	8,050	90.9%
Arrowtooth Flounder	<i>Atheresthes stomias</i>	212.7	2.3%	184	2.1%
Pacific Halibut	<i>Hippoglossus stenolepis</i>	72.8	0.8%	11	0.1%
Big Skate	<i>Raja binoculata</i>	28.4	0.3%	2	<0.1%
Longnose Skate	<i>Raja rhina</i>	23.0	0.2%	1	<0.1%
Flathead Sole	<i>Hippoglossoides elassodon</i>	21.3	0.2%	48	0.5%
Whiteblotched skate	<i>Bathyraja maculata</i>	14.0	0.2%	1	<0.1%
Bairdi Tanner Crab	<i>Chionoecetes bairdi</i>	9.7	0.1%	87	1.0%
Sea Cucumber Unidentified	Holothuroidea	8.8	0.1%	94	1.1%
Eulachon	<i>Thaleichthys pacificus</i>	8.2	0.1%	103	1.2%
Pacific Cod	<i>Gadus macrocephalus</i>	5.3	0.1%	2	<0.1%
Dover Sole	<i>Microstomus pacificus</i>	2.7	<0.1%	4	<0.1%
Shortraker Rockfish	<i>Sebastes borealis</i>	2.4	<0.1%	2	<0.1%
Sidestripe Shrimp	<i>Pandalopsis dispar</i>	1.4	<0.1%	92	1.0%
Spinyhead Sculpin	<i>Dasycottus setiger</i>	1.4	<0.1%	26	0.3%
Hermit Crab Unidentified	Paguridae	1.0	<0.1%	16	0.2%
Aleutian Skate	<i>Bathyraja aleutica</i>	0.8	<0.1%	7	0.1%
Shortspine Thornyhead	<i>Sebastolobus alascanus</i>	0.7	<0.1%	2	<0.1%
Ctenodiscus sp.		0.7	<0.1%	94	1.1%
Alaska Skate	<i>Bathyraja parmifera</i>	0.6	<0.1%	1	<0.1%
Empty gastropods shells		0.5	<0.1%	0	<0.1%
Oregon Triton	<i>Fusitriton oregonensis</i>	0.5	<0.1%	6	0.1%
Rex Sole	<i>Glyptocephalus zachirus</i>	0.5	<0.1%	1	<0.1%
Starfish Unidentified	Asteroidea	0.5	<0.1%	13	0.1%
Snake prickleback	<i>Lumpenus sagitta</i>	0.4	<0.1%	5	0.1%
Total		9,327.5		8,852	

Table 4. Summary of pollock biological samples and measurements collected from the Shelikof Strait area during the 1995 echo integration-trawl survey MF95-04.

Haul	Length	Maturity	Otoliths	Fish Weight	Ovary Weight	Stomachs	Age 0 Collection	Fecundity Samples	Pollock Spawned
1	141	58	58	58	5	20	50	0	
2	313	108	108	108	8	20	50	2	x
3	347	111	111	111	40	17	0	0	
4	290	37	37	37	8	7	0	1	
5	325	67	67	67	29	20	50	14	x
6	414	129	129	129	2	0	0	0	
7	364	113	113	113	0	0	0	0	
8	324	86	86	86	2	7	0	2	
9	400	98	98	98	2	20	0	0	x
10	327	124	124	124	9	0	0	1	
11	570	132	132	132	6	20	42	4	x
12	350	147	147	147	11	40	50	5	x
13	406	52	36	52	0	33	50	0	
14	542	211	143	211	6	21	0	1	
15	257	116	56	116	11	16	50	1	
16	478	147	0	147	0	0	0	0	
17	340	103	103	103	0	20	50	0	
18	189	79	54	79	2	29	50	0	
19	545	173	129	173	15	0	50	8	
20	496	129	50	129	5	0	0	0	
21	462	96	71	96	11	0	50	0	
22	271	106	106	106	3	0	50	0	
23	567	94	50	94	5	20	50	0	
24	356	84	40	84	15	0	50	0	
25	566	127	52	127	35	22	50	0	
Total	9,640	2,727	2,100	2,727	230	332	742	39	

Table 5. Summary of CTD casts conducted during the 1995 echo integration-trawl survey of the Shelikof Strait area, MF95-04.

Cast	Haul	Date (1995)	Time (GMT)	Position		Depth (m)			Temperature (deg C)	
				Latitude (N)	Longitude (W)	CTD cast	Bottom	Transect	surface	bottom
1	2	19 Mar	0621	57 44.22	155 07.23	no data	293	20.0	----	----
2	4	19 Mar	1245	57 33.97	154 55.71	212	230	21.0	3.0	5.2
3	5	19 Mar	1919	57 47.29	154 55.25	no data	286	25.0	----	----
4	7	20 Mar	1311	57 58.48	154 21.00	no data	279	30.0	----	----
5	10	23 Mar	0236	58 15.08	154 00.75	241	258	41.0	1.9	3.2
6	11	23 Mar	1143	57 55.40	153 51.12	no data	207	43.0	----	----
7	12	23 Mar	1528	57 52.01	154 20.62	no data	216	44.1	----	----
8	13	23 Mar	2016	57 41.45	154 26.15	193	208	46.0	3.1	5.2
9	14	24 Mar	0148	57 40.28	154 44.54	203	222	47.0	3.2	5.0
10	15	24 Mar	0643	57 27.61	155 12.18	225	246	47.1	1.9	5.1
11	16	24 Mar	1040	57 32.60	155 26.65	280	312	16.0	2.9	5.1
12	--	24 Mar	1249	57 42.74	155 15.15	*	299	--	*	*
13	--	24 Mar	1504	57 40.54	155 09.06	*	286	--	*	*
14	--	24 Mar	1738	57 35.94	155 00.44	*	239	--	*	*
15	--	24 Mar	2001	57 30.68	154 46.41	*	214	--	*	*
16	--	24 Mar	2154	57 32.85	154 52.50	*	*	--	*	*
17	17	25 Mar	1119	57 05.65	155 16.16	228	249	13.0	2.8	5.2
18	18	25 Mar	2143	56 57.95	155 13.45	225	232	12.0	2.6	5.1
19	21	31 Mar	2154	56 35.04	155 58.04	253	276	8.0	2.6	4.8
20	22	1 Apr	0114	56 13.89	156 06.48	223	243	5.0-6.0	2.9	5.0
21	24	1 Apr	1029	55 44.69	156 19.34	no data	252	1.0-2.0	----	----

\* Data not yet available.

Table 6. Summary of XBT casts conducted during the 1995 echo integration-trawl survey of the Shelikof Strait area, MF95-04.

Drop	Probe	Haul	Date (1995)	Time (GMT)	Position		Bottom depth (m)	Transect
					Latitude (N)	Longitude (W)		
1	T-4	1	18 Mar	1709	57 28.68	155 02.23	230	--
2	T-4	--	20 Mar	0835	58 01.43	154 16.77	273	30.0
3	T-6	8	20 Mar	1530	58 01.55	154 18.94	269	--
4	T-6	9	20 Mar	2012	58 08.12	154 07.93	271	33.0

Table 7. Summary of MBT casts conducted during the 1995 echo integration-trawl survey of the Shelikof Strait area, MF95-04.

Drop	Haul	Date (1995)	Time (GMT)	Position		Depth (m)		Transect	Trawl Type*
				Latitude (N)	Longitude (W)	MBT Cast	Bottom		
1	1	18 Mar	1604	57 28.72	155 02.41	153	233	17.0	R
2	2	19 Mar	0505	57 44.08	155 06.06	231	296	20.0	R
3	4	19 Mar	1129	57 33.80	154 54.89	failed	228	21.0	R
4	5	19 Mar	1910	57 47.40	154 53.59	152	278	25.0	R
5	6	20 Mar	1019	57 56.82	154 16.40	179	219	30.0	R
6	7	20 Mar	1145	57 58.43	154 20.69	228	274	30.0	R
7	8	20 Mar	1424	58 01.71	154 18.73	271	271	30.0	B
8	9	20 Mar	1923	58 07.95	154 08.28	271	271	33.0	B
9	10	23 Mar	0140	58 14.90	154 00.92	226	257	41.0	R
10	11	23 Mar	1044	57 54.87	153 50.95	166	192	43.0	R
11	12	23 Mar	1434	57 51.96	154 21.08	170	214	44.1	R
12	13	23 Mar	1918	57 41.74	154 27.71	127	209	46.0	R
13	14	24 Mar	0034	57 40.06	154 46.54	failed	220	47.0	R
14	15	24 Mar	0548	57 27.61	155 12.18	failed	243	16.0	R
15	16	24 Mar	0936	57 32.63	155 26.64	239	310	16.0	R
16	17	25 Mar	1019	57 05.41	155 16.83	193	248	13.0	R
17	18	25 Mar	2043	56 57.14	155 14.42	165	237	12.0	R
18	19	26 Mar	0431	56 51.91	155 34.62	243	276	11.0	R
19	20	31 Mar	1540	57 13.95	155 27.92	202	262	14.0	R
20	21	31 Mar	2052	56 35.30	155 58.65	256	278	8.0	R
21	22	1 Apr	0114	56 14.21	156 07.34	failed	246	6.0-7.0	R
22	23	1 Apr	0405	56 22.02	156 03.44	198	237	5.0-6.0	R
23	24	1 Apr	0920	55 41.91	156 17.26	failed	254	1.0-2.0	R
24	25	1 Apr	1115	55 44.14	156 18.98	218	243	1.0-2.0	R

\* R = midwater rope trawl, B = poly Nor'eastern bottom trawl

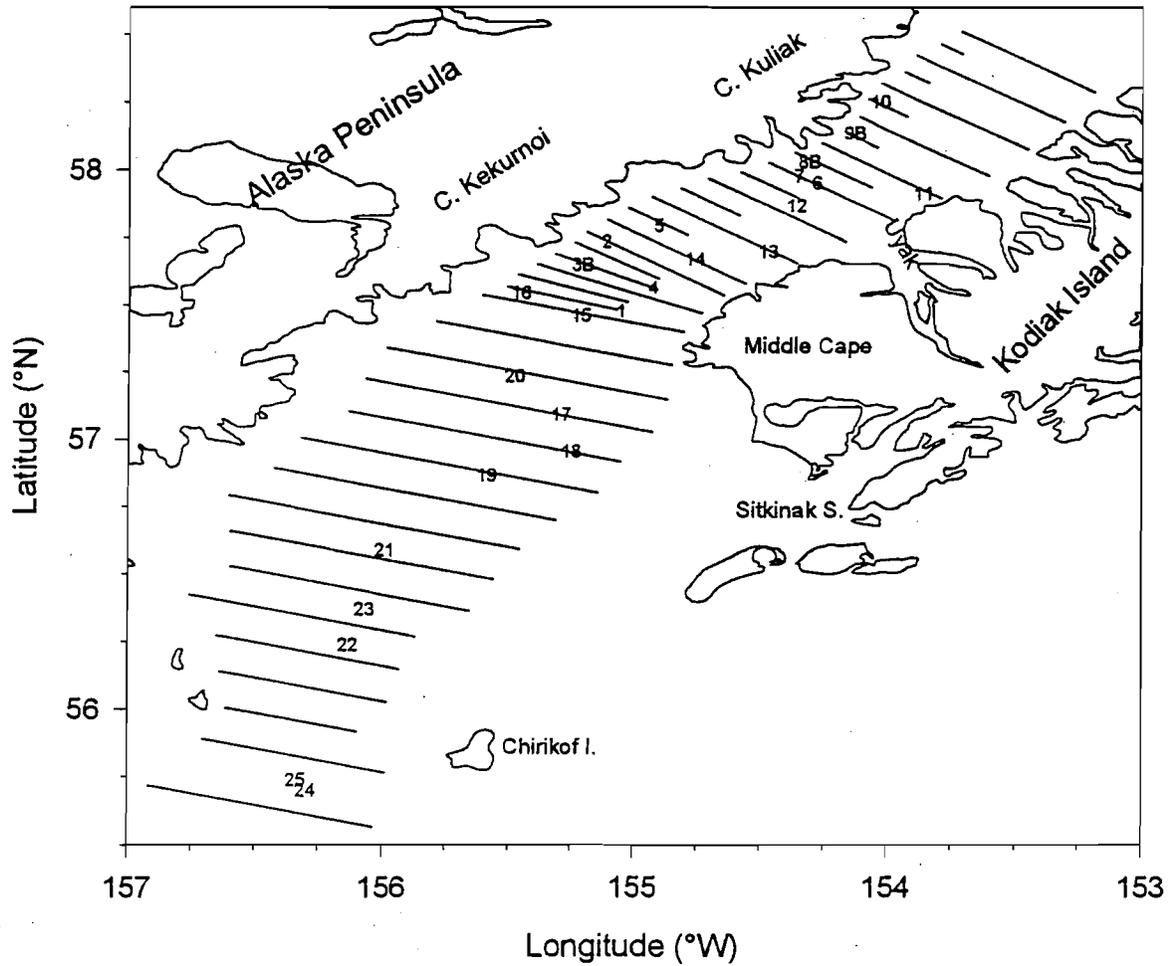


Figure 1. Survey trackline through the Shelikof Strait area during the 1995 echo integration-trawl survey, MF95-04. Numbers and numbers followed by "B" represent midwater rope trawl and bottom trawl haul positions, respectively. Cross transects are not shown.

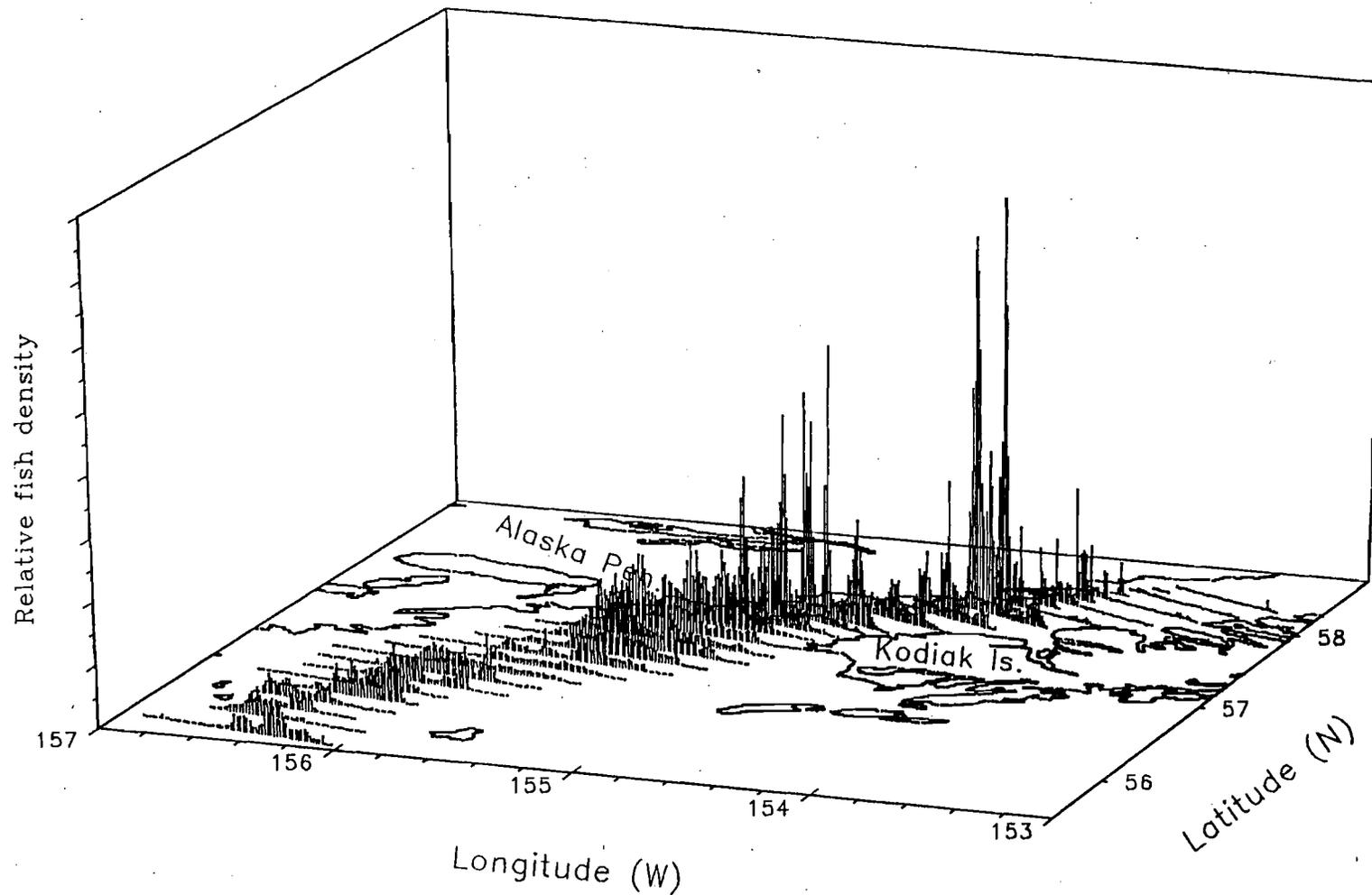


Figure 2. Acoustic backscattering ( $S_A$ ) attributed primarily to pollock greater than age 1 from the Shelikof Strait area during the 1995 echo integration-trawl survey MF95-04. The contribution of acoustic backscattering due to age-1 pollock has not yet been determined for  $S_A$  values in the southern strait area.

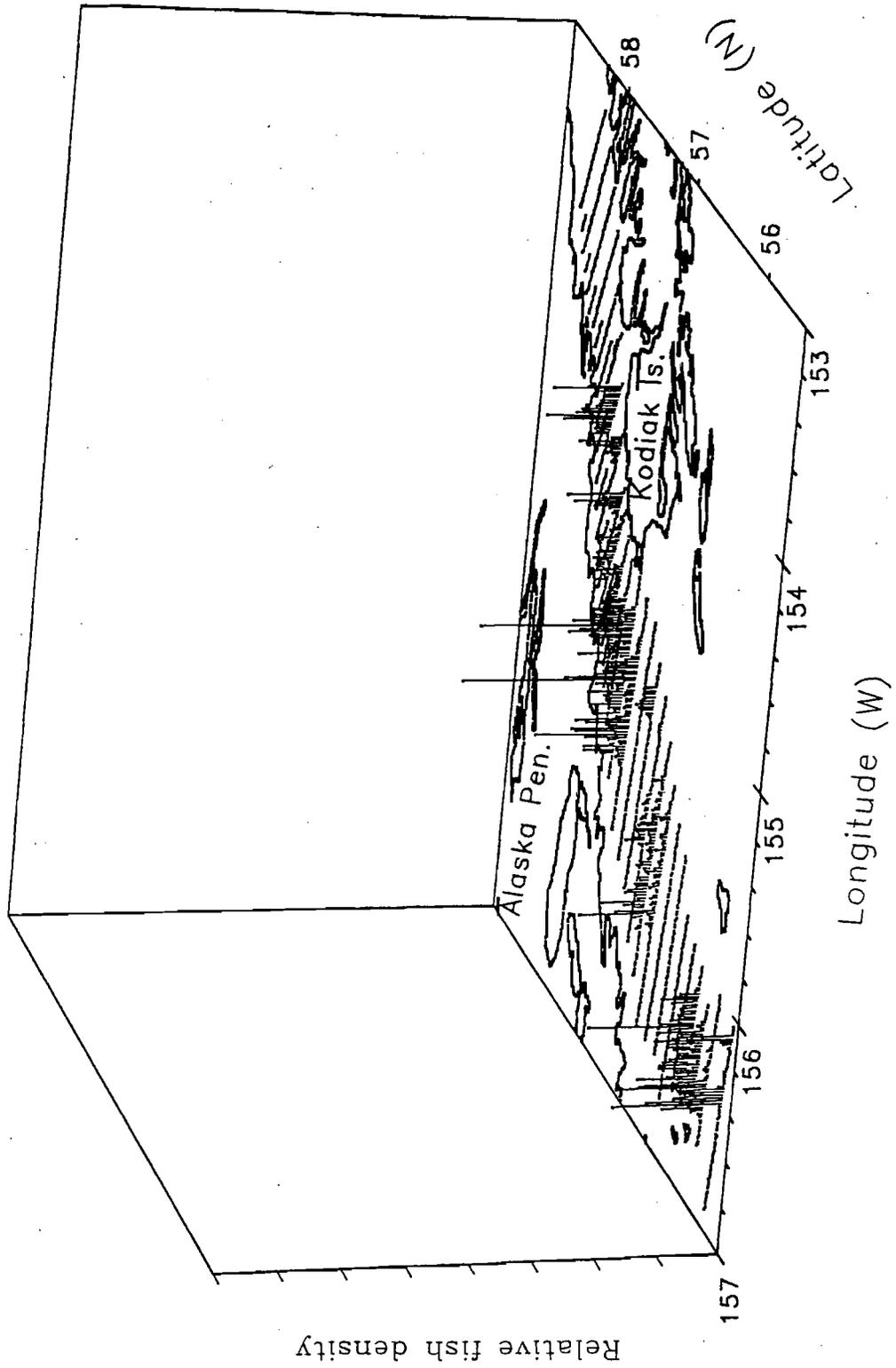


Figure 3. Acoustic backscattering ( $S_A$ ) attributed primarily to the distinct midwater layer of age 1 pollock along tracklines from the Shelikof Strait area during the 1995 echo integration-trawl survey MF95-04.

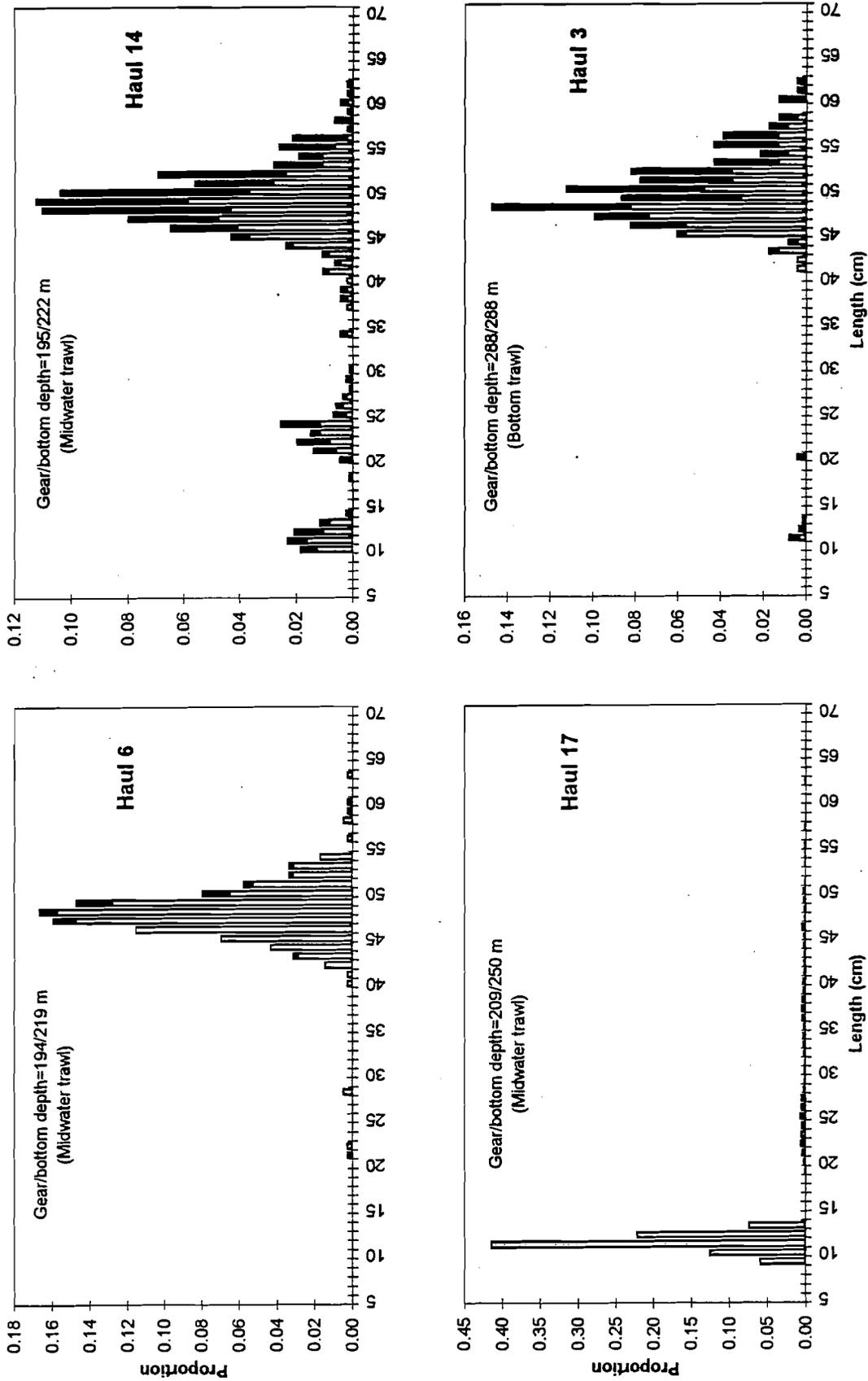


Figure 4. Typical pollock size compositions from trawls conducted in the Shelikof Strait area during the 1995 echo integration-trawl survey MF95-04. Hauls 3 and 6 were conducted near Cape Kuliak, haul 4 was conducted near Cape Kekurnoi, and haul 17 was conducted south of Middle Cape. Hauls 6, 14, and 17 were midwater trawls, and haul 3 was a bottom trawl. (Black bars=females, white bars=males, cross-hatched bars=unsexed).

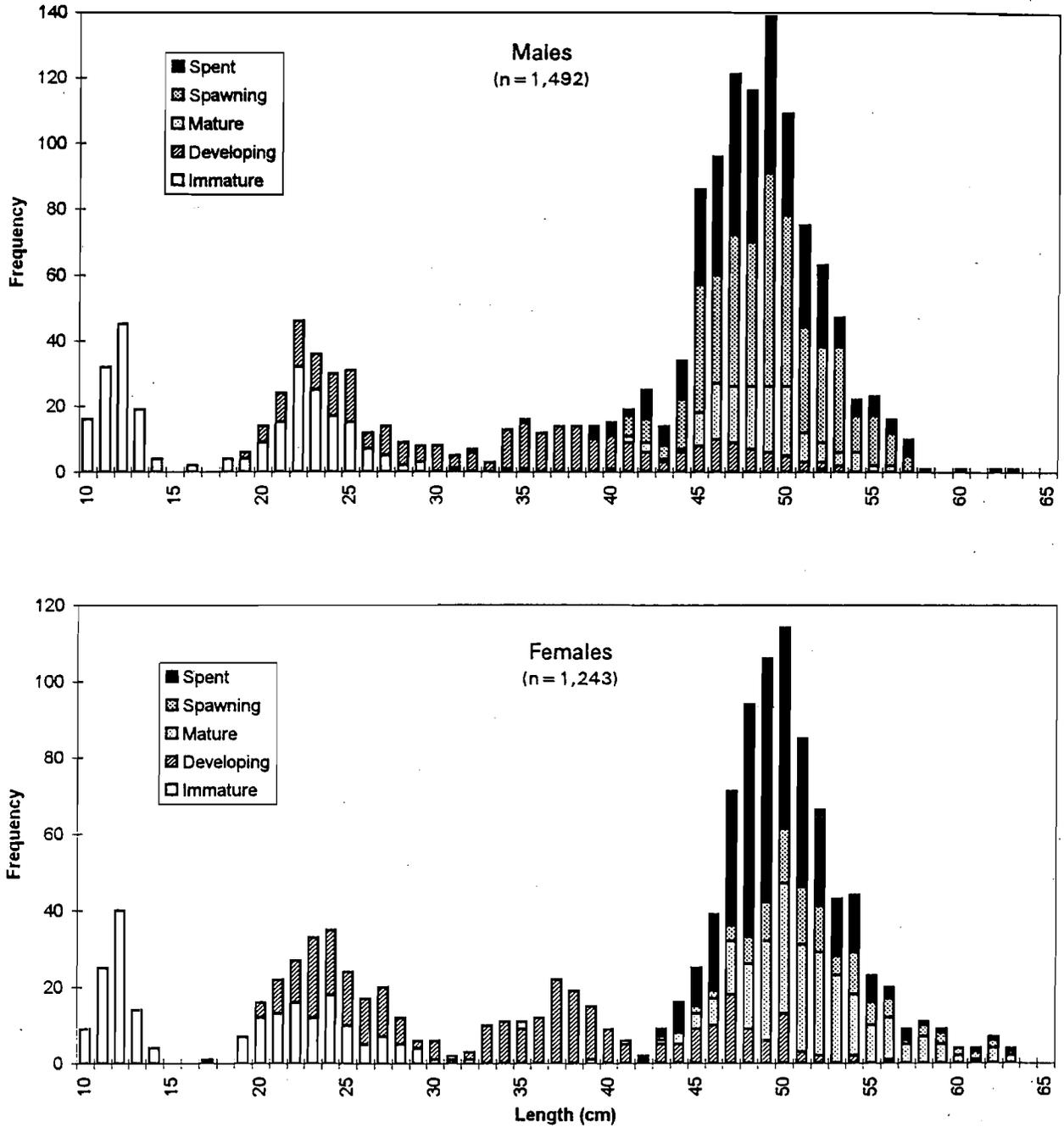


Figure 5. Maturity-length compositions for male and female pollock taken from the Shelikof Strait area during the echo integration-trawl survey MF95-04.

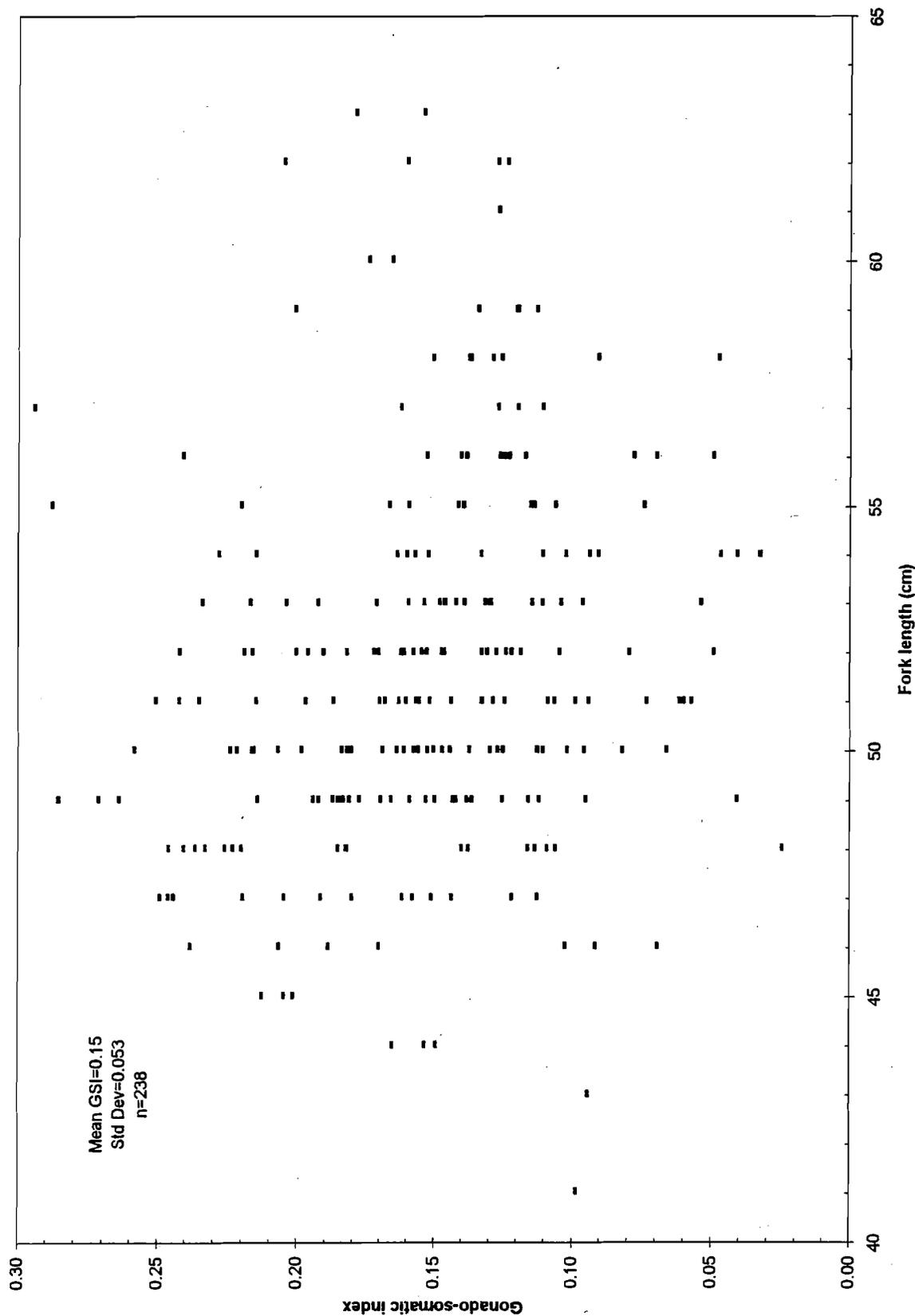


Figure 6. Pollock gonado-somatic indices for mature females plotted as a function of length from the Shelikof Strait area during the 1995 echo integration-trawl survey MF95-04.

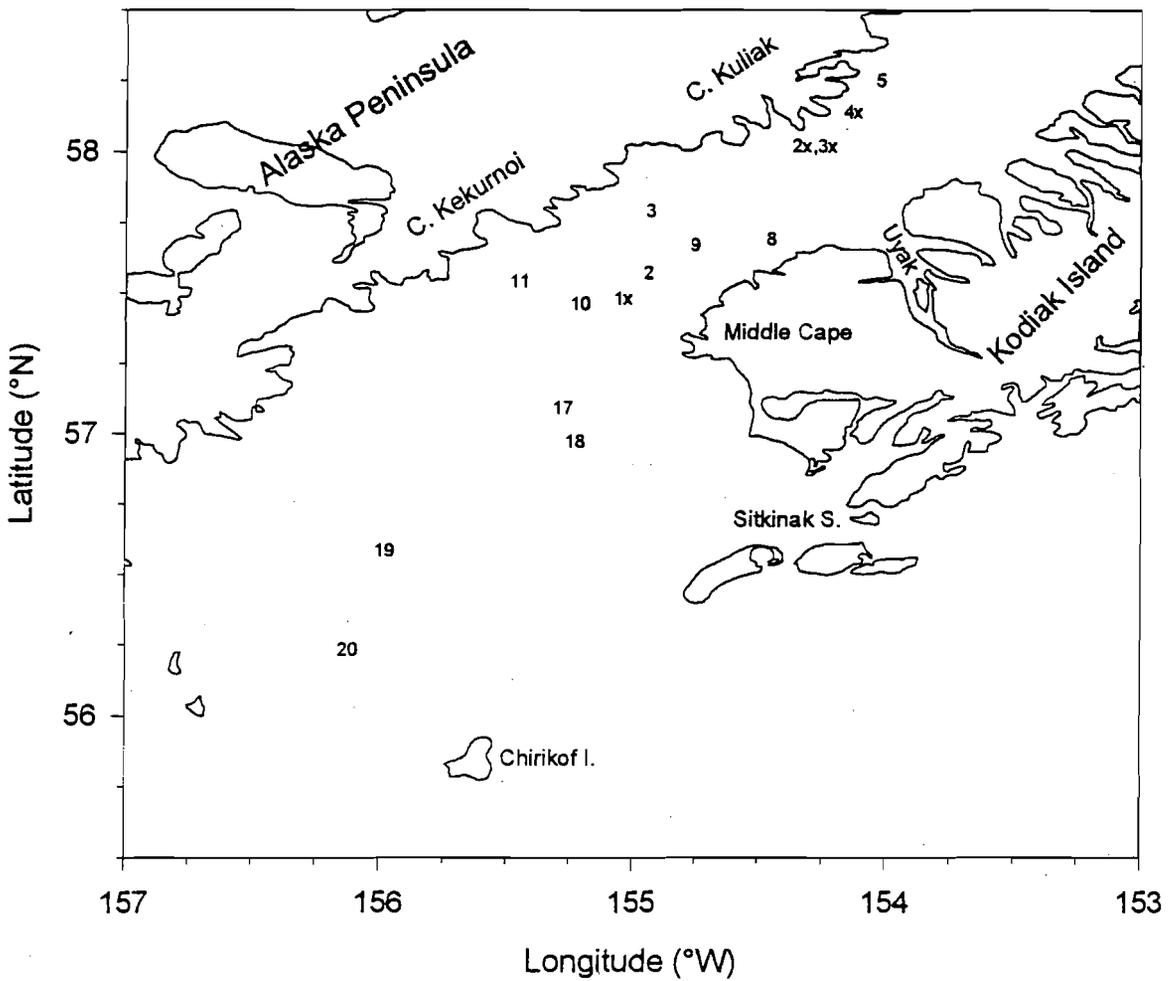


Figure 7. Successful CTD and XBT casts conducted in the Shelikof Strait area during the 1995 echo integration-trawl survey, MF95-04. Numbers and numbers followed by "x" represent CTD and XBT cast locations, respectively.