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Results of the February-April 2005 Echo Integration-trawl Surveys of Walleye Pollock (*Theragra chalcogramma*) Conducted in the Gulf of Alaska, Cruises MF2005-01 and MF2005-05

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INTRODUCTION

Scientists from the Midwater Assessment and Conservation Engineering Program of the Alaska Fisheries Science Center (AFSC) routinely conduct echo integration-trawl (EIT) surveys in the Gulf of Alaska (GOA) during late winter and early spring to estimate the distribution and abundance of walleye pollock (*Theragra chalcogramma*, hereafter referred to as pollock). Most of this effort has been focused on the Shelikof Strait area, which has been surveyed annually since 1980, except in 1982 and 1999. Surveys were also conducted in the Shumagin Islands area in 1994-96 and 2001-03 and along the GOA shelf break east of Chirikof Island in 2002-04. Results presented here are from EIT surveys carried out between 9 and 19 February in the Shumagin Islands and Sanak Trough (Cruise MF 2005-01) and between 24 March and 3 April in the Shelikof Strait area and along the GOA shelf break near Chirikof Island (Cruise MF2005-05).

METHODS

Shumagin Islands/Sanak Trough Itinerary

9 Feb	Embark scientists in Kodiak, AK.
10 Feb	Calibration of acoustic system in Three Saints Bay, AK.
11-19 Feb	EIT survey of the Shumagin Islands and Sanak Trough.
19 Feb	Inport in Kodiak, AK.

Shelikof Strait/Shelf Break Itinerary

24 Mar	Embark scientists in Kodiak, AK.
24-29 Mar	EIT survey of the Shelikof Strait area.
30 Mar-3 Apr	EIT survey of shelf break east of Chirikof Island.
4 Apr	Calibration of acoustic system in Ugak Bay, AK.
5 Apr	Inport in Kodiak, AK.

Acoustic Equipment

Acoustic data were collected with a Simrad EK500[1] echo sounding system using a 38 kHz split beam transducer with a Simrad ER60 quantitative echosounding system using 18, 120, and 200 kHz split beam transducers (Simrad 2001; Bodholt et al. 1989, Bodholt and Solli 1992). The transducers were installed on the NOAA ship *Miller Freeman*, a 66-m stern trawler equipped for fisheries and oceanographic research, on the bottom of a retractable centerboard extending 9 m below the water surface. Data were logged with SonarData EchoLog 500 (v. 3.25). The 38 kHz data were analyzed using SonarData Echoview (v. 3.25.54) PC-based post-processing software. Data for the other frequencies were also logged using ER60 software (v.2.1.1). Results presented here are based on the EK500 38 kHz data.

Trawl Gear

Midwater and near-bottom echosign was sampled using an Aleutian wing 30/26 trawl (AWT). This trawl was constructed with full-mesh nylon wings and polyethylene mesh in the codend and aft section of the body. The headrope and footrope each measured 81.7 m (268 ft). Mesh sizes tapered from 325.1 cm (128 in) in the forward section of the net to 8.9 cm (3.5 in) in the codend. The net was fitted with a 13 mm (0.5 in) nylon mesh codend liner for the Shumagin Island, Sanak Trough, and Chirikof surveys and a 32 mm (1.25 in) codend liner for the Shelikof Strait survey. The AWT was fished with 82.3 m (270 ft) of 1.9 cm (0.75 in) diameter (8 × 19 wire) non-rotational dandylines, 113.4 kg (250 lb) or 226.8 kg (500 lb) tom weights on each side, and 5 m^2 Fishbuster trawl doors [1,247 kg (2,750 lb) each]. Vertical net opening and depth were monitored with either a WESMAR third wire or Furuno netsounder system attached to the trawl headrope. The vertical net opening for the AWT ranged from 15 to 33 m (49-109 ft) and averaged 23 m (76 ft) while fishing.

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

Demersal echosign was sampled with a poly Nor'eastern bottom trawl (PNE) with roller gear. The PNE is a high-opening trawl equipped with roller gear and constructed with stretch mesh sizes that range from 13 cm (5 in) in the forward portion of the net to 8.9 cm (3.5 in) in the codend. The codend was fitted with a 3.2 cm (1.25 in) nylon mesh liner. 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 a 24.9 m (81.6 ft) footrope constructed of 1 cm (0.4 in) 6 × 19 wire rope wrapped with polypropylene rope. The trawl was also rigged with triple 54.9 m (180 ft) galvanized wire rope dandylines. The rollergear was attached to the fishing line using chain toggles [2.9 kg (6.5 lb) each] comprised of five links and one ring. 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 net was fished with the Fishbuster trawl doors. The vertical net opening and depth were monitored with a Furuno netsounder system attached to the headrope. The PNE trawl vertical mouth opening ranged from 6 to 8 m (20-26 ft).

Oceanographic Equipment

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. Sea surface temperature, salinity, and other environmental data were collected using the *Miller Freeman*'s Scientific Computing System (SCS).

Survey Design

Parallel transect designs were used, except where it was necessary to reorient tracklines in order to maintain a perpendicular alignment to the bathymetry. A random start position was generated for the first transect for all surveys. The Shumagin Islands survey was conducted between 11-14 and 16-19 February using transects spaced 9.3 km (5 nautical miles (nmi)) apart within Shumagin

Trough, 1.9 km (1 nmi) apart east of Renshaw Point, and 4.6 km (2.5 nmi) apart elsewhere (Fig. 1). Bottom depths did not exceed 220 m along any transect, and transects generally did not extend into waters less than about 50 m depth. The Sanak Trough survey was conducted between 15 and 16 February using transects spaced 3.7 km (2 nmi) apart. Bottom depths did not exceed 160 m along any transect, and transects generally did not extend into waters less than about 50 m depth (Fig. 1). The Shelikof Strait sea valley was surveyed from north of Kuliak Bay on the Alaska Peninsula to south of Chirikof Island between 24 and 29 March using 13.9 km (7.5 nmi) transect spacing (Fig. 2). Bottom depths did not exceed 340 m along any transect, and transects generally did not extend into waters less than about 100 m depth. The survey of the shelf break southeast of Chirikof Island to near the mouth of Barnabas Trough was conducted between 30 March and 3 April along transects spaced 11.1 km (6 nmi) apart between the 200 and 1,000 m depth contours. All surveys were conducted 24 hours per day.

Trawl hauls were conducted to identify echosign and to provide biological samples. Average trawling speed was approximately 1.5 m/s (3 kts). Pollock were sampled to determine sex, fork length (FL), body weight, age, maturity, and ovary weight of selected females (Tables 1 and 2). Pollock were measured to the nearest centimeter. An electronic motion-compensating scale was used to weigh individual pollock. For age determinations, pollock otoliths were collected and stored in a 50% ethanol-water solution. Maturity was determined by visual inspection and was categorized as immature, developing, pre-spawning, spawning, or post-spawning. All data were electronically recorded using the Fisheries Scientific Computing System (FSCS) developed by NOAA's Office of Marine and Aviation Operations to digitally collect data aboard research vessels. Data were stored in a relational database. Additional samples of pollock tissue and ovaries were collected for ongoing research by AFSC scientists. Whole fish were frozen for training specimens for the AFSC Fisheries Monitoring and Analysis Division's Observer Program.

Standard sphere acoustic system calibrations (Foote et al. 1987) were conducted to measure acoustic system performance for the EK500 (38 kHz) and for the ER60 (all frequencies). During the calibrations, the *Miller Freeman* was anchored at the bow and stern. Weather, sea state conditions, and acoustic system settings were recorded. A tungsten carbide sphere (38.1 mm diameter) and a copper sphere (64 mm diameter) were suspended below the centerboard-mounted transducers. The tungsten carbide sphere was used to calibrate the 38, 120, and 200 kHz systems. The copper sphere was used to calibrate the 18 kHz system. After each sphere was centered on the acoustic axis, split beam target strength and echo integration data were collected. Transducer beam characteristics were modeled by moving each sphere through the beam and collecting target strength (TS) data using Simrad EKLOBES software.

Data Analysis

Echo integration data were collected between 14 m of the surface and 0.5 m of the bottom, except where the bottom exceeded 1,000 m, the lower limit of data collection. Echosign data identified as pollock were stored in a relational database. Pollock length data were aggregated into strata based on echosign type, geographic proximity of hauls, and similarity in size composition data. Estimates of pollock backscattering strength for each stratum were then calculated using the s_V threshold of –70 decibels (dB). The echo integration values were summed and scaled using a previously derived relationship between TS and fish lengths (TS = 20 Log L - 66; Traynor 1996) and the length composition data to produce estimates of pollock numbers by length. Mean weight-at-length was estimated from the trawl data when there were more than five pollock for that length; otherwise mean weight was estimated from a linear regression of the natural logs of all the length-weight data. Age-specific estimates of biomass and numbers were generated for the Shelikof Strait area. These estimations will be generated for the Shumagin Islands, Sanak Trough, and the GOA shelf-break surveys after the otolith samples are aged.

Relative estimation errors for the acoustic data were derived using a one-dimensional geostatistical method (Petitgas 1993, Williamson and Traynor 1996, and Rivoirard et al. 2000). Relative estimation error is defined as the ratio of the square root of the estimation variance to the estimate of acoustic abundance. Geostatistical methods are used for computation of error because they account for the observed spatial structure in the fish distribution. These errors quantify only transect sampling variability. Other sources of error (e.g., target strength, trawl sampling) are not included.

RESULTS and DISCUSSION

Calibration

Acoustic system calibrations were conducted before, during, and after the winter EIT surveys in the Bering Sea and Gulf of Alaska (Table 3). The EK500 38-kHz collection system showed no significant differences in gain parameters or transducer beam pattern characteristics between calibrations, thus confirming that the acoustic system was stable throughout the surveys.

Shumagin Islands

Biological Sampling

Biological data and specimens were collected in the Shumagin Islands from six AWT trawl hauls and four bottom trawls (Tables 1, 4 and Fig. 1). Pollock was the most abundant species in the midwater trawl catches, comprising 99.5% by weight (Table 5). Pollock comprised 69% by weight of the bottom trawl catches (Table 6). Pacific sleeper shark (*Somniosus pacificus*) and arrowtooth flounder (*Atheresthes stomias*) were the next most abundant species by weight in the bottom trawl catches, comprising 16% and 11% of the catch, respectively.

Trawl catches contained generally unimodal length distributions of mostly adults (Fig. 3). The lengths were similar for the fish caught off Renshaw Point, in West Nagai Strait, and in Stepovak Bay with a mean of 47 cm FL. The fish were slightly larger in Unga Strait, where the mean length was 48 cm FL. Shumagin Trough yielded slightly smaller pollock with a mean of 46 cm FL. Few fish shorter than 40 cm FL were observed anywhere in the Shumagin Islands area.

The unweighted maturity composition for males longer than 40 cm FL was 0% immature, 12% developing, 49% pre-spawning, 33% spawning, and 7% spent (Fig. 4a). The female maturity composition of fish longer than 40 cm was 0% immature, 8% developing, 64% pre-spawning, 5% spawning, and 23% spent (Fig. 4b). Because of the lack of fish shorter than 40 cm, a logistic model could not be fitted to the female maturity at length data (Fig. 4c). The average GSI (gonadosomatic index: ovary weight/body weight) of pre-spawning females was 0.13 (Fig. 4d), which was similar to previous Shumagin Island surveys.

Distribution and Abundance

Acoustic data were collected along 723 km (390 nmi) of tracklines. The densest aggregations were off Renshaw Point and in northern Unga Strait (Fig. 5). Pollock were distributed both demersally as well as in dense, midwater schools. Little echosign was detected outside the Renshaw Point and northern Unga Strait areas.

The abundance estimate for the Shumagin Islands area is 64 million pollock weighing 52,000 metric tons (t). The area off Renshaw Point accounted for 56% of the biomass. The relative estimation error of the biomass based on the one-dimensional analysis of echosign was 11.5%.

The abundance of pollock in the Shumagin Islands has declined since the mid-1990s. The 2005 biomass is the lowest in survey history and is only 18% of the 1995 estimate of 290,000 t (Table 7, Fig. 6[2]). Inference about abundance trends, however, is difficult to make for several reasons. Only the 1995, 2001-03, and 2005 surveys covered the entire Shumagin Islands area. Also, it is unknown whether changes in abundance reflect variation in the timing of peak spawning or actual changes in the population. With the exception of the 1994 survey, which occurred in March well after peak spawning had occurred, the dates of the Shumagin Island survey have been similar between years but the timing of peak spawning has not. For example, for the 2001 survey, 52% of the adult females were pre-spawning whereas 15% were spawning and 30% were spent,

[2]Previously published Shumagin Island abundance estimates for 2001 included an adjustment for contamination by eulachon (*Thaleichthys pacificus*). See Shelikof Strait Results section for discussion.

which suggested that the peak had already occurred and that some fish might have already left the area. The Shumagin Islands surveys also may not provide predictions of future pollock abundance in the Gulf of Alaska. For example, over one-half of the adult pollock numbers in 2001 consisted of the 1993, 1994, and 1995 year classes; however, these year classes were detected in low numbers or were absent entirely as juveniles during the 1994, 1995, and 1996 surveys (Fig. 7).

Sanak Trough

Biological Sampling

Biological data and specimens were collected in Sanak Trough from five AWT trawl hauls and one bottom trawl haul (Tables 1 and 4; Fig. 1). Pollock was the most abundant species in the midwater trawl catches, comprising 95% by weight (Table 8). Pacific cod (*Gadus macrocephalus*) was the next most abundant species caught comprising 5% of the catch by weight. Pollock comprised 79% by weight of the bottom trawl catch (Table 9). Pacific cod was the next most abundant species, comprising 17% of the catch.

Most of the pollock in Sanak Trough exceeded 40 cm FL (Fig. 8). Of the few shorter than 40 cm FL, most were from 25 to 29 cm FL.

The unweighted maturity composition for males longer than 40 cm FL was 0% immature, 2% developing, 32% pre-spawning, 59% spawning, and 6% spent (Fig. 9a). The female maturity composition of fish longer than 40 cm FL was 0% immature, 6% developing, 70% pre-spawning, 7% spawning, and 17% spent (Fig. 9b). The high percentage of post-spawning fish suggests that the survey timing was late. A similar result was obtained for the 2003 Sanak Trough survey, in which 27% of the females were spent. A logistic model fit to the female maturity-at-length data predicted that 50% of females were mature at 36 cm FL (Fig. 9c), which is similar to 2003 (34 cm FL). However, the fit was poor because of a lack of fish shorter than 40 cm FL. The average GSI for pre-spawning females was 0.15 (Fig. 9d).

Distribution and Abundance

Acoustic data were collected along 200 km (108 nmi) of tracklines. The densest aggregations were detected in the southern part of the trough off Sanak Island (Fig. 5). Similar to the Shumagin Islands area, pollock were distributed both demersally as well as in dense, midwater schools. The abundance estimate for Sanak Trough is 72 million pollock weighing 66,000 t. The relative estimation error of the biomass based on the 1D analysis of echosign was 7.4%. Most of the biomass was detected in the southern part of the trough off of Sanak Island, which differs from the 2003 survey, where most of the biomass was observed in the northern part of the trough. The biomass in 2005 was less than the 2003 estimate of 82 thousand t, which was the only other survey of Sanak Trough (Table 7). Both the 2003 and 2005 survey estimates contained few age-1 or age-2 pollock.

Shelikof Strait

Biological Sampling

Biological data and specimens were collected in Shelikof Strait from 22 AWT trawl hauls and 1 bottom trawl (Tables 2, 10 and Fig. 2). Pollock and eulachon (*Thaleichthys pacificus*) were the most abundant species by weight in midwater trawl hauls, comprising 75% and 20%, respectively, of the total catch (Table 11). Pollock comprised 94% of the catch in the bottom trawl, with arrowtooth flounder forming most of the bycatch (6%, Table 12).

Trawl hauls conducted in near-bottom pollock echosign between Kuliak Bay and Cape Unalishagvak on the western side of the Strait contained fish mostly from the 1999 and 2000 year classes (35 to 50 cm FL, Fig. 10a). Trawl hauls conducted in near-bottom pollock echosign south of Cape Ikolik as well as on the Kodiak Island side of the Strait caught significant amounts of 1-and

2-year old pollock (9-16 and 17-24 cm FL, respectively), although adults dominated by weight (Fig. 10b). Hauls conducted in mid-water layers caught mostly 1-year old pollock (Fig. 10c).

The unweighted maturity composition in the Shelikof Strait area for males longer than 40 cm FL was 0% immature, 3% developing, 24% mature pre-spawning, 72% spawning, and 0% spent (Fig. 11a). The female maturity composition of fish longer than 40 cm FL was 0% immature, 16% developing, 75% pre-spawning, 7% spawning, and 1% spent (Fig. 11b). These results are similar to previous survey results in terms of low numbers of spawning and spent female fish, which suggests that the survey timing was appropriate. A logistic model provided a reasonable fit to the female maturity at length data and predicted that 50% of females were mature at 41 cm FL (Fig. 11c), which is similar to most estimates since 1985 but longer than the 2004 estimate of 34 cm FL. The average GSI for pre-spawning females of 0.15 (Fig. 11d) was similar to the mean GSI in 2004 (0.16), but greater than the mean GSIs for 2002 (0.12) and 2003 (0.11). The current mean is also similar to the mean GSIs (0.14-0.19) reported for other recent (1992-2001) surveys.

Distribution and Abundance

Acoustic data were collected along 1,761 km (950 nmi) of tracklines. Significant amounts of mature, pre-spawning pollock were detected from Cape Unalishagvak to Kuliak Bay (Fig. 12), although the abundance was lower than in the mid-to late-1990s. Significant quantities of adult pollock were detected south of the mouth of the Strait (between Cape Ikolik and Wide Bay) to about 56°N. Mid-water layers of age-1 pollock were detected in the southern portion of the survey area (Fig. 13).

The abundance estimate for Shelikof Strait is 2.3 billion pollock weighing 356,000 t. The estimates include adjustments for backscattering attributed to eulachon. The relative estimation error of the biomass based on the one-dimensional analysis of echosign was 4.1%.

Previously reported abundance estimates for the 1992-2004 Shelikof Strait and 2001 Shumagin Islands surveys included a reduction for eulachon. In areas where the eulachon catch weight was high, typically greater than 5% of the pollock catch, the pollock acoustic sign was reduced in a manner described by Hollowed et al. (1992). However, when using Gauthier and Horne's (2004) TS-to-length relationship of TS = 20 Log L – 84.5, which is typical for fish without a swim bladder (Foote 1980, Misund and Beltestad 1996), eulachon are virtually undetectable. For example, when applying MacLennan and Simmond's (1992) method for partitioning echosign between two species to the 2000 Shelikof Strait survey, which was a year of high eulachon bycatch, the pollock biomass is 448,000 t, which is 99.85% of the 449,000 t obtained when making no adjustment for eulachon. Given this minimal reduction, the abundance estimates were recalculated making no reduction for eulachon and are shown in Figures 6 and 14.

The 1994 year class, which represented the largest estimate of 1-year old pollock (10.7 billion fish) in the history of the Shelikof Strait area EIT surveys and dominated abundance estimates through 1998, effectively disappeared by 2003 (Figs. 15 and 16). The 1999 year class (4.5 billion fish in 2000) was the second largest 1-year old estimate in survey history and has dominated biomass estimates since 2001. The estimate of 1-year old pollock in 2005 of 1.6 billion fish is one of the highest estimates in recent survey history and suggests that the 2004 year class is strong. The historic numbers and biomass at age through the year 2004 are displayed in Tables 13 and 14, respectively. The historic numbers and biomass at length through the year 2005 are displayed in Tables 15 and 16, respectively.

The pollock biomass in Shelikof Strait declined dramatically in the 1980s, falling from 2.8 million t in 1981 to 290,000 t in 1989 (Fig. 14). The biomass gradually rose in the 1990s, reaching 777,000 t in 1996. The biomass then declined to an all-time low of 257,000 t in 2002. Since then, the population has gradually increased to its current level of 356,000 t (Table 7).

Shelf Break Area Near Chirikof Island

Biological Sampling

Biological data and specimens were collected along the Gulf of Alaska shelf break near Chirikof Island from six AWT trawl hauls (Tables 2, 10 and Fig. 2). No bottom trawls were conducted in this area. Pollock was the most abundant species by weight, comprising 84% of the catch (Table 17). Pacific ocean perch (*Sebastes alutus*) and shortraker rockfish (*S. borealis*) were the next most abundant species, comprising 9% and 5% of the catch, respectively. Myctophids also contributed 22% of the catch by numbers.

Most pollock captured ranged from 40 to 50 cm FL (Fig. 17), which was similar to the 2004 survey. In contrast, most of the pollock captured during the 2002-2003 surveys in this area were longer than 50 cm FL.

The unweighted maturity composition in the Chirikof Island area for males longer than 40 cm FL was 0% immature, 1% developing, 17% mature pre-spawning, 60% spawning, and 21% spent (Fig. 18a). The female maturity composition of fish longer than 40 cm FL was 0% immature, 12% developing, 47% pre-spawning, 8% spawning, and 33% spent (Fig. 18b). The high percentage of spawning and post-spawning females indicates that peak spawning may have already occurred and that some fish might have already left the area. Because of lack of fish, a logistic model could not be fitted to the female maturity length data (Fig. 18c). The average GSI for pre-spawning females was 0.17 (Fig. 18d) and was similar to the 2002-2004 surveys.

Distribution and Abundance

Acoustic data were collected along 300 km (162 nmi) of tracklines. Most of the echosign attributed to pollock occurred in midwater layers between 275-500 m depth near longitude 154° W over bottom depths of 350-800 m (Fig. 12). Substantial acoustic backscattering was attributed to myctophids and other micronekton species, which occurred along the offshore portions of the transects at about 200-300 m depth. This myctophid scattering layer, which occurred mostly over bottom depths from 800 m to deeper than 1,500 m, may have obscured low densities of pollock.

The abundance estimate for the Chirikof Island area is 95 million pollock weighing 77,000 t. The relative estimation error of the biomass based on the one-dimensional analysis of echosign was 20.7%. The biomass in 2005 was greater than the 2004 and 2003 estimates of 30,000 and 31,000 t, respectively, and was similar to the 82,000 t estimated in the same area in 2002 (Table 7). Forecasts of future pollock abundance are not possible due to the absence of age-1 and age-2 pollock during these surveys.

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SCIENTIFIC PERSONNEL

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Shelikof Strait and Shelf Break Area Near Chirikof Island Surveys

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Table 1.--Numbers of biological samples and measurements collected during the winter 2005 echo integration-trawl survey of walleye pollock in the Shumagin Islands area (hauls 1-9 and 16) and Sanak Trough (hauls 10-15) in the Gulf of Alaska.

Haul No.	Pollock Lengths	Pollock Weights and maturity	Pollock Ovary weights	Pollock Otoliths	Eulachon lengths	Eulachon weights
1	217	111	--	50	137	81
2	366	77	20	45	--	--
3	424	100	--	50	24	--
4	327	84	69	50	--	--
5	387	67	22	45	140	76
6	334	68	20	68	34	--
7	287	71	13	33	--	--
8	265	66	28	34	26	--
9	330	98	39	50	38	--
10	354	107	55	75	--	--
11	268	62	10	35	--	--
12	292	57	17	34	4	4
13	290	63	26	63	--	--
14	281	105	67	105	--	--
15	307	96	46	51	--	--
16	116	40	12	40	--	--
Totals	4845	1272	444	828	403	161

Table 2.--Numbers of biological samples and measurements collected during the winter 2005 echo integration-trawl survey of walleye pollock in the Shelikof Strait area (hauls 1-23) and Gulf of Alaska shelf break near Chirikof Island (hauls 24-29).

	Pollock										
Haul no.	Lengths	Weights and maturity	Ovary weights	Otoliths	Seabird observations	Eulachon lengths	Eulachon weights	Pacific ocean perch lengths	Pacific ocean perch weights	Shortraker rockfish lengths	Shortraker rockfish weights
1	22	11	--	11	--	59	--	--	--	--	--
2	89	56	--	18	--	48	36	--	--	--	--
3	9	9	2	9	--	--	--	--	--	--	--
4	342	54	7	54	--	--	--	--	--	--	--
5	206	69	6	65	--	77	--	--	--	--	--
6	416	46	11	46	y	111	49	--	--	--	--
7	158	97	4	97	y	48	--	--	--	--	--
8	451	97	6	79	--	77	52	--	--	--	--
9	419	87	34	71	--	102	52	--	--	--	--
10	150	44	1	44	y	71	--	--	--	--	--
11	363	117	31	85	y	119	22	--	--	--	--
12	238	97	29	60	--	84	43	--	--	--	--
13	218	89	16	79	y	117	57	--	--	--	--
14	95	10	--	--	y	--	--	--	--	--	--
15	289	97	30	65	--	70	28	--	--	--	--
16	372	105	17	60	--	129	62	--	--	--	--
17	168	50	37	50	--	59	--	--	--	--	--
18	12	--	--	--	y	--	--	--	--	--	--
19	108	--	--	--	y	54	--	--	--	--	--
20	441	45	12	--	--	100	1	--	--	--	--
21	110	12	--	--	--	--	--	--	--	--	--
22	73	--	--	--	--	--	--	--	--	--	--
23	67	--	--	--	--	19	--	--	--	--	--
24	289	100	32	100	--	--	--	--	--	--	--
25	450	101	40	101	y	--	--	--	--	--	--
26	147	42	32	35	--	--	--	--	--	--	--
27	104	79	30	74	y	--	--	31	--	--	--
28	244	52	30	52	--	--	--	14	14	14	--
29	10	10	4	--	--	73	26	76	--	2	2
Totals	6060	1576	411	1255		1417	428	121	14	16	2

Table 3.--Simrad EK500 38 kHz acoustic system description and settings during the late winter/early spring 2005 echo integration-trawl surveys of walleye pollock in the Gulf of Alaska and results from standard sphere acoustic system calibrations conducted before and after the surveys.

	Survey system settings	Calibrations 10-Feb Three Saint's Bay, Alaska	8-Mar Captains Bay, Alaska	3-Apr Ugak Bay, Alaska
Echosounder:	Simrad EK 500	--	--	--
Transducer:	ES38B	--	--	--
Frequency (kHz):	38	--	--	--
Transducer depth (m):	9.15	--	--	--
Absorption coefficient (dB/km):	10	--	--	--
Pulse length (ms):	1.0 (medium)	--	--	--
Band width (kHz):	3.8 (Wide)	--	--	--
Transmitted power (W):	2000	--	--	--
Angle sensitivity:	21.9	--	--	--
2-Way beam angle (dB):	-20.8	--	--	--
TS transducer gain (dB):	25.50	25.64	25.72	25.78
Sv transducer gain (dB):	25.43	25.66	25.50	25.53
3 dB beamwidth (deg)				
Along:	7.1	6.82	6.89	6.86
Athwart:	6.8	6.80	6.86	6.85
Angle offset (deg)				
Along:	0	-0.38	-0.36	-0.36
Athwart:	0	0.02	-0.02	0.00
Range (m):	1000	--	--	--
Post-processing Sv threshold (dB):	-70	--	--	--
Standard sphere TS (dB)	--	-42.22	-42.19	-42.18
Sphere range from transducer (m):	--	23.1	20.2	20.3
Water temp (^{o}C):				
at transducer:	--	4.6	4.2	4.1
at sphere:	--	5.3	4.5	4.1

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 , Strandpromenaden 50, P.O. Box 111, N-3191 Horten, Norway.

Table 4.--Summary of trawl and catch data from the 2005 pollock echo integration-trawl surveys of the Shumagin Islands area (hauls 1-9 and 16) and Sanak Trough (hauls 10-15) in the Gulf of Alaska.

Haul no.	Gear[1] type	Date (GMT)	Time (GMT)	Duration (minutes)	Start position Lat. (N)	Start position Long. (W)	Depth (m) footrope	Depth (m) bottom	Temp. (deg. C) footrope	Temp. (deg. C) surface	Pollock catch kg	Pollock catch number	Other catch kg	Other catch number
1	PNE	12 Feb	7:30	16	55 15.25	159 12.53	192	192	5.4	4.3	184	227	222	828
2	AWT	12 Feb	19:54	12	55 41.38	159 55.30	112	122	4.6	4.6	893	1,070	4	19
3	AWT	13 Feb	7:03	3	55 33.58	160 18.31	137	187	4.9	4.4	1,488	2,124	6	65
4	AWT	13 Feb	9:15	1	55 34.24	160 16.40	142	190	4.8	4.2	2,894	3,310	0	8
5	AWT	13 Feb	14:24	23	55 33.16	160 12.44	136	183	4.8	4.1	719	984	20	341
6	PNE	13 Feb	17:01	2	55 33.32	160 15.49	148	197	5.0	4.1	759	920	21	60
7	AWT	13 Feb	21:32	3	55 32.05	160 17.21	116	183	--	4.4	3,002	3,660	0	0
8	PNE	13 Feb	23:00	5	55 30.47	160 19.41	168	168	--	4.6	715	821	108	193
9	AWT	14 Feb	8:56	18	55 26.41	160 28.28	127	138	4.7	4.0	926	1,035	17	50
10	AWT	15 Feb	10:37	10	55 43.53	162 55.49	87	99	4.0	3.7	4,254	4,532	186	31
11	AWT	15 Feb	13:46	6	54 43.24	162 37.35	96	130	4.3	4.0	423	429	1	15
12	AWT	15 Feb	17:43	3	54 39.22	162 37.22	112	129	4.2	4.3	3,539	4,244	59	36
13	AWT	15 Feb	20:25	4	54 37.05	162 36.38	120	144	4.2	4.4	1,415	1,467	163	15
14	PNE	16 Feb	0:10	9	54 32.02	162 41.09	107	109	4.9	4.4	237	280	62	29
15	AWT	16 Feb	3:53	3	54 28.44	162 36.33	102	146	4.7	4.2	520	587	0	0
16	PNE	16 Feb	23:10	13	55 12.54	160 11.29	212	216	4.2	4.4	92	116	433	18

AWT = Aleutian wing trawl, PNE = poly Nor'eastern bottom trawl.

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Table 5.--Summary of catch by species in six midwater trawls conducted during the 2005 pollock echo integration-trawl survey of the Shumagin Island area.

Common name	Scientific name	Weight (kg)	Percent	Numbers	Percent
walleye pollock	*Theragra chalcogramma*	9,921.3	99.5%	12,183	96.2%
Pacific herring	*Clupea pallasi*	28.0	0.3%	13	0.1%
eulachon	*Thaleichthys pacificus*	8.5	0.1%	405	3.2%
chinook salmon	*Oncorhynchus tshawytscha*	8.3	0.1%	5	< 0.1%
northern rock sole	*Lepidopsetta polyxystra*	1.4	< 0.1%	2	< 0.1%
flathead sole	*Hippoglossoides elassodon*	0.9	< 0.1%	3	< 0.1%
shrimp unident.	Decapoda (order)	0.3	< 0.1%	46	0.4%
capelin	*Mallotus villosus*	0.2	< 0.1%	9	0.1%
Total		9,968.8		12,666	

Table 6.--Summary of catch by species in four bottom trawls conducted during the 2005 pollock echo integration-trawl survey of the Shumagin Islands area.

Common name	Scientific name	Weight (kg)	Percent	Numbers	Percent
walleye pollock	*Theragra chalcogramma*	1,750.7	69.1%	2,084	65.6%
Pacific sleeper shark	*Somniosus pacificus*	400.0	15.8%	2	0.1%
arrowtooth flounder	*Atheresthes stomias*	266.6	10.5%	431	13.6%
Pacific cod	*Gadus macrocephalus*	43.2	1.7%	7	0.2%
flathead sole	*Hippoglossoides elassodon*	24.2	1.0%	55	1.7%
longnose skate	*Raja rhina*	14.4	0.6%	11	0.3%
chinook salmon	*Oncorhynchus tshawytscha*	10.6	0.4%	4	0.1%
rex sole	*Glyptocephalus zachirus*	7.1	0.3%	19	0.6%
Pacific halibut	*Hippoglossus stenolepis*	6.6	0.3%	1	< 0.1%
eulachon	*Thaleichthys pacificus*	6.0	0.2%	289	9.1%
shrimp unident.	Decapoda (order)	1.6	0.1%	219	6.9%
smooth lumpsucker	*Aptocyclus ventricosus*	1.3	0.1%	1	< 0.1%
sidestripe shrimp	*Pandalus dispar*	0.6	< 0.1%	40	1.3%
harlequin rockfish	*Sebastes variegatus*	0.2	< 0.1%	1	< 0.1%
Oregon triton	*Fusitriton oregonensis*	0.1	< 0.1%	2	0.1%
crab unident.	Decapoda (order)	< 0.1	< 0.1%	2	0.1%
capelin	*Mallotus villosus*	< 0.1	< 0.1%	7	0.2%
Tanner crab	*Chionoecetes bairdi*	< 0.1	< 0.1%	1	< 0.1%
Total		2,533.3		3,176	

Table 7.--Estimates of pollock biomass (in metric tons) and relative estimation error for the Shelikof Strait area, Shumagin Islands, Chirikof Island shelf break, and Sanak Trough echo integration trawl surveys.

Year	Shelikof Strait		Shumagin Islands		Chirikof Shelf break		Sanak Trough	
	Biomass	Est. Error	Biomass	Est. Error	Biomass	Est. Error	Biomass	Est. Error
1981	2,785,800							
1982	no survey							
1983	2,278,200							
1984	1,757,200							
1985	1,175,300							
1986	585,800							
1987	no estimate*							
1988	301,700							
1989	290,500							
1990	374,800							
1991	380,300							
1992	713,400	3.6%						
1993	435,800	4.6%						
1994	492,600	4.5%	112,000					
1995	763,600	4.5%	290,100					
1996	777,200	3.7%	117,700					
1997	583,000	3.7%	no survey					
1998	504,800	3.8%	no survey					
1999	no survey		no survey					
2000	448,600	4.6%	no survey					
2001	432,700	4.5%	119,600					
2002	256,700	6.9%	135,600	27.1%	82,100	12.2%		
2003	317,300	5.2%	67,300	17.2%	30,900	20.7%	81,500	21.6%
2004	330,800	9.2%	no survey		30,400	20.4%	no survey	
2005	356,100	4.1%	52,000	11.4%	77,000	20.7%	67,800	7.4%

* Shelikof Strait was surveyed in 1987, but no estimate was made due to an equipment malfunction.

Table 8.--Summary of catch by species in five midwater trawls conducted during the 2005 pollock echo integration-trawl survey of Sanak Trough.

Common name	Scientific name	Weight (kg)	Percent	Numbers	Percent
walleye pollock	*Theragra chalcogramma*	10,151.7	95.2%	11,259	99.1%
Pacific cod	*Gadus macrocephalus*	508.1	4.8%	71	0.6%
rock sole sp.	*Lepidopsetta* spp.	1.2	< 0.1%	6	< 0.1%
eulachon	*Thaleichthys pacificus*	0.2	< 0.1%	26	0.2%
Total		10,661.2		11,362	

Table 9.--Summary of catch by species in the one bottom trawl conducted during the 2005 pollock echo integration-trawl survey of Sanak Trough.

Common name	Scientific name	Weight (kg)	Percent	Numbers	Percent
walleye pollock	*Theragra chalcogramma*	236.5	79.2%	280	90.6%
Pacific cod	*Gadus macrocephalus*	50.0	16.7%	10	3.2%
Anthozoa (class)	Anthozoa (class)	3.3	1.1%	7	2.3%
Pacific halibut	*Hippoglossus stenolepis*	2.9	1.0%	1	0.3%
arrowtooth flounder	*Atheresthes stomias*	1.5	0.5%	1	0.3%
chinook salmon	*Oncorhynchus tshawytscha*	1.4	0.5%	1	0.3%
flathead sole	*Hippoglossoides elassodon*	1.0	0.3%	3	1.0%
yellow Irish lord	*Hemilepidotus jordani*	1.0	0.3%	2	0.6%
rock sole sp.	*Lepidopsetta* spp.	0.6	0.2%	2	0.6%
Pacific ocean perch	*Sebastes alutus*	0.4	0.1%	2	0.6%
Total		298.5		309	

Table 10.--Summary of trawl and catch data from the 2005 pollock echo integration-trawl surveys of the Shelikof Strait area (hauls 1-23) and Gulf of Alaska shelf break near Chirikof Island (hauls 24-29).

Haul no.	Gear[1] type	Date (GMT)	Time (GMT)	Duration (minutes)	Start position Lat. (N)	Start position Long. (W)	Depth (m) footrope	Depth (m) bottom	Temp. (deg. C) footrope	Temp. (deg. C) bottom	Pollock catch kg	Pollock catch number	Eulachon catch kg	Eulachon catch number	Other catch kg
1	AWT	24-Mar	14:38	3	58 13.02	153 19.01	206	212	5.3	4.6	5	22	6	130	2
2	AWT	24-Mar	16:09	2	58 13.70	153 19.98	198	215	5.5	4.8	9	341	1	48	4
3	AWT	25-Mar	2:02	7	58 08.89	154 03.92	258	265	5.4	4.5	6	9	< 1	2	0
4	AWT	25-Mar	4:16	5	58 08.83	154 04.92	260	283	5.4	3.6	2,904	3,725	0	0	140
5	AWT	25-Mar	10:51	8	57 51.53	154 07.44	183	203	5.4	4.3	89	2,331	89	3,658	3
6	AWT	25-Mar	18:16	39	57 41.95	154 29.10	201	209	5.4	4.2	510	1,959	1,203	34,671	29
7	AWT	25-Mar	22:25	5	57 49.97	154 47.49	231	273	4.8	3.5	97	158	5	129	3
8	AWT	26-Mar	2:43	4	57 46.29	155 00.76	277	315	5.3	3.5	1,004	1,545	16	719	8
9	AWT	26-Mar	5:44	3	57 53.97	154 34.73	251	264	5.3	3.2	520	667	14	287	3
10	AWT	26-Mar	10:57	3	57 32.52	154 51.46	189	226	5.3	4.0	91	1,002	125	4,200	3
11	AWT	26-Mar	20:31	6	57 30.25	155 30.46	291	304	5.5	3.9	562	1,603	56	1,429	13
12	AWT	26-Mar	23:14	5	57 35.01	155 22.09	294	321	5.5	3.6	740	2,158	93	2,309	22
13	AWT	27-Mar	16:23	8	57 06.63	155 30.03	250	264	--	4.0	193	887	6	212	4
14	AWT	27-Mar	21:01	10	56 55.85	155 13.89	184	230	5.1	4.2	4	339	0	0	0
15	AWT	28-Mar	3:52	6	56 54.13	155 49.12	284	304	5.4	3.9	209	1,233	13	531	118
16	AWT	28-Mar	14:07	8	56 40.25	155 58.95	270	300	5.5	4.0	340	1,879	29	1,162	2
17	AWT	28-Mar	17:11	15	56 37.38	155 42.30	219	237	5.5	4.1	109	455	295	15,343	14
18	AWT	28-Mar	20:20	25	56 30.81	155 49.18	180	223	5.4	4.1	< 1	12	< 1	18	156
19	AWT	28-Mar	23:14	15	56 32.43	155 58.51	196	265	5.4	4.2	23	2,259	1	54	1
20	AWT	29-Mar	4:44	5	56 27.12	156 13.80	250	269	5.4	3.9	386	5,590	143	6,314	10
21	AWT	29-Mar	19:59	12	55 50.70	156 29.65	209	249	5.6	3.8	26	2,388	2	107	2
22	PNE	29-Mar	21:37	20	55 50.63	156 29.63	249	249	5.6	3.9	53	73	< 1	23	3
23	AWT	30-Mar	0:45	35	55 49.23	156 30.63	154	253	5.0	4.2	4	191	< 1	19	1
24	AWT	1-Apr	16:31	29	55 58.20	154 40.95	380	446	4.5	4.5	269	363	< 1	6	5
25	AWT	1-Apr	22:14	5	55 57.43	154 24.25	328	697	5.0	4.8	331	450	0	0	3
26	AWT	2-Apr	5:05	12	55 53.71	153 55.89	313	691	5.0	4.7	105	147	0	0	< 1
27	AWT	2-Apr	19:20	20	56 16.31	152 57.61	365	919	4.5	4.7	85	103	< 1	2	16
28	AWT	3-Apr	0:49	15	56 51.48	152 39.54	381	620	4.5	5.1	735	682	< 1	6	75
29	AWT	3-Apr	6:48	22	56 33.50	152 28.34	197	208	5.4	5.1	6	9	5	157	22

[1] AWT = Aleutian wing trawl, PNE = poly Nor'eastern bottom trawl.

Table 11.--Summary of catch by species in 22 midwater trawls conducted during the 2005 pollock echo integration-trawl survey of the Shelikof Strait area.

Common name	Scientific name	Weight (kg)	Percent	Numbers	Percent
walleye pollock	*Theragra chalcogramma*	7,827.8	74.8%	30,753	29.2%
eulachon	*Thaleichthys pacificus*	2,097.6	20.0%	71,342	67.7%
salmon shark	*Lamna ditropis*	262.0	2.5%	2	< 0.1%
Pacific sleeper shark	*Somniosus pacificus*	129.2	1.2%	4	< 0.1%
chinook salmon	*Oncorhynchus tshawytscha*	43.9	0.4%	23	< 0.1%
squid unident.	Teuthoidea (order)	31.2	0.3%	1,261	1.2%
Majestic squid	*Berryteuthis magister*	24.9	0.2%	31	< 0.1%
Pacific herring	*Clupea pallasi*	11.0	0.1%	168	0.2%
Pacific cod	*Gadus macrocephalus*	8.8	0.1%	2	< 0.1%
arrowtooth flounder	*Atheresthes stomias*	8.5	0.1%	16	< 0.1%
shrimp unident.	Decapoda (order)	5.6	0.1%	1,503	1.4%
northern smoothtongue	*Leuroglossus schmidti*	4.8	< 0.1%	289	0.3%
shortraker rockfish	*Sebastes borealis*	2.7	< 0.1%	1	< 0.1%
chum salmon	*Oncorhynchus keta*	2.6	< 0.1%	1	< 0.1%
jellyfish unident.	Scyphozoa (class)	1.4	< 0.1%	5	< 0.1%
smooth lumpsucker	*Aptocyclus ventricosus*	0.7	< 0.1%	1	< 0.1%
flathead sole	*Hippoglossoides elassodon*	0.5	< 0.1%	3	< 0.1%
capelin	*Mallotus villosus*	0.2	< 0.1%	23	< 0.1%
Myctophidae	Myctophidae	< 1	< 0.1%	8	< 0.1%
Total		10,463.5		105,436	

Table 12.--Summary of catch by species in one bottom trawl conducted during the 2005 pollock echo integration-trawl survey of the Shelikof Strait area.

Common name	Scientific name	Weight (kg)	Percent	Numbers	Percent
walleye pollock	*Theragra chalcogramma*	53.2	93.9%	73	72.3%
arrowtooth flounder	*Atheresthes stomias*	3.2	5.7%	2	2.0%
eulachon	*Thaleichthys pacificus*	0.2	0.4%	23	22.8%
shrimp unident.	Decapoda (order)	< 1	< 0.1%	3	3.0%
Total		56.7		101	

Table 13.--Numbers-at-age estimates (millions) from echo integration-trawl surveys of walleye pollock in the Shelikof Strait area. No surveys were conducted in 1982 or 1999, and no estimate was produced for 1987 because of an equipment malfunction.

Age	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1	78	--	1	62	2,092	575	--	17	399	49	22	228	63	186	10,690	56	70	395	--	4,484	289	8	51	53	1,626
2	3,481	--	902	58	544	2,115	--	110	90	1,210	174	34	76	36	510	3,307	183	89	--	755	4,104	163	90	94	157
3	1,511	--	380	324	123	184	--	694	90	72	550	74	37	49	79	119	1,247	126	--	217	352	1,107	208	58	56
4	769	--	1,297	142	315	46	--	322	216	63	48	188	72	32	78	25	80	474	--	16	61	97	802	160	35
5	2,786	--	1,171	635	181	75	--	78	249	116	65	368	233	155	103	54	18	136	--	67	42	16	57	356	173
6	1,052	--	698	988	347	49	--	17	43	180	70	84	126	84	245	71	44	14	--	132	23	16	8	49	162
7	210	--	599	450	439	86	--	6	14	46	116	85	27	42	122	201	52	32	--	17	35	8	4	3	36
8	129	--	132	224	167	149	--	6	4	22	24	171	36	27	54	119	98	36	--	13	13	7	2	3	4
9	79	--	14	41	43	60	--	4	2	8	29	33	39	44	17	40	53	74	--	10	6	1	1	3	2
10	25	--	12	3	6	11	--	9	1	8	2	56	16	48	11	13	14	26	--	8	3	1	1	1	--
11	2	--	4	0	2	1	--	2	10	1	4	2	8	15	15	11	2	14	--	14	1	< 1	< 1	< 1	1
12	0	--	2	1	1	0	--	2	1	3	1	15	3	7	6	5	3	7	--	7	2	< 1	0	0	--
13	0	--	0	0	0	0	--	< 1	< 1	2	4	1	2	1	2	3	1	< 1	--	2	1	< 1	< 1	1	--
14	0	--	0	0	0	0	--	0	0	1	0	< 1	< 1	2	< 1	< 1	< 1	1	--	1	< 1	< 1	0	0	--
15	0	--	0	0	0	0	--	0	0	< 1	0	0	1	< 1	0	0	0	1	--	0	< 1	0	0	0	--
16	0	--	0	0	0	0	--	0	0	< 1	0	0	1	0	0	< 1	0	0	--	0	0	0	0	0	--
17	0	--	0	0	0	0	--	0	0	0	0	0	< 1	< 1	0	0	0	0	--	0	0	0	0	0	--
18	0	--	0	0	0	0	--	0	0	< 1	0	0	0	0	0	0	0	0	--	0	0	0	0	0	--
Total	10,122	--	5,212	2,928	4,260	3,351	--	1,267	1,119	1,781	1,109	1,339	740	728	11,932	4,024	1,865	1,425	--	5,743	4,932	1,424	1,224	781	2,252

Table 14.--Biomass-at-age estimates (millions) from echo integration-trawl surveys of walleye pollock in the Shelikof Strait area. No surveys were conducted in 1982 or 1999, and no estimate was produced for 1987 because of an equipment malfunction.

Age	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1	1	--	< 1	1	24	4	--	< 1	4	< 1	< 1	3	1	2	114	1	1	4	--	57	2	< 1	1	1	18
2	309	--	71	6	54	139	--	8	8	67	12	3	6	3	46	180	15	8	--	63	214	13	8	8	13
3	342	--	117	83	41	40	--	130	21	15	85	16	11	14	23	24	195	28	--	60	60	164	43	14	17
4	255	--	529	78	159	17	--	91	86	23	13	60	34	20	41	12	28	153	--	9	25	29	222	78	19
5	1,068	--	650	373	109	56	--	31	111	61	33	144	136	127	83	50	13	53	--	54	27	12	25	179	132
6	496	--	455	684	253	41	--	9	27	120	54	68	90	75	220	73	53	12	--	107	24	16	7	37	119
7	133	--	332	331	353	76	--	6	12	36	106	92	28	48	116	212	61	39	--	17	40	9	5	4	29
8	92	--	94	161	138	140	--	6	4	24	23	194	43	34	55	132	120	47	--	17	18	8	2	5	4
9	68	--	11	36	35	58	--	5	3	9	36	36	46	64	19	48	67	95	--	15	8	2	3	5	3
10	19	--	12	3	6	11	--	11	1	11	3	71	21	68	15	17	20	33	--	11	5	1	1	1	--
11	1	--	5	0	2	2	--	2	12	1	6	3	10	21	20	16	3	21	--	22	2	1	< 1	1	1
12	0	--	1	1	1	0	--	3	1	4	1	21	4	10	7	7	5	10	--	11	3	1	0	0	--
13	0	--	0	0	0	0	--	< 1	< 1	2	7	1	3	2	3	4	1	< 1	--	4	1	< 1	< 1	1	--
14	0	--	0	0	0	0	--	0	0	1	0	1	1	4	1	< 1	1	1	--	2	1	< 1	0	0	--
15	0	--	0	0	0	0	--	0	0	< 1	0	0	1	< 1	0	0	0	1	--	0	< 1	0	0	0	--
16	0	--	0	0	0	0	--	0	0	< 1	0	0	1	0	0	< 1	0	0	--	0	0	0	0	0	--
17	0	--	0	0	0	0	--	0	0	0	0	0	< 1	1	0	0	0	0	--	0	0	0	0	0	--
18	0	--	0	0	0	0	--	0	0	< 1	0	0	0	0	0	0	0	0	--	0	0	0	0	0	--
Total	2,786	--	2,278	1,757	1,175	586	--	302	290	375	380	713	436	493	764	777	583	505	--	449	433	257	317	331	356

Table 15.--Numbers-at-length estimates (millions) from echo integration-trawl surveys of walleye pollock in the Shelikof Strait area. No surveys were conducted in 1982 or 1999, and no estimate was produced for 1987 because of an equipment malfunction.

Length	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
5	0	--	0	0	0	0	--	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0	0	0	0
6	0	--	0	0	0	0	--	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0	0	0	0
7	0	--	0	0	0	0	--	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0	0	0	0
8	0	--	0	0	0	0	--	0	0	0	0	0	0	0	2	0	0	0	--	< 1	0	0	0	< 1	0
9	0	--	0	0	21	60	--	0	4	1	1	< 1	< 1	4	163	0	3	4	--	29	4	0	0	< 1	6
10	0	--	0	0	310	175	--	0	47	5	0	4	3	32	1,120	3	3	16	--	372	33	0	1	10	106
11	2	--	0	1	581	206	--	4	133	16	4	27	16	51	3,906	12	20	70	--	1,162	87	0	8	15	476
12	10	--	1	60	810	102	--	8	153	16	9	74	26	60	3,779	20	21	140	--	1,565	87	5	14	24	621
13	26	--	1	0	278	32	--	4	50	9	4	79	13	33	1,538	18	15	104	--	999	52	2	20	3	296
14	31	--	0	1	79	1	--	1	9	1	4	36	3	6	157	4	7	49	--	320	24	1	8	1	98
15	5	--	0	0	13	0	--	< 1	3	< 1	< 1	6	1	< 1	25	< 1	1	10	--	30	2	1	1	< 1	19
16	5	--	0	0	1	3	--	0	< 1	0	< 1	1	0	< 1	1	5	< 1	2	--	7	2	0	< 1	< 1	4
17	1	--	1	0	< 1	7	--	0	0	4	< 1	0	0	0	1	51	< 1	< 1	--	1	20	0	< 1	< 1	< 1
18	5	--	1	0	1	41	--	1	< 1	36	1	0	< 1	1	4	249	1	< 1	--	10	185	< 1	0	< 1	1
19	12	--	8	0	2	187	--	2	1	165	7	< 1	< 1	< 1	16	634	1	1	--	32	808	3	1	1	2
20	70	--	70	0	6	444	--	8	2	341	12	1	4	2	39	945	8	3	--	81	1,407	15	3	4	8
21	280	--	177	< 1	20	535	--	26	7	362	33	2	8	5	68	772	23	10	--	147	1,043	36	11	10	20
22	733	--	221	1	75	431	--	32	17	198	48	5	17	7	92	441	50	16	--	196	460	29	15	20	29
23	952	--	198	7	152	267	--	29	23	75	41	8	20	6	93	131	48	20	--	176	107	43	17	23	38
24	695	--	142	15	151	136	--	9	19	21	23	10	14	5	73	54	48	21	--	68	20	56	16	18	30
25	389	--	37	21	75	46	--	4	11	7	23	6	7	4	53	18	89	10	--	30	22	128	11	12	16
26	219	--	28	12	36	23	--	11	5	1	59	5	5	2	36	9	208	8	--	11	31	239	8	9	7
27	90	--	6	5	16	11	--	40	3	6	108	3	1	3	27	9	275	6	--	6	60	250	9	4	2
28	70	--	6	6	6	9	--	107	3	3	142	3	1	1	17	11	268	5	--	10	85	210	23	2	3
29	83	--	3	9	3	15	--	158	6	9	123	8	1	1	5	22	205	10	--	13	91	124	52	3	1
30	235	--	7	26	5	31	--	191	12	16	72	19	1	3	2	23	104	25	--	18	50	74	107	4	8
31	420	--	3	48	6	34	--	129	23	19	32	25	2	6	6	15	59	42	--	32	37	42	153	7	8
32	492	--	24	67	4	38	--	92	27	17	22	37	3	7	4	15	31	78	--	37	15	25	185	16	2
33	490	--	65	68	11	29	--	85	24	11	8	48	5	11	8	13	21	102	--	34	14	29	145	25	10
34	499	--	141	53	22	18	--	89	28	10	8	67	6	6	6	6	16	99	--	28	7	20	122	41	3
35	592	--	195	27	27	12	--	63	37	8	7	85	10	7	11	4	11	103	--	22	6	17	77	56	10
36	665	--	258	21	41	9	--	41	53	12	8	83	9	6	15	4	10	84	--	13	8	7	57	59	4
37	541	--	339	20	44	7	--	28	62	19	9	84	17	3	14	3	10	66	--	9	9	5	38	54	18
38	403	--	368	35	53	3	--	24	66	23	8	65	26	3	20	2	9	45	--	8	9	6	28	47	10
39	352	--	341	87	64	4	--	12	57	21	6	36	40	2	9	2	5	26	--	7	11	6	23	39	11

Table 15.--Continued.

Length	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
40	339	--	343	138	77	3	--	13	52	33	10	30	53	3	15	2	8	15	--	11	9	2	14	35	23
41	231	--	290	170	82	8	--	8	46	34	9	22	57	5	5	2	4	16	--	13	12	2	13	35	22
42	224	--	326	219	96	8	--	5	36	37	13	15	57	9	7	2	5	6	--	19	8	3	7	38	32
43	178	--	311	271	106	12	--	5	22	32	14	14	48	16	17	4	4	7	--	19	7	2	6	32	33
44	145	--	304	309	113	22	--	3	16	37	19	14	37	23	18	6	5	5	--	18	7	2	5	27	41
45	116	--	256	316	119	35	--	2	12	34	21	17	33	36	35	7	3	2	--	19	8	3	3	24	39
46	84	--	201	283	148	39	--	2	6	25	24	22	23	39	53	13	4	2	--	22	5	2	3	18	33
47	113	--	171	213	140	50	--	2	6	23	22	21	19	46	62	25	4	3	--	19	5	3	3	17	37
48	62	--	116	158	139	57	--	2	4	20	26	32	17	37	74	37	6	4	--	17	6	4	2	11	33
49	75	--	91	104	117	52	--	3	5	16	20	38	16	33	73	53	13	6	--	13	9	3	2	8	22
50	58	--	52	68	83	51	--	4	5	15	19	46	17	29	66	64	20	13	--	16	8	3	2	7	28
51	50	--	49	40	52	42	--	4	4	8	20	40	15	24	51	69	30	18	--	10	5	4	2	5	14
52	25	--	23	25	28	21	--	3	4	8	14	38	14	21	40	64	36	24	--	11	9	4	2	4	7
53	12	--	17	13	23	18	--	3	5	7	13	35	14	24	30	53	37	26	--	10	6	3	2	2	6
54	9	--	7	4	9	6	--	2	4	5	9	35	13	18	22	39	34	23	--	9	4	3	1	3	4
55	15	--	9	3	4	11	--	2	2	7	10	30	11	18	16	29	28	20	--	9	5	2	1	3	3
56	5	--	2	2	2	2	--	2	1	2	6	15	9	18	14	19	24	19	--	8	5	1	< 1	2	2
57	7	--	2	1	2	< 1	--	1	1	2	3	18	7	13	7	13	12	12	--	9	3	1	< 1	1	1
58	3	--	1	1	1	1	--	< 1	1	1	5	14	7	11	6	10	8	9	--	6	2	1	< 1	1	1
59	1	--	1	< 1	1	< 1	--	< 1	1	1	2	4	4	9	3	6	5	8	--	5	3	1	1	1	1
60	0	--	1	< 1	2	1	--	0	1	1	2	2	3	7	2	5	3	4	--	2	3	< 1	1	< 1	1
61	0	--	1	< 1	< 1	1	--	< 1	< 1	< 1	1	2	2	5	1	3	2	2	--	1	1	< 1	1	< 1	< 1
62	0	--	0	1	1	< 1	--	< 1	< 1	< 1	< 1	3	1	2	2	2	1	2	--	2	< 1	< 1	< 1	< 1	0
63	0	--	0	1	1	< 1	--	0	< 1	< 1	1	1	1	1	< 1	1	1	2	--	1	1	< 1	< 1	< 1	1
64	0	--	0	< 1	0	< 1	--	0	< 1	< 1	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1	--	< 1	< 1	< 1	< 1	< 1	< 1
65	0	--	0	0	0	< 1	--	0	0	< 1	1	0	< 1	1	< 1	< 1	< 1	< 1	--	< 1	< 1	< 1	0	< 1	< 1
66	0	--	0	0	< 1	< 1	--	0	< 1	< 1	0	< 1	< 1	< 1	0	< 1	< 1	< 1	--	< 1	1	0	0	0	< 1
67	0	--	0	0	0	< 1	--	< 1	0	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1	0	--	< 1	0	< 1	< 1	0	0
68	0	--	0	0	0	0	--	0	0	< 1	0	0	< 1	0	0	< 1	< 1	< 1	--	0	< 1	< 1	0	< 1	0
69	0	--	0	0	0	0	--	0	0	< 1	1	0	< 1	< 1	0	< 1	< 1	0	--	0	0	0	0	0	0
70	0	--	0	0	0	0	--	< 1	0	0	0	0	0	0	0	0	0	0	--	0	0	0	0	0	0
71	0	--	0	0	0	0	--	0	0	< 1	0	0	0	< 1	0	0	0	0	--	0	0	< 1	0	0	0
72	0	--	0	0	0	0	--	0	0	0	0	0	0	0	0	< 1	0	0	--	0	0	0	0	0	0
73	0	--	0	0	0	0	--	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0	0	0	0
74	0	--	0	0	0	0	--	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0	0	0	0
75	0	--	0	0	0	0	--	0	0	0	0	0	0	0	0	0	0	0	--	< 1	0	0	0	0	0
Total	10,121	--	5,211	2,928	4,259	3,352	--	1,266	1,119	1,782	1,109	1,339	740	729	11,931	4,024	1,866	1,425	--	5,742	4,931	1,424	1,224	780	2,252

Table 16.--Biomass-at-length estimates (thousands of t) from echo integration-trawl surveys of walleye pollock in the Shelikof Strait area. No surveys were conducted in 1982 or 1999, and no estimate was produced for 1987 because of an equipment malfunction.

Length	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
5	0	--	0	0	0	0	--	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0	0	0	0
6	0	--	0	0	0	0	--	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0	0	0	0
7	0	--	0	0	0	0	--	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0	0	0	0
8	0	--	0	0	0	0	--	0	0	0	0	0	0	0	< 1	0	0	0	--	0	0	0	0	< 1	0
9	0	--	0	0	< 1	< 1	--	0	< 1	< 1	< 1	< 1	< 1	< 1	1	0	< 1	< 1	--	< 1	< 1	0	0	< 1	< 1
10	0	--	0	0	2	1	--	0	< 1	< 1	0	< 1	< 1	< 1	7	< 1	< 1	< 1	--	3	< 1	0	< 1	< 1	1
11	< 1	--	0	< 1	6	2	--	< 1	1	< 1	< 1	< 1	< 1	< 1	35	< 1	< 1	1	--	11	1	0	< 1	< 1	4
12	< 1	--	< 1	1	10	1	--	< 1	2	< 1	< 1	1	< 1	1	44	< 1	< 1	1	--	20	1	< 1	< 1	< 1	7
13	< 1	--	< 1	0	4	< 1	--	< 1	1	< 1	< 1	1	< 1	< 1	23	< 1	< 1	1	--	16	1	< 1	< 1	< 1	4
14	1	--	0	< 1	2	< 1	--	< 1	< 1	< 1	< 1	1	< 1	< 1	3	< 1	< 1	1	--	7	< 1	< 1	< 1	< 1	2
15	< 1	--	0	0	< 1	0	--	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1	< 1	< 1	< 1	--	1	< 1	< 1	< 1	< 1	< 1
16	< 1	--	0	0	< 1	< 1	--	0	< 1	0	< 1	< 1	0	< 1	< 1	< 1	< 1	< 1	--	< 1	< 1	0	< 1	< 1	< 1
17	< 1	--	< 1	0	< 1	< 1	--	0	0	< 1	< 1	0	0	0	< 1	2	< 1	< 1	--	< 1	1	0	< 1	< 1	< 1
18	< 1	--	< 1	0	< 1	2	--	< 1	< 1	1	< 1	0	< 1	< 1	< 1	9	< 1	< 1	--	< 1	6	< 1	0	< 1	< 1
19	1	--	< 1	0	< 1	8	--	< 1	< 1	7	< 1	< 1	< 1	< 1	1	27	< 1	< 1	--	2	33	< 1	< 1	< 1	< 1
20	4	--	4	0	< 1	23	--	< 1	< 1	16	1	< 1	< 1	< 1	2	48	< 1	< 1	--	5	68	1	< 1	< 1	< 1
21	18	--	11	< 1	1	33	--	1	< 1	21	2	< 1	< 1	< 1	4	46	1	1	--	10	59	2	1	1	1
22	53	--	16	< 1	6	31	--	2	1	13	3	< 1	1	1	7	30	4	1	--	16	31	2	1	1	2
23	78	--	16	1	14	22	--	2	2	6	3	1	2	1	8	10	4	2	--	17	8	4	1	2	3
24	65	--	13	2	15	13	--	1	2	2	2	1	1	1	7	5	5	2	--	7	2	5	2	2	3
25	41	--	4	2	9	5	--	< 1	1	1	2	1	1	< 1	6	2	10	1	--	4	2	14	1	1	2
26	26	--	3	2	5	3	--	1	1	< 1	7	1	1	< 1	5	1	25	1	--	1	4	29	1	1	1
27	12	--	1	1	2	2	--	5	< 1	1	14	< 1	< 1	< 1	4	1	38	1	--	1	8	35	1	< 1	< 1
28	11	--	1	1	1	1	--	16	< 1	< 1	21	< 1	< 1	< 1	3	2	42	1	--	2	13	33	3	< 1	< 1
29	14	--	1	2	1	3	--	26	1	1	20	1	< 1	< 1	1	4	36	2	--	2	15	22	9	1	< 1
30	44	--	1	5	1	6	--	35	2	3	13	4	< 1	1	< 1	4	20	5	--	4	9	15	20	1	2
31	86	--	1	10	1	7	--	27	5	4	7	5	< 1	1	1	3	13	9	--	8	8	9	32	1	2
32	111	--	5	16	1	9	--	21	6	4	5	9	1	2	1	3	7	19	--	10	3	6	43	4	1
33	122	--	16	18	3	7	--	22	6	3	2	12	1	3	2	3	5	26	--	10	4	8	37	7	3
34	136	--	39	15	6	5	--	25	8	3	2	19	2	2	2	2	5	28	--	9	2	6	34	12	1
35	176	--	59	9	9	4	--	19	11	2	2	27	3	2	4	1	4	33	--	8	2	6	24	18	3
36	216	--	84	7	14	3	--	14	18	4	3	29	3	2	5	1	3	29	--	5	3	2	19	20	1
37	191	--	121	7	17	2	--	11	23	7	3	32	6	1	5	1	4	25	--	4	3	2	14	21	7
38	154	--	142	14	21	1	--	10	26	9	3	26	11	1	8	1	4	19	--	4	4	2	11	20	4
39	146	--	143	38	28	2	--	5	25	9	3	16	18	1	4	1	2	12	--	3	5	3	10	18	5

Table 16.--Continued.

Length	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
40	152	--	155	66	37	1	--	6	24	15	5	15	26	2	7	1	4	7	--	6	4	1	7	17	12
41	112	--	142	87	42	4	--	4	23	17	4	11	30	3	3	1	2	8	--	7	6	1	7	19	13
42	117	--	172	121	53	4	--	3	20	20	7	9	32	5	4	1	3	3	--	11	5	2	4	22	19
43	100	--	176	161	63	7	--	3	13	19	9	9	29	10	10	2	2	4	--	13	5	1	4	20	21
44	87	--	185	197	72	14	--	2	10	24	12	9	24	16	12	4	3	3	--	13	5	1	3	19	27
45	75	--	167	215	81	24	--	2	8	23	15	12	23	26	24	5	2	2	--	15	6	2	2	17	27
46	58	--	140	206	107	29	--	2	4	19	18	17	18	31	39	10	3	1	--	17	4	2	3	15	24
47	83	--	127	166	108	40	--	1	5	18	18	17	16	39	49	20	3	3	--	16	4	2	3	14	29
48	49	--	92	131	115	49	--	2	3	17	22	29	15	34	63	32	6	4	--	15	6	3	2	10	28
49	63	--	77	92	102	47	--	2	4	15	19	36	15	32	66	48	13	6	--	13	8	3	2	8	19
50	51	--	46	63	78	49	--	4	4	15	19	47	17	30	63	62	20	13	--	16	8	3	2	8	28
51	47	--	47	40	52	43	--	4	4	8	21	43	16	26	52	71	32	20	--	12	6	4	2	5	14
52	25	--	23	26	29	24	--	3	4	8	15	44	15	24	43	70	41	27	--	13	10	5	2	5	8
53	13	--	19	15	26	21	--	4	5	8	15	43	17	29	34	62	45	32	--	12	8	4	2	3	7
54	11	--	8	5	10	7	--	3	5	6	12	45	17	23	26	48	44	30	--	13	6	4	1	4	5
55	18	--	11	4	5	14	--	3	2	9	14	41	15	24	20	38	38	27	--	12	7	3	2	4	4
56	6	--	2	2	3	3	--	2	2	3	9	22	13	27	19	27	35	28	--	12	8	2	< 1	3	3
57	10	--	3	2	3	< 1	--	1	2	4	5	28	11	21	10	20	19	18	--	13	5	2	< 1	1	1
58	4	--	1	1	1	2	--	1	1	2	7	24	12	19	10	15	13	15	--	11	4	2	1	2	2
59	1	--	1	< 1	2	1	--	1	1	2	3	8	7	16	4	11	8	13	--	8	6	2	2	1	1
60	0	--	1	< 1	3	1	--	0	1	2	4	4	5	13	3	9	5	8	--	4	6	1	1	< 1	1
61	0	--	1	1	< 1	1	--	< 1	1	1	1	4	3	9	3	5	4	4	--	2	3	1	1	< 1	< 1
62	0	--	0	2	1	1	--	1	< 1	< 1	1	5	2	4	3	3	2	3	--	3	1	1	< 1	< 1	0
63	0	--	0	2	2	< 1	--	0	< 1	< 1	1	3	1	3	< 1	2	2	4	--	1	3	< 1	< 1	1	1
64	0	--	0	1	0	< 1	--	0	< 1	< 1	< 1	1	< 1	2	1	1	< 1	1	--	1	1	< 1	1	< 1	< 1
65	0	--	0	0	0	< 1	--	0	0	< 1	3	0	< 1	2	< 1	1	< 1	1	--	< 1	< 1	< 1	0	< 1	< 1
66	0	--	0	0	< 1	1	--	0	< 1	< 1	0	1	< 1	< 1	0	< 1	< 1	1	--	< 1	3	0	0	0	1
67	0	--	0	0	0	1	--	1	0	< 1	< 1	1	< 1	1	0	< 1	< 1	0	--	< 1	0	< 1	< 1	0	0
68	0	--	0	0	0	0	--	0	0	< 1	0	0	< 1	0	0	< 1	1	< 1	--	0	1	< 1	0	< 1	0
69	0	--	0	0	0	0	--	0	0	< 1	2	0	< 1	< 1	0	< 1	< 1	0	--	0	0	0	0	0	0
70	0	--	0	0	0	0	--	< 1	0	0	0	0	0	0	0	0	0	0	--	0	0	0	0	0	0
71	0	--	0	0	0	0	--	0	0	< 1	0	0	0	< 1	0	0	0	0	--	0	0	< 1	0	0	0
72	0	--	0	0	0	0	--	0	0	0	0	0	0	0	0	< 1	0	0	--	0	0	0	0	0	0
73	0	--	0	0	0	0	--	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0	0	0	0
74	0	--	0	0	0	0	--	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0	0	0	0
75	0	--	0	0	0	0	--	0	0	0	0	0	0	0	0	0	0	0	--	< 1	0	0	0	0	0
Total	2,786	--	2,278	1,757	1,175	586	--	302	290	375	380	713	436	493	764	777	583	505	--	449	433	257	317	331	356

Table 17.--Summary of catch by species in six midwater trawls conducted during the 2005 pollock echo integration-trawl survey of the Gulf of Alaska shelf-break near Chirikof Island.

Common name	Scientific name	Weight (kg)	Percent	Numbers	Percent
walleye pollock	*Theragra chalcogramma*	1,531.9	84.4%	1,754.0	35.2%
Pacific ocean perch	*Sebastes alutus*	155.4	8.6%	281	5.6%
shortraker rockfish	*Sebastes borealis*	83.1	4.6%	16	< 0.1%
arrowtooth flounder	*Atheresthes stomias*	9.1	0.5%	12	< 0.1%
giant grenadier	*Albatrossia pectoralis*	6.7	< 0.1%	2	< 0.1%
Myctophidae	Myctophidae	5.8	< 0.1%	1,104.0	22%
eulachon	*Thaleichthys pacificus*	5.4	< 0.1%	171	3%
rougheye rockfish	*Sebastes aleutianus*	5.2	< 0.1%	2	< 0.1%
jellyfish unident.	Scyphozoa (class)	5.1	< 0.1%	6	< 0.1%
chinook salmon	*Oncorhynchus tshawytscha*	4.3	< 0.1%	2	< 0.1%
northern smoothtongue	*Leuroglossus schmidti*	1.0	< 0.1%	47	1%
shrimp unident.	Decapoda (order)	0.8	< 0.1%	1,557.0	31%
salps unident.	Thaliacea	0.2	< 0.1%	7	< 0.1%
squid unident.	Teuthoidea	0.2	< 0.1%	25	1%
Pacific lamprey	*Lampetra tridentata*	< 1	< 0.1%	1	< 0.1%
capelin	*Mallotus villosus*	< 1	< 0.1%	1	< 0.1%
Total		1,814.2		4,988.0	

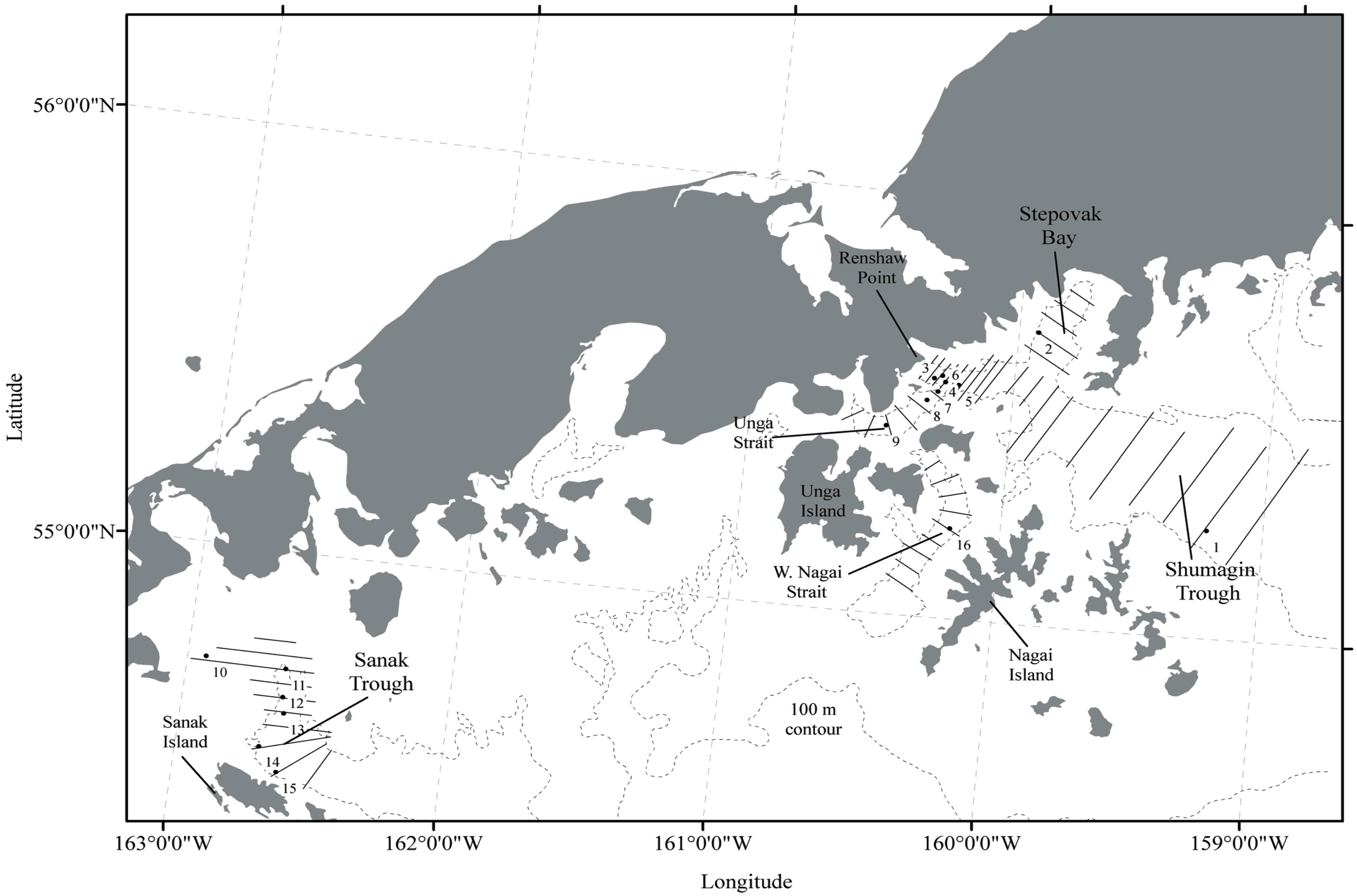

Figure 1.--Transect lines and distribution of trawls during the winter 2005 echo integration-trawl surveys of the Shumagin Islands area and Sanak Trough in the Gulf of Alaska.

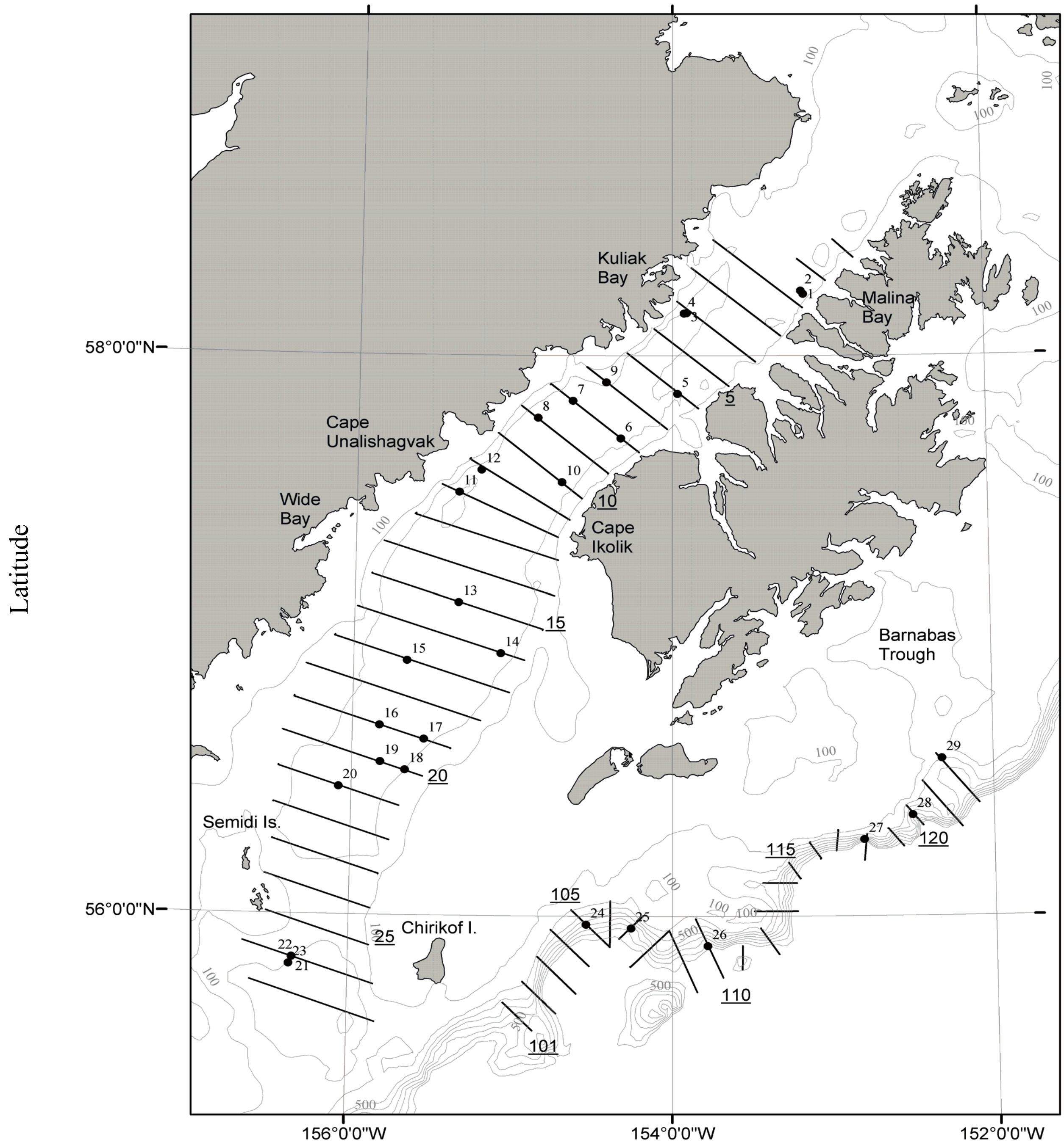

Figure 2.--Transect lines and distribution of trawls in the Shelikof Strait area and along the Gulf of Alaska shelf break near Chirikof Island echo integration-trawl surveys, 24 March - 3 April 2005.

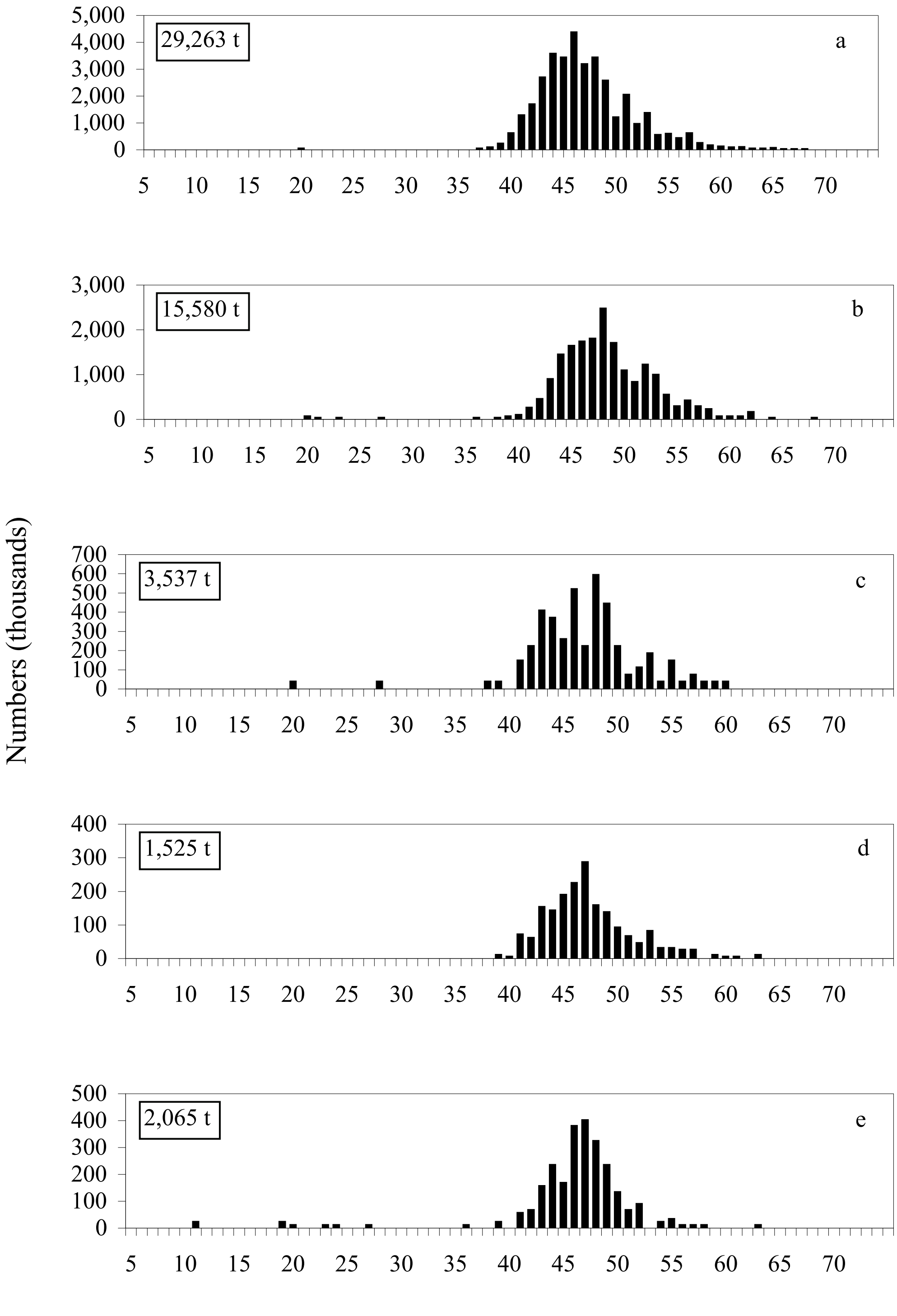

Figure 3.--Size distribution of pollock (numbers) (a) off Renshaw Point, (b) in Unga Strait, (c) in West Nagai Strait, (d) in Stepovak Bay, and (e) in Shumagin Trough for the 2005 echo integration-trawl survey of the Shumagin Islands.

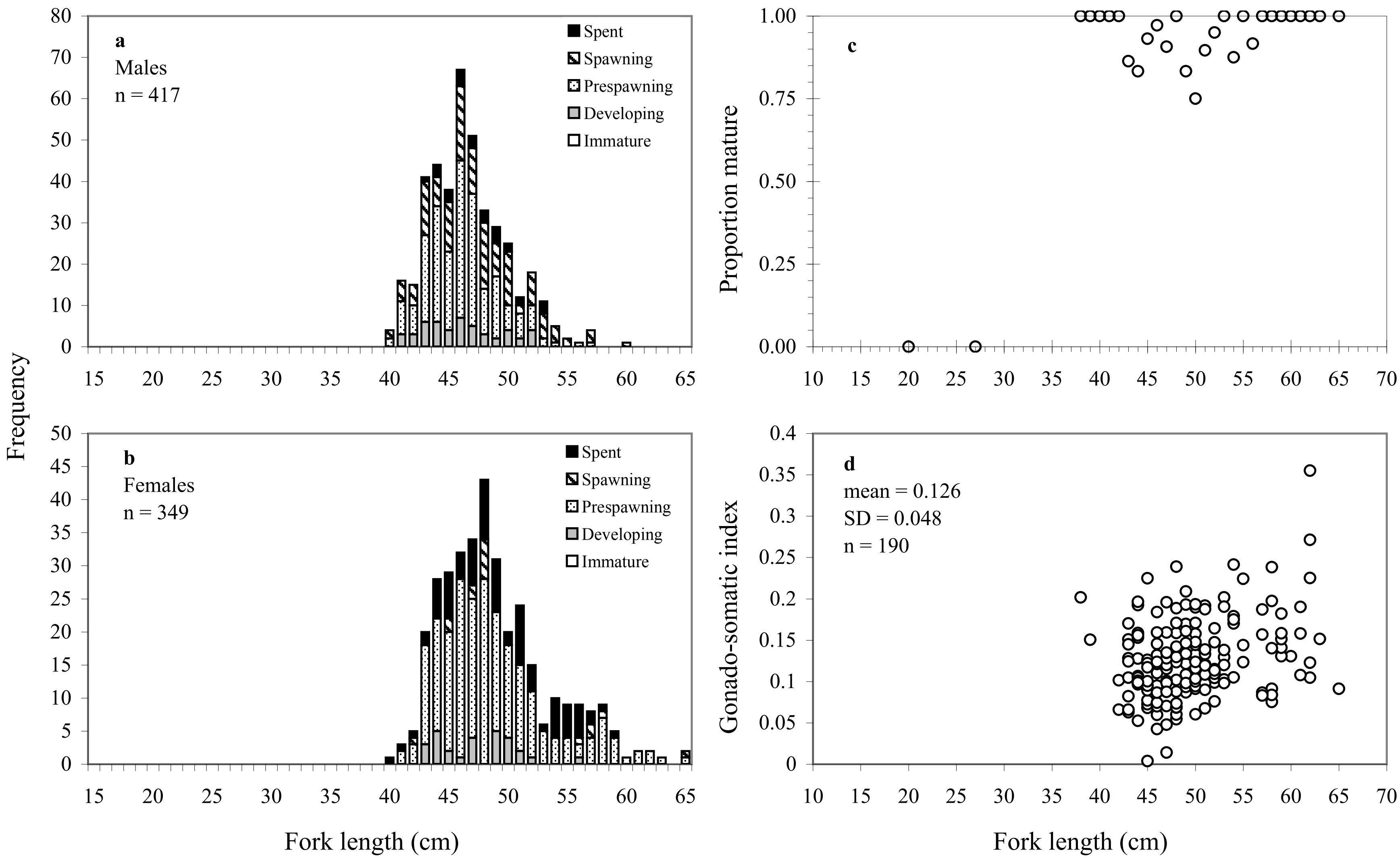

Figure 4.--Maturity stages for (a) male and (b) female pollock, (c) proportion mature by 1-cm size group for female pollock and (d) gonadosomatic index for pre-spawning females examined during the 2005 echo integration-trawl survey of

Shumagin Islands in the Gulf of Alaska.

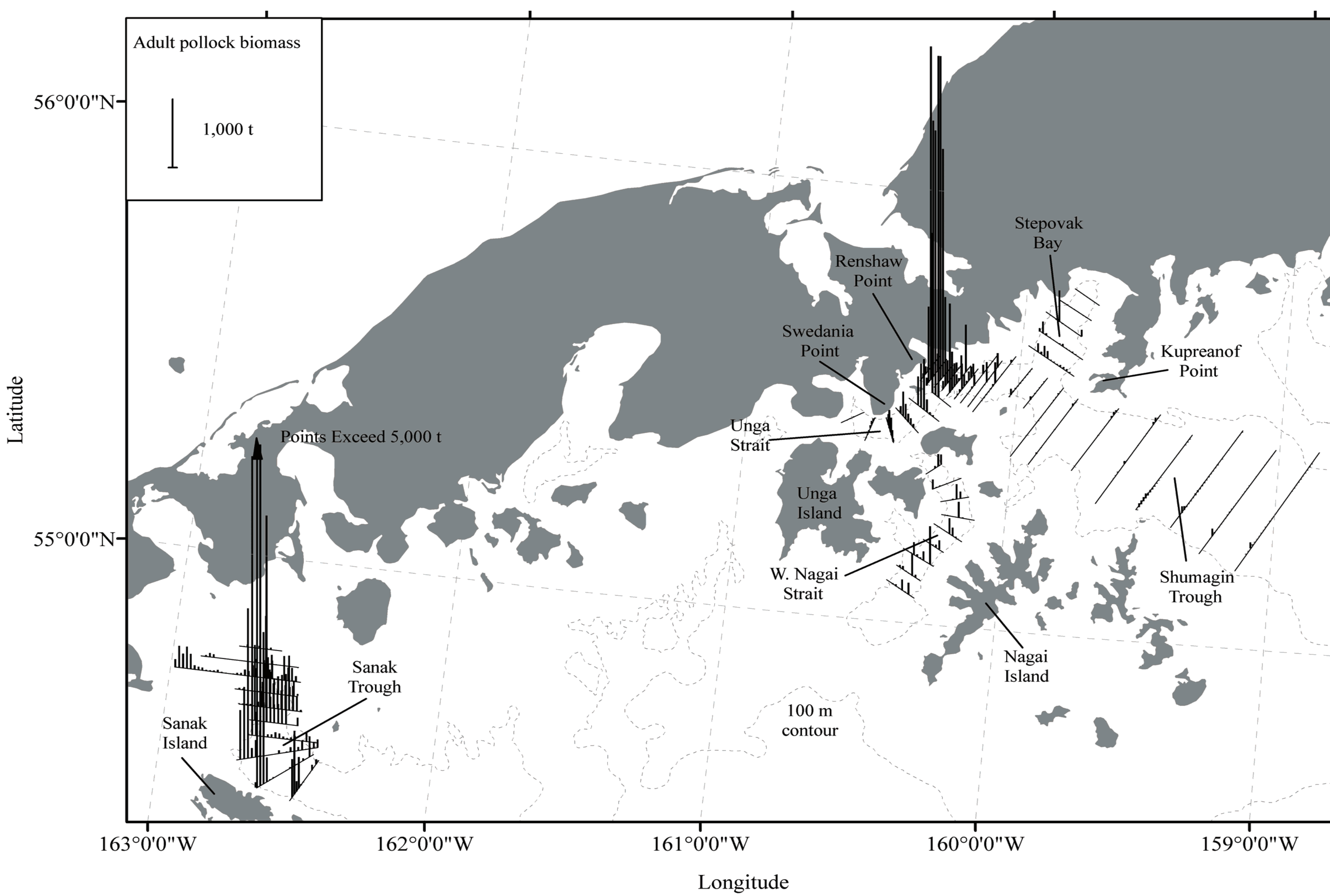

Figure 5.--Adult pollock biomass along track lines during the winter 2005 echo integration-trawl surveys of the Shumagin Islands and Sanak Trough in the Gulf of Alaska.

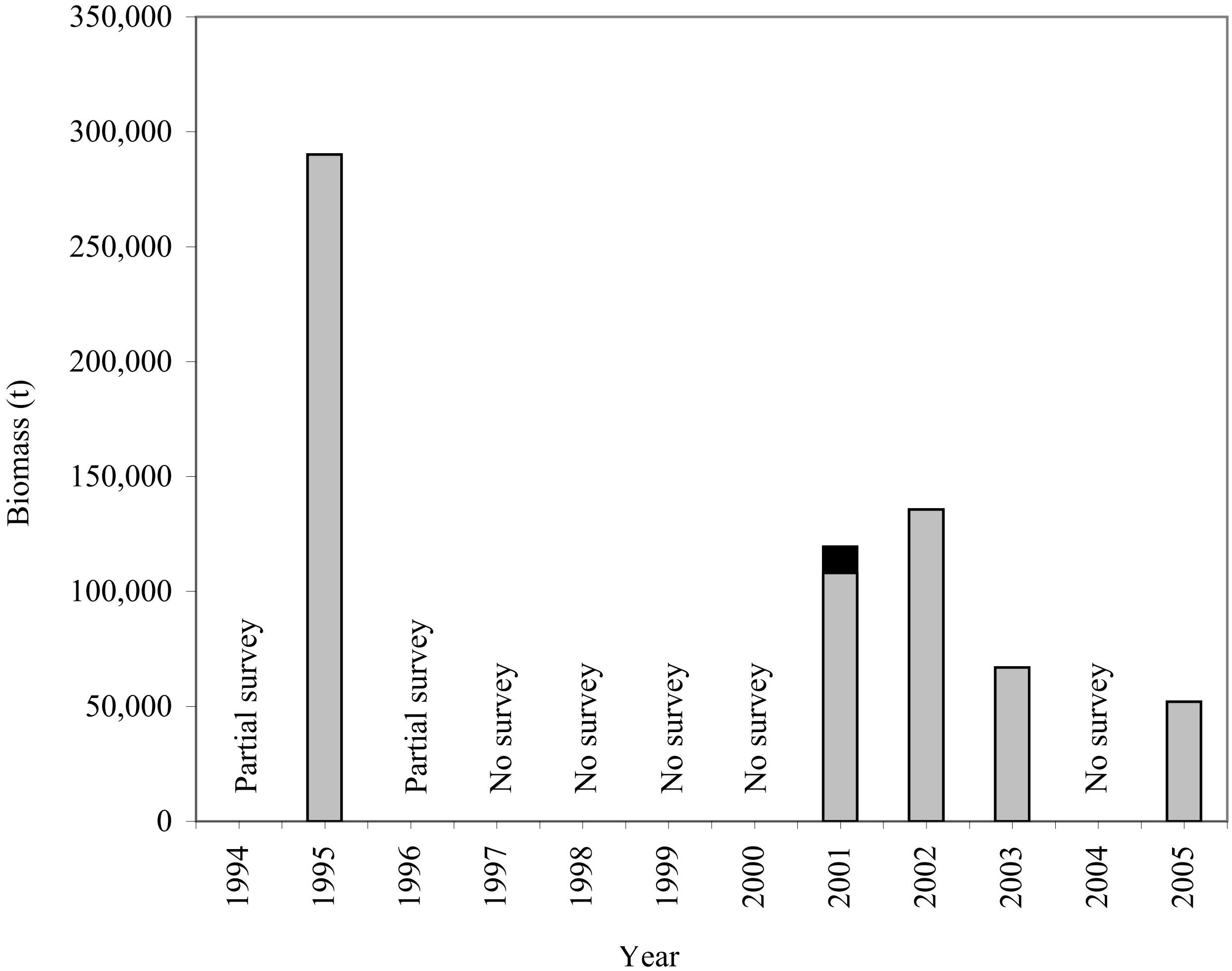

Figure 6.--Summary of annual pollock biomass estimates based on echo integration-trawl surveys of the Shumagin Islands. The black bar shows the increase in biomass for the 2001 survey by not adjusting for eulachon (see text).

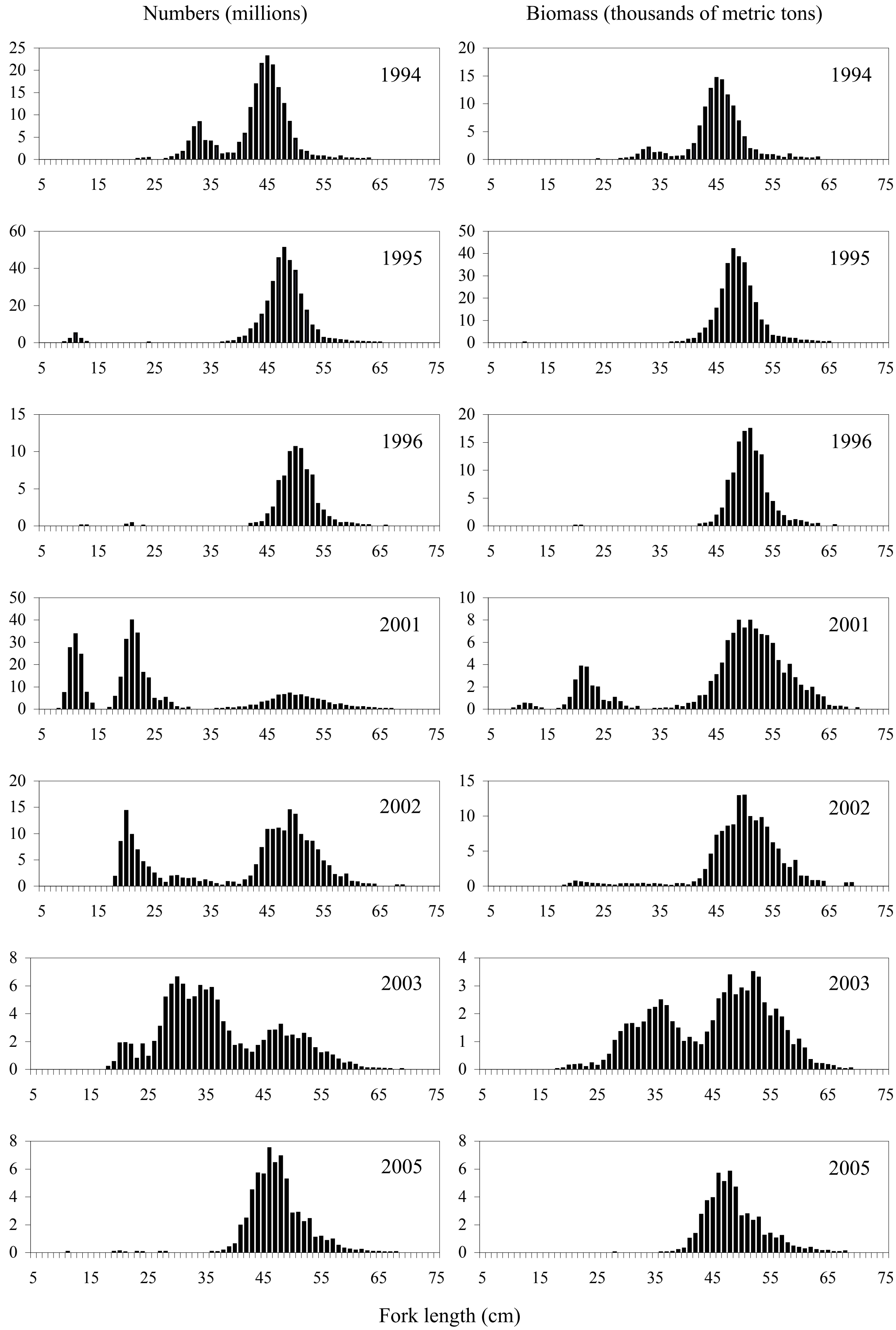

Figure 7.--Pollock size composition estimates for the Shumagin Islands area based on echo integration-trawl surveys during 1994-96, 2001-03, and 2005.

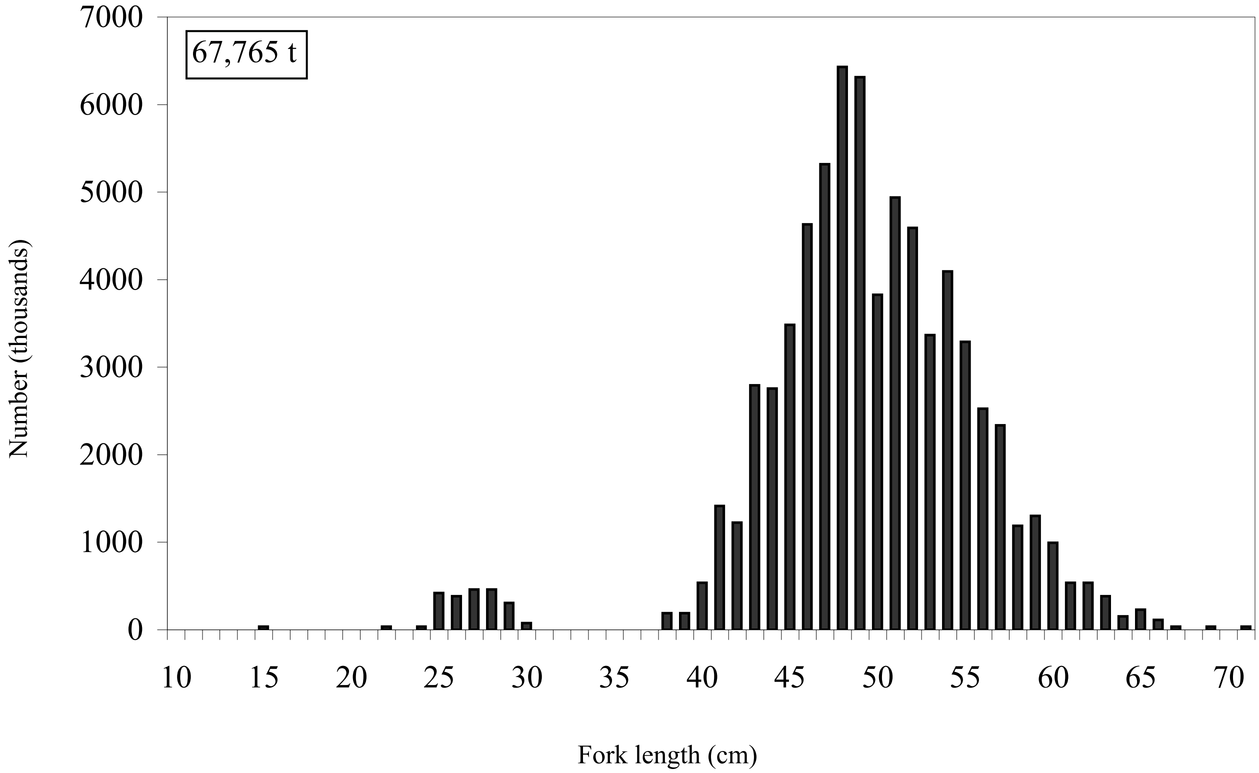

Figure 8.--The size distribution of pollock (numbers) for the 2005 echo integration-trawl survey of Sanak Trough.

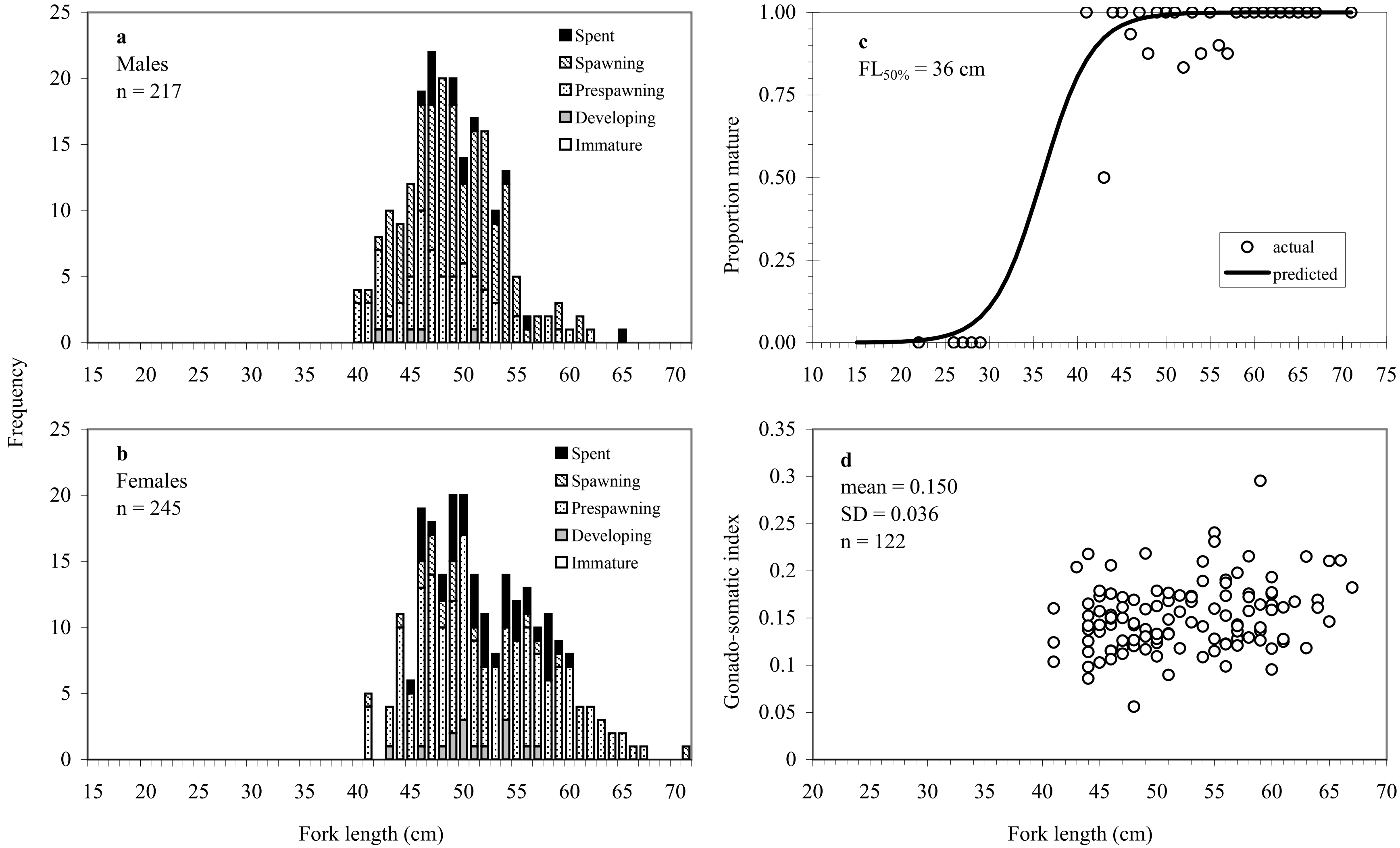

Figure 9.--Maturity stages for (a) male and (b) female pollock, (c) a fitted logistic function and proportion mature by 1-cm size group for female pollock. and (d) gonadosomatic index for pre-spawning females examined during the winter 2005 echo integration-trawl survey of Sanak Trough in the Gulf of Alaska.

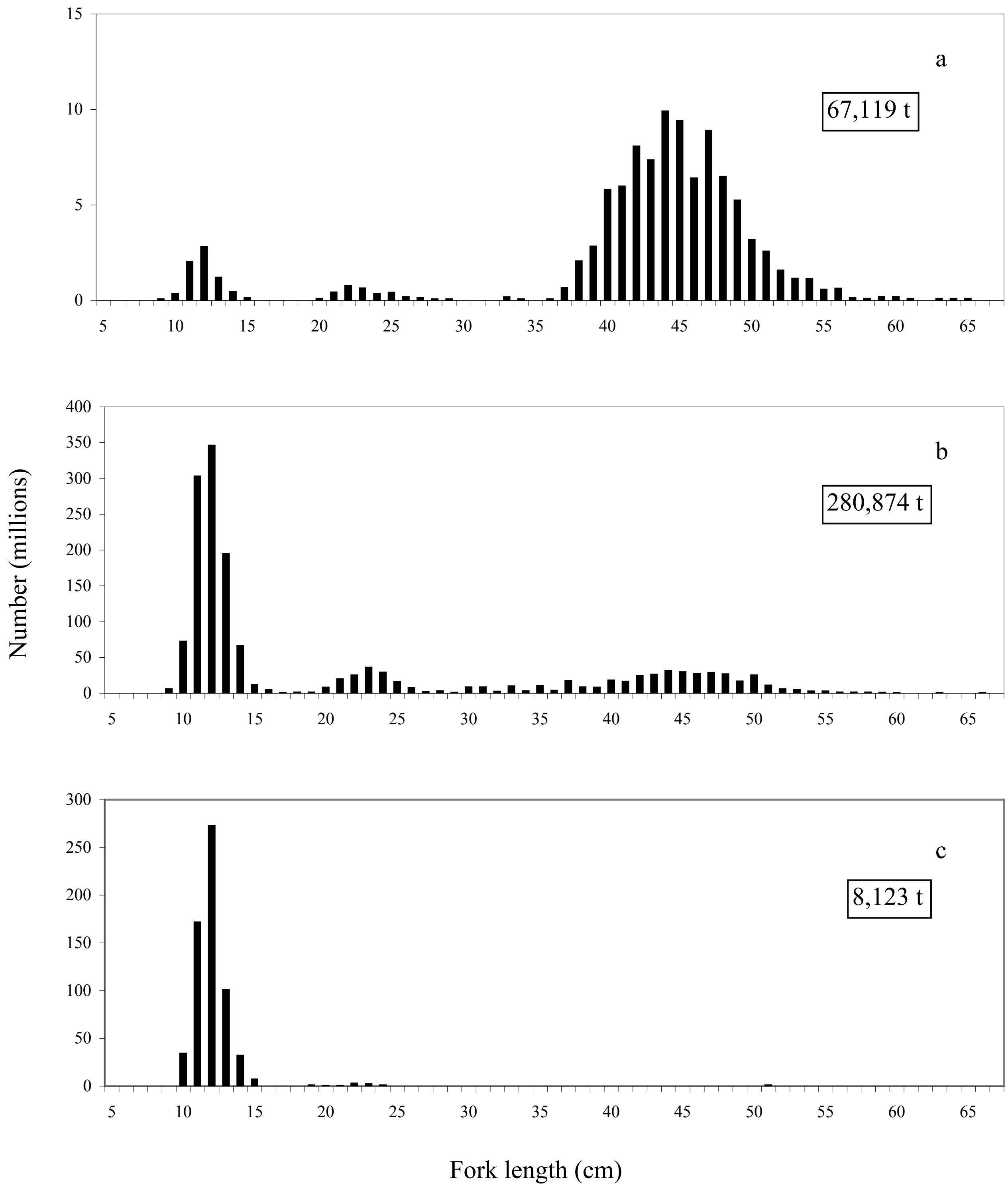

Figure 10.--The size distribution of pollock (by numbers) in (a) the spawning aggregation along the west side of the Strait (b) near-bottom layers in the southern strait and off Kodiak Island, and (c) the mid-water age-1 layer during the 2005 echo integration-trawl survey of the Shelikof Strait area.

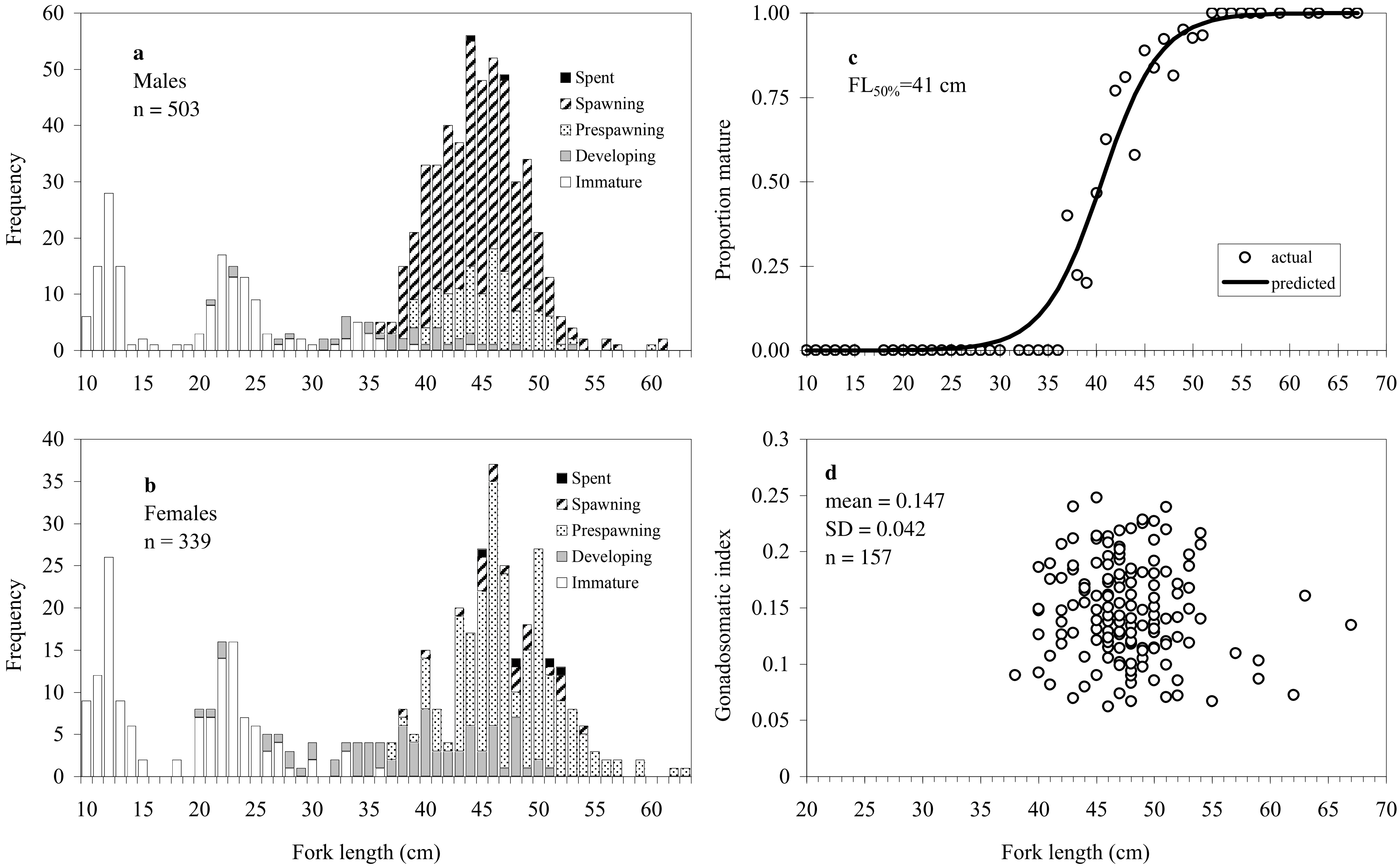

Figure 11.--Maturity stages for (a) male and (b) female pollock, (c) a fitted logistic function and proportion mature by 1-cm size class for female pollock. and (d) gonadosomatic index for pre-spawning females examined during the early spring 2005 echo integration-trawl survey of the Shelikof Strait in the Gulf of Alaska.

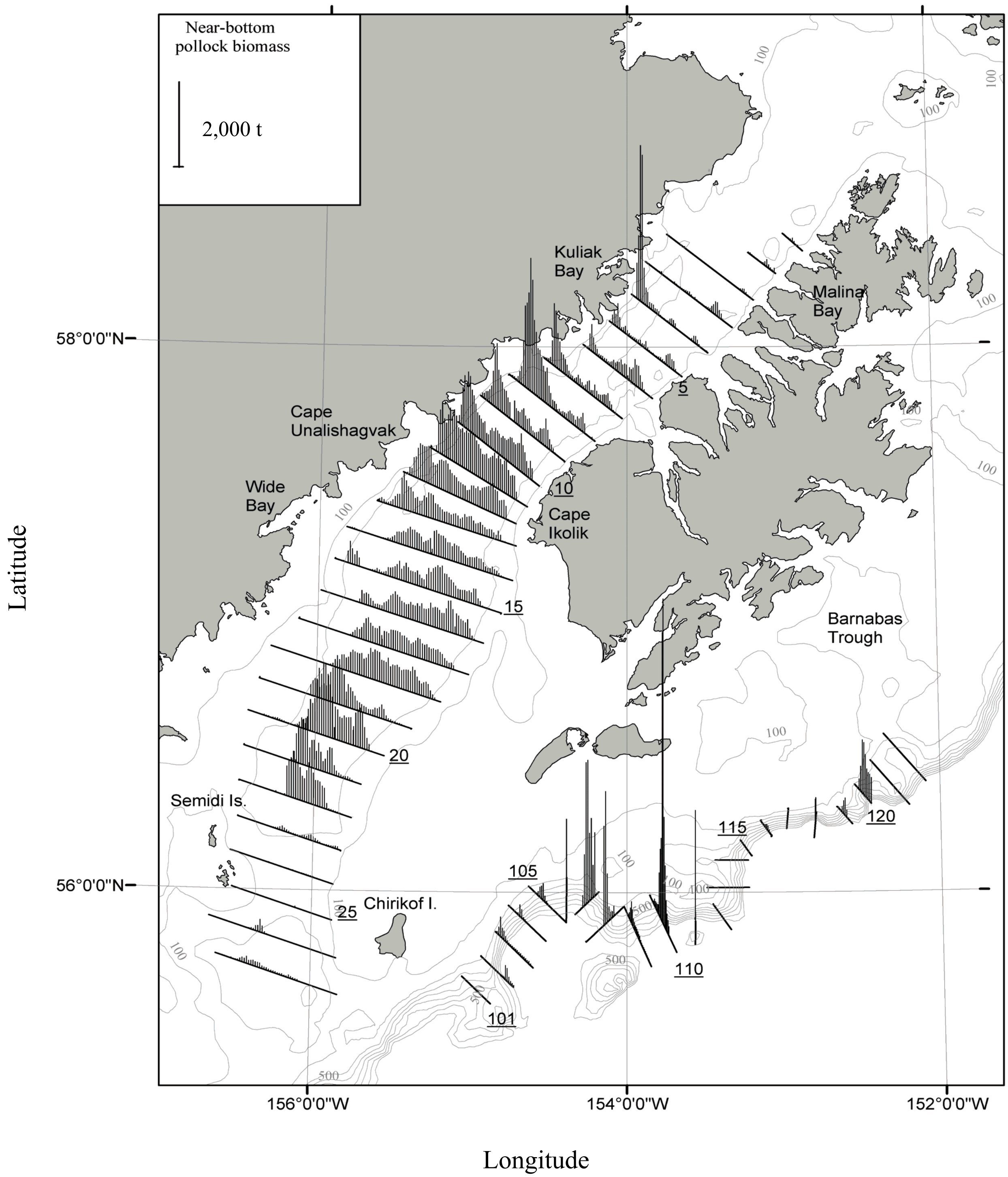

Figure 12.--Near-bottom pollock biomass along transects from the 2005 echo integration-trawl survey of the Shelikof Strait area and all pollock along the Gulf of Alaska shelf break near Chirikof Island.

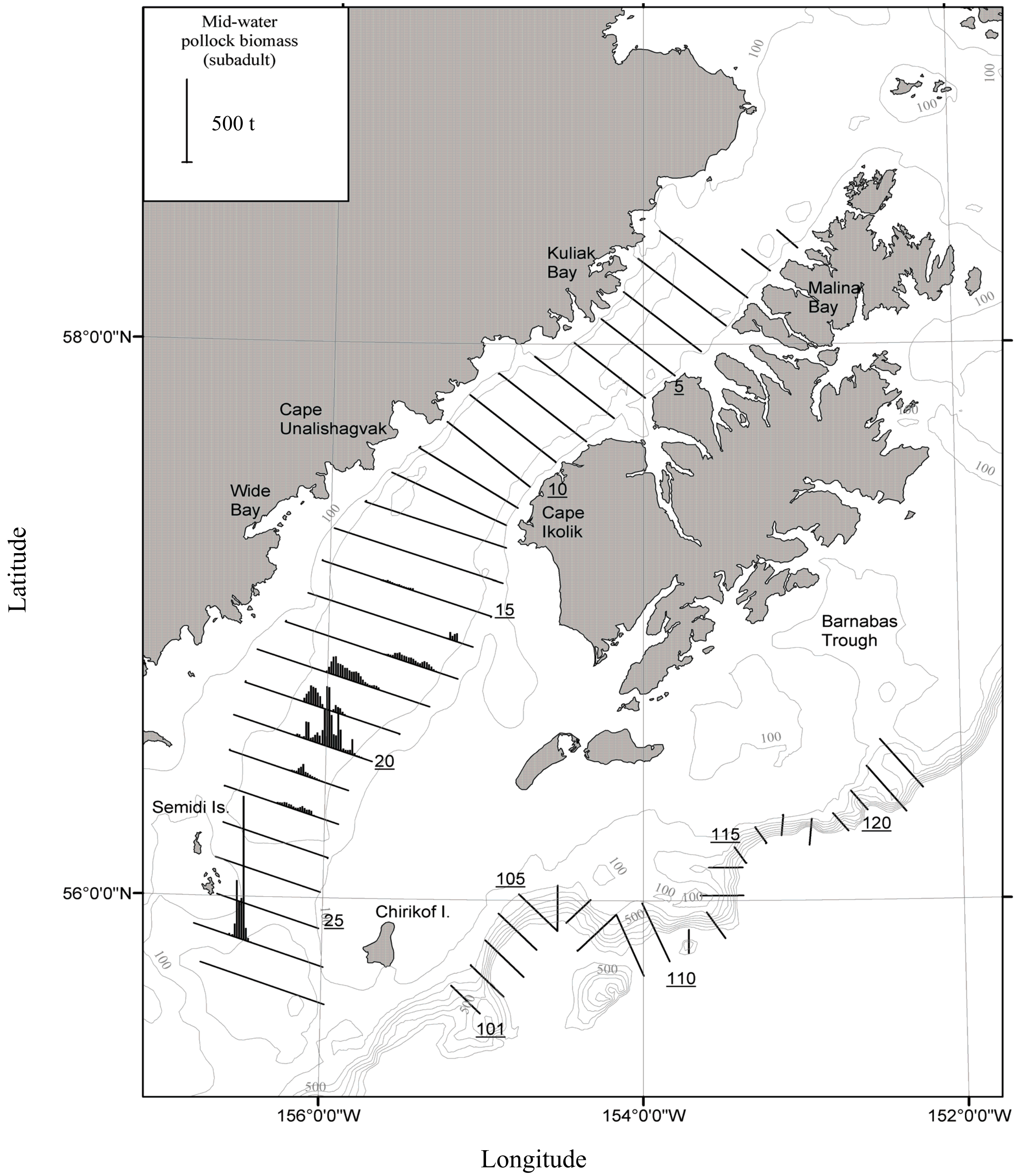

Figure 13.--Mid-water pollock biomass (subadult) along transects from the 2005 echo integration-trawl survey of the Shelikof Strait area.

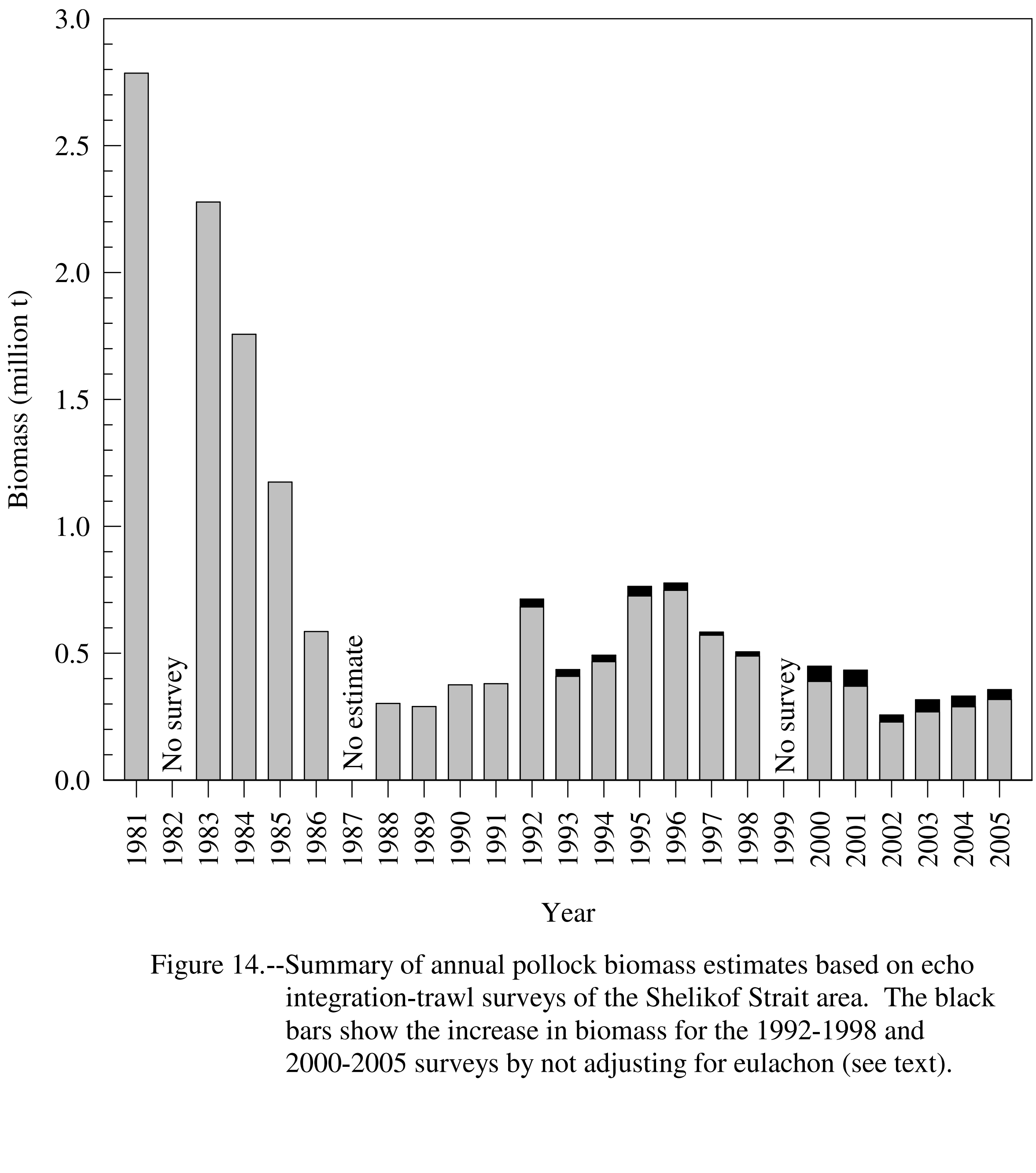

Figure 14.--Summary of annual pollock biomass estimates based on echo integration-trawl surveys of the Shelikof Strait area. The black bars show the increase in biomass for the 1992-1998 and 2000-2005 surveys by not adjusting for eulachon (see text).

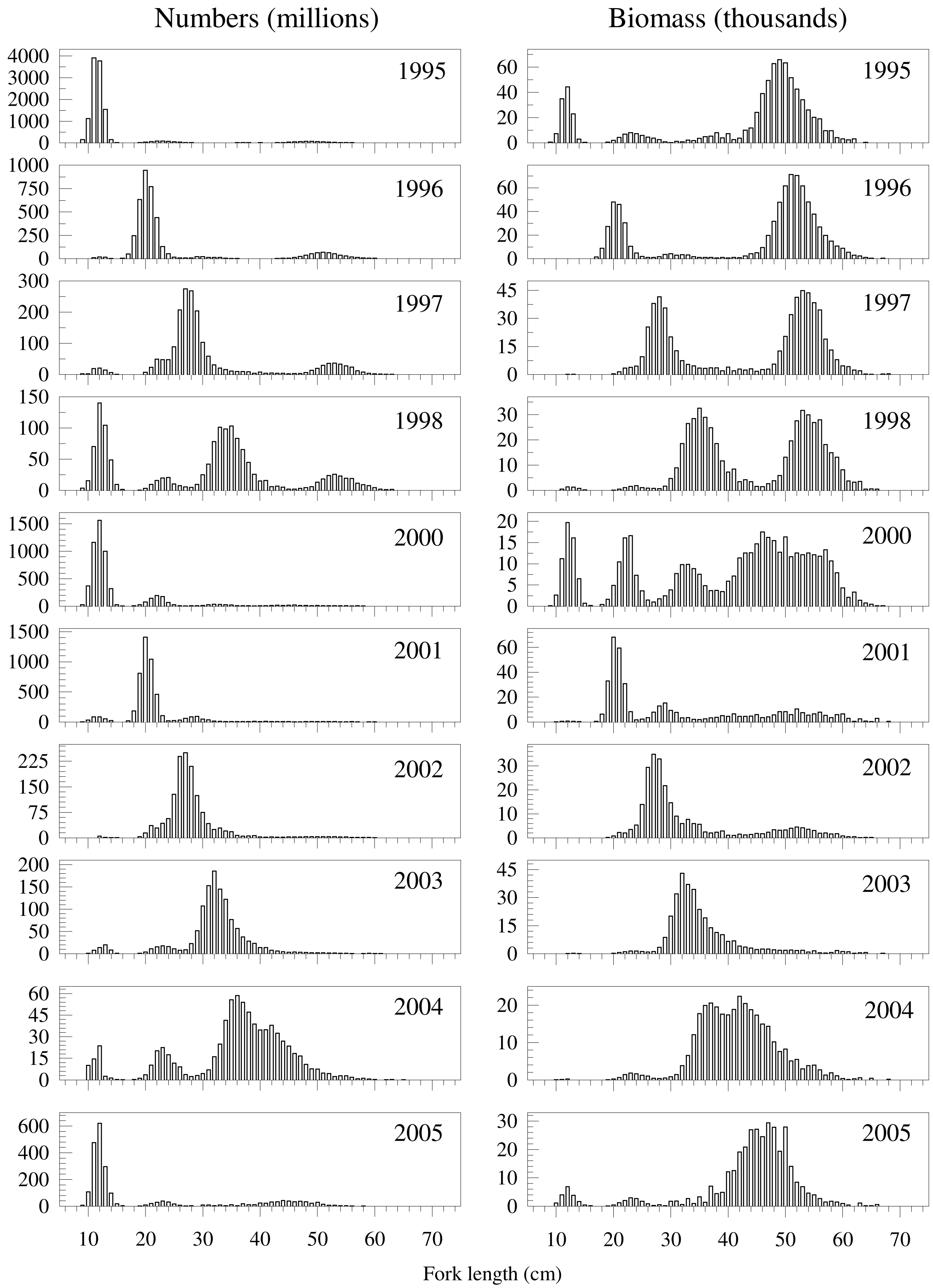

Figure 15.--Annual pollock size composition estimates for the Shelikof Strait area based on echo integration-trawl surveys conducted from 1995 to 2005. Note: area was not surveyed in 1999.

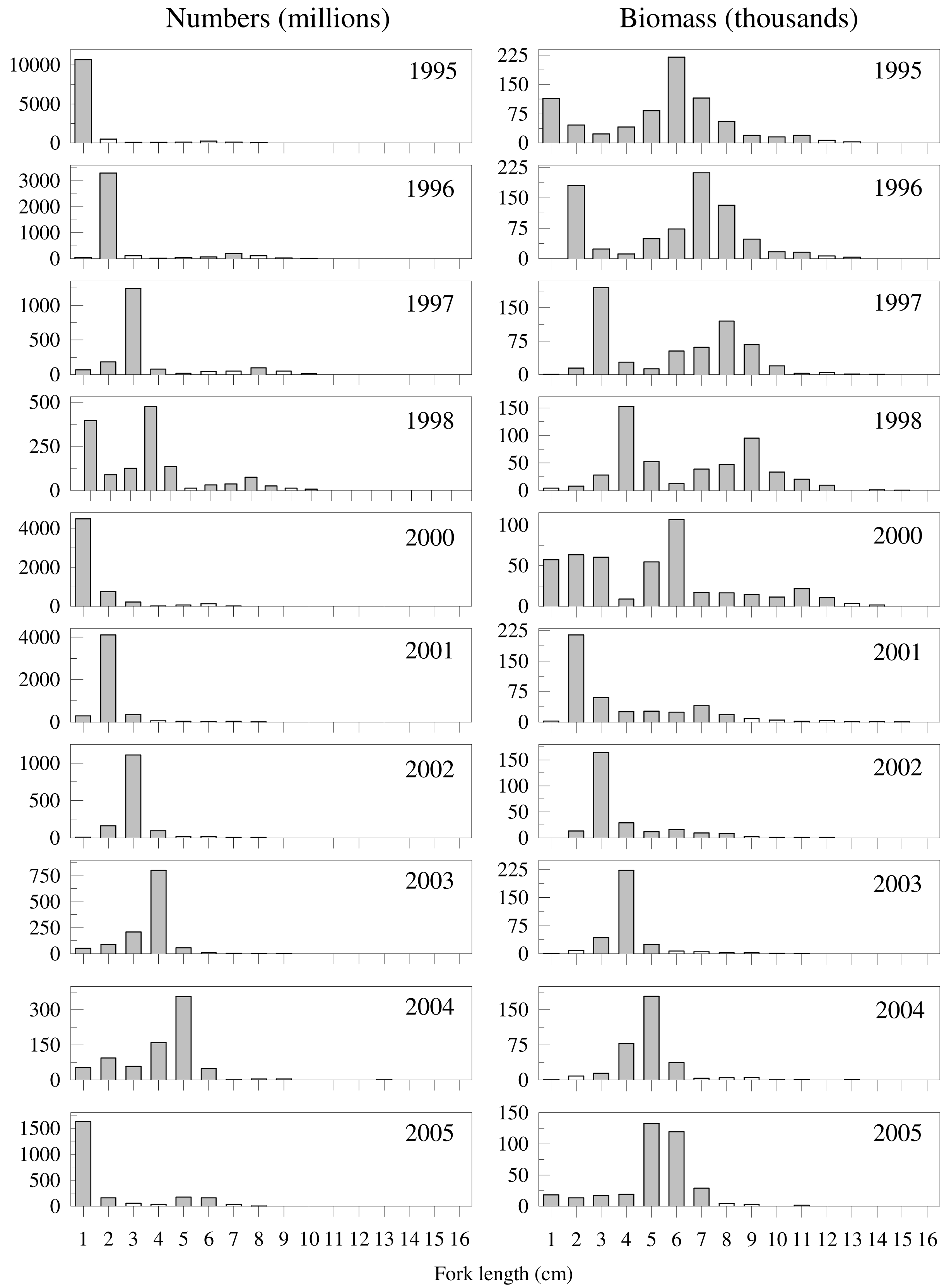

Figure 16.--Annual pollock age composition estimates for the Shelikof Strait area based on echo integration-trawl surveys conducted from 1995 to 2005. Note: area was not surveyed in 1999.

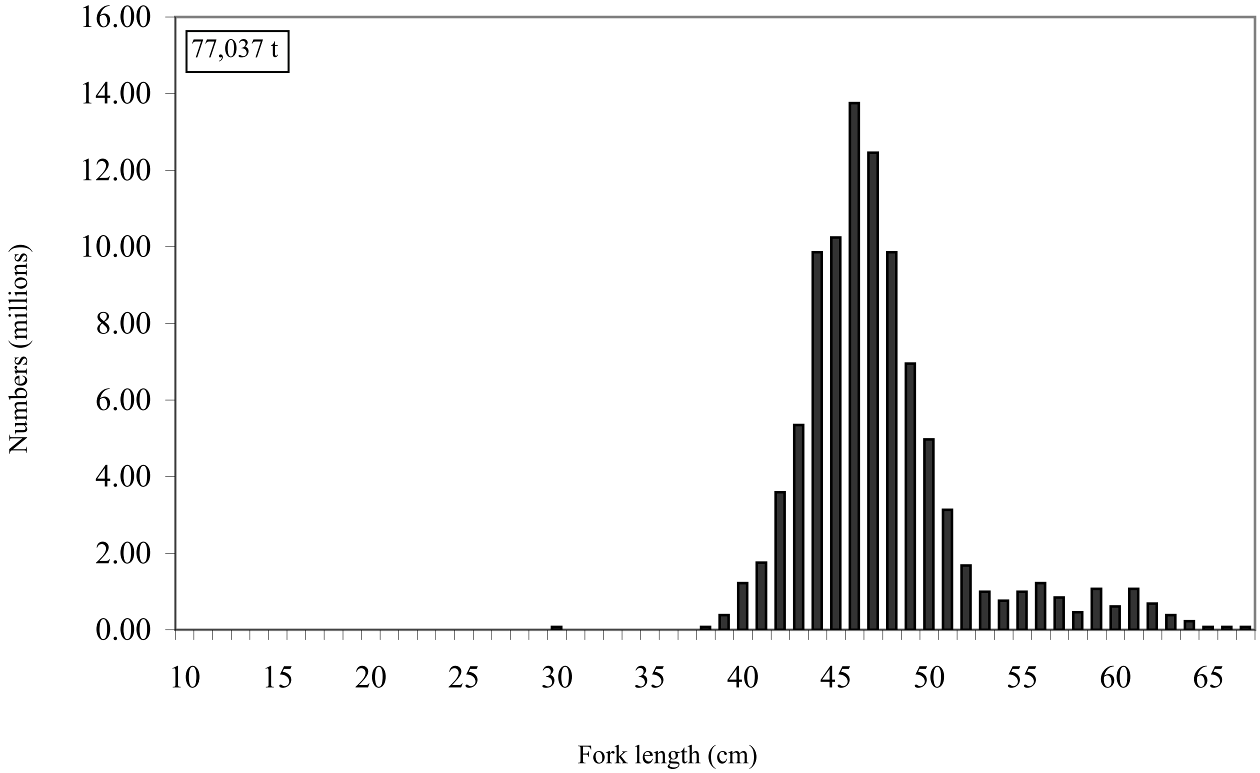

Figure 17.--The size distribution of pollock (numbers) of the shelf-break area near Chirikof Island during the 2005 echo integration-trawl surveys in the Gulf of Alaska.

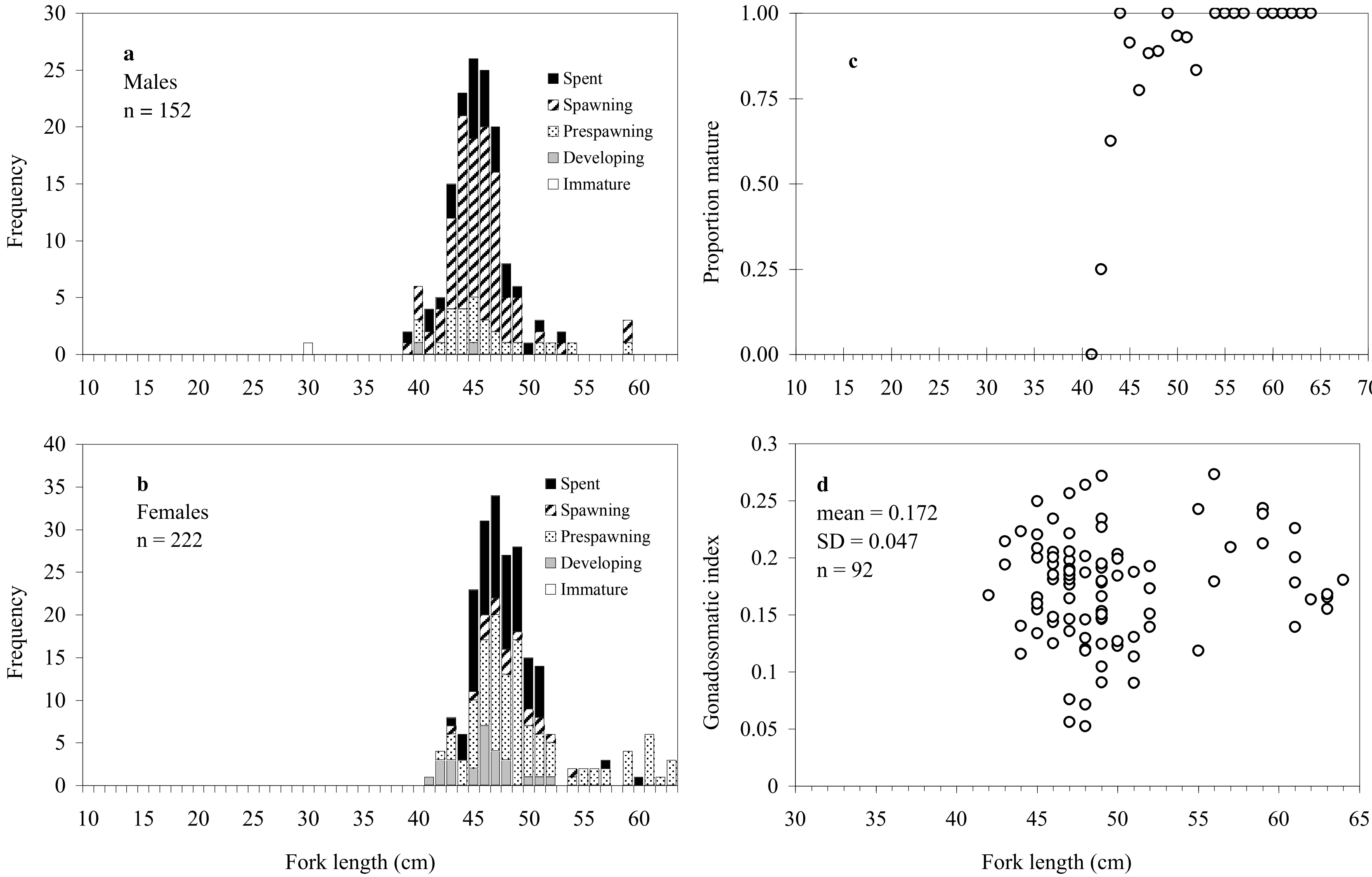

Figure 18.--Maturity stages for (a) male and (b) female pollock, (c) a fitted logistic function and proportion mature by 1-cm size group for female pollock, and (d) gonadosomatic index for pre-spawning females examined during the early

spring 2005 echo integration-trawl survey of the Chirikof Island area in the Gulf of Alaska.