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Results of the Acoustic-Trawl Surveys of Walleye Pollock (*Theragra chalcogramma*) in the Gulf of Alaska, February-March 2012 (DY2012-01 and DY2012-03)

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Results of the Acoustic-Trawl Surveys of Walleye Pollock (*Theragra chalcogramma*) in the Gulf of Alaska, February-March 2012 (DY2012-01 and DY2012-03)

by

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INTRODUCTION

Scientists from the Midwater Assessment and Conservation Engineering (MACE) Program of the Alaska Fisheries Science Center's (AFSC) Resource Assessment and Conservation Engineering (RACE) Division routinely conduct acoustic-trawl (AT) stock assessment surveys in the Gulf of Alaska (GOA) during late winter and early spring to estimate the distribution and abundance of walleye pollock (*Theragra chalcogramma*). Historically, most of these efforts have been focused on the Shelikof Strait area, which has been surveyed annually since 1981, except in 1982, when no survey was scheduled, and in 1999 and 2011, when all winter GOA surveys were cancelled because of vessel delays. The Shumagin Islands area has also been surveyed annually since 2005 (except in 2011) with prior surveys in 1994-1996 and 2001-2003. Additionally, the GOA continental shelf break east of Chirikof Island to Barnabas Trough has been surveyed annually since 2002 with the exception of 2011. This report presents the results from AT surveys conducted in the GOA during February and March 2012.

METHODS

Surveys were conducted 13-22 February (cruise DY2012-01) in Sanak Trough and in the Shumagin Islands area (comprised of Shumagin Trough, Stepovak Bay, Renshaw Point, Unga Strait, and West Nagai Strait), and 17-27 March (cruise DY2012-03) along the shelf break east of Chirikof Island and throughout the Shelikof Strait sea valley. Survey itineraries and scientific personnel are listed in Appendices I and II, respectively. Both surveys were conducted aboard the NOAA ship *Oscar Dyson*, a 64-m stern trawler equipped for fisheries and oceanographic research. Surveys followed established AT methods as specified in NOAA protocols for fisheries acoustics surveys and related sampling[1].

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[1] National Marine Fisheries Service (NMFS) 2009. NOAA protocols for fisheries acoustics surveys and related sampling (Alaska Fisheries Science Center), NOAA Policy Directive 04-105-05, 26 p. Prepared by Midwater Assessment and Conservation Engineering Program, Alaska Fish. Sci. Center, Natl. Mar. Fish. Serv., NOAA. Available online http://www.afsc.noaa.gov/RACE/midwater/MACESurveyProtocol2009.pdf

Acoustic Equipment, Calibration, and Data Collection

Acoustic measurements were collected with a Simrad EK60 scientific echosounding system (Simrad 2004, Bodholt and Solli 1992). System electronics were housed inside the vessel in a permanent laboratory space dedicated to acoustics. Five split-beam transducers (18-, 38-, 70-, 120-, and 200-kHz) were mounted on the bottom of the vessel's retractable centerboard, which extended 9 m below the water surface. Multibeam data were collected during all surveys using a Simrad ME70 echosounder (Simrad 2007, Trenkel et al. 2008) mounted on the hull 10 m forward of the centerboard at a depth of 6 m below the water surface. The ME70 and EK60 were synchronized with custom-written software that used a dynamic delay based on the current bottom depth to control the maximum recording depth. This allowed for faster pinging in shallower water, which improved multi-frequency species classification of the backscatter and improved sea-floor classification by the ME70.

Standard sphere acoustic system calibrations were conducted to measure acoustic system performance. During calibrations, the ship was anchored at the bow and stern. A tungsten carbide sphere (38.1 mm diameter) suspended below the centerboard-mounted transducers was used to calibrate the 38-, 70-, 120-, and 200-kHz systems. The tungsten carbide sphere was replaced with a 64-mm diameter copper sphere for calibration of the 18-kHz system. After each sphere was centered on the acoustic axis, split-beam target-strength and acoustic measurements were collected to estimate transducer gains following methods of Foote et al. (1987). Transducer beam characteristics were modeled by moving each sphere through a grid of angular coordinates and collecting target-strength data using EKLOBES software (Simrad 2004). Acoustic system gain and beam pattern parameters measured during the February and March calibrations were used to provide a final-analysis parameter set for data analysis (Table 1).

Acoustic data were logged at the five split-beam frequencies using Myriax EchoLog 500 (v. 4.70.1.14256) and ER60 software (v. 2.2.0). Multibeam acoustic data were also collected. Results presented in this report are based on 38-kHz acoustic raw data using a post-processing S_v threshold of –70 decibels (dB). Acoustic measurements were collected from 16 m below the sea surface to within 0.5 m of the sounder-detected bottom or a maximum of 1,000 m in deep water. Data were analyzed using Myriax Echoview post-processing software (Version 5.1.41.20118).

Trawl Gear and Oceanographic Equipment

Midwater and near-bottom acoustic backscatter 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, where it was fitted with a single 12 mm (0.5 in) codend liner. Near-bottom backscatter was sampled with a poly Nor'eastern (PNE) bottom trawl, which is a 4-panel 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 PNE codend was also fitted with a single 12 mm (0.5 in) codend liner. Both nets were fished with 5 m^2 Fishbuster trawl doors each weighing 1,089 kg (2,400 lb). Vertical net openings and depths were monitored with either a Simrad FS70 third-wire netsonde or a Furuno (CN-24) acoustic-link netsonde attached to the headrope. The vertical net opening for the AWT ranged from 22 to 29 m (72 to 95 ft) and averaged 25 m (82 ft) while fishing. The PNE vertical mouth opening ranged from 6 to 8 m (20-26 ft) and averaged 7 m (23 ft) while fishing. Detailed trawl gear specifications are described in Guttormsen et al. (2010). Average trawling speed was 1.7 m/sec (3.4 knots).

Physical oceanographic data collected during the cruises included temperature 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 (SBE 9-11 plus) system at calibration sites. Sea surface temperature data were measured using the ship's Furuno T-2000 sea surface temperature system located mid-ship, approximately 1.4 m below the surface. These and other environmental data were recorded using the ship's Scientific Computing Systems. Surface water temperatures were plotted as 10 nautical mile (nmi) averages along the cruise track.

Survey Design

The survey design consisted of a series of parallel line transects, except where necessary, to reorient tracklines to maintain a perpendicular alignment to the isobaths and to work around landmasses. A random start position was generated for the first transect for each area. Survey activities were conducted 24 hours/day.

Trawl hauls were conducted to determine species and size composition of walleye pollock specimens to classify observed backscatter by species and size composition. Walleye pollock were sampled to determine sex, fork length (FL), body weight, age, gonad maturity, and ovary weight of selected females. Walleye pollock and other fishes were measured to the nearest 1 mm FL using an electronic measuring board (Towler and Williams 2010), except for capelin (*Mallotus villosus*), which were measured to the nearest mm standard length. When large numbers of juveniles mixed with adults were encountered in a haul, the predominant size groups were subsampled separately (e.g., age 1 vs. adults). For each trawl catch, sex and length measurements were collected from an average of 300 randomly sampled walleye pollock, and an additional 60 individuals were sampled for body weight, maturity, and age. An electronic motion-compensating scale (Marel M60) was used to weigh individual walleye pollock to the nearest 2 g. Maturity was determined by visual inspection and was categorized as immature, developing, pre-spawning, spawning, or post-spawning[2]. Trawl station and biological measurements were electronically recorded to the Catch Logger for Acoustic Midwater Surveys (CLAMS) database. For age determinations, walleye pollock otoliths were collected from all areas and stored in a 50% glycerin/thymol-water solution. Otoliths from the Shelikof Strait area were processed by AFSC Age and Growth Program researchers to determine individual fish ages. An age-length key based on the Shelikof age samples (n = 618) was used to convert Shelikof abundance-at-length estimates to abundance-at-age.

[2] ADP Codebook. 2012. Unpublished document. RACE Division, AFSC, NMFS, NOAA; 7600 Sand Point Way NE, Seattle, WA 98115. Available online http://www.afsc.noaa.gov/RACE/groundfish/adp_codebook.pdf.

Data Analysis

Walleye pollock abundance was estimated by combining acoustic and trawl information. The detected bottom was calculated using the mean of sounder-detected bottom lines for all five frequencies (Jones et al. 2011). Acoustic backscatter, identified as either walleye pollock, rockfish, or an undifferentiated mixture of primarily macrozooplankton, was recorded between depths of 16 m below the surface to 0.5 m above the sounder-detected bottom (except where the bottom depth exceeded the 1,000 m lower limit of data collection). Acoustic backscatter data were binned at 0.5 nmi horizontal by 10-m vertical resolution. Walleye pollock length compositions were combined into regional length strata based on geographic proximity, similarity of length composition, and backscatter characteristics. Mean fish weight-at-length for each length interval (cm) was estimated from the trawl information when there were six or more walleye pollock for a length interval; otherwise, it was estimated using a linear regression of the natural logs of all length-weight data (De Robertis and Williams 2008). Numbers and biomass for each regional length stratum were estimated as in Honkalehto et al. (2008). Total abundance was estimated by summing the stratum estimates.

Relative errors for the acoustic-based estimates were derived using a one-dimensional (1-D) geostatistical method (Petitgas 1993, Williamson and Traynor 1996, Rivoirard et al. 2000, Walline 2007). "Relative estimation error" is defined as the ratio of the square root of the estimation variance to the estimate of biomass. Geostatistical methods were used for computation of error because they account for the observed spatial structure in the fish distribution. These errors quantify only transect sampling variability of the acoustic data. Other sources of error (e.g., target strength, trawl sampling) were not evaluated.

RESULTS and DISCUSSION

Calibration

Pre- and post-survey calibration measurements of gain and transducer beam pattern were quite similar, confirming that the ER60 38-kHz acoustic system was stable throughout the survey (Table 1). The difference in integration gain (i.e. gain + s_A correction) measured before and after the survey was < 0.2 dB, so an averaged value was used in the final analysis. Transducer beam pattern measurements were also quite similar before and after the survey. Because the pre-survey calibration beam pattern values were derived from the 64 mm copper sphere, only the results from the post-survey calibration were used.

Sanak Trough

The Sanak Trough was surveyed on 15 February. Acoustic backscatter was measured along 181 km (98 nmi) of tracklines spaced 3.7 km (2 nmi) apart (Fig. 1). Bottom depths ranged from 50 m at the transect end points to 170 m along the deepest part of the southernmost transects.

Physical Oceanography

Surface water temperatures averaged 1.6° C at the two trawl locations in this area (Figs. 2 and 3). The water column temperature was nearly uniform at the trawl sites, varying by less than 0.3° C from surface to trawl depth. Mean water temperatures at the surface and at depth where fishing occurred were cooler than in previous surveys, which have been in the range of 2.3-5.1° C and 2.9-4.4° C, respectively.

Trawl Samples

Biological data and specimens were collected in Sanak Trough from two AWT hauls (Tables 2-4; Fig. 1). Walleye pollock was the most abundant species caught, contributing 78.8% by weight and 60.4% by numbers (Table 3). Pacific cod (*Gadus macrocephalus*) was the second most abundant species caught by weight (18.7%) while northern shrimp (*Pandulas borealis*) were the second most abundant species by numbers (27.5%). Except for one 26 cm fish, the walleye pollock captured were adult fish ranging from 41 to 73 cm FL with a mean of 53 cm FL (Fig. 4). Of the eight surveys conducted in this area between 2003 and 2012, significant numbers of juvenile walleye pollock were only encountered twice (in 2003 and 2010).

The unweighted maturity composition for males longer than 40 cm FL (n = 36) was 0% immature, 3% developing, 6% pre-spawning, 78% spawning, and 14% spent (Fig. 5a). The unweighted maturity composition for females longer than 40 cm FL (n = 31) was 0% immature, 3% developing, 84% pre-spawning, 6% spawning, and 6% spent (Fig. 5b). The combined percentage of spawning and spent female fish this year was much lower than in previous years and together with the high percentage of pre-spawning females indicates that survey timing was closer to peak spawning than in previous years. A logistic model could not be fitted to the female maturity-at-length data because of the lack of immature fish (Fig. 5c). The average GSI [gonadosomatic index: ovary weight/(ovary weight + body weight)] of pre-spawning females was 0.15 (Fig. 5d) - similar to previous surveys in this area.

Distribution and Abundance

The majority of the walleye pollock biomass was located over the northeast portion of the trough (Fig. 6), unlike past surveys where most of the biomass was spread over the center of the trough, or 2009 when most of the biomass was located along the western slope and along the shelf to the west. Most of the walleye pollock backscattering was located in dense schools at depths of 70-100 m over bottom depths of 80-150 m (Fig. 7).

The biomass estimate of 24,300 t was slightly less than in 2010 (26,700 t) and 2009 (31,400 t), but greater than the 2008 low of 19,800 t (Table 5). However, the 2012 estimate was only 20% of the 2006 high (127,200 t). The relative estimation error for 2012 based on the one-dimensional geostatistical analysis of the biomass was 15.6%.

Shumagin Islands

The Shumagin Islands survey was conducted from 16 to 19 February. Acoustic backscatter was measured along 682 km (368 nmi) of tracklines. Transects were spaced 1.9 km (1.0 nmi) apart east of Renshaw Point and the eastern half of Unga Strait, 4.6 km (2.5 nmi) apart in Stepovak Bay, West Nagai Strait, and the western half of Unga Strait, and 9.3 km (5.0 nmi) apart in Shumagin Trough (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.

Physical Oceanography

Surface water temperatures averaged 2.0° C (Figs. 3 and 8) at the two trawl locations sampled in the Shumagin Islands, which was cooler than in all of the 12 previous surveys of the area, where mean temperatures ranged from 2.6 to 5.3° C. The temperature at the depth where most of the adult walleye pollock biomass occurred (170 m off Renshaw Point and 200 m in Shumagin Trough) averaged 3.1° C, which was cooler than during previous surveys (3.5- 4.8°C).

Trawl Samples

Biological data and specimens were collected in the Shumagin Islands from one PNE and two AWT hauls (Tables 2, 4, 6, and 7; Fig. 1). Walleye pollock was the most abundant species caught with both gear types, contributing 50.6% and 77.7% by weight to the total catch from AWT and PNE trawls, respectively (Tables 6 and 7). Pacific cod was the second most abundant species caught by weight in the AWT, 99% of which was caught in haul 5 beyond the last transect in Shumagin Trough in an exploratory haul conducted to verify that the backscatter seen in that area was not pollock. Bigmouth sculpin (*Hemitripterus bolini*) comprised the second most abundant species by weight (7.6%) in the PNE. Eulachon (*Thaleichthys pacificus*) was the most abundant species caught by numbers (third by weight) with both the AWT and PNE, comprising 70.0% and 81.3% of the catch, respectively.

Except for one 11-cm fish, walleye pollock ranged in length from 42 to 70 cm FL with a mean of 54 cm FL (Fig. 9). The adult walleye pollock captured in the Shumagin Islands area spanned the same range of lengths as those in Sanak Trough, however with a stronger contribution from the fish longer than 55 cm FL. The lack of juveniles in Shumagin Island catches in 2012 was similar to surveys conducted prior to 2006, in contrast to the 2006-2009 surveys when most of the catch consisted of juvenile fish.

The unweighted maturity composition for males longer than 40 cm FL (n = 79) was 0% immature, 5% developing, 16% pre-spawning, 68% spawning, and 10% spent (Fig. 10a). The maturity composition of females longer than 40 cm FL (n = 45) was 0% immature, 9% developing, 82% pre-spawning, 2% spawning, and 7% spent (Fig. 10b). The high percentage of pre-spawning females together with the low percentage of spawning and spent female fish indicates that survey timing was appropriate. A logistic model fit to the female maturity-at-length data predicted that 50% (L_{50}) of females were mature at 43 cm FL (Fig. 10c). The average GSI of pre-spawning females, based on 37 samples, was 0.13 (Fig. 10d), which was slightly higher than the three previous surveys (0.11, 0.09, and 0.08, respectively) but is within the range of historical surveys.

<u>Distribution and Abundance</u>
Overall, very little walleye pollock were observed in the Shumagin Islands, and what was observed was very diffuse and sparse. The densest walleye pollock aggregations in the Shumagin Islands area were located off Renshaw Point (Fig. 6). However, as in 2007-2009, densities off Renshaw Point were low compared with earlier surveys. Walleye pollock were distributed on or near bottom in diffuse schools. Most of the biomass was found between 100 and 200-m bottom depth and was within 40 m of the bottom (Fig 11).

The biomass estimate of 15,500 t is the lowest in survey history and was less than one-quarter of the 2009 estimate of 63,300 t (Table 5, Figs. 12 and 13). The relative estimation error of the biomass based on the one-dimensional geostatistical analysis was 5.2%.

GOA Shelf Break from Chirikof Island to Barnabas Trough

The GOA shelf break from south of Barnabas Trough to southeast of Chirikof Island between approximately the 200 and 1,000-m bottom depth contours was surveyed from 17 to 19 March. Acoustic backscatter was measured along 287 km (155 nmi) of trackline (Fig. 14). Transects were placed perpendicular to bottom depth contours on the slope, and transect midpoints were spaced 11.1 km (6 nmi) apart along the 300-m contour.

Physical Oceanography

Surface water temperatures in the Chirikof shelf break area averaged 3.0° C (Figs. 15 and 16), which was roughly the same as 2007 and 2009, but about 1.0° C cooler than the average surface temperature in 2002, 2004, and 2006, and about 2.0° C cooler than in 2003, 2005, and 2010. The temperatures at the depths where most walleye pollock biomass occurred (300 m) averaged 4.9° C, which was approximately 0.7° C cooler than the average in 2010 but similar to that of the previous five surveys.

Trawl Samples

Biological data and specimens were collected from two AWT hauls (Table 8-10; Fig. 14). Only one of the hauls, however, caught an adequate sample of fish. Walleye pollock was the most abundant species by weight (87.2%) and numbers (48.5%; Table 9). Pacific ocean perch (POP; *Sebastes alutus* [5.5%]) and giant grenadier (*Albatrossia pectoralis* [3.2%]) were second and third most abundant species by weight, respectively. Lanternfish (myctophidae [19.7%]) and squid (Cephalopoda [10.0%]) were second and third most abundant by numbers, respectively. Backscatter identified as POP was suspected in moderate to dense concentrations throughout much of the survey area over bottom depths of 175 to 300 m. Attempts were made to sample this backscatter in 2012 but adverse weather conditions and time constraints resulted in low effort and catch quantities. POP backscatter was thus identified based on backscatter appearance and trawl catches from previous surveys in this area. This non-walleye pollock echosign accounted for 43% of the overall backscatter attributed to fishes.

The walleye pollock captured in the AWT hauls ranged from 40 to 71 cm FL with modes at 44 and 62 cm FL (Fig. 17). As is typical for this survey, no juvenile walleye pollock were captured. The unweighted maturity composition for males longer than 40 cm FL (n = 79) was 11% immature, 0% developing, 67% pre-spawning, 22% spawning, and 0% spent (Fig. 18a). The unweighted maturity composition for females longer than 40 cm FL (n = 50) was 18% immature, 0% developing, 80% pre-spawning, 2% spawning, and 0% spent (Fig. 18b). The high percentage of pre-spawning females together with the very low percentage of spawning and spent female fish suggests that spawning may occur in this area and that survey timing was appropriate to assess the pre-spawners that aggregate here. A logistic model fit to the maturity-at-length data predicted that 50% of the females were mature at 45 cm for the Chirikof fish (Fig. 18c). The average GSI of pre-spawning females based on 11 samples was 0.15 (Fig. 18d).

Distribution and Abundance

Most walleye pollock backscatter in the Chirikof survey was detected on two transects just west of the mouth of Barnabas Trough (Fig. 19) in layers between 250 and 400 m deep over bottom depths of 250-600 m (Fig. 20). However, trawl verification of the backscatter was only satisfactorily performed in one location because of low catch at another location and weather and time constraints preventing additional trawling activities.

The walleye pollock biomass estimate of 21,200 t was similar to 2008 (22,100 t) but significantly higher than in 2010 (9,300 t) and 2009 (400 t; Table 5). The relative estimation error of the biomass based on the one-dimensional geostatistical analysis was 16.4%.

Shelikof Strait

The Shelikof Strait sea valley was surveyed from 20 to 26 March using 13.9 km (7.5 nmi) transect spacing (Fig. 14). Acoustic backscatter was measured along 1,406 km (759 nmi) of tracklines. Bottom depths ranged from 60 m at the shallowest to 330 m at the deepest.

Physical Oceanography

Surface water temperatures at trawl locations ranged from 0.3 to 2.6° C with a mean of 1.7° C (Figs. 16 and 21), which was the coldest in survey history. Mean surface water temperatures since 1997 have been at least 1.5° C higher than they were in the present survey. Temperatures increased with depth down to approximately 250 m, rising to an average of 4.0° C, similar to 2007 and 2008, but cooler than other recent surveys by more than 1.0° C.

Trawl Samples

Biological data and specimens were collected in the Shelikof Strait area from 8 AWT hauls and 3 PNE hauls (Tables 8, 10-12; Fig. 14). Walleye pollock and eulachon were the most abundant species by weight and numbers in midwater trawl hauls, contributing 91.0% and 8.3% by weight, and 64.2% and 32.8% by numbers, respectively, to the total catch. Eulachon were less prevalent in trawl catches than in past surveys. Walleye pollock was also the most abundant species in the PNE catch, accounting for 98.3% by weight and 94.5% by number of fish captured.

The unweighted maturity composition in the Shelikof Strait area for males longer than 40 cm FL (n = 253) was 37% immature, 20% developing, 38% mature pre-spawning, 4% spawning, and 1% spent (Fig. 22a). The maturity composition of females longer than 40 cm FL (n = 386) was 4% immature, 47% developing, 49% pre-spawning, < 1% spawning, and < 1% spent (Fig. 22b). The small fraction of spawning and spent females relative to pre-spawning females suggests that the survey timing was appropriate. The female L_{50} of 48 cm FL (Fig. 22c, n = 524) was the longest in survey history, although only 1 cm longer than that in 2007 and 2008. The average GSI from 70 pre-spawning females of 0.12 (Fig. 22d) is similar to 2008-2010 (0.12-0.13) and 2002-2003 (0.11-0.12), but slightly lower than 2004-2007, where the mean GSI ranged from 0.14 to 0.16. The current mean is also lower than the mean GSIs (0.14-0.19) reported for the 1992-2001 surveys.

Distribution and Abundance

As in 2010 and prior to 2000, the highest walleye pollock densities were observed along the west side of the Strait proper between Puale Bay and Kukak Bay (Fig. 19). Relatively dense aggregations were also detected along the south central portion of the Strait northeast of the Semidi Islands.

Walleye pollock aggregations in the south-central portion of the survey area northeast of the Semidi Islands formed a continuous dense near-bottom layer within 80 m of the seafloor over bottom depths exceeding 200 m (Figs. 23 and 24) and consisted of a mixture of sizes primarily in the 9 to 29 cm FL range, with major modes at 13 and 22 (Fig. 25a), representing age-1 and age-2 fish, respectively. Some larger fish, up to 70 cm FL, were also present but in much smaller numbers. Similar aggregations were also located farther north, into the Strait proper, and along the Kodiak side of the Strait, but these aggregations contained more large adults in the 30 to 70 cm FL range (Fig. 25b). Within the deepest section of the strait along the Alaska Peninsula side between Puale Bay and Kukak Bay, dense aggregations of pre-spawning adult fish (Fig. 26) primarily in the 40 to 65 cm FL range were detected (Fig. 25c). These pre-spawning adult fish were predominantly between the ages of 4 and 7 years old. Several dense schools were also present in midwater (Figs. 23 and 24) in the north central portion of the Strait proper and consisted mostly of age-4 and -5-year-old non-spawning pollock in the 30 to 60 cm FL range (Fig. 25d).

The Shelikof Strait biomass estimate of 335,800 t was 22% lower than in 2010 (429,700 t) which was the largest seen in the region since 2001 (Table 5; Figs. 27 and 28). The relative estimation error of the biomass based on the one-dimensional geostatistical analysis was 7.9% (Table 5). Two-year-old walleye pollock dominated the numbers and biomass in Shelikof Strait in 2012 (Fig. 29; Tables 13-14). The numbers of age-2 fish were 8% greater than the 28-survey mean for this age group (Table 13). These age-2 walleye pollock ranged in length from 19 to 28 cm and represented 68% of all walleye pollock numbers and 20% of the biomass. Numbers and biomass of all other age classes of walleye pollock in Shelikof Strait in 2012 were below the long-term average (Table 13).

Special Projects

Ovaries were collected from prespawning walleye pollock (n=1[Sanak], 30[Shumagins], 11[Chirikof], 69[Shelikof]) to investigate interannual variation in fecundity of mature female walleye pollock (Martin Dorn, NOAA-AFSC, 206-526-6548, Martin.Dorn@noaa.gov). During DY2012-01, multibeam acoustic data were collected, and 44 XBTs were deployed, along 82 transects over the RACE bottom-trawl survey tow locations reported as "failed" or "marginally successful" by the AFSC Groundfish Program, as part of ongoing collections for essential fish habitat mapping (Tom Weber, University of New Hampshire, weber@ccom.unh.edu). Two ARGO drifters were deployed during DY2012-01 (one south of the Shumagin Islands and one south of Kodiak Island) in water exceeding 2,000 m bottom depth for monitoring conductivity and temperature profile data from roughly 1,000 m depth to the surface (Elizabeth Steffen, NOAA, 206-526-6747, elizabeth.steffen@noaa.gov). During DY2012-03, spawning walleye pollock were collected, spawned, and the fertilized eggs transported to Seattle to examine genomic evidence of localized adaptation of half-sibling families relative to temperature for fish from Shelikof compared to fish collected from Puget Sound (Mike Canino, NOAA-AFSC, 206-206-4108, mike.canino@noaa.gov). Ovaries were also collected from several rockfish species during DY2012-03 for use in developing estimates of reproductive parameters to be utilized in stock assessments (Cristina Conrath, NOAA-AFSC, 907-481-1732, Christina.Conrath@noaa.gov). Results for all special projects will be reported elsewhere.

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TABLES AND FIGURES

Table 1. -- Simrad ER60 38 kHz acoustic system description and settings used during the late winter/early spring 2012 acoustic-trawl surveys of walleye pollock in the Gulf of Alaska, results from standard sphere acoustic system calibrations conducted in association with the surveys, and final analysis parameters.

	DY1201 system settings	DY1203 system settings	14 Feb Ikatan Bay Alaska	26 Mar Malina Bay Alaska	Analysis Parameters
Echosounder	Simrad ER60	Simrad ER60	--	--	Simrad ER60
Transducer	ES38B	ES38B	--	--	ES38B
Frequency (kHz)	38	38	--	--	38
Transducer depth (m)	9.15	9.15	--	--	9.15
Pulse length (ms)	1.024	1.024	--	--	1.024
Transmitted power (W)	2000	2000	--	--	2000
Angle sensitivity along	22.83	22.83	--	--	22.83
Angle sensitivity athwart	21.43	21.43	--	--	21.43
2-way beam angle (dB)	-20.77	-20.77	--	--	-20.77
Gain (dB)	23.09	23.09	23.09	22.91	23.00
s_A correction (dB)	-0.67	-0.62	-0.62	-0.58	-0.60
Integration gain (dB)	22.42	22.47	22.47	22.33	22.40
3 dB beamwidth along	6.79	6.68	6.68*	6.57	6.57
3 dB beamwidth athwart	7.13	7.17	7.17*	7.13	7.13
Angle offset along	-0.14	-0.08	-0.08*	-0.09	-0.09
Angle offset athwart	-0.07	-0.11	-0.11*	-0.05	-0.05
Post-processing sv threshold (dB)	-70	-70	--	--	--
Standard sphere TS (dB)	--	--	-41.56	-42.43	--
Sphere range from transducer (m)	--	--	19.34	19.82	--
Absorption coefficient (dB/m)	0.0099	0.0099	0.0095	0.0099	--
Sound velocity (m/s)	1466.0	1466.0	1445.8	1454.3	--
Water temp at transducer (ºC)	--	--	0.3	1.8	--

*Results derived using 64 mm copper sphere.

Note: Gain and beam pattern terms are defined in the Operator Manual for Simrad ER60 Scientific echosounder application, which is available from Simrad Strandpromenaden 50, Box 111, N-3191 Horten, Norway.

Table 2. -- Summary of trawl and catch data from the 2012 walleye pollock acoustic-trawl surveys of the Sanak Trough (hauls 1-2) and Shumagin Islands (haul 3-5).

Haul	Gear[1]	Date	Time	Duration	Start position		Depth (m)		Temp. (° C)		Walleye pollock		Other
no.	type	(GMT)	(GMT)	(minutes)	Lat. (N)	Long. (W)	footrope	bottom	Headrope[2]	surface[2]	(kg)	number	(kg)
1	AWT	15-Feb	10:36	32	54° 31.66'	162° 20.23'	125	140	1.7	1.7	30.1	18	204.3
2	AWT	15-Feb	23:36	1	54° 41.23'	162° 33.98'	92	116	1.6	1.5	727.2	620	-
3	AWT	16-Feb	19:02	18	55° 34.08'	160° 17.87'	181	192	2.2	1.8	454.0	342	40.1
4	PNE	19-Feb	4:38	15	55° 11.37'	158° 54.19'	187	187	3.9	2.2	95.1	74	27.3
5	AWT	19-Feb	8:33	45	54° 59.77'	158° 35.97'	134	156	2.2	2.0	-	-	402.6

[1]Gear type: AWT = Aleutian wing trawl, PNE = poly Nor' Eastern bottom trawl

[2]Temperature from Sea-Bird Electronics SBE-39 attached to trawl net headrope

Table 3. -- Summary of catch by species in two Aleutian wing trawls conducted during the 2012 walleye pollock acoustic-trawl survey of Sanak Trough.

Common name	Scientific name	Weight kg	Weight Percent	Numbers Nos.	Numbers Percent
walleye pollock	*Theragra chalcogramma*	757.3	78.8	638	60.4
Pacific cod	*Gadus macrocephalus*	179.9	18.7	46	4.4
jellyfish unident.	Scyphozoa (class)	10.9	1.1	-	-
rock sole sp.	*Lepidopsetta* sp.	10.5	1.1	23	2.2
northern shrimp	*Pandalus borealis*	1.2	0.1	290	27.5
flathead sole	*Hippoglossoides elassodon*	1.2	0.1	6	0.6
northern rockfish	*Sebastes polyspinis*	0.4	<0.1	1	0.1
eulachon	*Thaleichthys pacificus*	0.2	<0.1	21	2.0
scissortail sculpin	*Triglops forficata*	0.1	<0.1	17	1.6
smooth lumpsucker	*Aptocyclus ventricosus*	<0.1	<0.1	1	0.1
fish larvae unident.	Actinopterygii (class)	<0.1	<0.1	12	1.1
Pacific staghorn sculpin	*Leptocottus armatus*	<0.1	<0.1	1	0.1
Total		961.7		1,056	

Table 4. -- Number of biological samples and measurements collected during the winter 2012 walleye pollock acoustic-trawl surveys of Sanak Trough (hauls 1-2) and Shumagin Islands (hauls 3-5).

Haul no.	Walleye pollock Lengths	Walleye pollock Weights	Walleye pollock Maturity	Walleye pollock Otoliths	Eulachon lengths	Capelin lengths	Pacific cod lengths
1	18	18	18	18	21	-	46
2	338	50	50	50	-	-	-
3	260	51	51	51	51	44	-
4	74	74	74	74	91	-	-
5	-	-	-	-	-	-	103
Total	690	193	193	193	163	44	149

Table 5. -- Estimates of walleye pollock biomass (in metric tons) and relative estimation error for the Shelikof Strait, Shumagin Islands, Chirikof Island shelf break, and Sanak Trough acoustic-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 [1]							
1988	301,700							
1989	290,500							
1990	374,700							
1991	380,300							
1992	713,400	3.6%						
1993	435,800	4.6%						
1994	492,600	4.5%	112,000 [2]					
1995	763,600	4.5%	290,100					
1996	777,200	3.7%	117,700 [3]					
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	432,800	4.5%	119,600					
2002	256,700	6.9%	135,600	27.1%	82,100	12.2%		
2003	316,500	5.2%	67,700	17.2%	30,900	20.7%	80,500	21.6%
2004	326,800	9.2%	no survey	--	30,400	20.4%	no survey	--
2005	356,100	4.1%	52,000	11.4%	77,000	20.7%	65,500	7.4%
2006	293,600	4.0%	37,300	10.1%	69,000	11.0%	127,200	10.4%
2007	180,900	5.8%	20,000	8.6%	36,600	6.7%	60,300	5.7%
2008	208,000	5.6%	30,600	9.8%	22,100	9.6%	19,800	6.7%
2009	266,000	5.9%	63,300	10.8%	400	32.3%	31,400	17.4%
2010	429,700	2.6%	18,200	11.6%	9,300	15.0%	26,700	11.6%
2011	no survey	--	no survey	--	no survey	--	no survey	--
2012	335,800	7.9%	15,500	5.2%	21,200	16.4%	24,300	15.6%

[1]Shelikof Strait surveyed in 1987, but no estimate was made due to an equipment malfunction.
[2]Survey conducted after peak spawning had occurred.
[3]Partial survey.

Table 6. -- Summary of catch by species in two Aleutian wing trawls conducted during the 2012 walleye pollock acoustic-trawl survey of the Shumagin Islands area.

		Weight		Numbers	
Common name	Scientific name	kg	Percent	Nos.	Percent
walleye pollock	*Theragra chalcogramma*	454.0	50.6	343	20.6
Pacific cod	*Gadus macrocephalus*	398.5	44.4	103	6.2
eulachon	*Thaleichthys pacificus*	32.9	3.7	1,167	70.0
arrowtooth flounder	*Atheresthes stomias*	3.7	0.4	3	0.2
Pacific cod	*Gadus macrocephalus*	3.2	0.4	1	0.1
smooth lumpsucker	*Aptocyclus ventricosus*	2.2	0.2	1	0.1
flathead sole	*Hippoglossoides elassodon*	1.6	0.2	3	0.2
rock sole sp.	*Lepidopsetta* sp.	0.3	<0.1	1	0.1
capelin	*Mallotus villosus*	0.2	<0.1	44	2.6
lumpsucker unident.	Cyclopterinae (family)	<0.1	<0.1	2	0.1
		896.7		1,668	

Table 7. -- Summary of catch by species in one poly-Nor'eastern bottom trawl conducted during the 2012 walleye pollock acoustic-trawl survey of the Shumagin Islands area.

		Weight		Numbers	
Common name	Scientific name	kg	Percent	Nos.	Percent
walleye pollock	*Theragra chalcogramma*	95.1	77.7	74	15.4
bigmouth sculpin	*Hemitripterus bolini*	9.6	7.8	1	0.2
eulachon	*Thaleichthys pacificus*	6.9	5.6	391	81.3
arrowtooth flounder	*Atheresthes stomias*	6.1	5.0	6	1.2
Pacific cod	*Gadus macrocephalus*	1.7	1.4	1	<0.1
smooth lumpsucker	*Aptocyclus ventricosus*	1.6	1.3	1	<0.1
English sole	*Parophrys vetulus*	1.4	1.2	2	<0.1
shrimp unident.	Decapoda (order)	<0.1	<0.1	5	1.0
Total		122.4		481	

Table 8. -- Summary of trawl and catch data from the 2012 walleye pollock acoustic-trawl surveys of the Gulf of Alaska shelf break near Chirikof Island

Haul	Gear[1]	Date	Time	Duration	Start position		Depth (m)		Temp. (° C)		Walleye pollock		Other
no.	type	(GMT)	(GMT)	(minutes)	Lat. (N)	Long. (W)	Footrope	Bottom	Headrope[2]	surface[2]	(kg)	Number	(kg)
1	AWT	17-Mar	13:05	15	56° 1.06'	154° 33.12'	294	307	4.8	2.7	8.4	6	11.2
2	AWT	19-Mar	13:06	9	56° 17.33'	153° 4.01'	289	475	4.9	3.4	242.3	189	25.6
3	AWT	23-Mar	0:06	8	56° 20.51'	156° 11.27'	249	268	5.0	2.1	660.0	8,073	51.6
4	AWT	23-Mar	7:59	10	56° 34.93'	156° 2.88'	226	287	1.4	2.1	583.0	5,589	8.4
5	AWT	24-Mar	2:31	10	57° 1.41'	155° 44.73'	266	290	4.0	2.0	459.2	1,958	96.5
6	AWT	24-Mar	12:26	11	57° 16.88'	155° 36.90'	241	282	3.2	1.9	193.5	1,367	5.6
7	AWT	24-Mar	22:25	5	57° 35.73'	155° 19.91'	248	315	4.4	1.2	770.1	3,907	53.2
8	AWT	25-Mar	4:05	8	57° 38.99'	155° 5.21'	115	261	2.9	2.0	530.9	1,034	3.1
9	AWT	25-Mar	10:19	11	57° 44.19'	154° 32.59'	192	214	4.3	2.1	1,163.2	4,371	201.0
10	PNE	25-Mar	14:07	2	57° 52.59'	154° 54.30'	236	236	3.4	0.3	115.5	120	2.1
11	PNE	25-Mar	21:26	1	57° 58.75'	154° 25.79'	301	334	4.1	0.7	1,222.9	1,283	10.4
12	AWT	26-Mar	2:22	9	58° 0.60'	153° 42.69'	199	219	3.8	2.6	654.4	3,336	76.3
13	PNE	26-Mar	7:41	11	58° 17.45'	153° 56.79'	254	254	-	-	4,261.7	2,986	86.3

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

[2]Temperature from Sea-Bird Electronics SBE-39 attached to trawl net headrope.

Table 9. -- Summary of catch by species in two Aleutian wing trawls conducted during the 2012 walleye pollock acoustic-trawl survey of the Chirikof shelf break area.

		Weight		Numbers	
Common name	Scientific name	kg	Percent	Nos.	Percent
walleye pollock	*Theragra chalcogramma*	250.8	87.2	195	48.5
Pacific ocean perch	*Sebastes alutus*	12.9	4.5	22	5.5
giant grenadier	*Albatrossia pectoralis*	9.3	3.2	3	0.7
shortraker rockfish	*Sebastes borealis*	8.8	3.1	1	0.2
rougheye rockfish	*Sebastes aleutianus*	2.6	0.9	1	0.2
eulachon	*Thaleichthys pacificus*	2.2	0.8	37	9.2
lanternfish unident.	Myctophidae (Family)	0.7	0.2	79	19.7
jellyfish unident.	Scyphozoa (class)	0.2	0.1	1	0.2
squid unident.	Cephalopoda (class)	0.1	<0.1	40	10.0
northern smoothtongue	*Leuroglossus schmidti*	<0.1	<0.1	3	0.7
shrimp unident.	Decapoda (order)	<0.1	<0.1	20	5.0
Total		287.6		402	

Table 10. -- Number of biological samples and measurements collected during the winter 2012 acoustic-trawl survey of walleye pollock of the Gulf of Alaska shelf break near Chirikof Island (hauls 1-2) and Shelikof Strait (hauls 3-13).

Haul	walleye pollock				eulachon	capelin	rougheye rockfish	shortraker rockfish	POP
no.	lengths	weights	maturity	otoliths	lengths	lengths	lengths/otoliths	lengths/otoliths	lengths/otoliths
1	6	6	6	6	-	-	-	1/-	3/-
2	189	54	54	54	-	-	1/1	-	19/7
3	346	108	108	66	25	-	-	1/1	8/5
4	361	102	102	60	61	-	-	-	-
5	441	117	117	54	86	2	-	-	-
6	202	55	55	45	-	-	-	-	-
7	465	99	99	55	92	-	-	-	-
8	662	147	147	51	47	-	-	-	-
9	354	88	88	88	66	-	-	-	-
10	120	42	42	42	12	-	-	-	-
11	475	68	68	68	58	-	-	-	-
12	412	76	76	45	50	2	-	-	-
13	175	44	44	44	-	-	-	-	-
Totals	4,208	1,006	1,006	678	497	4	1/1	2/1	30/12

Table 11. -- Summary of catch by species in eight Aleutian wing trawls conducted during the 2012 walleye pollock acoustic-trawl survey of the Shelikof Strait area.

		Weight		Numbers	
Common name	Scientific name	kg	Percent	Nos.	Percent
walleye pollock	*Theragra chalcogramma*	5,014.3	91.0	29,635	64.2
eulachon	*Thaleichthys pacificus*	456.1	8.3	15,124	32.8
squid unident.	Cephalopoda (class)	8.6	0.2	765	1.7
chinook salmon	*Oncorhynchus tshawytscha*	7.6	0.1	7	<0.1
smooth lumpsucker	*Aptocyclus ventricosus*	5.4	0.1	6	<0.1
Pacific ocean perch	*Sebastes alutus*	5.0	0.1	8	<0.1
shortraker rockfish	*Sebastes borealis*	4.2	0.1	1	<0.1
Pacific cod	*Gadus macrocephalus*	3.7	0.1	2	<0.1
magistrate armhook squid	*Berryteuthis magister*	1.1	<0.1	1	<0.1
Pacific herring	*Clupea pallasi*	1.0	<0.1	5	<0.1
shrimp unident.	Decapoda (order)	0.9	<0.1	361	0.8
arrowtooth flounder	*Atheresthes stomias*	0.9	<0.1	2	<0.1
northern smoothtongue	*Leuroglossus schmidti*	0.7	<0.1	164	0.4
flathead sole	*Hippoglossoides elassodon*	0.3	<0.1	1	<0.1
Pacific lamprey	*Lampetra tridentata*	0.1	<0.1	1	<0.1
capelin	*Mallotus villosus*	0.1	<0.1	18	<0.1
lanternfish unident.	Myctophidae (family)	<0.1	<0.1	69	0.1
snailfish unident.	Liparidinae (family)	<0.1	<0.1	5	<0.1
Total		5,509.9		46,175	

Table 12. -- Summary of catch by species in three poly-Nor'eastern bottom trawls conducted during the 2012 walleye pollock acoustic-trawl survey of the Shelikof Strait area.

		Weight		Numbers	
Common name	Scientific name	kg	Percent	Nos.	Percent
walleye pollock	*Theragra chalcogramma*	5,600.0	98.3	4,389	94.5
Pacific halibut	*Hippoglossus stenolepis*	44.6	0.8	11	0.2
arrowtooth flounder	*Atheresthes stomias*	36.4	0.6	24	0.5
flathead sole	*Hippoglossoides elassodon*	6.9	0.1	17	0.4
eulachon	*Thaleichthys pacificus*	6.9	0.1	150	3.2
smooth lumpsucker	*Aptocyclus ventricosus*	1.5	<0.1	1	<0.1
longsnout prickleback	*Lumpenella longirostris*	1.4	<0.1	11	0.2
lanternfish unident.	*Lampanyctus* sp.	0.6	<0.1	11	0.2
sea urchin unident.	Echinoidea (class)	0.2	<0.1	4	0.1
jellyfish unident.	Scyphozoa (class)	0.1	<0.1	1	<0.1
shrimp unident.	Decapoda (order)	0.1	<0.1	23	0.5
Total		5,698.8		4,642	

Table 13. -- Numbers-at-age estimates (millions) from acoustic-trawl surveys of walleye pollock in the Shelikof Strait area. No surveys were conducted in 1982, 1999, or 2011, and no estimate was produced for 1987 due to mechanical problems.

Age	1981	1983	1984	1985	1986	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2012	Mean
1	78	1	62	2,092	575	17	399	49	22	228	63	186	10,690	56	70	395	4,484	289	8	48	53	1,626	162	54	1,368	332	90	95	843
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	94	94	157	836	232	391	1,205	306	852	789
3	1,511	380	324	123	184	694	90	72	550	74	37	49	79	119	1,247	126	217	352	1,107	205	58	56	41	175	250	110	532	43	314
4	769	1,297	142	315	46	322	216	63	48	188	72	32	78	25	80	474	16	61	97	800	159	35	12	30	53	99	84	77	203
5	2,786	1,171	635	181	75	78	249	116	65	368	233	155	103	54	18	136	67	42	16	56	357	173	17	10	12	60	79	96	265
6	1,052	698	988	347	49	17	43	180	70	84	126	84	245	71	44	14	132	23	16	8	48	162	56	17	2	10	29	46	167
7	210	599	450	439	86	6	14	46	116	85	27	42	122	201	52	32	17	35	8	4	3	36	75	34	4	3	12	29	99
8	129	132	224	167	149	6	4	22	24	171	36	27	54	119	98	36	13	13	7	2	3	4	32	21	11	1	5	4	54
9	79	14	41	43	60	4	2	8	29	33	39	44	17	40	53	74	10	6	1	1	3	2	7	2	7	5	5	1	23
10	25	12	3	6	11	9	1	8	2	56	16	48	11	13	14	26	8	3	1	< 1	< 1	0	< 1	1	2	6	11	< 1	11
11	2	4	0	2	1	2	10	1	4	2	8	15	15	11	2	14	14	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1	9	< 1	4
12	0	2	1	1	0	2	1	3	1	15	3	7	6	5	3	7	7	2	< 1	0	0	0	< 1	0	0	< 1	3	1	2
13	0	0	0	0	0	< 1	< 1	2	4	1	2	1	2	3	1	< 1	2	1	< 1	< 1	< 1	0	0	0	0	0	0	0	1
14	0	0	0	0	0	0	0	1	0	< 1	< 1	2	< 1	< 1	< 1	1	1	< 1	< 1	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	< 1	0	0	1	< 1	0	0	0	1	0	< 1	0	0	0	0	0	0	0	0	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	0	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	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	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	1,220	777	2,252	1,240	576	2,100	1,832	1,165	1,245	

Table 14. -- Biomass-at-age estimates (thousands of metric tons) from acoustic-trawl surveys of walleye pollock in the Shelikof Strait area. No surveys were conducted in 1982, 1999, or 2011, and no estimate was produced for 1987 due to mechanical problems.

Age	1981	1983	1984	1985	1986	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2012	Mean
1	1	< 1	1	24	4	< 1	4	< 1	< 1	3	1	2	114	1	1	4	57	2	< 1	< 1	< 1	18	1	< 1	19	4	1	1	10
2	309	71	6	54	139	8	8	67	12	3	6	3	46	180	15	8	63	214	13	8	8	13	55	15	39	94	24	68	55
3	342	117	83	41	40	130	21	15	85	16	11	14	23	24	195	28	60	60	164	42	14	17	11	39	67	29	127	12	65
4	255	529	78	159	17	91	86	23	13	60	34	20	41	12	28	153	9	25	29	222	77	19	5	13	26	51	57	50	78
5	1,068	650	373	109	56	31	111	61	33	144	136	127	83	50	13	53	54	27	12	25	179	132	14	9	10	44	86	89	135
6	496	455	684	253	41	9	27	120	54	68	90	75	220	73	53	12	107	24	16	7	35	119	63	22	3	11	37	62	116
7	133	332	331	353	76	6	12	36	106	92	28	48	116	212	61	39	17	40	9	5	4	29	87	47	8	5	22	43	82
8	92	94	161	138	140	6	4	24	23	194	43	34	55	132	120	47	17	18	8	2	3	4	43	30	20	2	11	7	53
9	68	11	36	35	58	5	3	9	36	36	46	64	19	48	67	95	15	8	2	2	4	3	10	3	13	11	12	2	26
10	19	12	3	6	11	11	1	11	3	71	21	68	15	17	20	33	11	5	1	1	< 1	0	1	2	4	13	22	1	14
11	1	5	0	2	2	2	12	1	6	3	10	21	20	16	3	21	22	2	1	< 1	< 1	1	2	1	< 1	3	22	< 1	6
12	0	1	1	1	0	3	1	4	1	21	4	10	7	7	5	10	11	3	1	0	0	0	1	0	0	< 1	9	1	4
13	0	0	0	0	0	< 1	< 1	2	7	1	3	2	3	4	1	< 1	4	1	< 1	< 1	< 1	0	0	0	0	0	0	0	1
14	0	0	0	0	0	0	0	1	0	1	1	4	1	< 1	1	1	2	1	< 1	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	< 1	0	0	1	< 1	0	0	0	1	0	< 1	0	0	0	0	0	0	0	0	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	0	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	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	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	316	327	356	294	181	208	266	430	336	

Table 15. -- Numbers-at-length estimates (millions) from acoustic-trawl surveys of walleye pollock in the Shelikof Strait area.
No surveys were conducted in 1982, 1999, or 2011, and no estimate was produced for 1987 due to mechanical problems.

Length	1981	1983	1984	1985	1986	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2012
5	0	0	0	0	0	0	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	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	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	0	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	4	<1	7	1	1	<1
10	0	0	0	310	175	0	47	5	0	4	3	32	1,120	3	3	16	372	33	0	1	10	106	36	4	25	16	10	2
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	61	14	161	74	20	8
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	39	20	407	134	28	22
13	26	1	0	278	32	4	50	9	4	79	13	33	1,538	18	15	104	999	52	2	20	3	296	13	11	412	74	21	34
14	31	0	1	79	1	1	9	1	4	36	3	6	157	4	7	49	320	24	1	8	1	98	5	4	265	30	7	18
15	5	0	0	13	0	<1	3	<1	<1	6	1	<1	25	<1	1	10	30	2	1	1	<1	19	2	1	77	2	1	9
16	5	0	0	1	3	0	<1	0	<1	1	0	<1	1	5	<1	2	7	2	0	<1	<1	4	1	0	11	1	<1	2
17	1	1	0	<1	7	0	0	4	<1	0	0	0	1	51	<1	<1	1	20	0	<1	<1	<1	7	2	2	0	<1	0
18	5	1	0	1	41	1	<1	36	1	0	<1	1	4	249	1	<1	10	185	<1	0	<1	1	23	8	0	6	<1	0
19	12	8	0	2	187	2	1	165	7	<1	<1	<1	16	634	1	1	32	808	3	1	1	2	75	24	5	7	9	11
20	70	70	0	6	444	8	2	341	12	1	4	2	39	945	8	3	81	1,407	15	3	4	8	141	54	5	77	16	55
21	280	177	<1	20	535	26	7	362	33	2	8	5	68	772	23	10	147	1,043	36	11	10	20	203	60	20	179	36	156
22	733	221	1	75	431	32	17	198	48	5	17	7	92	441	50	16	196	460	29	15	20	29	161	42	38	347	64	184
23	952	198	7	152	267	29	23	75	41	8	20	6	93	131	48	20	176	107	43	17	23	38	107	20	83	293	89	189
24	695	142	15	151	136	9	19	21	23	10	14	5	73	54	48	21	68	20	56	16	18	30	66	9	117	181	50	142
25	389	37	21	75	46	4	11	7	23	6	7	4	53	18	89	10	30	22	128	11	12	16	27	6	76	80	27	65
26	219	28	12	36	23	11	5	1	59	5	5	2	36	9	208	8	11	31	239	8	9	7	14	7	36	20	16	34
27	90	6	5	16	11	40	3	6	108	3	1	3	27	9	275	6	6	60	250	9	4	2	6	11	30	9	8	9
28	70	6	6	6	9	107	3	3	142	3	1	1	17	11	268	5	10	85	210	23	2	3	3	15	19	14	9	10
29	83	3	9	3	15	158	6	9	123	8	1	1	5	22	205	10	13	91	124	52	3	1	5	23	13	6	28	1
30	235	7	26	5	31	191	12	16	72	19	1	3	2	23	104	25	18	50	74	107	4	8	6	30	11	6	55	6
31	420	3	48	6	34	129	23	19	32	25	2	6	6	15	59	42	32	37	42	153	7	8	6	23	27	9	91	2
32	492	24	67	4	38	92	27	17	22	37	3	7	4	15	31	78	37	15	25	185	16	2	6	23	38	13	108	5
33	490	65	68	11	29	85	24	11	8	48	5	11	8	13	21	102	34	14	29	145	25	10	6	19	42	24	91	6
34	499	141	53	22	18	89	28	10	8	67	6	6	6	6	16	99	28	7	20	122	41	3	8	16	31	24	66	6
35	592	195	27	27	12	63	37	8	7	85	10	7	11	4	11	103	22	6	17	77	56	10	5	12	32	19	32	6
36	665	258	21	41	9	41	53	12	8	83	9	6	15	4	10	84	13	8	7	57	59	4	4	8	17	17	25	6
37	541	339	20	44	7	28	62	19	9	84	17	3	14	3	10	66	9	9	5	38	54	18	3	5	19	8	14	5
38	403	368	35	53	3	24	66	23	8	65	26	3	20	2	9	45	8	9	6	28	47	10	2	4	7	12	11	4
39	352	341	87	64	4	12	57	21	6	36	40	2	9	2	5	26	7	11	6	23	39	11	1	4	3	16	8	3

Table 15.--Continued.

Length	1981	1983	1984	1985	1986	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2012
40	339	343	138	77	3	13	52	33	10	30	53	3	15	2	8	15	11	9	2	14	35	23	2	4	8	10	9	4
41	231	290	170	82	8	8	46	34	9	22	57	5	5	2	4	16	13	12	2	13	35	22	2	3	7	14	9	6
42	224	326	219	96	8	5	36	37	13	15	57	9	7	2	5	6	19	8	3	7	38	32	2	2	4	16	10	9
43	178	311	271	106	12	5	22	32	14	14	48	16	17	4	4	7	19	7	2	6	32	33	4	3	4	15	11	12
44	145	304	309	113	22	3	16	37	19	14	37	23	18	6	5	5	18	7	2	5	27	41	5	2	3	14	11	13
45	116	256	316	119	35	2	12	34	21	17	33	36	35	7	3	2	19	8	3	3	24	39	7	3	4	12	15	17
46	84	201	283	148	39	2	6	25	24	22	23	39	53	13	4	2	22	5	2	3	18	33	9	2	3	9	14	17
47	113	171	213	140	50	2	6	23	22	21	19	46	62	25	4	3	19	5	3	3	17	37	11	3	1	6	11	19
48	62	116	158	139	57	2	4	20	26	32	17	37	74	37	6	4	17	6	4	2	11	33	14	3	1	5	12	18
49	75	91	104	117	52	3	5	16	20	38	16	33	73	53	13	6	13	9	3	2	8	22	15	4	1	3	10	16
50	58	52	68	83	51	4	5	15	19	46	17	29	66	64	20	13	16	8	3	2	7	28	18	6	<1	3	12	17
51	50	49	40	52	42	4	4	8	20	40	15	24	51	69	30	18	10	5	4	2	5	14	19	8	<1	3	11	13
52	25	23	25	28	21	3	4	8	14	38	14	21	40	64	36	24	11	9	4	2	4	7	19	6	1	4	10	13
53	12	17	13	23	18	3	5	7	13	35	14	24	30	53	37	26	10	6	3	2	2	6	16	9	1	2	6	11
54	9	7	4	9	6	2	4	5	9	35	13	18	22	39	34	23	9	4	3	1	3	4	12	7	2	2	7	9
55	15	9	3	4	11	2	2	7	10	30	11	18	16	29	28	20	9	5	2	1	3	3	13	8	2	2	8	10
56	5	2	2	2	2	2	1	2	6	15	9	18	14	19	24	19	8	5	1	<1	2	2	7	6	4	3	6	8
57	7	2	1	2	<1	1	1	2	3	18	7	13	7	13	12	12	9	3	1	<1	1	1	5	5	1	2	5	8
58	3	1	1	1	1	<1	1	1	5	14	7	11	6	10	8	9	6	2	1	<1	1	1	3	4	2	1	6	8
59	1	1	<1	1	<1	<1	1	1	2	4	4	9	3	6	5	8	5	3	1	1	1	1	3	3	3	1	6	5
60	0	1	<1	2	1	0	1	1	2	2	3	7	2	5	3	4	2	3	<1	1	<1	1	2	2	2	1	4	5
61	0	1	<1	<1	1	<1	<1	<1	1	2	2	5	1	3	2	2	1	1	<1	1	<1	<1	2	2	3	1	5	2
62	0	0	1	1	<1	<1	<1	<1	<1	3	1	2	2	2	1	2	2	<1	<1	<1	<1	0	1	1	1	1	4	1
63	0	0	1	1	<1	0	<1	<1	1	1	1	1	<1	1	1	2	1	1	<1	<1	<1	1	1	1	1	1	4	2
64	0	0	<1	0	<1	0	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	1	4	1
65	0	0	0	0	<1	0	0	<1	1	0	<1	1	<1	<1	<1	<1	<1	<1	<1	0	<1	<1	<1	<1	<1	<1	4	1
66	0	0	0	<1	<1	0	<1	<1	0	<1	<1	<1	0	<1	<1	<1	<1	1	0	0	0	<1	<1	<1	1	1	3	<1
67	0	0	0	0	<1	<1	0	<1	<1	<1	<1	<1	0	<1	<1	0	<1	0	<1	<1	0	0	<1	<1	<1	1	3	<1
68	0	0	0	0	0	0	0	<1	0	0	<1	0	0	<1	<1	<1	0	<1	<1	0	<1	0	<1	<1	<1	<1	1	<1
69	0	0	0	0	0	0	0	<1	1	0	<1	<1	0	<1	<1	0	0	0	0	0	0	0	0	<1	<1	<1	<1	0
70	0	0	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	<1	<1
71	0	0	0	0	0	0	0	<1	0	0	0	<1	0	0	0	0	0	0	<1	0	0	0	0	<1	0	<1	<1	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	<1	0
73	0	0	0	0	0	0	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	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	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	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	1,240	575	2,100	1,832	1,165	1,245

Table 16. -- Biomass-at-length estimates (thousands of metric tons) from acoustic-trawl surveys of walleye pollock in the Shelikof Strait area. No surveys were conducted in 1982, 1999, or 2011, and no estimate was produced for 1987 due to mechanical problems.

Length	1981	1983	1984	1985	1986	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2012
5	0	0	0	0	0	0	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	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	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	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	< 1	< 1	<1	<1	<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	< 1	< 1	<1	<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	< 1	< 1	2	1	<1	<1
12	< 1	< 1	1	10	1	< 1	2	< 1	< 1	1	< 1	1	44	< 1	< 1	1	20	1	< 1	< 1	< 1	7	< 1	< 1	4	1	<1	<1
13	< 1	< 1	0	4	< 1	< 1	1	< 1	< 1	1	< 1	< 1	23	< 1	< 1	1	16	1	< 1	< 1	< 1	4	< 1	< 1	6	1	<1	<1
14	1	0	< 1	2	< 1	< 1	< 1	< 1	< 1	1	< 1	< 1	3	< 1	< 1	1	7	< 1	< 1	< 1	< 1	2	< 1	< 1	5	1	<1	<1
15	< 1	0	0	< 1	0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	2	<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	< 1	< 1	<1	<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	< 1	< 1	<1	0	<1	0
18	< 1	< 1	0	< 1	2	< 1	< 1	1	< 1	0	< 1	< 1	< 1	9	< 1	< 1	< 1	6	< 1	0	< 1	< 1	< 1	< 1	<1	<1	<1	0
19	1	< 1	0	< 1	8	< 1	< 1	7	< 1	< 1	< 1	< 1	1	27	< 1	< 1	2	33	< 1	< 1	< 1	< 1	3	1	<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	7	3	<1	4	<1	3
21	18	11	< 1	1	33	1	< 1	21	2	< 1	< 1	< 1	4	46	1	1	10	59	2	1	1	1	12	4	1	11	2	10
22	53	16	< 1	6	31	2	1	13	3	< 1	1	1	7	30	4	1	16	31	2	1	1	2	11	3	3	25	4	13
23	78	16	1	14	22	2	2	6	3	1	2	1	8	10	4	2	17	8	4	1	2	3	8	2	7	23	7	15
24	65	13	2	15	13	1	2	2	2	1	1	1	7	5	5	2	7	2	5	2	2	3	6	1	11	16	5	13
25	41	4	2	9	5	< 1	1	1	2	1	1	< 1	6	2	10	1	4	2	14	1	1	2	3	1	8	8	3	6
26	26	3	2	5	3	1	1	< 1	7	1	1	< 1	5	1	25	1	1	4	29	1	1	1	2	1	5	2	2	4
27	12	1	1	2	2	5	< 1	1	14	< 1	< 1	< 1	4	1	38	1	1	8	35	1	< 1	< 1	< 1	1	4	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	< 1	2	3	2	1	2
29	14	1	2	1	3	26	1	1	20	1	< 1	< 1	1	4	36	2	2	15	22	9	1	< 1	< 1	4	2	1	5	<1
30	44	1	5	1	6	35	2	3	13	4	< 1	1	< 1	4	20	5	4	9	15	20	1	2	1	5	2	1	11	1
31	86	1	10	1	7	27	5	4	7	5	< 1	1	1	3	13	9	8	8	9	32	1	2	1	5	6	2	19	<1
32	111	5	16	1	9	21	6	4	5	9	1	2	1	3	7	19	10	3	6	43	4	1	1	5	10	3	25	1
33	122	16	18	3	7	22	6	3	2	12	1	3	2	3	5	26	10	4	8	37	7	3	2	5	12	6	23	2
34	136	39	15	6	5	25	8	3	2	19	2	2	2	2	5	28	9	2	6	34	12	1	2	5	10	7	18	2
35	176	59	9	9	4	19	11	2	2	27	3	2	4	1	4	33	8	2	6	24	18	3	2	4	11	6	9	2
36	216	84	7	14	3	14	18	4	3	29	3	2	5	1	3	29	5	3	2	19	20	1	1	3	6	6	9	2
37	191	121	7	17	2	11	23	7	3	32	6	1	5	1	4	25	4	3	2	14	21	7	1	2	8	3	5	2
38	154	142	14	21	1	10	26	9	3	26	11	1	8	1	4	19	4	4	2	11	20	4	< 1	2	3	5	4	1
39	146	143	38	28	2	5	25	9	3	16	18	1	4	1	2	12	3	5	3	10	18	5	< 1	2	2	7	4	1

Table 16.-- Continued.

Length	1981	1983	1984	1985	1986	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2012
40	152	155	66	37	1	6	24	15	5	15	26	2	7	1	4	7	6	4	1	7	17	12	1	2	4	5	4	2
41	112	142	87	42	4	4	23	17	4	11	30	3	3	1	2	8	7	6	1	7	19	13	1	2	4	8	5	3
42	117	172	121	53	4	3	20	20	7	9	32	5	4	1	3	3	11	5	2	4	22	19	1	1	3	9	6	5
43	100	176	161	63	7	3	13	19	9	9	29	10	10	2	2	4	13	5	1	4	20	21	2	2	3	9	7	8
44	87	185	197	72	14	2	10	24	12	9	24	16	12	4	3	3	13	5	1	3	19	27	4	2	2	10	8	8
45	75	167	215	81	24	2	8	23	15	12	23	26	24	5	2	2	15	6	2	2	17	27	5	2	3	9	11	12
46	58	140	206	107	29	2	4	19	18	17	18	31	39	10	3	1	17	4	2	3	15	24	7	2	2	7	11	12
47	83	127	166	108	40	1	5	18	18	17	16	39	49	20	3	3	16	4	2	3	14	29	10	3	1	5	10	15
48	49	92	131	115	49	2	3	17	22	29	15	34	63	32	6	4	15	6	3	2	10	28	12	3	1	4	11	15
49	63	77	92	102	47	2	4	15	19	36	15	32	66	48	13	6	13	8	3	2	8	19	15	4	1	3	11	15
50	51	46	63	78	49	4	4	15	19	47	17	30	63	62	20	13	16	8	3	2	8	28	18	6	<1	3	13	17
51	47	47	40	52	43	4	4	8	21	43	16	26	52	71	32	20	12	6	4	2	5	14	22	9	<1	3	12	14
52	25	23	26	29	24	3	4	8	15	44	15	24	43	70	41	27	13	10	5	2	5	8	23	7	2	5	12	15
53	13	19	15	26	21	4	5	8	15	43	17	29	34	62	45	32	12	8	4	2	3	7	20	11	1	3	9	13
54	11	8	5	10	7	3	5	6	12	45	17	23	26	48	44	30	13	6	4	1	4	5	16	10	3	4	10	11
55	18	11	4	5	14	3	2	9	14	41	15	24	20	38	38	27	12	7	3	2	4	4	19	11	3	3	13	14
56	6	2	2	3	3	2	2	3	9	22	13	27	19	27	35	28	12	8	2	< 1	3	3	10	9	6	4	10	12
57	10	3	2	3	< 1	1	2	4	5	28	11	21	10	20	19	18	13	5	2	< 1	1	1	8	8	2	3	9	12
58	4	1	1	1	2	1	1	2	7	24	12	19	10	15	13	15	11	4	2	1	2	2	6	8	4	2	11	14
59	1	1	< 1	2	1	1	1	2	3	8	7	16	4	11	8	13	8	6	2	2	1	1	6	5	5	3	11	8
60	0	1	< 1	3	1	0	1	2	4	4	5	13	3	9	5	8	4	6	1	1	< 1	1	4	4	4	2	7	8
61	0	1	1	< 1	1	< 1	1	1	1	4	3	9	3	5	4	4	2	3	1	1	< 1	< 1	4	3	6	3	11	4
62	0	0	2	1	1	1	< 1	< 1	1	5	2	4	3	3	2	3	3	1	1	< 1	< 1	0	2	2	3	2	9	3
63	0	0	2	2	< 1	0	< 1	< 1	1	3	1	3	< 1	2	2	4	1	3	< 1	< 1	1	1	2	2	3	2	8	3
64	0	0	1	0	< 1	0	< 1	< 1	< 1	1	< 1	2	1	1	< 1	1	1	1	< 1	1	< 1	< 1	1	1	4	2	9	2
65	0	0	0	0	< 1	0	0	< 1	3	0	< 1	2	< 1	1	< 1	1	< 1	< 1	< 1	0	< 1	< 1	< 1	1	1	1	9	2
66	0	0	0	< 1	1	0	< 1	< 1	0	1	< 1	< 1	0	< 1	< 1	1	< 1	3	0	0	0	1	< 1	< 1	2	3	6	<1
67	0	0	0	0	1	1	0	< 1	< 1	1	< 1	1	0	< 1	< 1	0	< 1	0	< 1	< 1	0	0	< 1	< 1	1	2	7	1
68	0	0	0	0	0	0	0	< 1	0	0	< 1	0	0	< 1	1	< 1	0	1	< 1	0	< 1	0	< 1	< 1	<1	1	4	<1
69	0	0	0	0	0	0	0	< 1	2	0	< 1	< 1	0	< 1	< 1	0	0	0	0	0	0	0	0	< 1	<1	1	2	0
70	0	0	0	0	0	< 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	3	<1
71	0	0	0	0	0	0	0	< 1	0	0	0	< 1	0	0	0	0	0	0	< 1	0	0	0	0	< 1	0	1	2	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	< 1	0	0	0	0	0	0	0	0	0	0	0	0	2	0
73	0	0	0	0	0	0	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	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	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	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	294	181	208	266	430	336

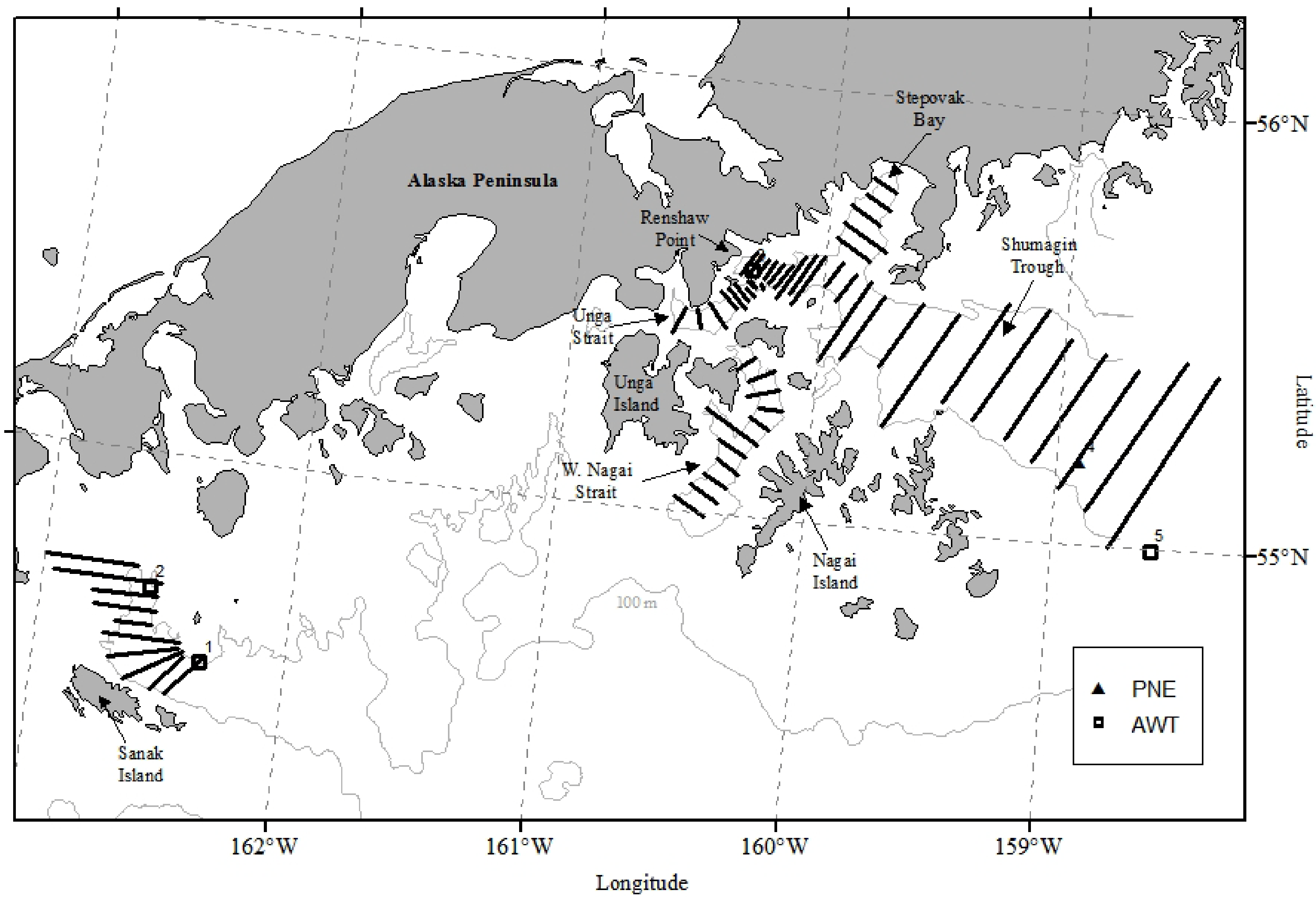

Figure 1. -- Transect lines and locations of Aleutian-wing trawl (AWT) and poly-Nor'eastern trawl (PNE) hauls during the winter 2012 acoustic-trawl survey of walleye pollock in the Shumagin Islands and Sanak Trough.

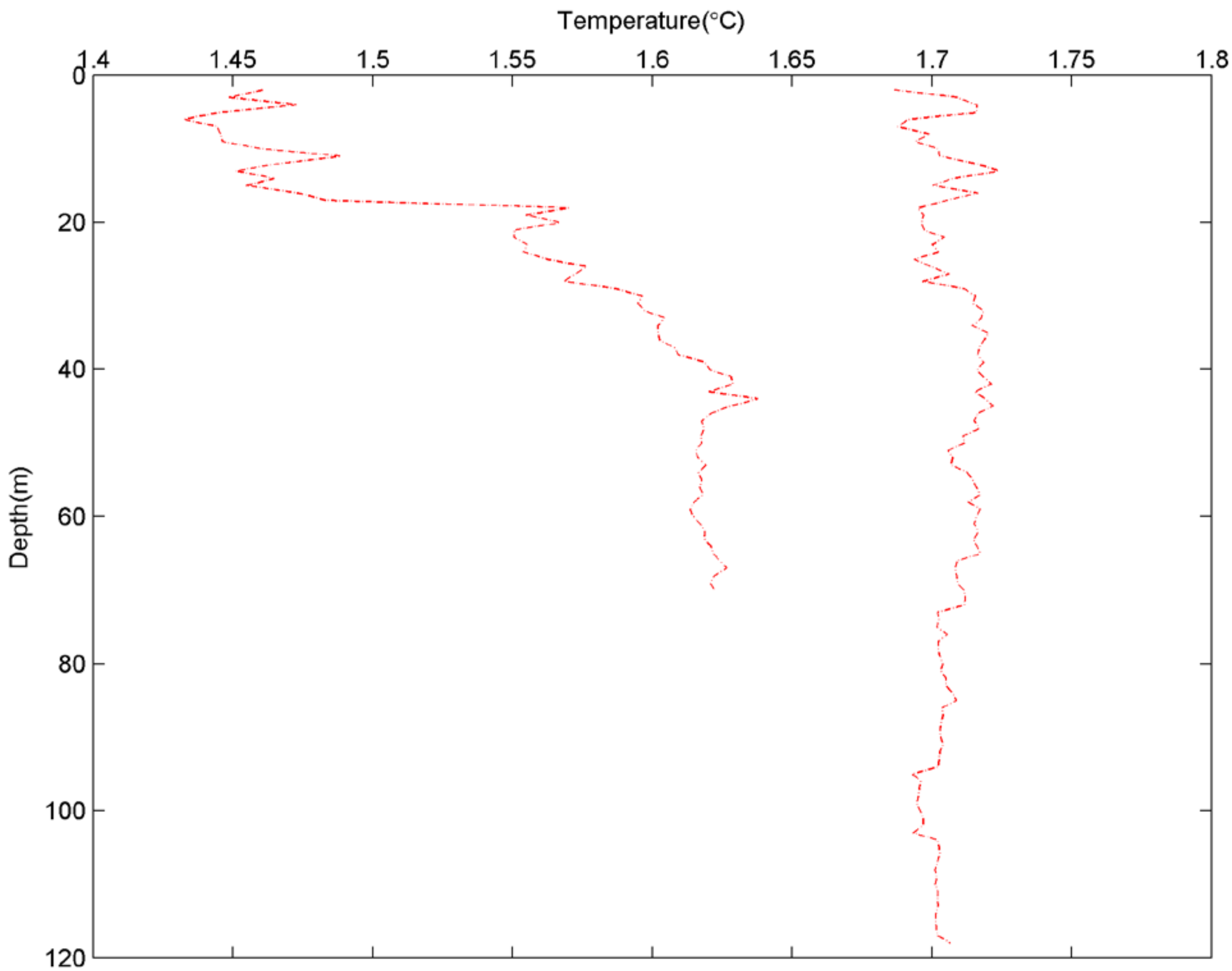

Figure 2. -- Water temperature (°C) by 1-m depth intervals observed during the winter 2012 acoustic-trawl survey of walleye pollock in Sanak Trough. Data collected at two trawl locations with Sea-Bird Electronics temperature-depth probe (SBE-39) attached to the trawl headrope.

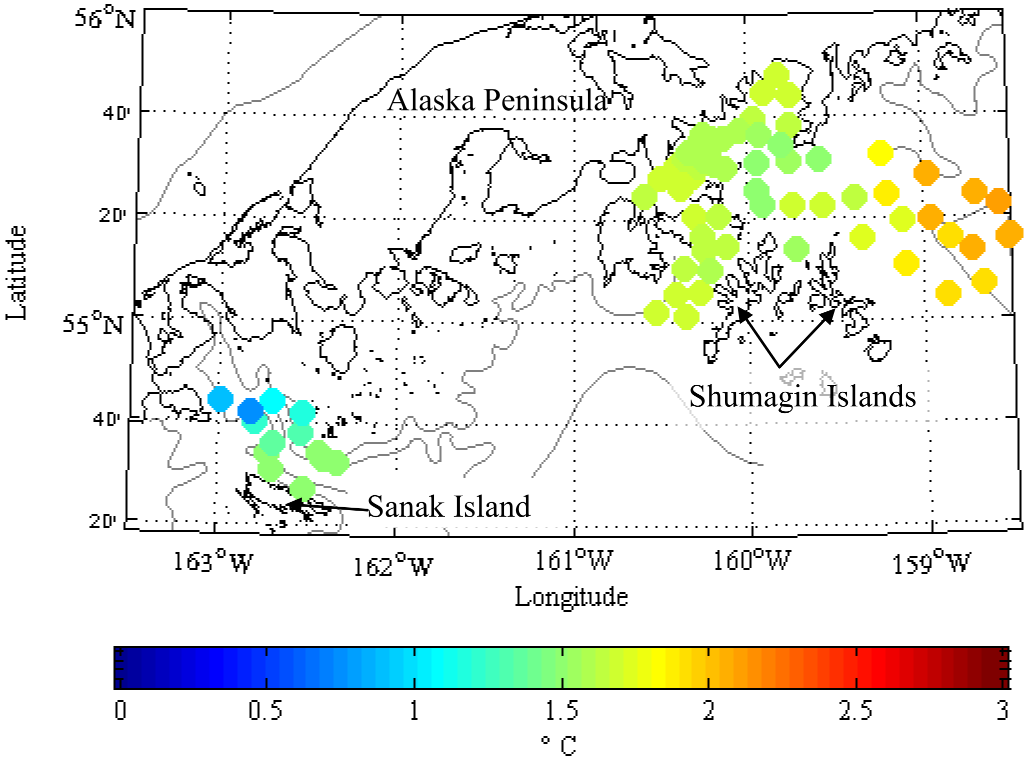

Fig 3. -- Surface water temperatures during DY1201 Sanak/Shumagin Islands survey recorded from the ship's Furuno T-2000 temperature probe located 1.4 m below the surface.

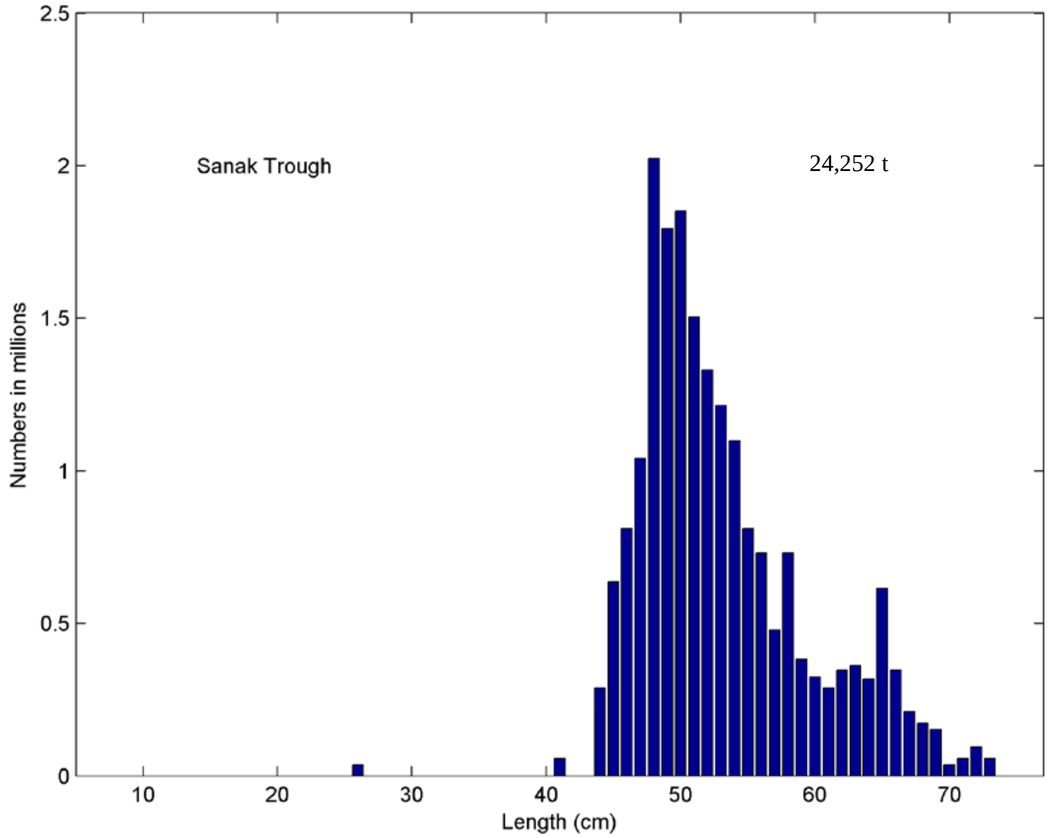

Figure 4. -- Length distribution of walleye pollock (numbers) and biomass estimate (metric tons, t) for the 2012 acoustic-trawl survey of Sanak Trough.

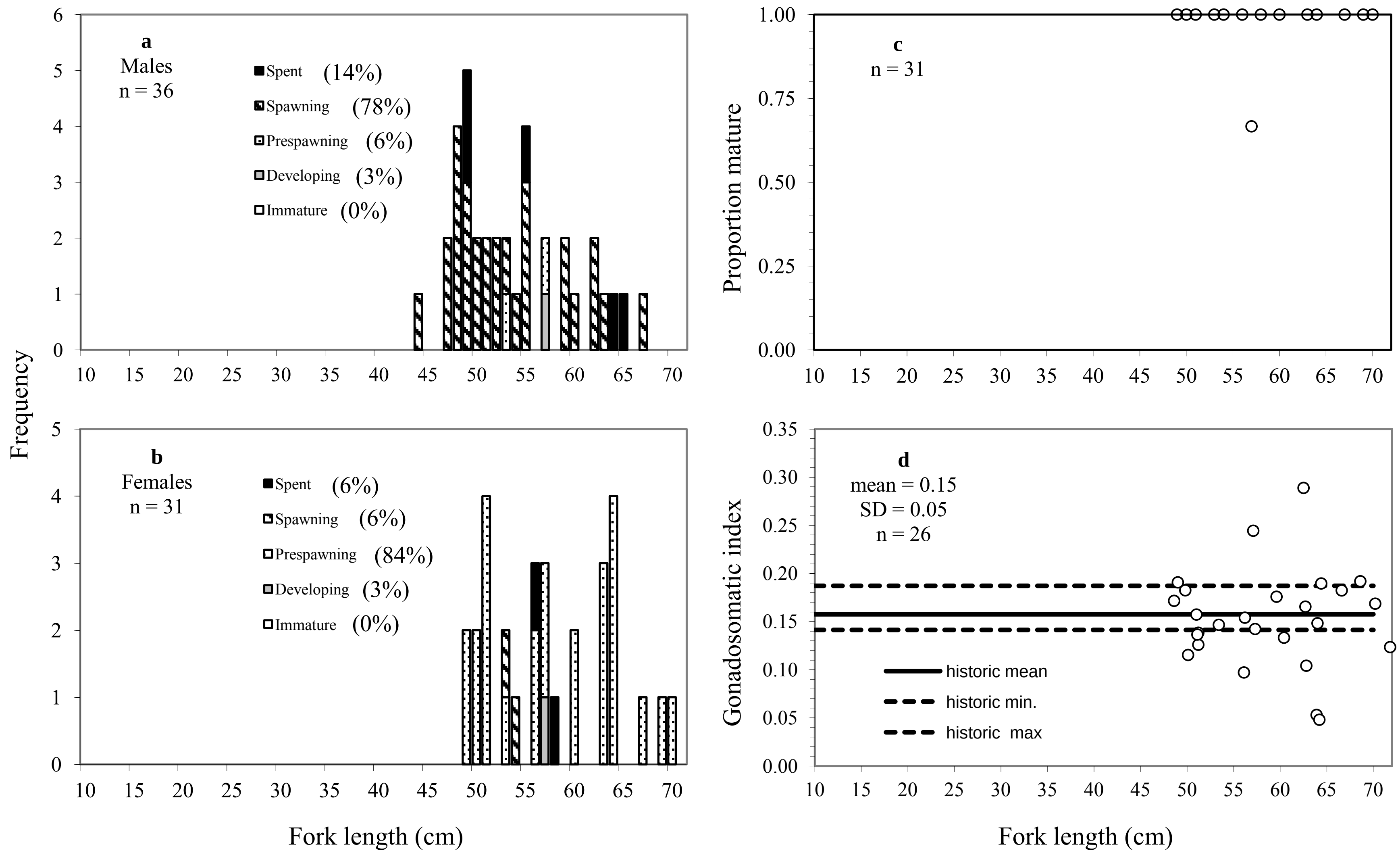

Figure 5. -- Maturity stages and percentage of fish in each for (a) male and (b) female walleye pollock; (c) proportion mature by 1-cm size group for female walleye pollock; and (d) gonadosomatic index for pre-spawning females examined during the 2012 acoustic-trawl survey of Sanak Trough with historic survey mean, and minimum and maximum historic survey means.

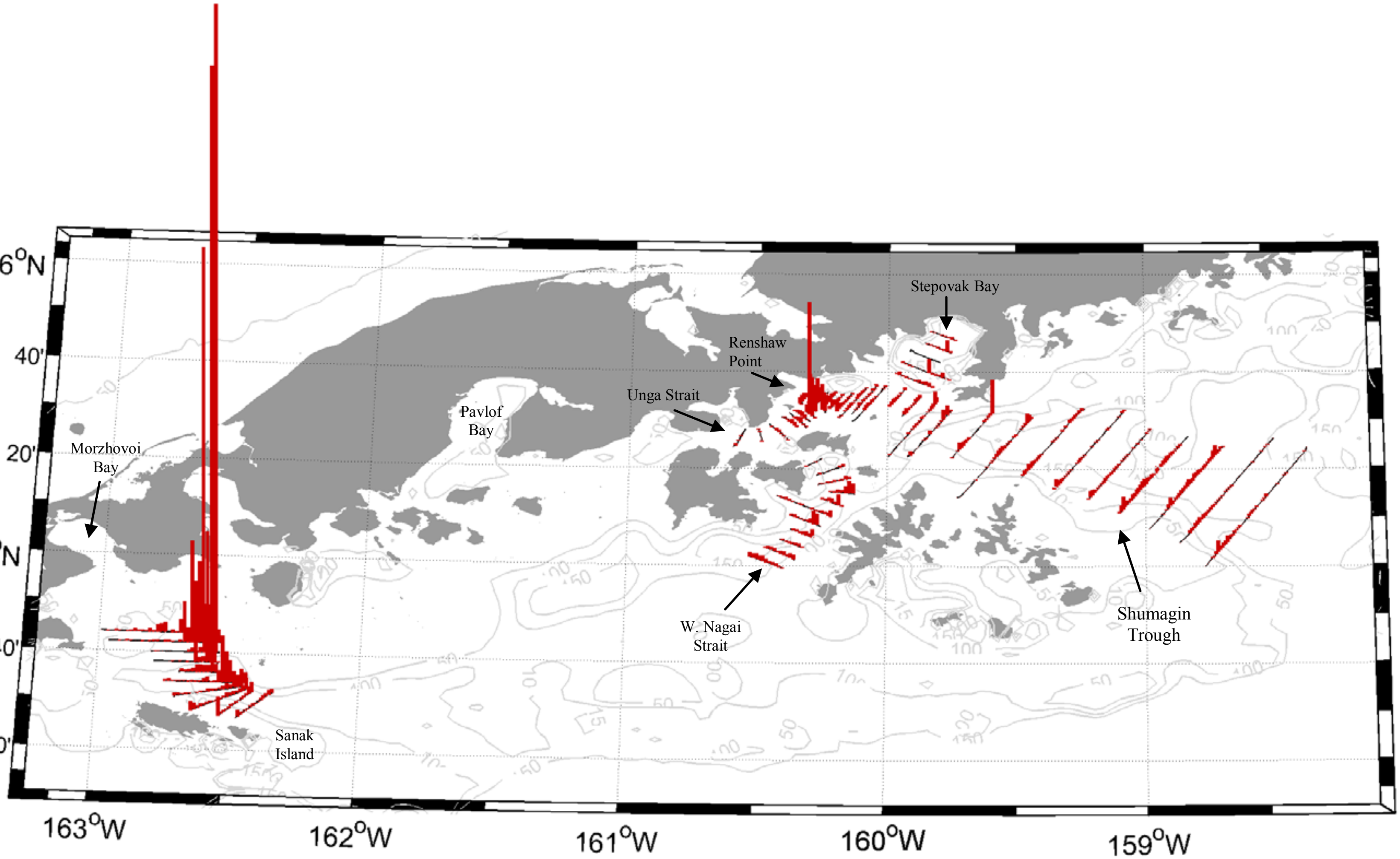

Figure 6. -- Acoustic backscatter (s_A) attributed primarily to walleye pollock (vertical lines) along tracklines surveyed during the winter 2012 acoustic-trawl survey of Sanak Trough and the Shumagin Islands.

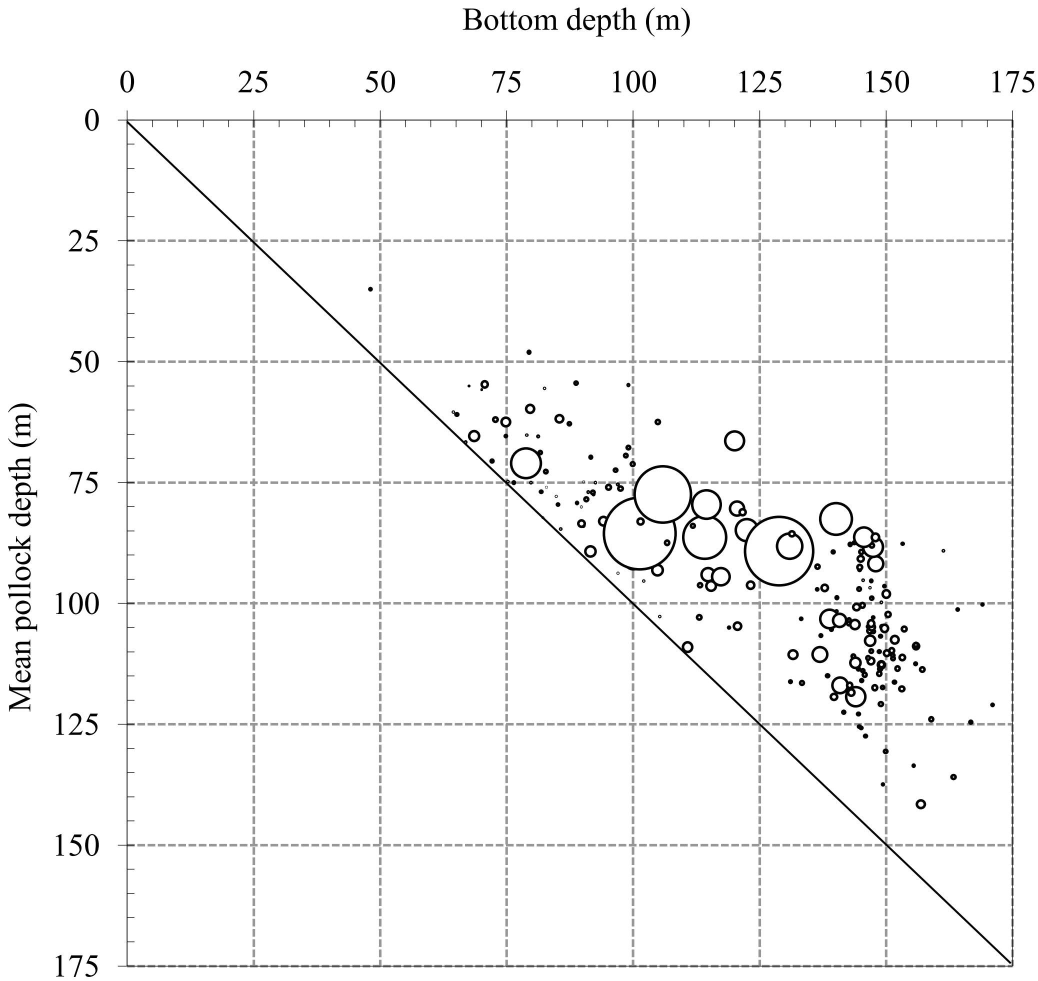

Figure 7. -- Average pollock depth (weighted by biomass) versus bottom depth (m) by 0.5-nmi interval for walleye pollock during the winter 2012 acoustic-trawl survey of Sanak Trough. Circle size is scaled to the maximum biomass.

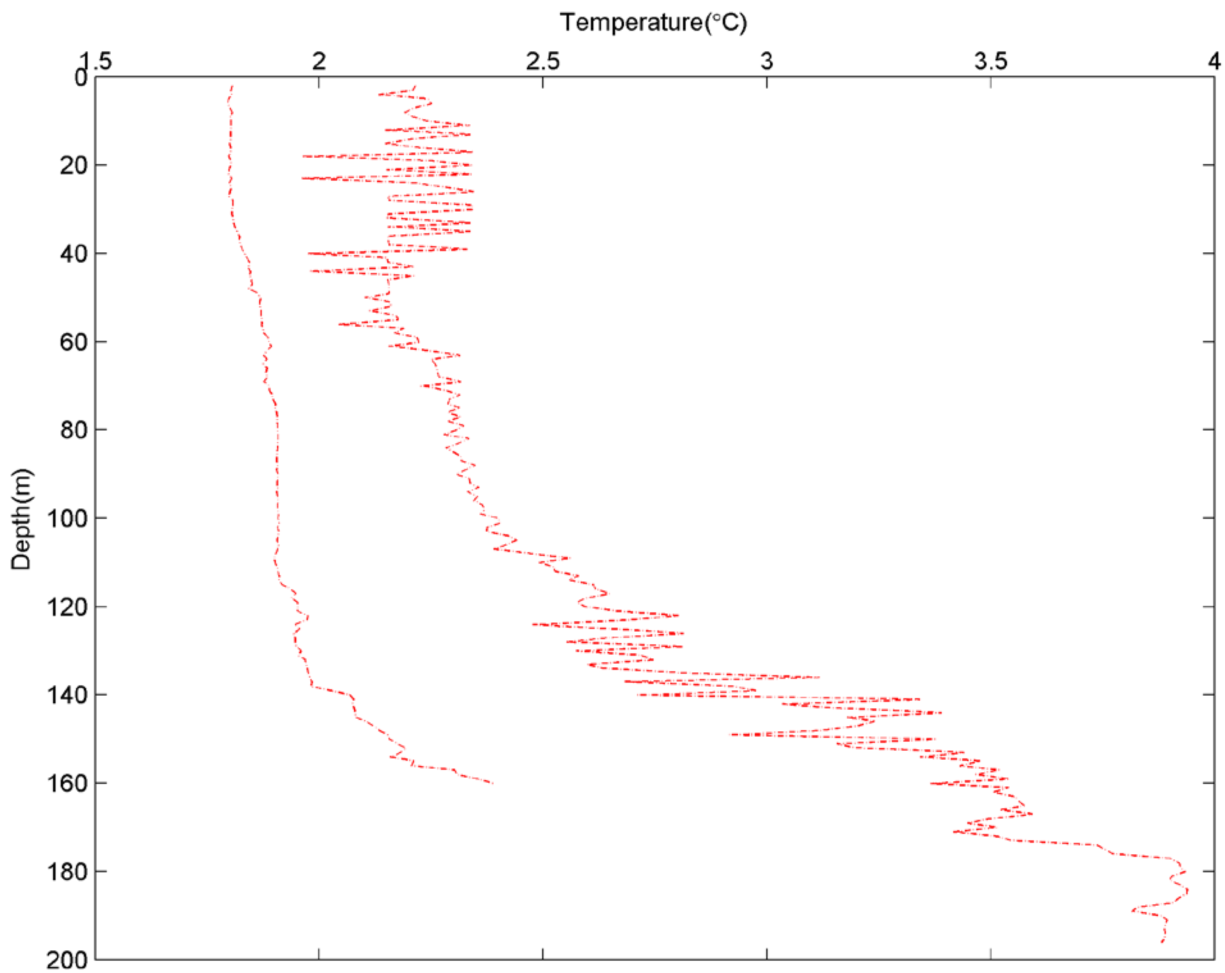

Figure 8. -- Water temperature (°C) by 1-m depth intervals observed during the winter 2012 acoustic-trawl survey of walleye pollock in the Shumagin Islands. Data collected at two trawl locations with Sea-Bird Electronics temperature-depth probe (SBE-39) attached to the trawl headrope.

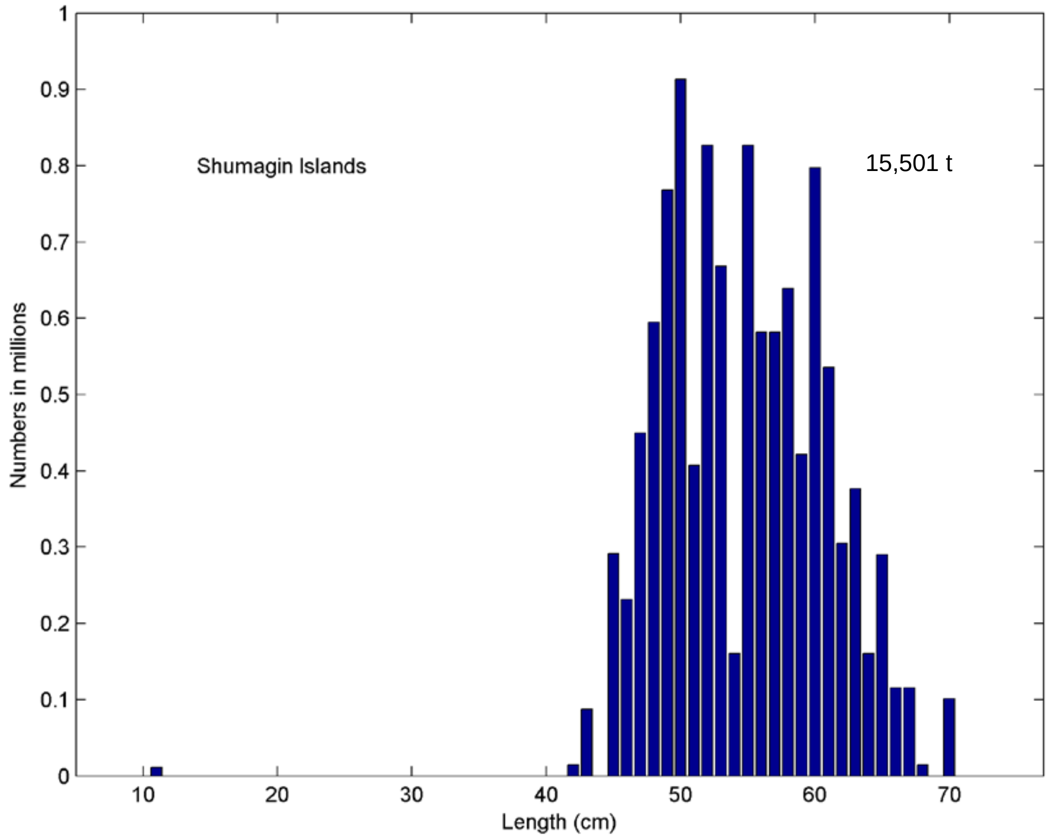

Figure 9. -- Length distribution of walleye pollock (numbers) and biomass estimate (metric tons, t) for the 2012 acoustic-trawl survey of Shumagin Islands.

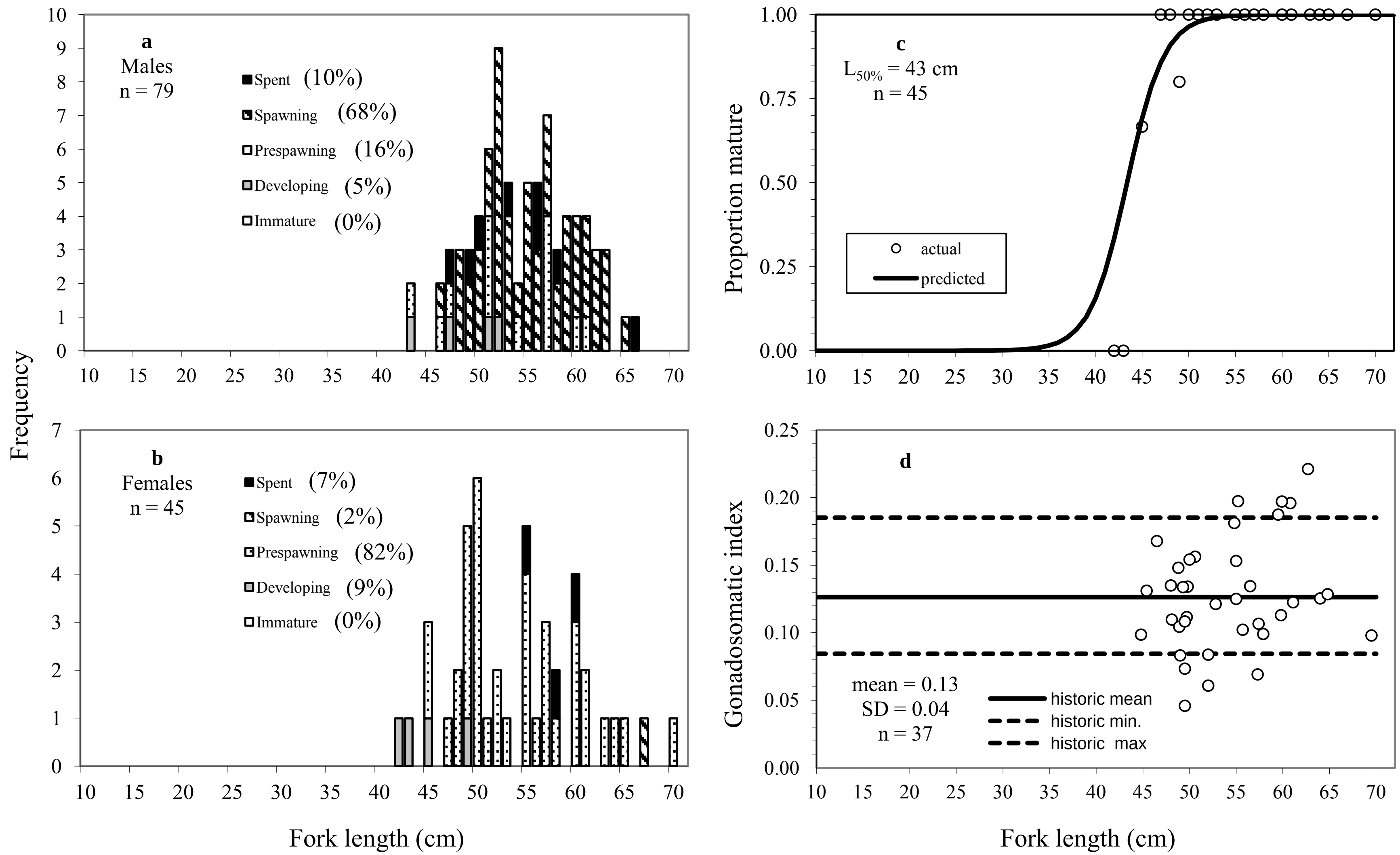

Figure 10. -- Maturity stages and percentage of fish in each for (a) male and (b) female walleye pollock; (c) proportion mature by 1-cm size group for female walleye pollock; and (d) gonadosomatic index for pre-spawning females examined during the 2012 acoustic-trawl survey of the Shumagin Islands with historic survey mean, and minimum and maximum of historic survey means.

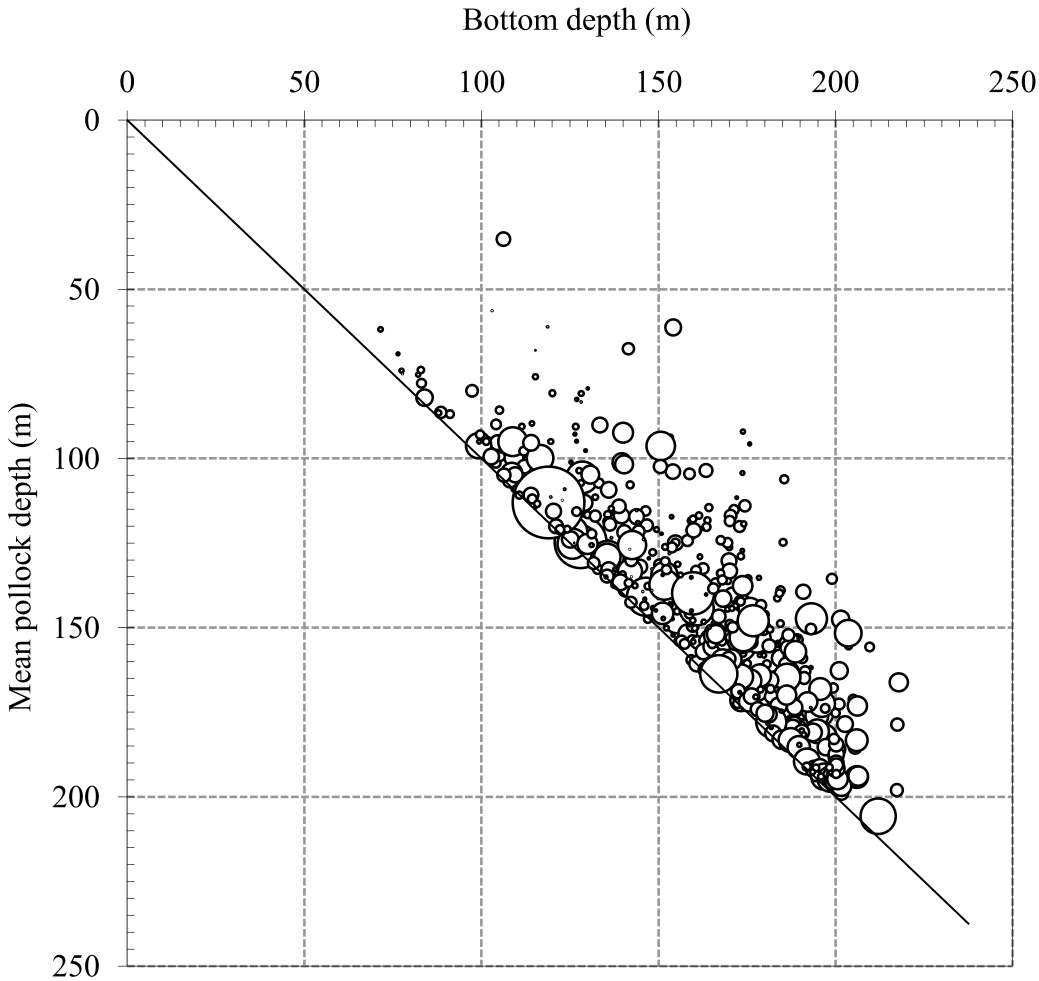

Figure 11. -- Average pollock depth (weighted by biomass) versus depth (m) by 0.5 nautical mile for walleye pollock observed during the winter 2012 acoustic-trawl survey of Shumagin Islands area. Circle size is scaled to the maximum biomass.

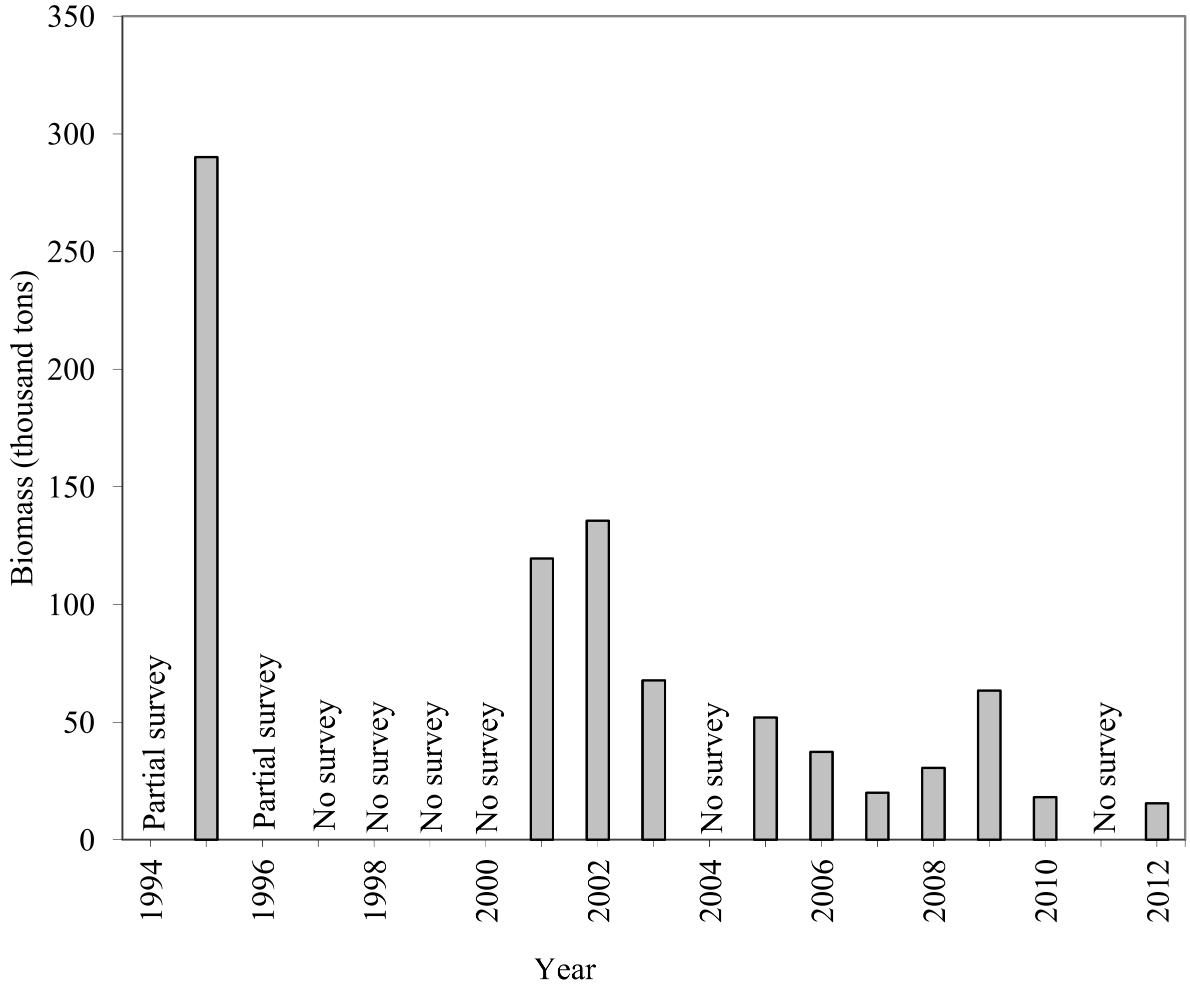

Figure 12. -- Summary of walleye pollock biomass estimates (thousand tons) based on acoustic-trawl surveys of the Shumagin Islands area.

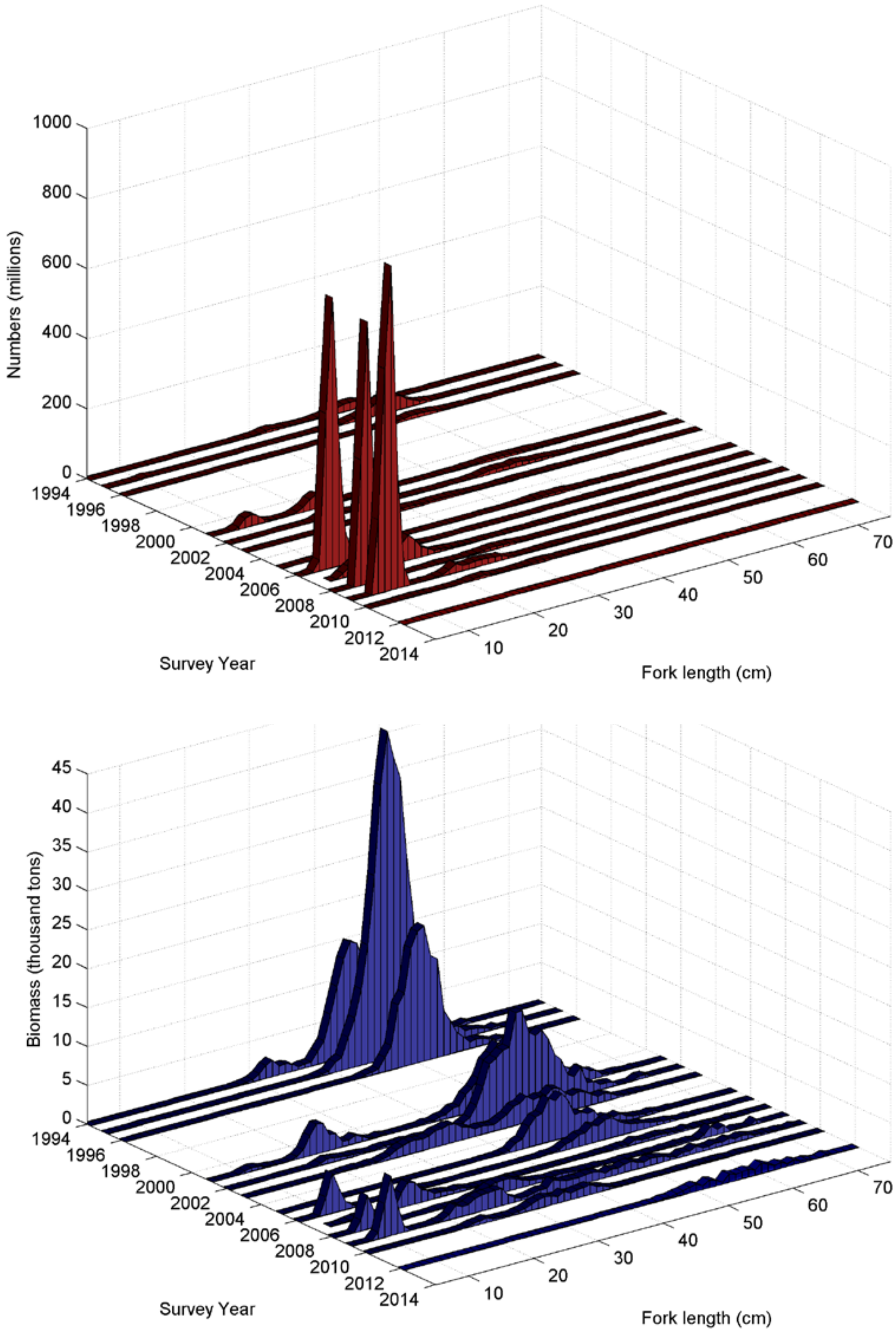

Figure 13. -- Walleye pollock biomass in thousands of metric tons and numbers in millions at length from the Shumagin Islands acoustic-trawl surveys since 1994. No surveys were conducted in 1997-2000, 2004, or 2011.

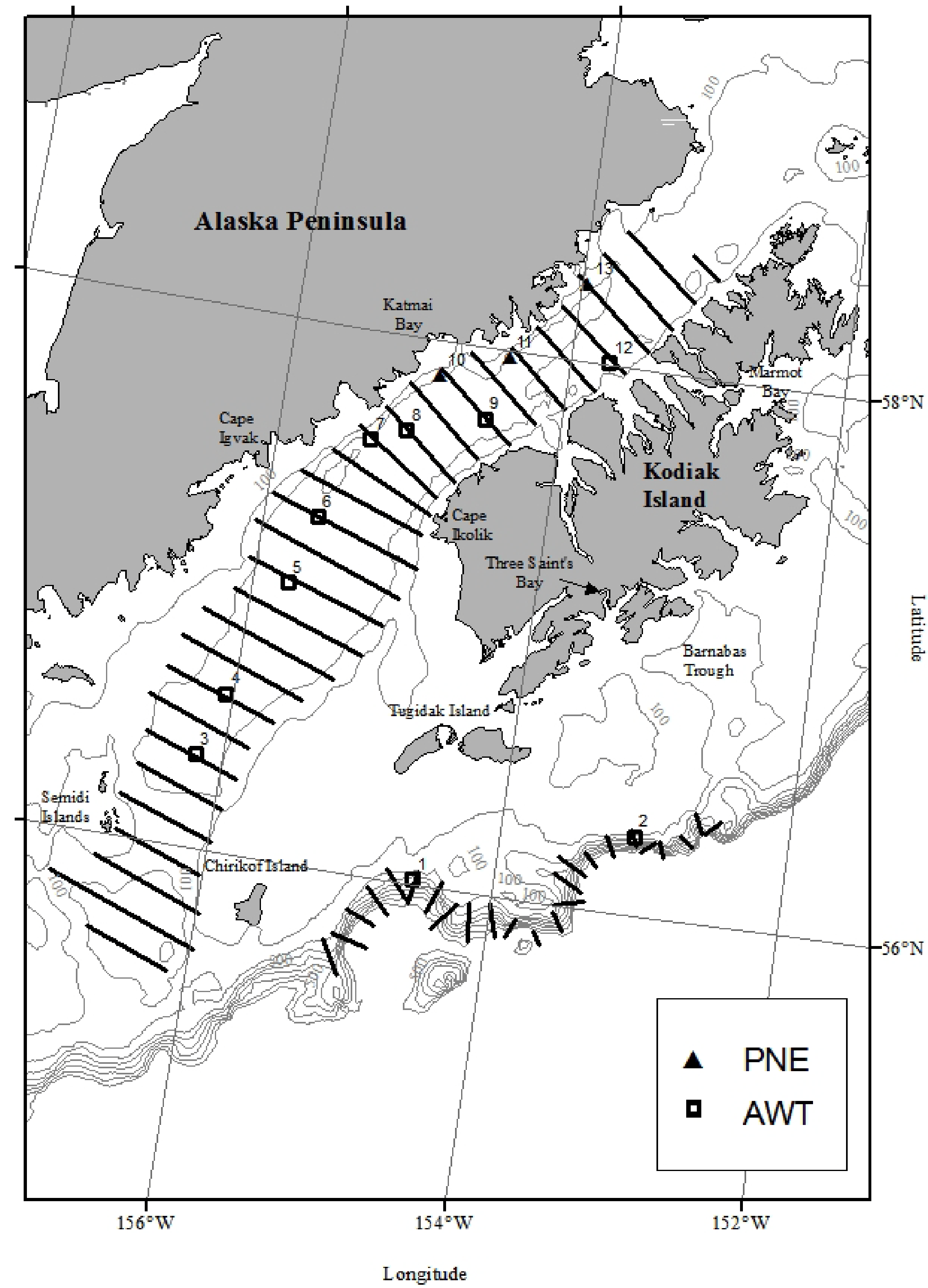

Figure 14. -- Transect lines and locations of Aleutian-wing trawl (AWT) and poly-Nor'eastern trawl (PNE) hauls during the winter 2012 acoustic-trawl survey of walleye pollock in the Shelikof Strait area, and along the Gulf of Alaska shelf break from Chirikof Island to Barnabas Trough.

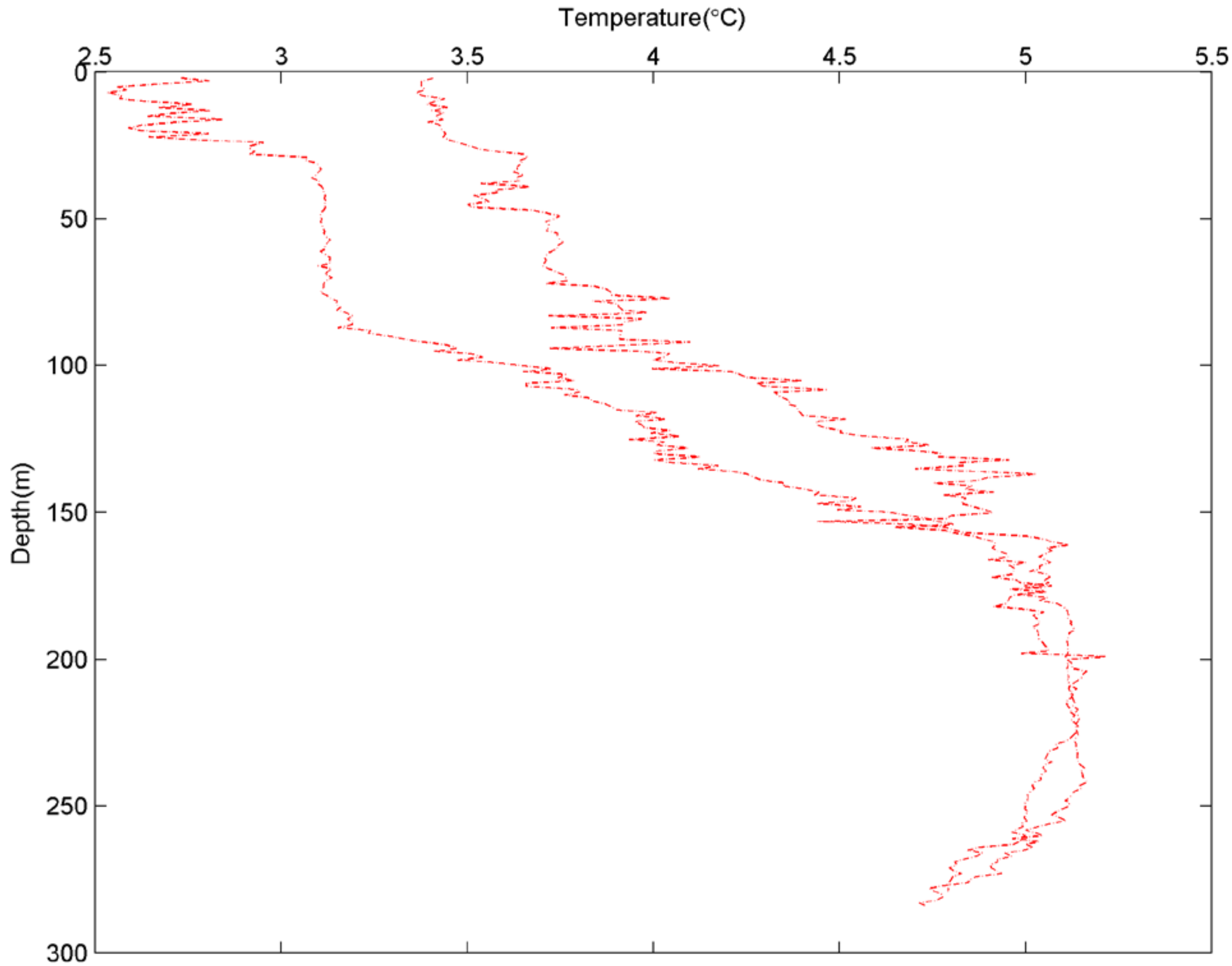

Figure 15. -- Water temperature (°C) by 1-m depth intervals observed during the winter 2012 acoustic-trawl survey of walleye pollock on the Chirikof Shelf Break. Data collected at two trawl locations with Sea-Bird Electronics temperature-depth probe (SBE-39) attached to the trawl headrope.

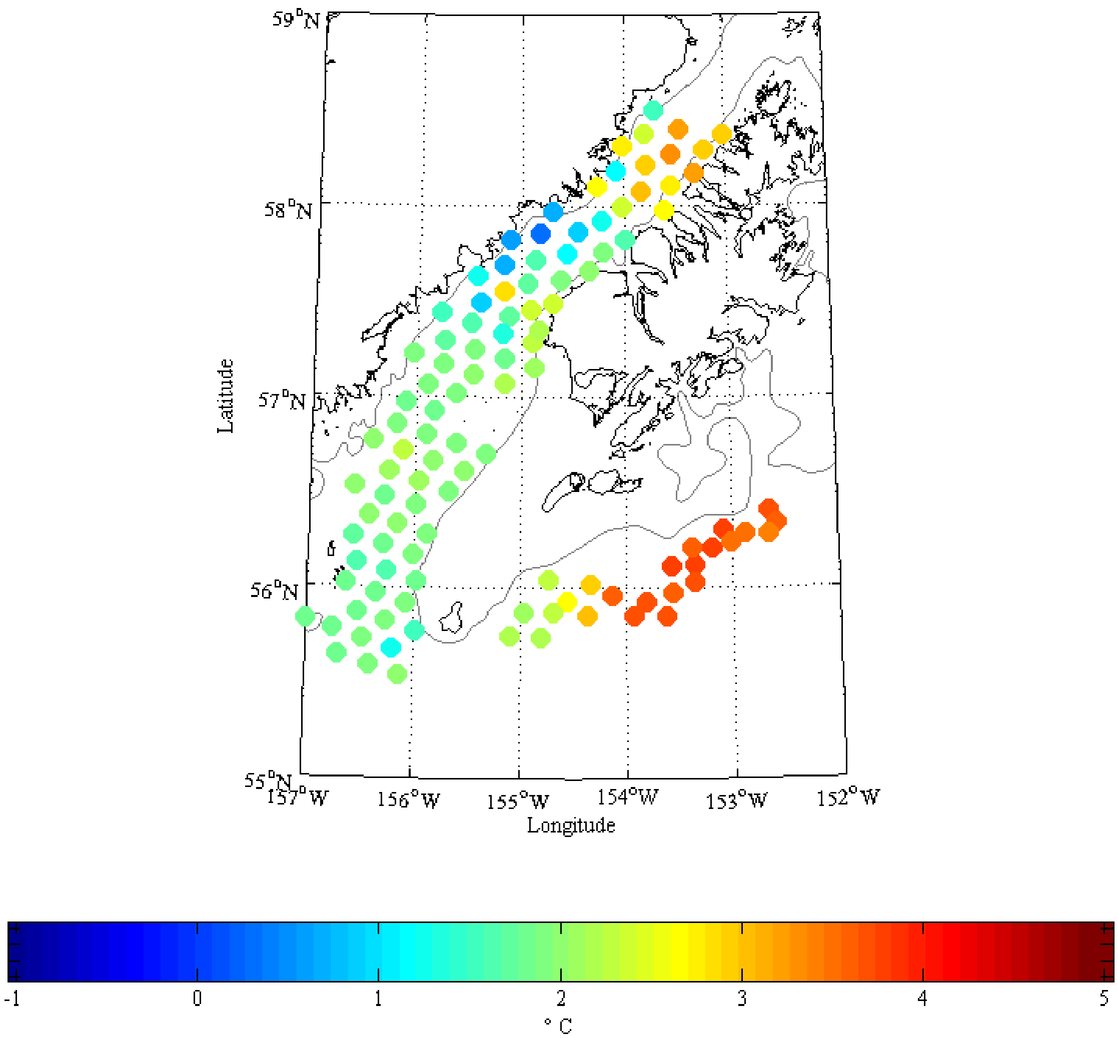

Fig 16. -- Surface water temperatures during DY1203 Chirikof/Shelikof Strait survey recorded from the ship's Furuno T-2000 temperature probe located 1.4 m below the surface.

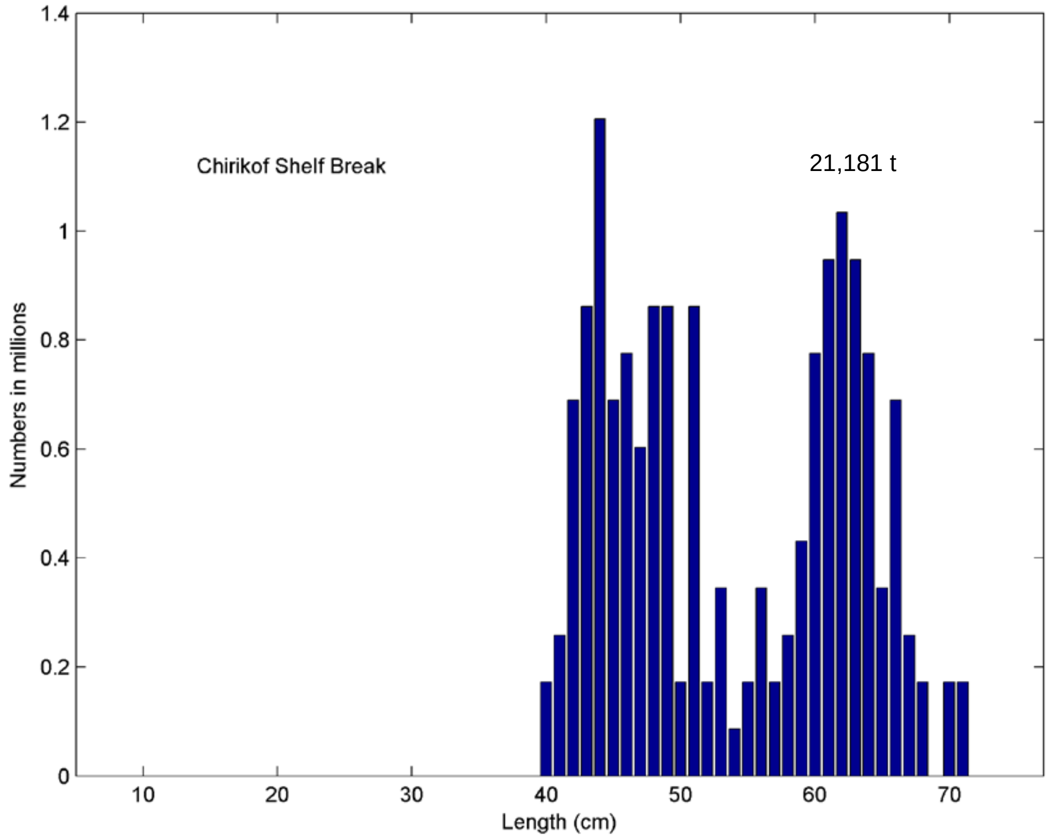

Figure 17. -- Length distribution of walleye pollock (numbers) and biomass estimate (metric tons, t) for the 2012 acoustic-trawl survey of the Chirikof shelf break.

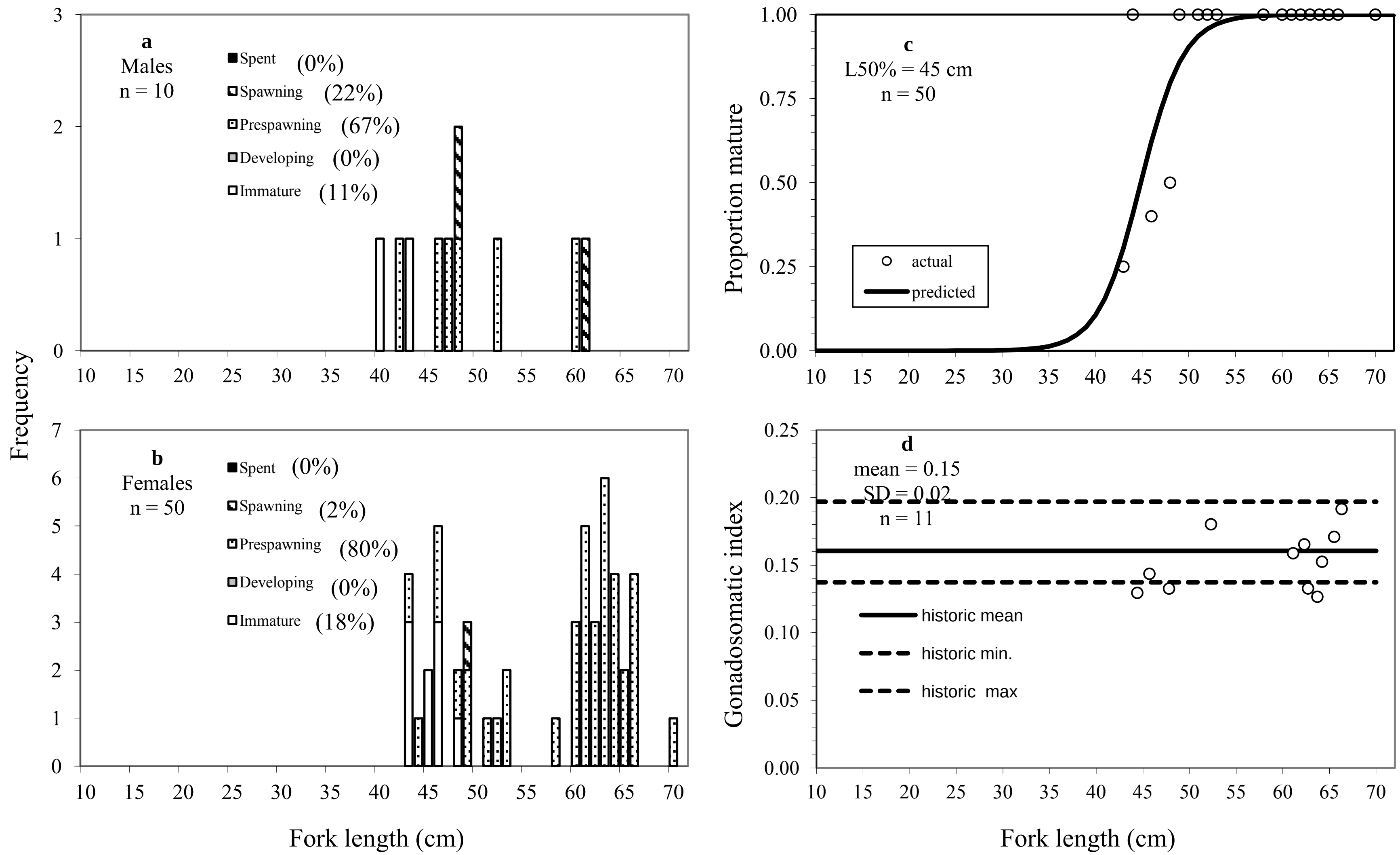

Figure 18. -- Maturity stages and percentage of fish in each for (a) male and (b) female walleye pollock; (c) proportion mature by 1-cm size group for female walleye pollock; and (d) gonadosomatic index for pre-spawning females examined during the 2012 acoustic-trawl survey of the Chirikof shelf break, with historic survey mean, and minimum and maximum historic survey means.

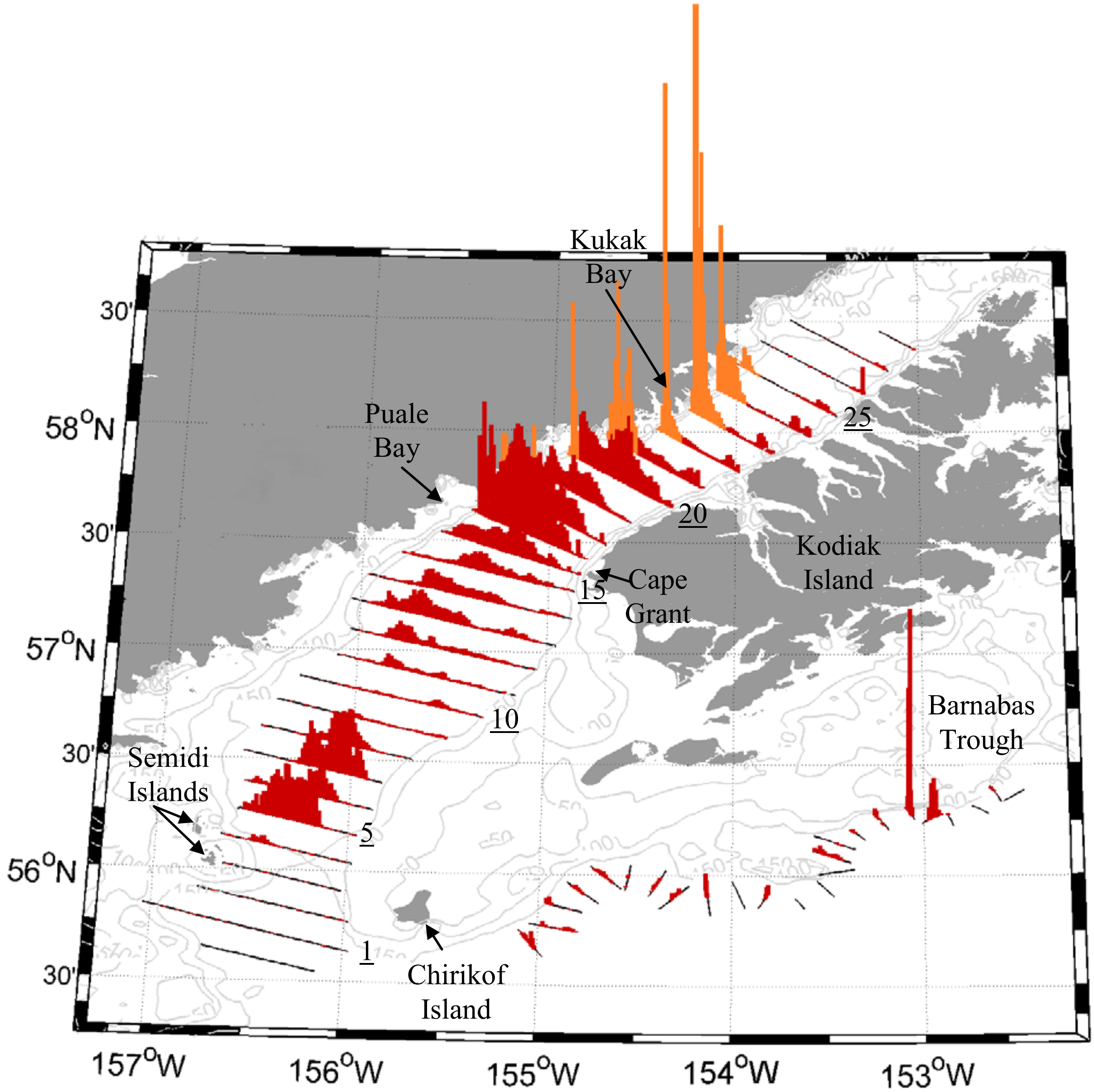

Figure 19. -- Acoustic backscatter (s_A) attributed to walleye pollock (vertical lines) along tracklines surveyed during the winter 2012 acoustic-trawl survey of the Shelikof Strait area and along the Gulf of Alaska shelf break from Chirikof Island to Barnabas Trough. Backscatter designated in red consists of midwater schools and near bottom aggregations. Backscatter designated in orange consists of pre-spawning adult aggregations. Underlined numerals indicate transect number (an additional transect was added at the southern extent of the strait and is therefore out of sequence numerically).

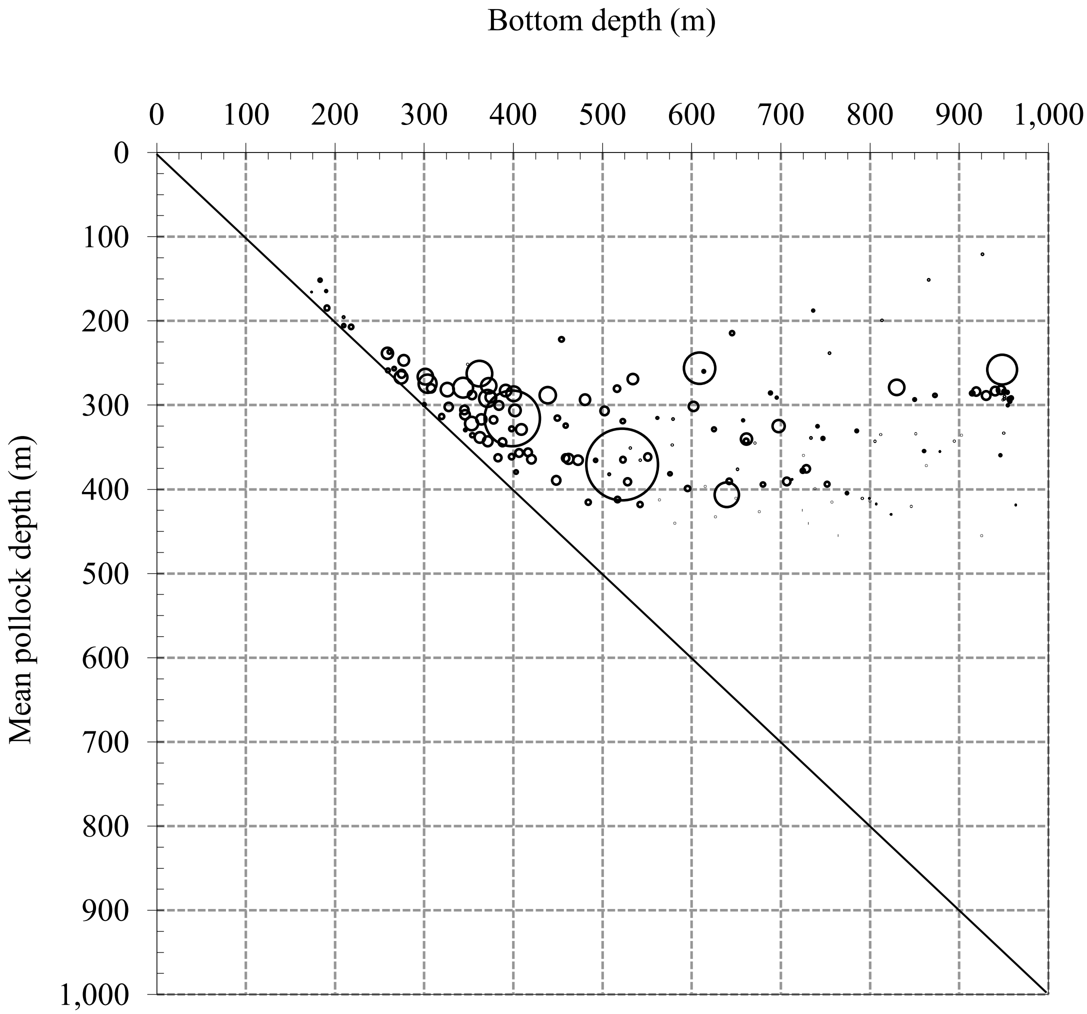

Figure 20. -- Average pollock depth (weighted by biomass) versus bottom depth (m) by 0.5-nmi interval for walleye pollock during the winter 2012 acoustic-trawl survey of the Chirikof Island area. Circle size is scaled to the maximum biomass.

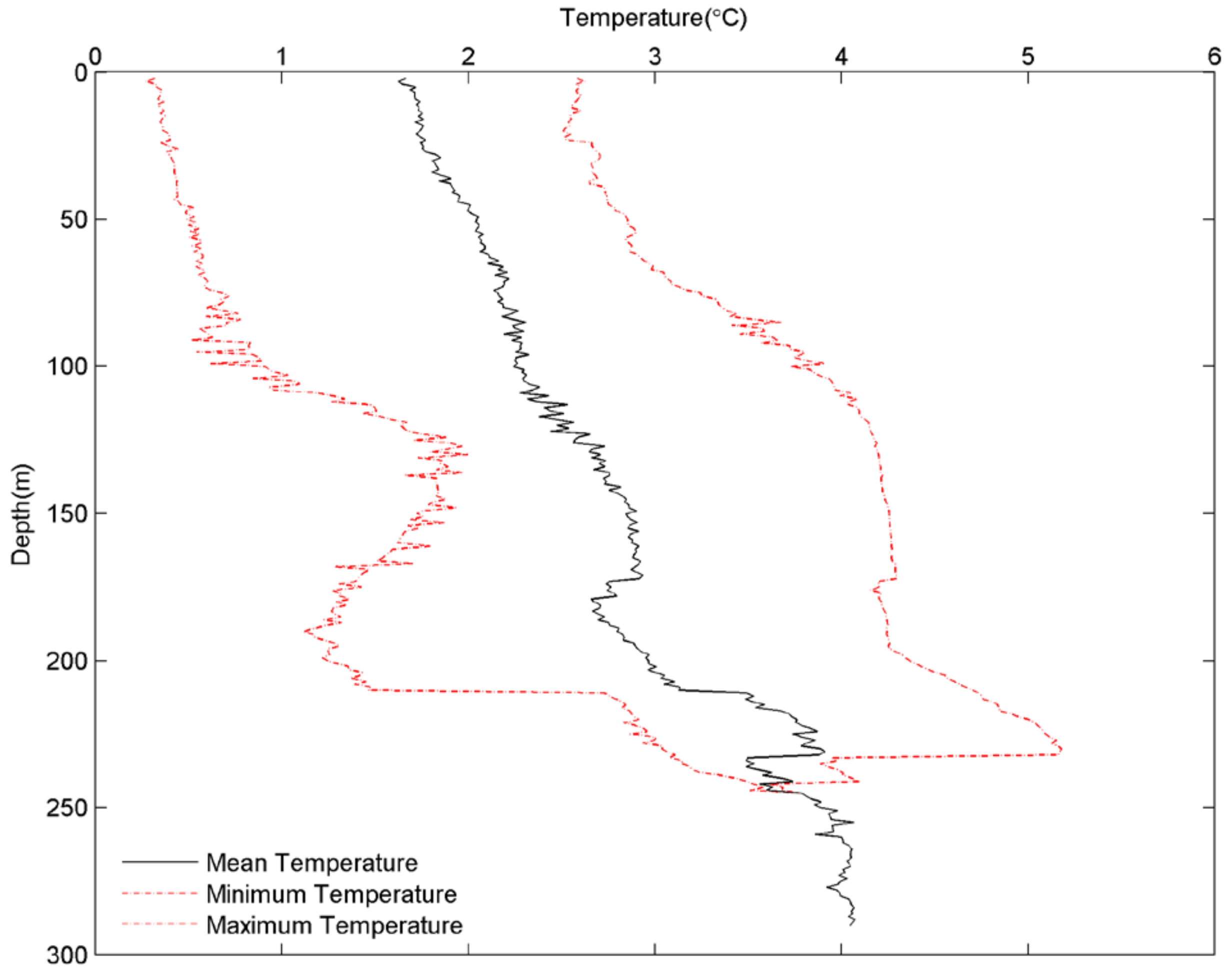

Figure 21. -- Mean water temperature (°C) (solid line) by 1-m depth intervals observed during the winter 2012 acoustic-trawl survey of walleye pollock in Shelikof Strait. Data collected at 10 trawl locations with Sea-Bird Electronics temperature-depth probe (SBE-39) attached to the trawl headrope. Dashed-lines represent minimum and maximum temperatures observed.

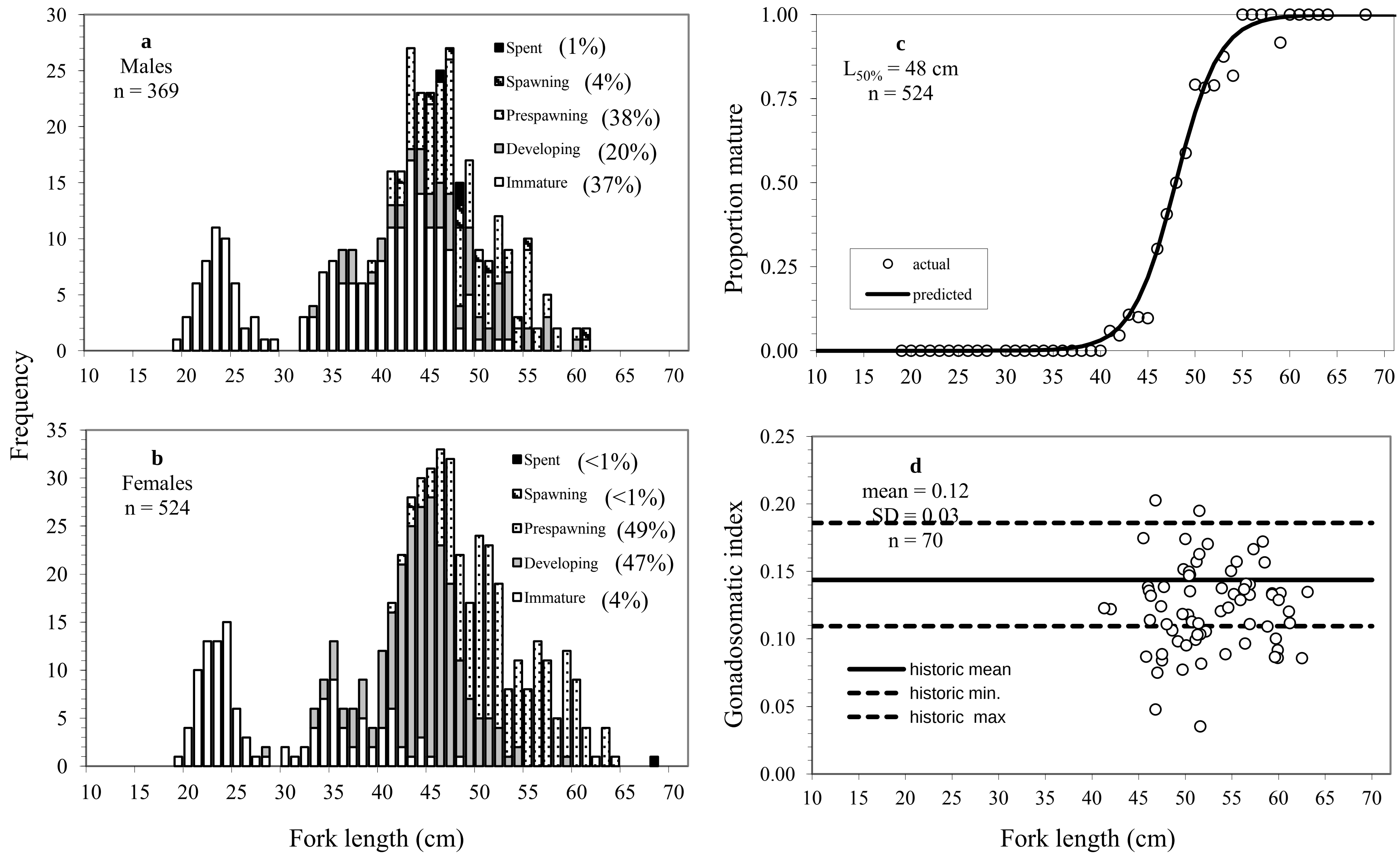

Figure 22. -- Maturity stages and percentage of fish in each for (a) male and (b) female walleye pollock; (c) proportion mature by 1-cm size group for female walleye pollock; and (d) gonadosomatic index for pre-spawning females examined during the 2012 acoustic-trawl survey of Shelikof Strait, with historic survey mean, and minimum and maximum historic survey means.

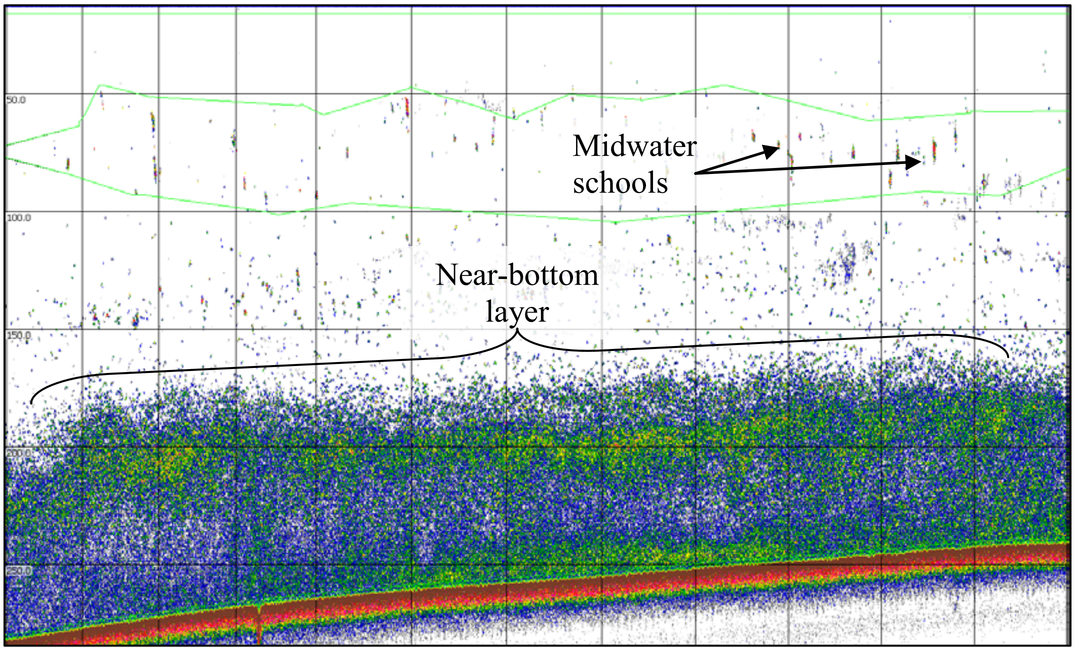

Fig 23. -- Example of acoustic backscatter from mid-water schools and near-bottom layer in Shelikof Strait (transect 17) during winter AT survey DY1203.

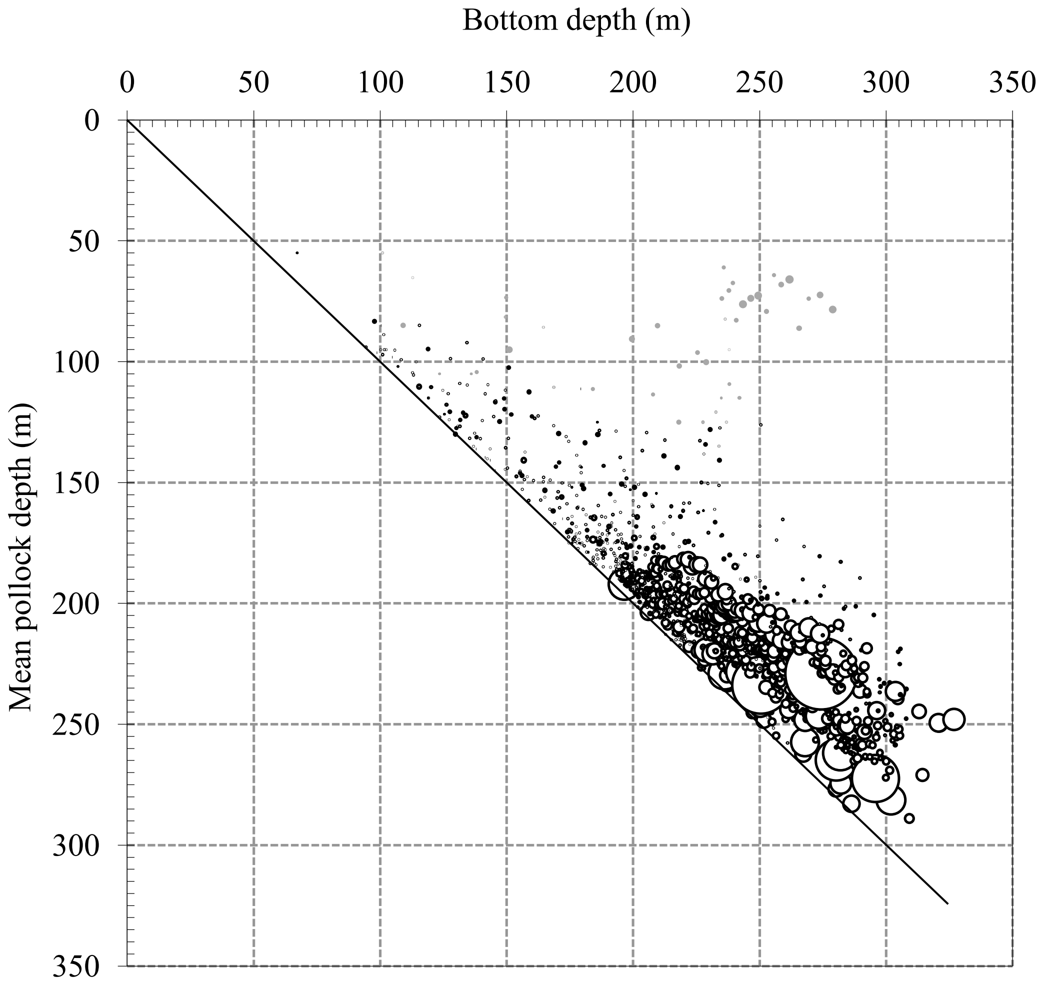

Figure 24. -- Average pollock depth (weighted by biomass) versus depth (m) by 0.5-nmi interval for near-bottom walleye pollock (open circles) and mid-water juvenile walleye pollock (gray circles) for the winter 2012 acoustic-trawl survey of the Shelikof Strait area. Circle size is scaled to the maximum biomass.

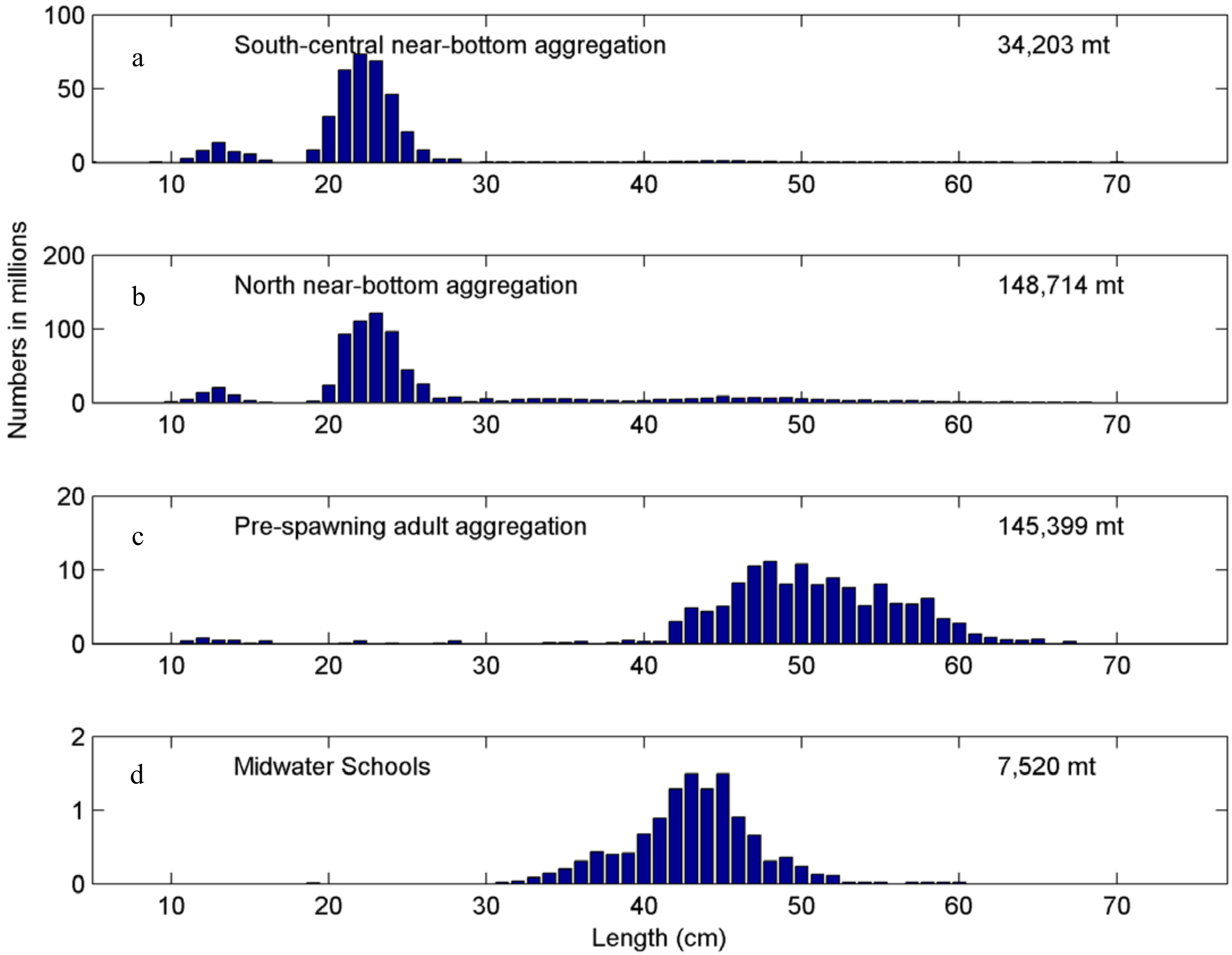

Figure 25. -- Length distribution of walleye pollock (numbers) and biomass for the 2012 acoustic-trawl surveys of (a) the near bottom mix in the south-central portion of Shelikof Strait near the Semidi Islands, (b) near-bottom mix in the north and eastern side of Shelikof Strait, (c) "spawning" aggregations in the northwest portion of Shelikof Strait, and (d) midwater schools in north central Shelikof Strait.

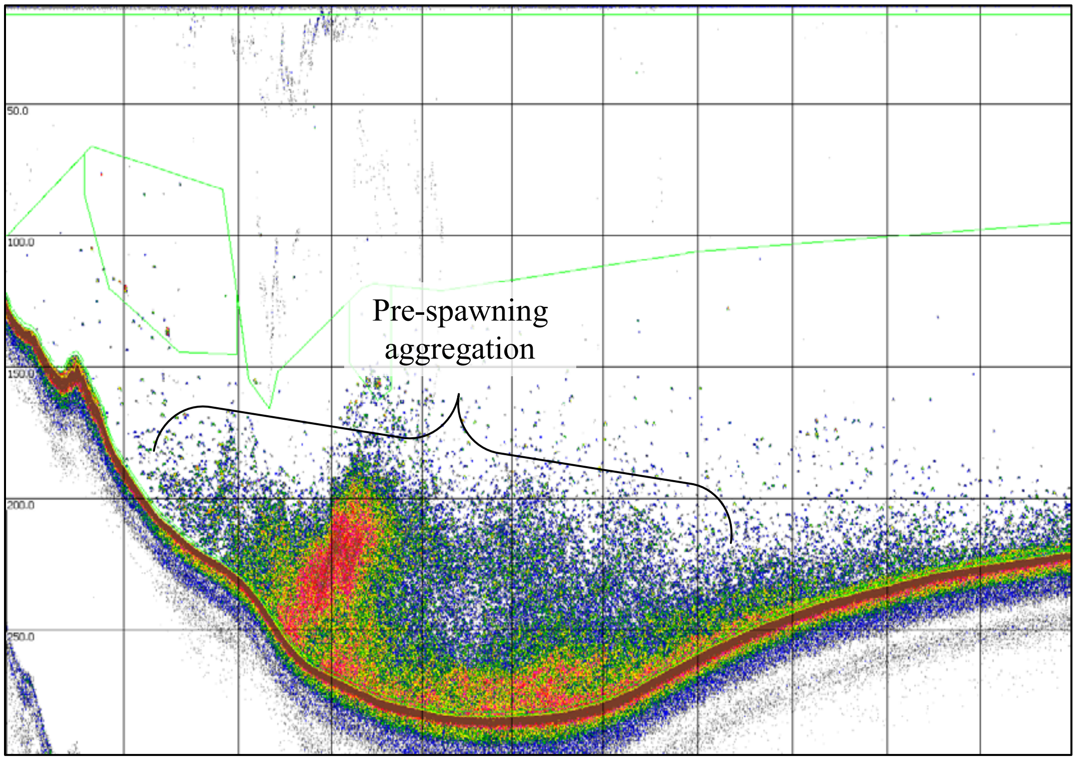

Fig 26. -- Example of acoustic backscatter of pollock pre-spawning aggregation on northwest side of Shelikof Strait (transect 23) near Alaska Peninsula during winter AT survey DY1203.

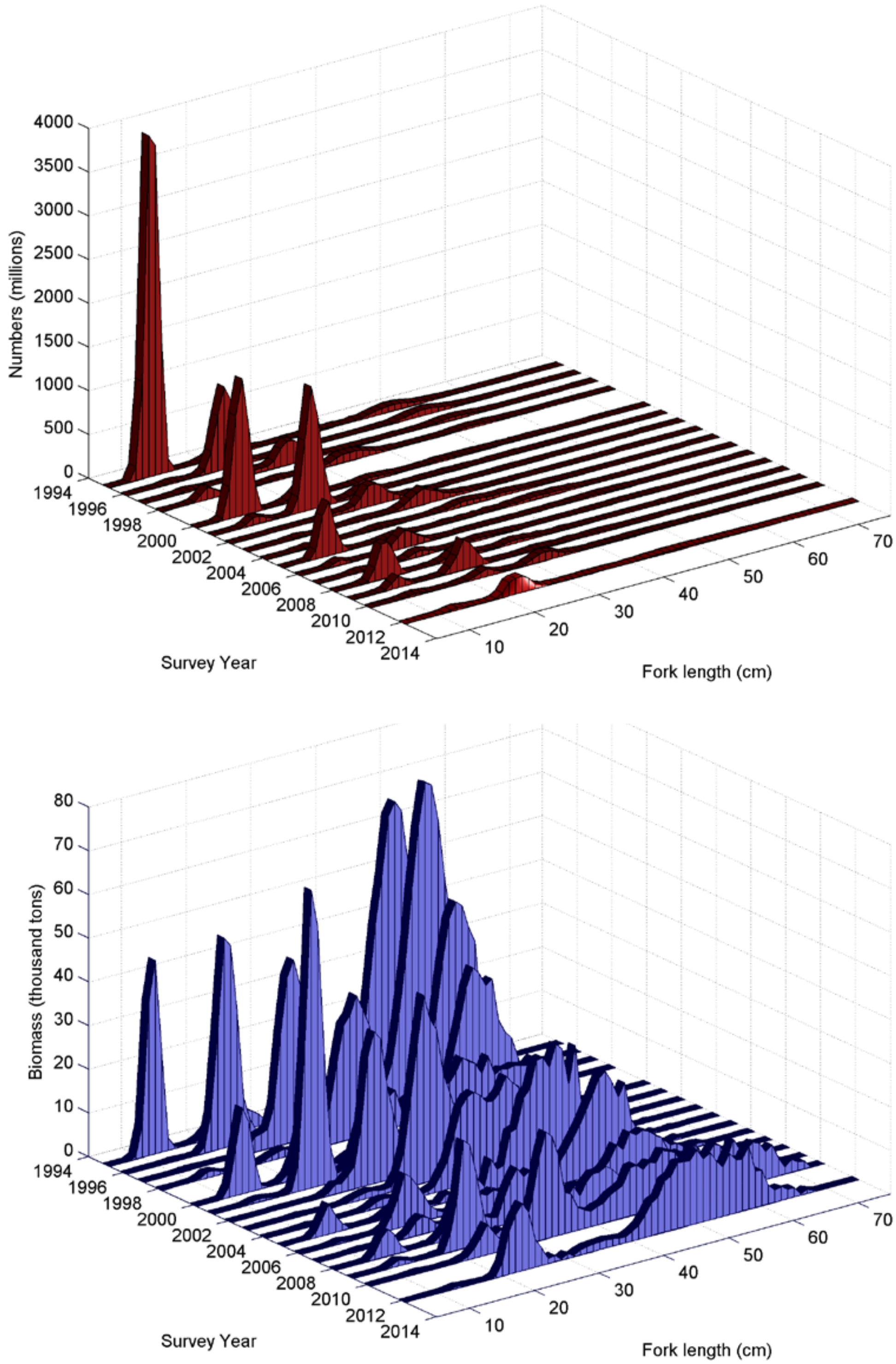

Figure 27. -- Walleye pollock numbers at length in millions and biomass in thousands of metric tons from the Shelikof Strait acoustic-trawl surveys since 1995. Surveys were not conducted in 1999 or 2011.

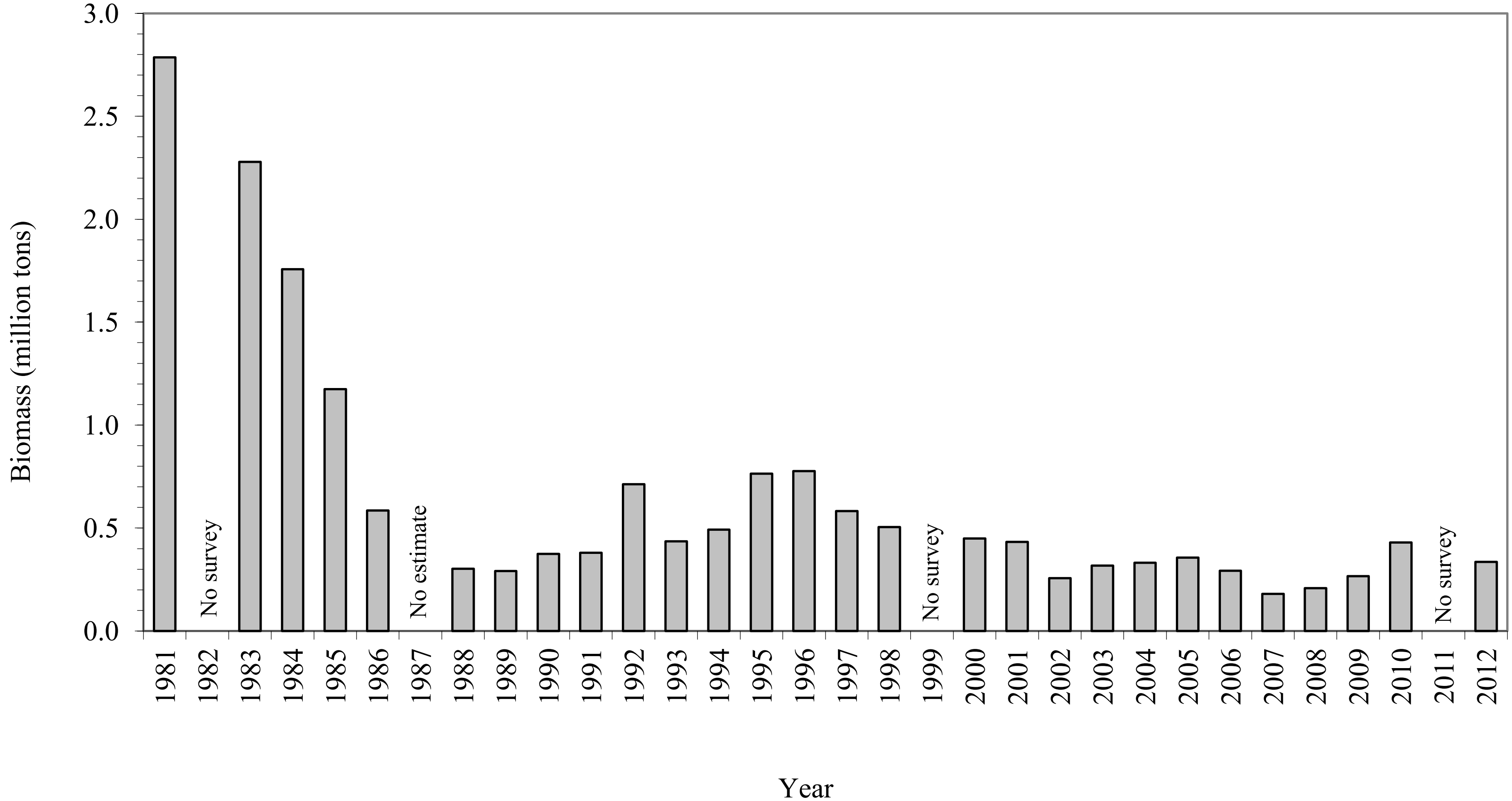

Figure 28. -- Summary of walleye pollock biomass estimates (million tons) based on acoustic-trawl surveys of the Shelikof Strait area.

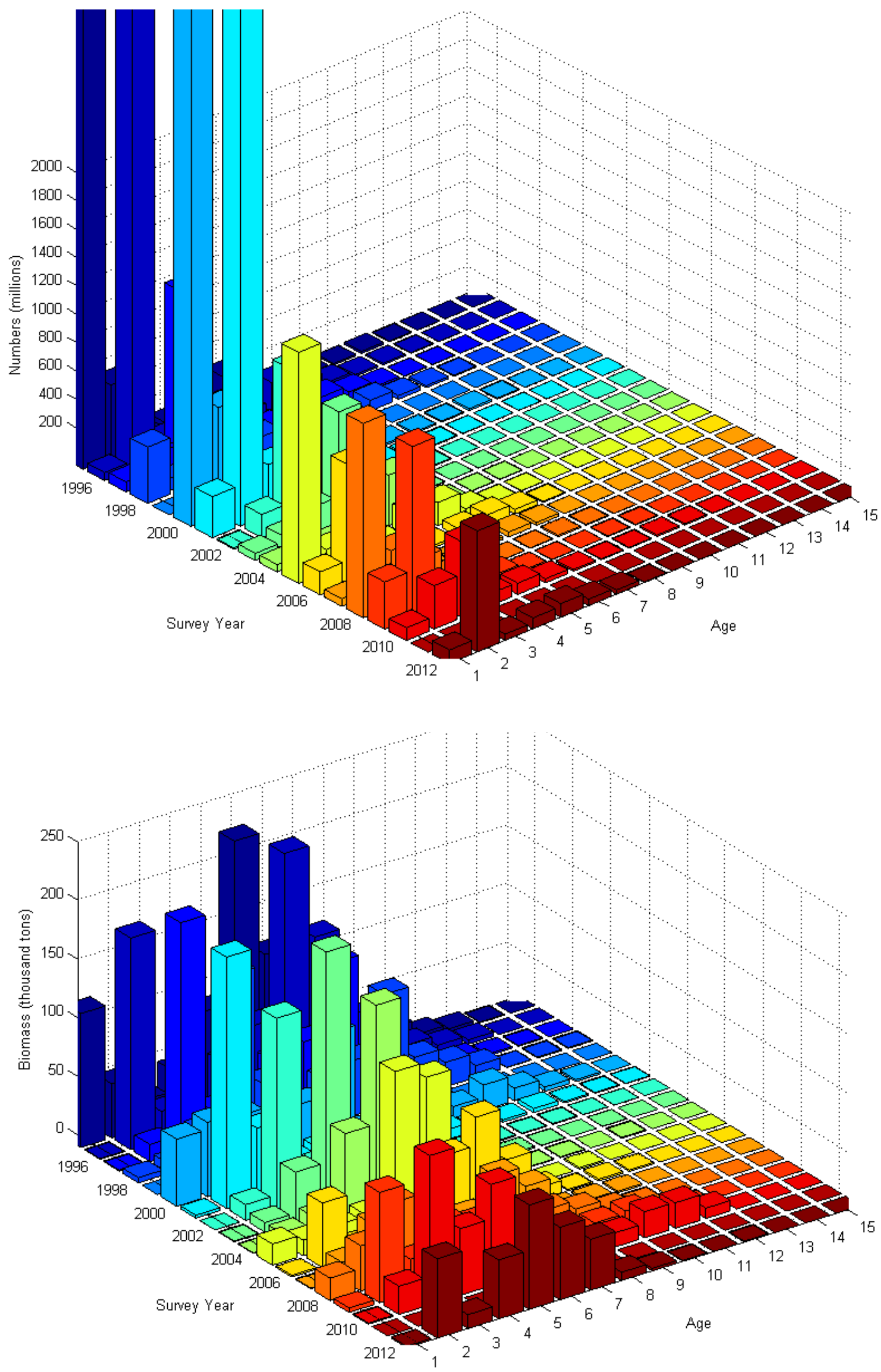

Figure 29. -- Walleye pollock numbers at age in millions and biomass at age in thousands of metric tons from the Shelikof Strait acoustic-trawl surveys since 1995. Surveys were not conducted in 1999 or 2011.

APPENDIX I. ITINERARY

DY2012-01

Sanak Trough/Shumagin Islands

13 Feb.	Depart Kodiak, AK.
14 Feb.	Acoustic sphere calibration in Ikatan Bay, Alaska Peninsula, AK.
15 Feb.	Acoustic-trawl survey of Sanak Trough.
16-19 Feb.	Acoustic-trawl surveys of Shumagin Islands.
19-22 Feb.	Multibeam acoustic surveys of select locations and deploy ARGO drifters.
22 Feb.	Arrive Kodiak, AK. End cruise.

DY2012-03

Chirikof Shelf Break/Shelikof Strait

17-19 Mar.	Acoustic-trawl survey of Chirikof shelf break.
19 Mar.	Scientific crew transfer Kodiak, AK.
20-26 Mar.	Acoustic-trawl survey of the Shelikof Strait.
26 Mar.	Acoustic sphere calibration in Malina Bay, Afognak Island, AK.
27 Mar.	Arrive Kodiak, AK. End cruise.

APPENDIX II. SCIENTIFIC PERSONNEL

DY2012-01

Shumagin Islands/Sanak Trough

Name	Position	Organization
Michael Guttormsen	Chief Scientist	AFSC
Paul Walline	Fishery Biologist	AFSC
Scott Furnish	Computer Spec.	AFSC
Denise McKelvey	Fishery Biologist	AFSC
William Floering	Fishery Biologist	AFSC
Carwyn Hammond	Fishery Biologist	AFSC

DY2012-03

Shelikof Strait/Chirikof Shelf Break

Name	Position	Organization
Michael Guttormsen	Chief Scientist/Shelikof	AFSC
Denise McKelvey	Chief Scientist/Chirikof	AFSC
Darin Jones	Fishery Biologist	AFSC
Scott Furnish	Computer Spec.	AFSC
William Floering	Fishery Biologist	AFSC
Taina Honkalehto	Fishery Biologist/Chirikof	AFSC
Patrick Ressler	Fishery Biologist/Shelikof	AFSC
Mike Canino	Fishery Biologist/Shelikof	AFSC
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