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National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
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PRELIMINARY CRUISE RESULTS
NOAA SHIP *Miller Freeman*
CRUISE NO. 97-03

ECHO INTEGRATION-TRAWL SURVEY OF WALLEYE POLLOCK IN SHELIKOF STRAIT

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*) in the Shelikof Strait area in the Gulf of Alaska aboard the NOAA ship *Miller Freeman* from March 13-26, 1997, for a total of 14 sea days. The cruise began in Dutch Harbor and ended in Homer, Alaska. The itinerary for the *Miller Freeman* was as follows:

VESSEL ITINERARY

Mar 13	Embark scientists in Dutch Harbor and transit to Nateekin Bay, for sphere calibration.
Mar 13-14	Transit to Shelikof Strait.
Mar 14-25	EIT survey of Shelikof Strait area.
Mar 22	Transit to Kodiak to disembark scientist, embark personnel, resume EIT survey.
Mar 25-26	Conduct sphere calibration; transit to Homer.
Mar 27	Disembark scientists; end of cruise.

OBJECTIVES

The primary objectives of the cruise were to:

1) collect echo integration data and midwater and bottom trawl data necessary to determine the distribution, abundance, and biological composition of walleye pollock in the area of operations; and,

2) collect pollock target strength data for use in scaling echo integration data to estimates of absolute abundance.

The secondary objectives of the cruise were to:

1) calibrate the 38 kHz and 120 kHz scientific acoustic systems using standard sphere techniques;

2) collect physical oceanographic data including temperature and salinity profiles at selected sites, and conduct continuous monitoring of sea surface parameters (e.g., temperature, salinity, and light level);

3) collect stomachs from walleye pollock, and arrowtooth flounder (*Atheresthes stomias*) for food habits analysis;

4) spawn mature pollock and culture the fertilized eggs for laboratory experiments on eggs and larvae;

5) collect samples of pollock ovary tissue for studying the interannual variation in fecundity;

6) collect genetic samples of pollock and pacific cod (*Gadus macrocephalus*) for stock identification studies; and,

7) collect eulachon for a seabird foraging study.

VESSEL, ACOUSTIC EQUIPMENT, AND TRAWL GEAR

The survey was conducted on board the NOAA ship *Miller Freeman*, a 66 m stern trawler equipped for fisheries and oceanographic research. Acoustic data were collected with a Simrad EK500[1] quantitative echo-sounding system. Simrad 38 kHz and 120 kHz

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[1]Reference to trade names or commercial firms does not constitute U.S. Government endorsement.

split-beam transducers were mounted on the bottom of the vessel's retractable centerboard. The centerboard was fully extended during all scientific operations. This positioned the transducers 9 m below the surface. All results presented here are based on data collected with the 38 kHz transducer. Data from the Simrad EK500 echo sounder/receiver were processed using Simrad BI500 echo integration and target strength data analysis software on a SUN workstation.

Midwater echo sign was sampled with an Aleutian Wing 30/26 trawl (AWT), which is a full mesh wing trawl constructed of nylon except for polyethylene towards the aft section of the body and the codend. The headrope and footrope both measured 81.7 m (268 ft). Mesh sizes tapered from 3.25 m (128 in) in the forward section of the net to 89 mm (3.5 in) in the codend. The codend was fitted with a 32 mm (1.25 in) liner. The AWT was fished with 82.3 m (270 ft) of 1.9 cm (0.75 in) diameter 8x19 non-rotational dandylines, 455 kg (1,000 lb.) tom weights on each side, and 5 m^2 (53.8 ft^2) "Fishbuster" doors (1,250 kg [2,750 lb.]).

Fish on and near bottom were sampled with a polyethylene Nor'eastern (PNE) 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 89 mm (3.5 in) in the codend. It was fitted with a nylon codend liner with a mesh size of 32 mm (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 dandylines. The net was fished with the "Fishbuster" doors.

Most trawl hauls were monitored with a WesMar third wire trawl sonar attached to the headrope of the trawl. Vertical and horizontal net openings, depth, and temperature at depth were measured. A Furuno wireless net sounder system was used on four trawl hauls.

Vertical profile measurements of water temperature and salinity were collected at calibration sites using a Seabird CTD (conductivity/temperature/depth) system. Temperature profile data were also collected by attaching micro bathythermographs (MBT) to most trawls. The acoustic Doppler current profiler transducer cable was damaged immediately prior to the cruise and prevented successful operation of the acoustic Doppler profiler during the survey.

SURVEY METHODS

Two EIT survey passes were 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 14 km (7.5 nmi) apart except on the western side of the Strait, where 7 km (3.75 nmi) spacing was used (Figs. 1- 2). Greater sampling effort was allocated to the western side of the Strait because it has historically contained most of the pollock spawning biomass. Transects generally did not extend into waters less than about 30 m in depth.

Survey operations were conducted 24 hours a day. Typical vessel speed was about 11-12 knots when running transects. Echo integration data were collected with a horizontal resolution of about 9 m and a vertical resolution of 0.5-1 m. 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 knots. The vertical net opening for the midwater AWT trawl averaged about 29 m (range 25-34 m). The PNE trawl vertical mouth opening was about 9 m (range 6-10 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 (8 point scale), and body and ovary weights. An electronic scale was used to determine weights of 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

and arrowtooth flounder and were preserved in 10% formalin. Tissue and otolith samples were collected from individual walleye pollock for Fisheries-Oceanography Coordinated Investigations (FOCI) and Alaska Department of Fish and Game genetic research. Fecundity samples were removed from mature females and preserved in 10% formalin. Adult pollock were successfully spawned, and the fertilized eggs were transported to Seattle, WA, and Newport, OR, where various studies utilizing pollock eggs and larvae are conducted.

PRELIMINARY RESULTS

Four standard sphere calibrations were carried out in conjunction with the survey (Table 1). Three calibrations were completed prior to the cruise: on February 11 in Puget Sound, WA; on February 28 in Captain's Bay, Unalaska Is., AK; and, on March 14 in Nateekin Bay, Unalaska Is., AK. Upon completion of the cruise a calibration was conducted on March 26 in Malina Bay, Kodiak Is., AK. No significant differences in the 38 kHz system parameters were observed among the four calibrations.

Acoustic data were collected between March 14-25 in the Shelikof Strait area along about 2,040 km (1,100 nmi) of transect tracklines on two passes (Figs. 1-2). Pollock acoustic backscattering was assigned to 2 categories of echosign: 1) that attributed primarily to pollock from the 1994 year class which formed a well-defined midwater layer; and, 2) echosign attributed primarily to adult pollock. A distributional plot of the acoustic backscattering attributed primarily to adult pollock during pass 1 indicated that the densest adult pollock aggregations were broadly distributed around Cape Kekurnoi and Cape Kuliak along the west side of the Strait (Fig. 3). The greatest densities of pollock have historically been observed in these areas during surveys conducted in March. Backscattering attributed primarily to adult pollock during pass 2 was similarly distributed, although relatively greater scattering was detected off Katmai Bay (Fig. 4). Most echosign from adult pollock was detected within 50-100 m of the bottom. Acoustic backscattering attributed primarily to pollock from the 1994 year class (year class tentatively identified on the basis of fork length, otolith age data not yet available) during passes 1 and 2 was often detectable as a well-defined, mid-water layer about 150-200 m below the surface. This layer existed from Sitkinak Strait to about Uyak Bay, although during pass 2 some fish were also found near Cape Kuliak (Figs. 5-6). Some 2-year-old fish likely occurred in the mid-water layer, based on the

size distribution data from the layer, although this will need to be confirmed with the otolith age data when they become available.

Biological data were collected at 16 AWT midwater and 14 PNE (5 conducted in midwater) bottom trawl locations (Tables 2-3, Fig. 1). The size composition of pollock varied in different regions of the survey area (Fig. 7). The numbers of age-3 pollock (modal FL range 26-28 cm) exceeded the catch of older pollock in all tows that targeted the mid-water layer in the survey area. The near-bottom tows conducted in the southern Strait area caught mostly age-3 pollock, with varying amounts of age-1 (modal FL range 12-13 cm) and adult pollock (modal FL range 37-53 cm). Tows made between Cape Kekurnoi and Kuikpalik Island on the western side of the Strait caught mostly adult pollock (modal FL range 50-55 cm).

Pollock was the dominant fish species captured in midwater trawl hauls, comprising 93.8% by weight and 79.2% by numbers of the total catch (Table 4). Eulachon (*Thaleichthys pacificus*) was the next most common species caught (20.5% by number) and were primarily associated with tows occurring within 50 m of the bottom south of Cape Kekurnoi. Pollock ranked first in weight and numbers among fishes captured in bottom trawl hauls (includes midwater and on-bottom hauls), comprising 93.4% and 89.4% respectively (Table 5). Arrowtooth flounder (3.3% by weight) and eulachon (5.7% by numbers) were the next most common species caught. Table 6 summarizes the special studies carried out during the survey.

A total of 2,836 pollock were sampled for maturity from the trawl catches during the survey. No females less than 33 cm FL or males less than 25 cm FL were classified as mature (Fig. 8). Eighty-eight percent of the females greater than 34 cm FL were either in prespawning or spawning condition and only 6% were in spent condition. The mean gonadosomatic index, defined as the ratio of gonad weight to total body weight for mature females, was 0.19 (Fig. 9).

A total of 31 successful MBT casts were made during the survey (Table 2).

SCIENTIFIC PERSONNEL

Name	Nationality	Position	Organization	Dates Aboard
Chris Wilson	USA	Chief Scientist	AFSC	Mar. 13-26
Dan Twohig	USA	Electronics Tech.	AFSC	Mar. 13-26
Michael Guttormsen	USA	Fish. Biologist	AFSC	Mar. 13-22
Taina Honkalehto	USA	Fish. Biologist	AFSC	Mar. 13-26
Steve de Blois	USA	Fish. Biologist	AFSC	Mar. 13-26
Kevin Landgraf	USA	Fish. Biologist	AFSC	Mar. 13-26
Tom Wilderbuer	USA	Fish. Biologist	AFSC	Mar. 13-26
Harold Zenger	USA	Fish. Biologist	AFSC	Mar. 13-26
Lisa Britt	USA	Fish. Biologist	FOCI	Mar. 13-26

AFSC - Alaska Fisheries Science Center, Seattle, Washington
FOCI - Fisheries-Oceanography Coordinated Investigations, Seattle, Washington

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Table 1. Summary of sphere calibrations conducted before, during and after the winter 1997 pollock echo integration-trawl survey of the Shelikof Strait region.

Date (1997)	Location	Freq (kHz)	Water Temp (deg. C) at Transducer*	Water Temp (deg. C) at Sphere	Sphere Range from Transducer (m)	TS Gain (dB)	SV Gain (dB)	3dB Beam Width (deg.)	Angle Offset Along	Angle Offset Athwart
11 Feb	Port Susan, WA	38	7.5	8.2	31.8	27.2	27.1	6.81	-0.03	-0.06
28 Feb	Captains Bay, AK	38	3.5	3.8	31.5	27.1	27.1	6.80	0.00	-0.05
14 Mar	Nateekin Bay, AK	38	3.4	3.4	28.8	27.1	--	6.79	0.00	-0.03
26 Mar	Malina Bay, AK	38	3.8	3.8	26.6	27.1	27.1	6.71	-0.01	-0.06
Feb-Mar	System settings during surveys	38	--	--	--	27.1	27.1	6.70	-0.09	-0.02

* The transducer is 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 1997 pollock echo integration-trawl survey of the Shelikof Strait area, MF9703.

Haul	Gear[1]	Date	Time	Duration	Start position		Depth (m)		Temp. (deg.		MBT cast	Pollock catch		Other catch	
No.	type	(GMT)	(GMT)	minutes	Lat (N)	Long (W)	gear	bottom	gear	surface	number	kg	number	kg	number
1	317	15 Mar	23:42	25	56 9.81	156 0.92	216	233	5.1	4.3	2	1,520.9	5,522	529.1	2,592
2	172	16 Mar	8:16	20	56 27.42	156 11.73	248	275	5.1	3.8	3	551.8	[2]	39.0	68
3	172	16 Mar	10:33	37	56 26.95	156 12.19	188	270	4.9	3.8	4	71.7	388	15.0	8
4	317	16 Mar	20:55	16	56 41.49	156 9.15	191	235	4.3	3.6	5	2,085.8	14,969	0.2	3
5	317	17 Mar	0:34	15	56 39.51	155 53.84	257	282	5.0	3.9	6	1,955.4	6,859	712.6	16,085
6	317	17 Mar	11:41	5	56 55.43	155 51.23	196	300	4.6	3.4	7	1,196.9	9,379	3.1	27
7	172	18 Mar	6:48	20	57 12.45	155 15.06	176	246	4.4	3.5	8	182.0	1,118	3.8	5
8	172	18 Mar	11:02	40	57 16.28	155 36.54	254	281	5.0	3.6	9	788.1	923	62.4	786
9	317	19 Mar	3:35	20	57 27.48	155 32.55	280	298	4.9	4.0	10	1,711.8	3,054	86.2	2,326
10	317	19 Mar	5:48	20	57 26.98	155 32.90	123	299	4.0	4.0	11	521.3	3,495	0.3	11
11	317	19 Mar	10:07	12	57 29.15	155 1.80	91	235	4.0	4.3	12	564.3	3,957	0.0	1
12	317	19 Mar	12:00	10	57 28.87	155 1.57	182	233	4.9	4.3	13	1,673.4	9,937	140.6	306
13	172	19 Mar	17:25	5	57 36.87	155 13.45	264	264	5.0	3.5	14	229.7	204	58.0	174
14	317	19 Mar	21:32	30	57 39.98	155 7.93	235	283	4.9	3.8	15	609.8	755	34.0	599
15	172	20 Mar	4:00	3	57 47.01	155 2.42	275	275	4.9	3.0	16	4,783.5	3,935	556.5	253
16	317	20 Mar	6:31	5	57 46.44	155 0.46	269	312	4.9	3.0	17	4,586.5	12,608	28.5	266
17	317	20 Mar	10:35	12	57 43.28	155 4.68	92	291	4.1	4.8	18	367.7	2,442	0.0	2
18	317	20 Mar	13:25	15	57 43.31	155 3.43	86	284	4.1	3.4	19	51.3	293	3.4	12
19	172	20 Mar	19:31	10	57 50.95	154 49.12	282	282	4.8	3.1	20	2,691.5	2,153	173.5	215
20	172	21 Mar	6:01	1	57 55.71	154 27.47	251	263	4.5	3.2	21	2,414.8	1,809	135.2	40
21	317	21 Mar	8:48	1	57 59.47	154 24.27	198	355	4.2	2.9	22	133.2	111	5.2	4
22	317	21 Mar	10:08	3	57 59.41	154 24.47	199	355	4.2	2.9	23	4,922.6	3,695	2.4	8
23	172	21 Mar	17:26	2	58 2.32	154 19.56	251	251	4.3	2.9	24	1,038.8	817	88.0	13
24	172	21 Mar	20:41	2	57 59.28	154 12.73	221	221	4.6	3.9	25	772.6	616	3.1	11
25	172	22 Mar	0:54	3	58 9.14	154 2.56	256	256	4.6	4.1	26	4,043.9	3,779	26.1	14
26	172	23 Mar	16:40	13	58 11.80	153 57.26	215	215	4.4	4.2	27	4,924.4	3,563	95.7	48
27	317	24 Mar	5:31	2	57 32.74	155 19.72	273	285	4.9	3.2	28	1,288.7	1,279	83.7	1,386
28	172	24 Mar	10:24	10	57 26.86	154 54.74	220	220	4.9	3.3	29	135.9	291	331.7	772
29	172	25 Mar	4:31	1	57 52.80	154 32.60	240	240	4.4	3.9	30	890.5	696	72.4	61
30	317	25 Mar	8:50	21	57 55.53	154 15.57	78	212	4.1	4.1	31	1,667.5	11,656	2.5	2

[1]Gear type 172 = poly Nor'eastern bottom trawl, 317 = Aleutian wing trawl

[2]Total pollock numbers not determined because of a sampling processing error.

Table 3 Summary of pollock biological samples and measurements collected during the winter 1997 echo integration-trawl survey of the Shelikof Strait area, MF97-03.

Haul	Length	Maturity	Otoliths	Fish Weight	Ovary Weight
1	645	130	55	179	6
2	373	105	50	142	73
3	178	70	45	70	8
4	370	57	25	57	0
5	749	139	56	202	11
6	470	75	37	96	0
7	380	104	50	104	0
8	608	123	74	180	51
9	600	131	61	190	6
10	403	81	0	81	0
11	311	131	0	131	0
12	486	64	0	120	0
13	248	104	54	144	54
14	594	76	76	155	1
15	311	65	54	65	26
16	578	100	48	100	11
17	460	50	0	50	0
18	293	35	0	35	0
19	347	100	100	100	33
20	372	100	100	100	62
21	111	26	0	26	20
22	307	101	101	101	83
23	378	106	106	106	43
24	334	100	100	100	46
25	458	126	126	126	10
26	315	102	102	102	94
27	462	150	40	196	61
28	344	84	0	140	14
29	347	108	108	108	55
30	397	93	0	93	0
Totals	12,229	2,836	1,568	3,399	768

Table 4. Summary of catch by species in 16 midwater trawls fished in the Shelikof Strait area during the 1997 pollock echo integration-trawl survey MF97-03.

Common name	Scientific name	Weight (kg)	Percent	Numbers	Percent
Walleye pollock	*Theragra chalcogramma*	24,857.1	93.8%	90,011	79.2%
Eulachon	*Thaleichthys pacificus*	975.7	3.7%	23,346	20.5%
Pacific sleeper shark	*Somniosus pacificus*	497.0	1.9%	3	<0.1%
Rougheye rockfish	*Sebastes aleutianus*	70.9	0.3%	33	<0.1%
Chinook salmon	*Oncorhynchus tshawytscha*	25.6	0.1%	8	<0.1%
Arrowtooth flounder	*Atheresthes stomias*	22.5	0.1%	20	<0.1%
Pacific cod	*Gadus macrocephalus*	14.9	0.1%	4	<0.1%
Berryteuthis magister	*Berryteuthis magister*	13.0	<0.1%	78	<0.1%
Smooth lumpsucker	*Aptocyclus ventricosus*	5.4	<0.1%	5	<0.1%
Shortraker rockfish	*Sebastes borealis*	5.4	<0.1%	1	<0.1%
Sidestripe shrimp	*Pandalopsis dispar*	0.6	<0.1%	121	<0.1%
Flathead sole	*Hippoglossoides elassodon*	0.3	<0.1%	1	<0.1%
Rex sole	*Glyptocephalus zachirus*	0.3	<0.1%	1	<0.1%
Sablefish	*Anoplopoma fimbria*	0.2	<0.1%	1	<0.1%
Squid unidentified	Teuthoidea	<0.1	<0.1%	3	<0.1%
Capelin	*Mallotus villosus*	<0.1	<0.1%	4	<0.1%
Pandalus borealis	*Pandalus borealis*	<0.1	<0.1%	1	<0.1%
Total		26,488.9		113,641	

Table 5. Summary of catch by species in 14 bottom trawls from the Shelikof Strait area during the 1997 pollock echo integration-trawl survey MF97-03. *Pollock total number not determined for haul 2 due to sample processing error.

Common name	Scientific name	Weight (kg)	Percent	Numbers*	Percent
Walleye pollock	*Theragra chalcogramma*	22,967.3	93.4%	20,292	89.4%
Arrowtooth flounder	*Atheresthes stomias*	805.8	3.3%	472	2.1%
Pacific halibut	*Hippoglossus stenolepis*	296.5	1.2%	41	0.2%
Big skate	*Raja binoculata*	279.8	1.1%	15	0.1%
Eulachon	*Thaleichthys pacificus*	84.0	0.3%	1,288	5.7%
Pacific cod	*Gadus macrocephalus*	39.7	0.2%	15	0.1%
Berryteuthis magister	*Berryteuthis magister*	26.8	0.1%	23	0.1%
Pacific sleeper shark	*Somniosus pacificus*	22.0	0.1%	1	<0.1%
Aleutian skate	*Bathyraja aleutica*	15.0	0.1%	1	<0.1%
Bigmouth sculpin	*Hemitripterus bolini*	14.6	<0.1%	1	<0.1%
Dover sole	*Microstomus pacificus*	8.6	<0.1%	5	<0.1%
Flathead sole	*Hippoglossoides elassodon*	8.0	<0.1%	21	0.1%
Longnose skate	*Raja rhina*	7.2	<0.1%	1	<0.1%
Sidestripe shrimp	*Pandalopsis dispar*	7.1	<0.1%	472	2.1%
Chionoecetes bairdi	*Chionoecetes bairdi*	2.3	<0.1%	9	<0.1%
Sea pen unidentified	Pennatulacea (order)	1.6	<0.1%	7	<0.1%
Shortfin eelpout	*Lycodes brevipes*	0.5	<0.1%	2	<0.1%
Sea urchin unidentified		0.3	<0.1%	5	<0.1%
Hermit crab unidentified	Paguridae	0.3	<0.1%	4	<0.1%
Rougheye rockfish	*Sebastes aleutianus*	0.3	<0.1%	1	<0.1%
Skate unidentified	Rajidae unident.	0.3	<0.1%	1	<0.1%
Sablefish	*Anoplopoma fimbria*	0.2	<0.1%	1	<0.1%
Rex sole	*Glyptocephalus zachirus*	0.2	<0.1%	1	<0.1%
Jellyfish unidentified	Scyphozoa	0.2	<0.1%	1	<0.1%
Snail unidentified	Gastropod unident.	0.1	<0.1%	1	<0.1%
Squid unidentified	Teuthoidea	0.1	<0.1%	1	<0.1%
Prickleback unidentified	Stichaeidae	0.1	<0.1%	5	<0.1%
Ribbed sculpin	*Triglops pingeli*	<0.1	<0.1%	1	<0.1%
Starfish unidentified	Asteroidea	<0.1	<0.1%	2	<0.1%
Skate egg case		<0.1	<0.1%	1	<0.1%
Shrimp unidentified	Decapoda	<0.1	<0.1%	1	<0.1%
Total		24,588.6		22,692	

Table 6. Summary of biological samples collected for special studies during the winter 1997 pollock echo integration-trawl survey of the Shelikof Strait area (MF9703).

Haul	Spawned Pollock	Stomach Samples POL[1]/ATF[2]	Pollock Ovary Collection	Pollock Genetics Tissue[3]	Pollock Genetics Fin clip
1	-	20/2	36	-	-
2	-	-/-	15	-	-
3	-	8/1	2	-	-
4	-	-	-	-	-
5	-	-/1	4	-	-
6	-	8/-	-	-	-
7	-	-/1	-	-	-
8	-	-	6	-	-
9	Y	-	1	-	7
10	-	3/-	-	-	-
11	-	5/-	-	-	-
12	-	-	-	-	-
13	-	-/2	-	-	-
14	-	4/-	-	-	-
15	-	-/10	1	-	-
16	-	-	-	20	-
17	-	-	-	-	-
18	-	7/-	-	-	-
19	Y	-/7	3	-	9
20	-	-/10	2	20	-
21	-	-	-	-	-
22	-	-	-	-	-
23	-	-	-	-	-
24	-	10/-	-	20	4
25	Y	-	-	-	-
26	-	-	-	-	-
27	Y	-/1	2	-	8
28	-	-/1	-	-	-
29	-	-/3	-	20	20
30	-	-	-	-	-
Total	4	65/39	72	80	48

[1] Walleye Pollock

[2] Arrowtooth flounder

[3] Muscle, heart, liver and eye fluid

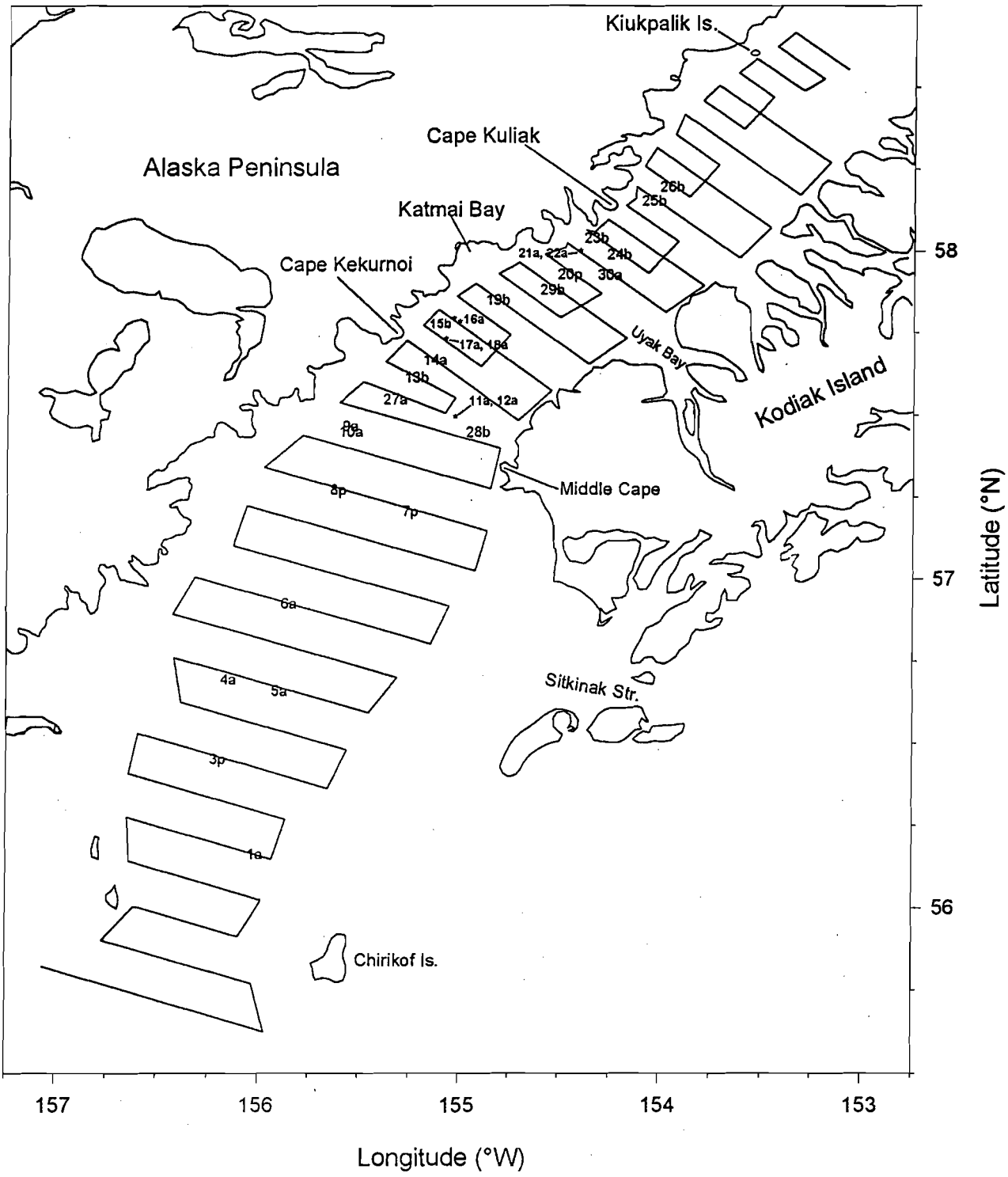

Figure 1. Survey trackline and locations of hauls conducted during the winter 1997 pollock echo integration-trawl survey of the Shelikof Strait area, MF97-03. Numbers followed by "p" and "a" represent hauls made off-bottom with the poly nor'eastern (PNE) bottom trawl and Aleutian wing trawl, respectively. Numbers followed by "b" represent on-bottom hauls made with the PNE trawl.

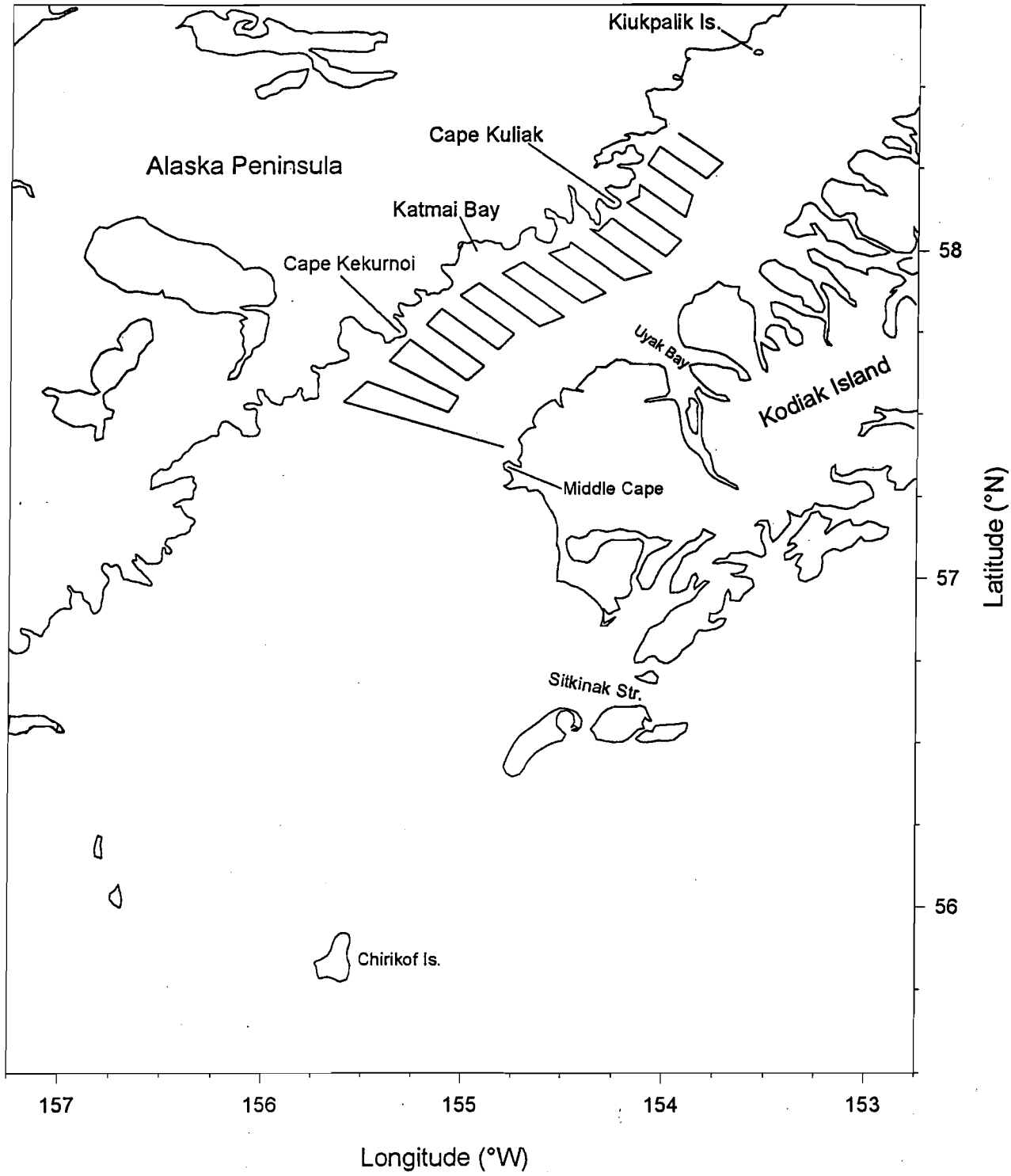

Figure 2. Survey trackline during pass 2 of the winter 1997 pollock echo integration-trawl survey of the Shelikof Strait area, MF97-03.

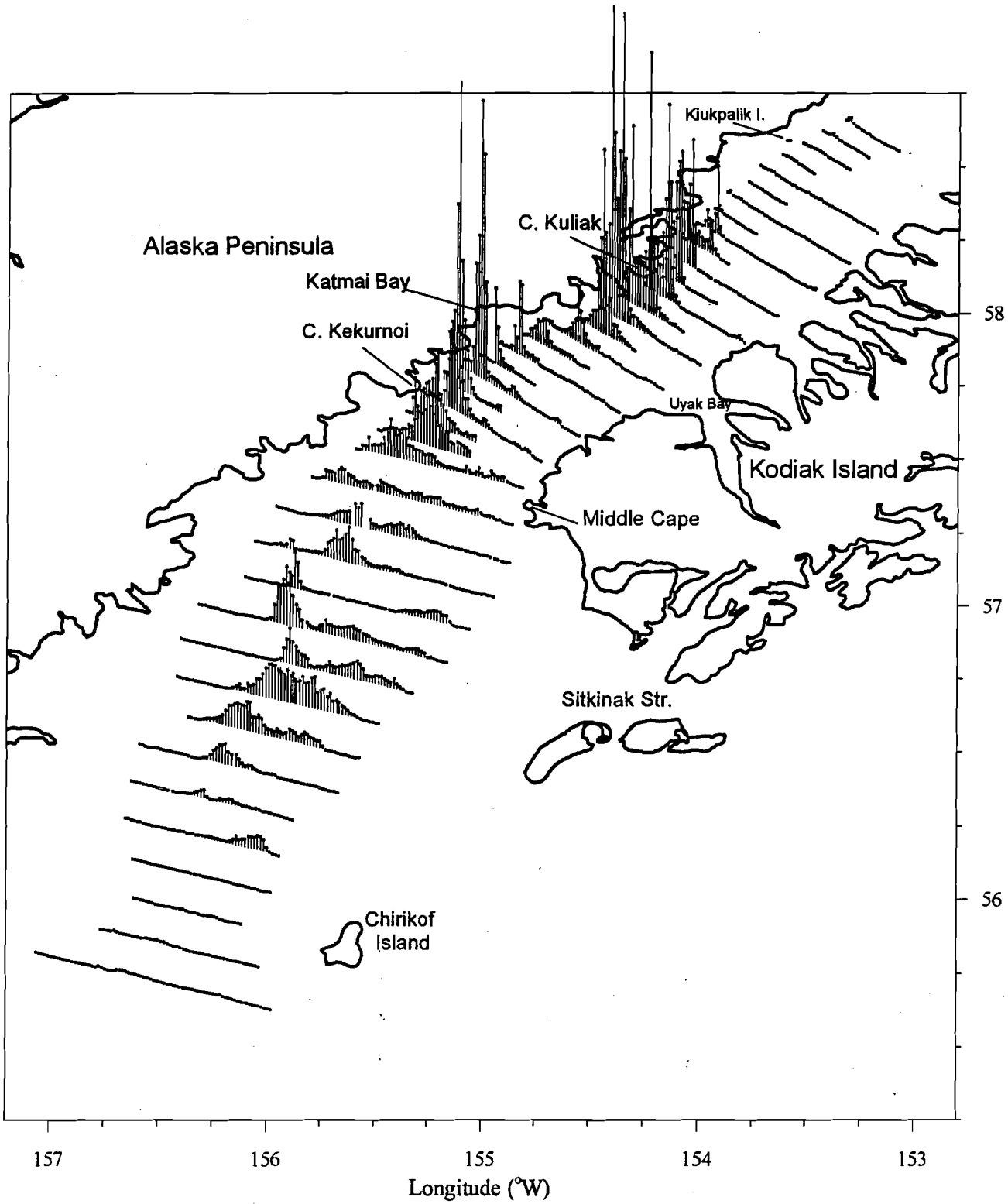

Figure 3. Acoustic backscattering (S_A) attributed primarily to greater than age-3 pollock along trackline during pass 1 of the 1997 echo integration-trawl survey of the Shelikof Strait area.

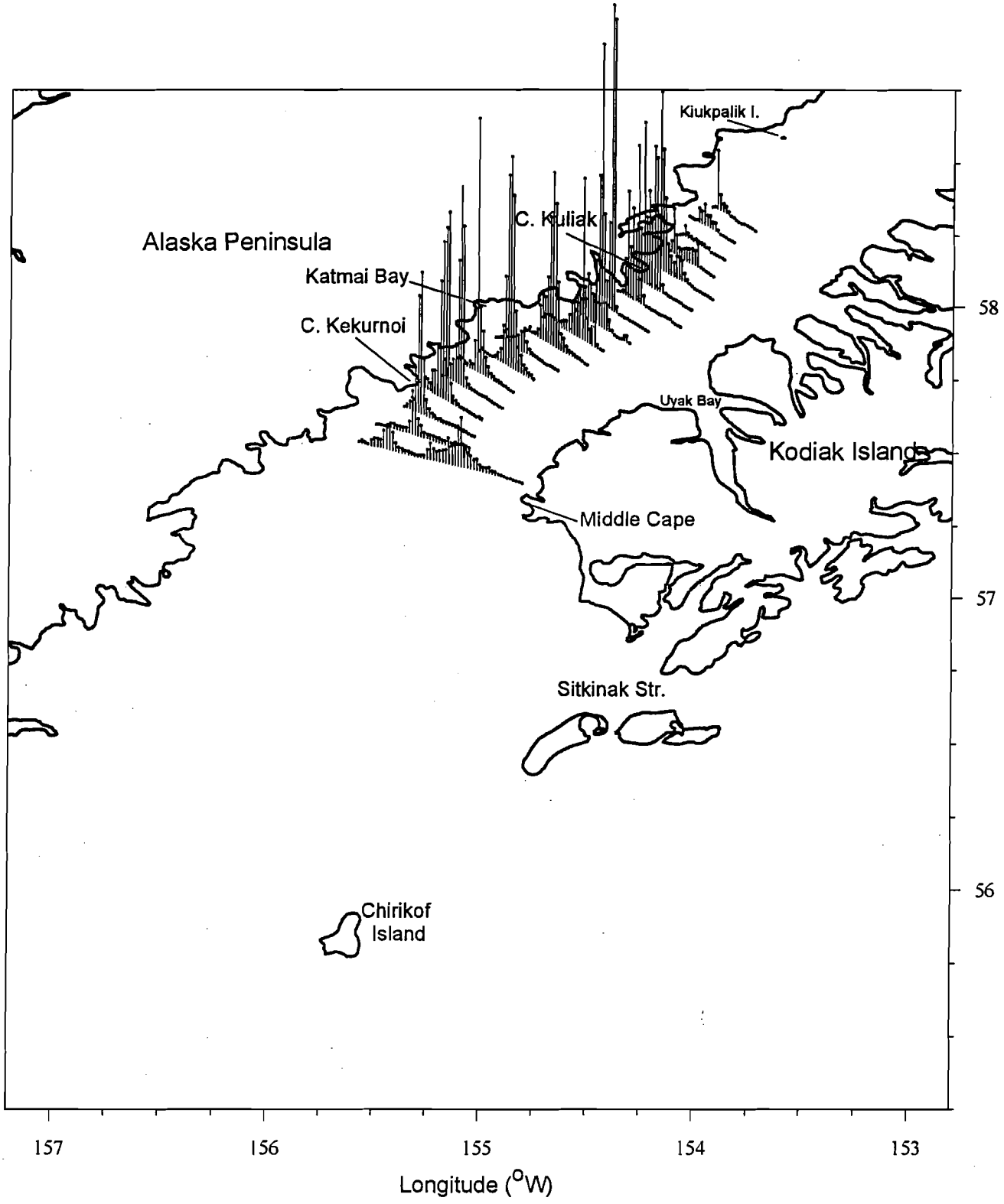

Figure 4. Acoustic backscattering (S_A) attributed primarily to greater than age-3 pollock along trackline during pass 2 of the 1997 echo integration-trawl survey of the Shelikof Strait area.

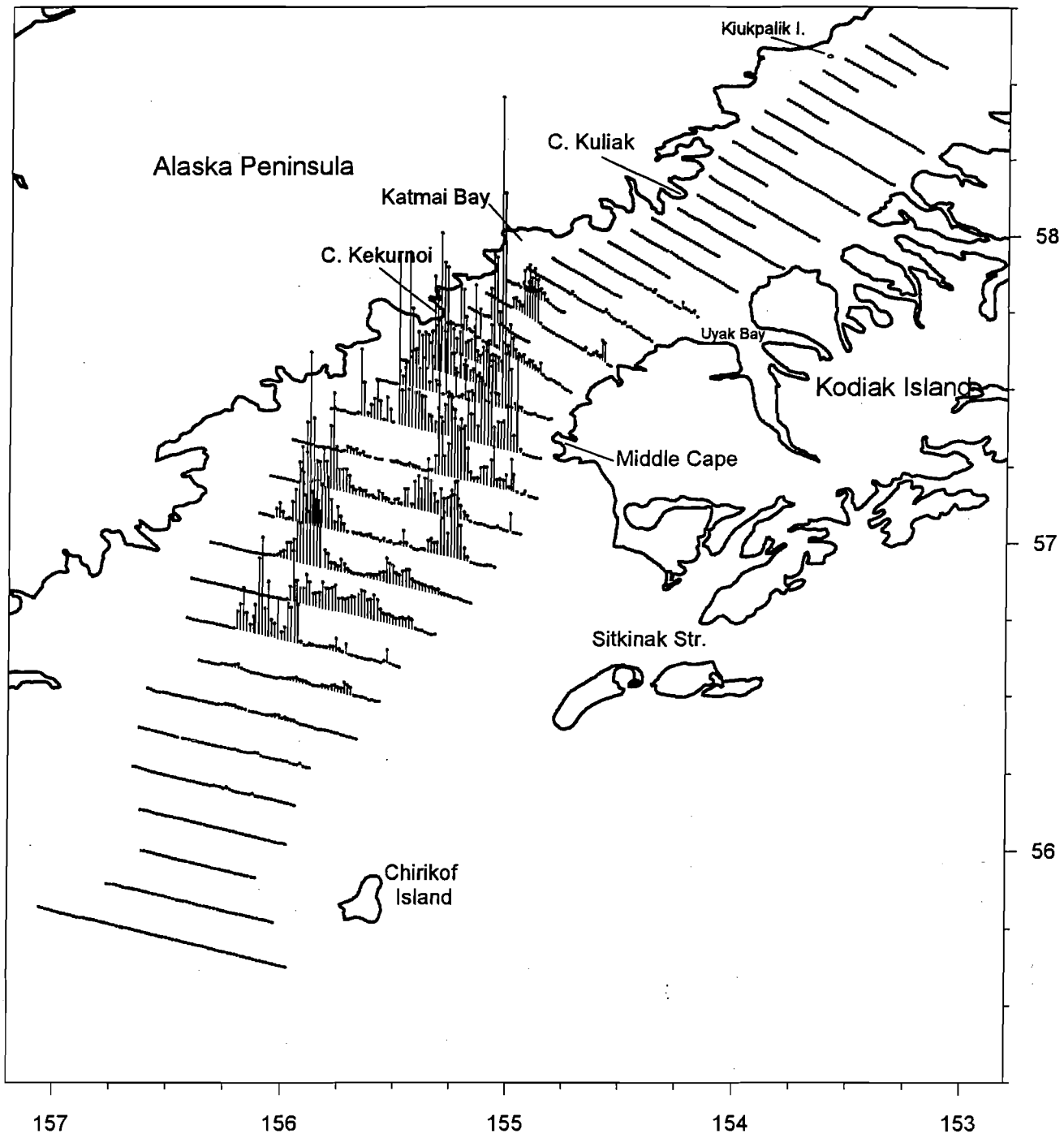

Figure 5. Acoustic backscattering (S_A) attributed primarily to pollock from the 1994 year class along trackline during pass 1 of the 1997 echo integration-trawl survey of the Shelikof Strait area. Tentative identification of 1994 year class based on forklength (age data not available yet).

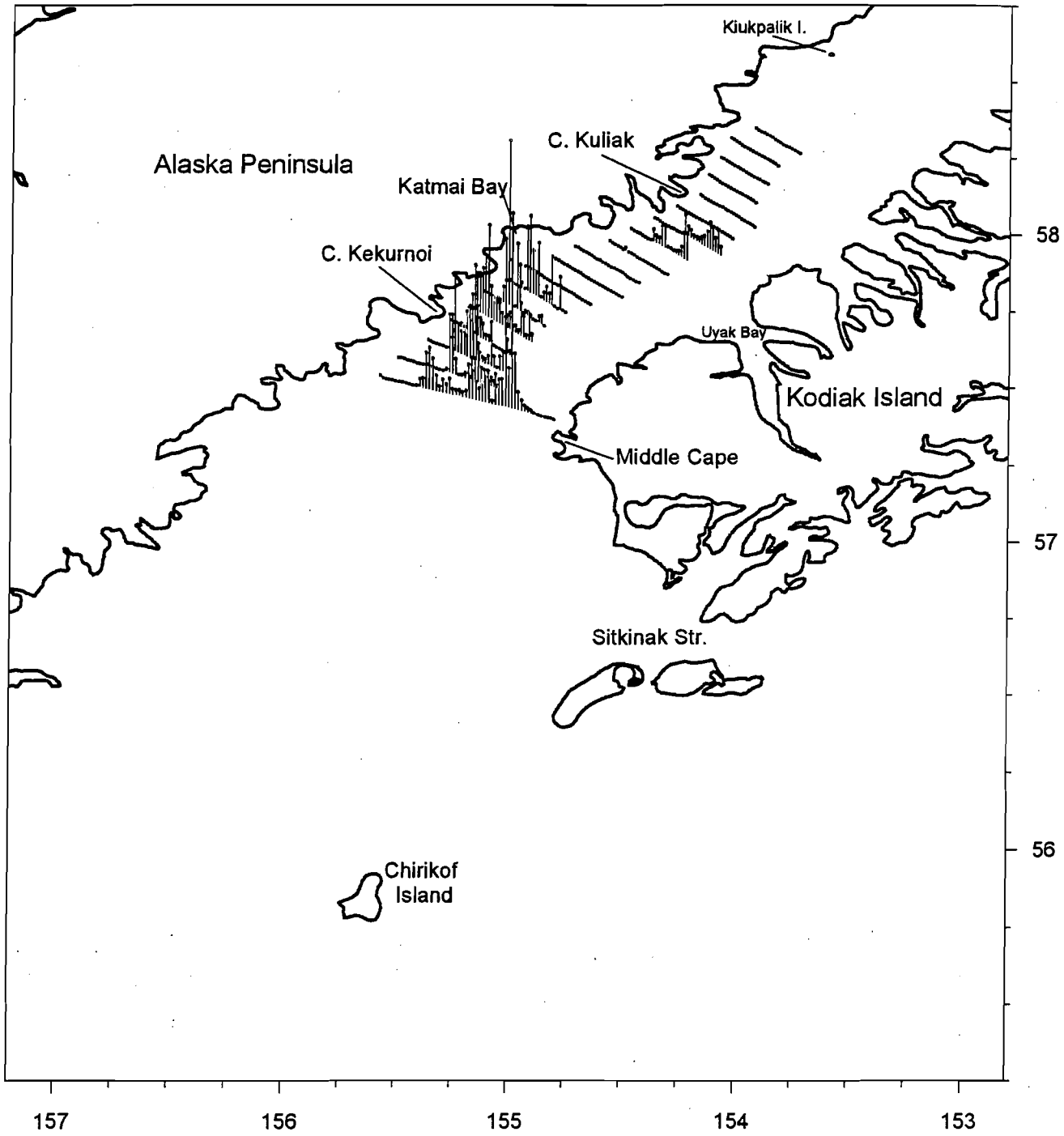

Figure 6. Acoustic backscattering (S_A) attributed primarily to pollock from the 1994 year class along trackline during pass 2 of the 1997 echo integration-trawl survey of the Shelikof Strait area. Tentative identification of 1994 year class based on forklength (age data not available yet).

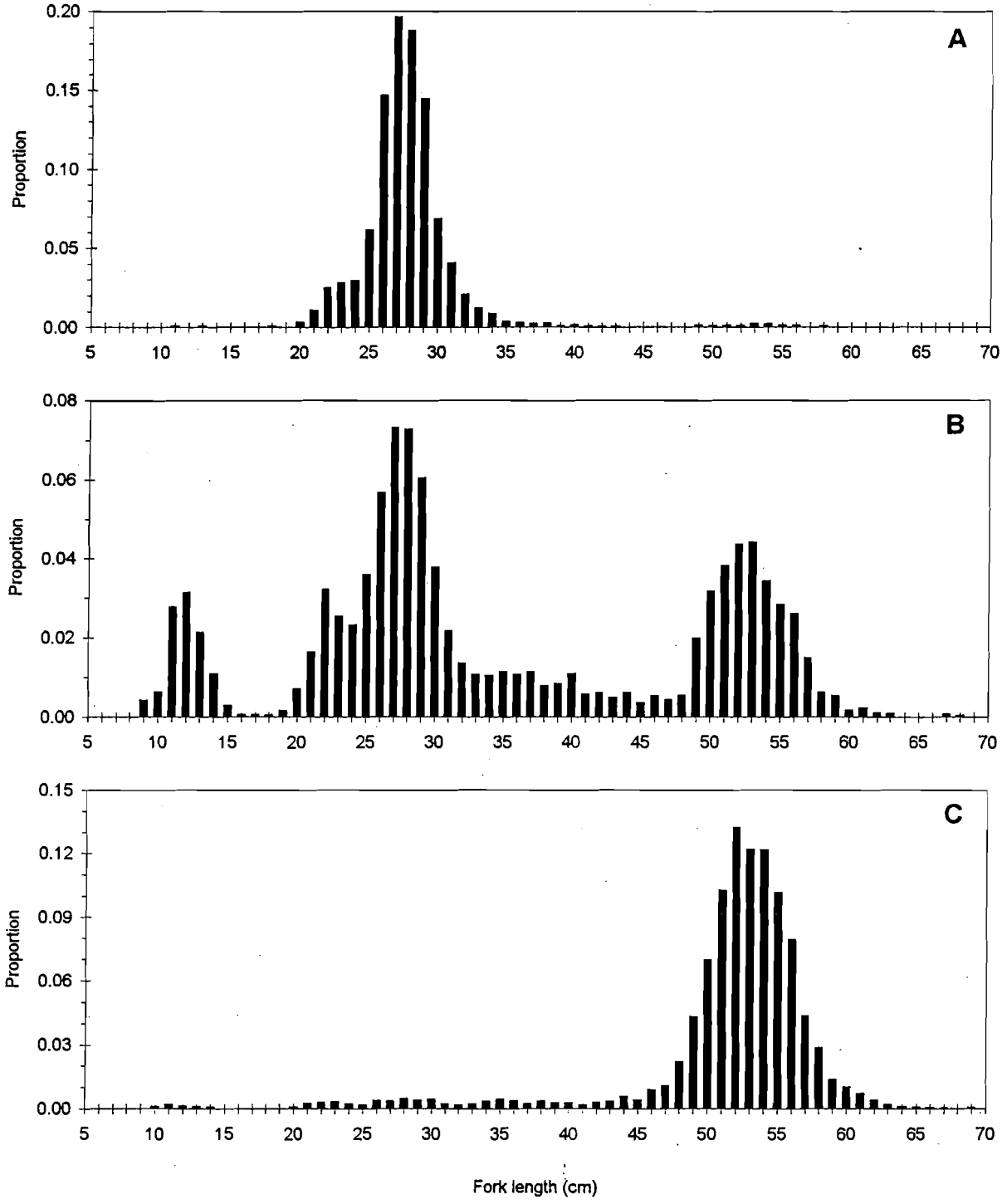

Figure 7. Size distribution of walleye pollock from (A) the midwater scattering layer of fish, primarily from the 1994 year class in the southern half of the survey area, (B) the near-bottom acoustic scattering in the southern Strait area, and (C) the spawning aggregation along the west side of the Strait. Tentative identification of the 1994 year class is based on fork lengths (age data not yet available).

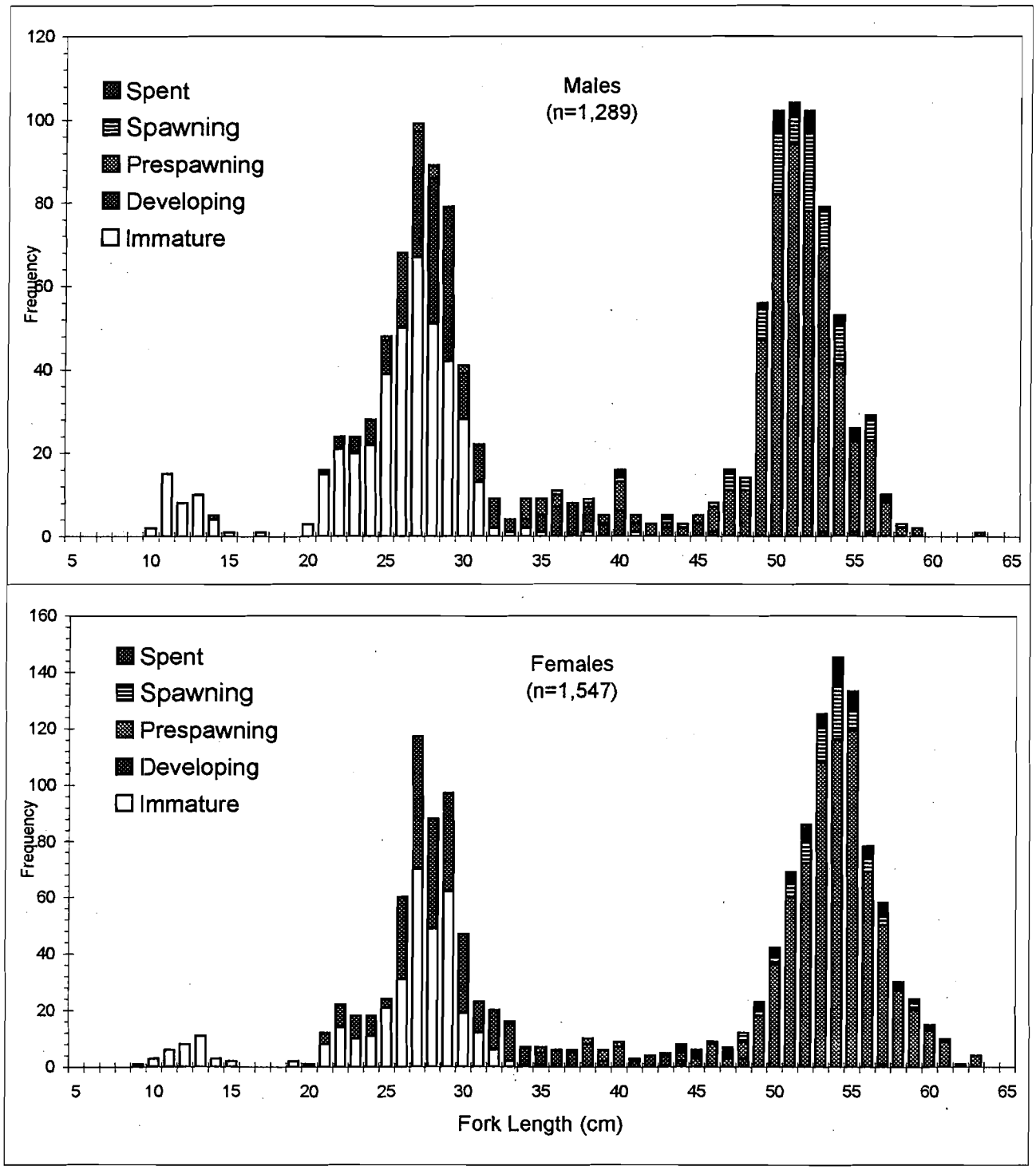

Figure 8. Maturity-length composition for male and female pollock taken during the 1997 echo integration-trawl survey of the Shelikof Strait area. Relative proportion by size for the maturity-length composition reflects the number of maturity samples collected and is not necessarily indicative of the actual size composition of the population.

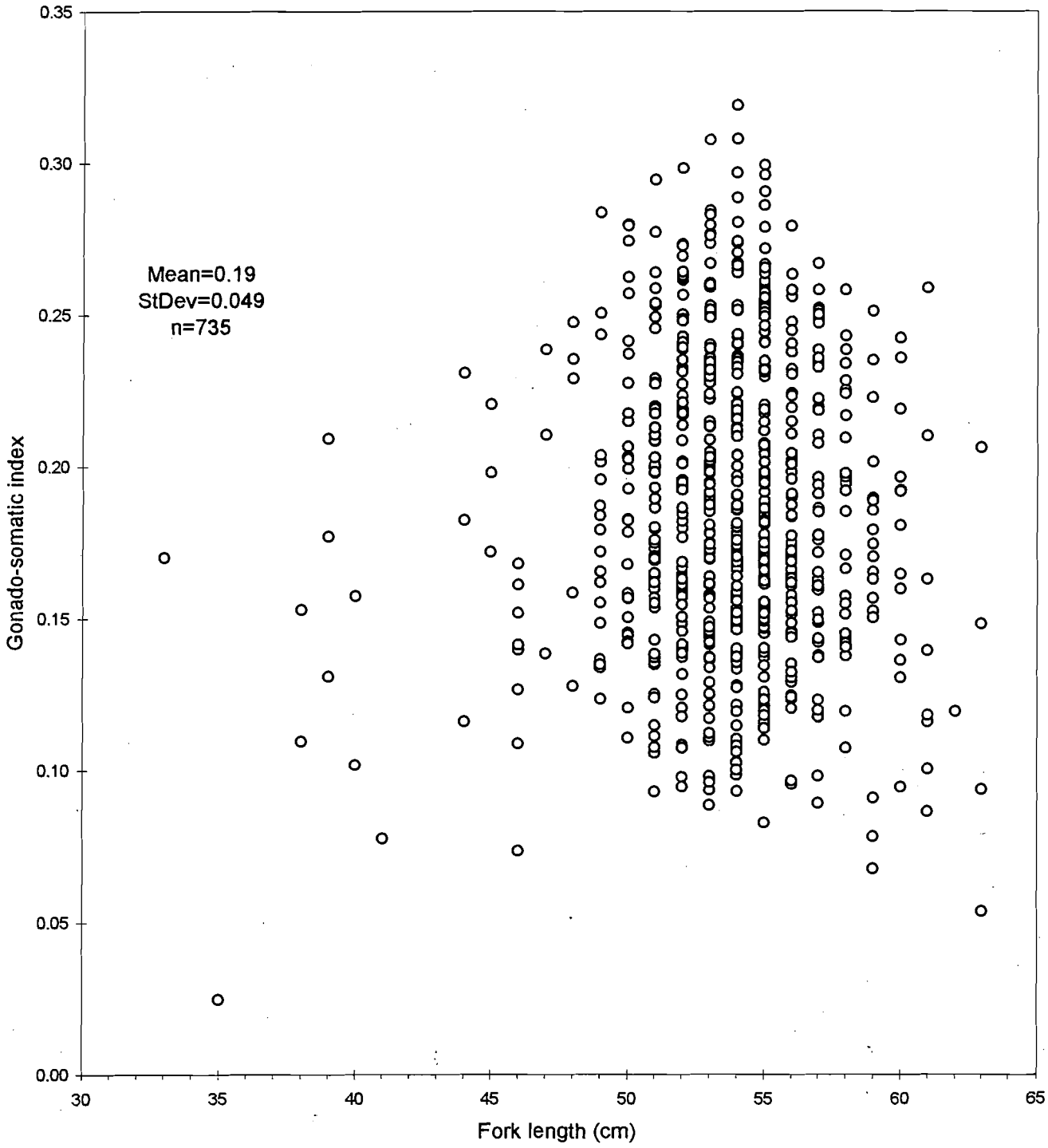

Figure 9. Pollock gonado-somatic indices plotted as a function of length for mature females caught during the 1997 echo integration-trawl survey of the Shelikof Strait area, MF97-03.