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Results of the Acoustic-Trawl Surveys of Walleye Pollock (*Gadus chalcogrammus*) in the Gulf of Alaska, February-March 2014 (DY2014-01 and DY2014-03)

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INTRODUCTION

The Midwater Assessment and Conservation Engineering (MACE) Program of the Alaska Fisheries Science Center's (AFSC) Resource Assessment and Conservation Engineering (RACE) Division conducts annual 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 (*Gadus chalcogrammus*). 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 due to vessel delays. The Shumagin Islands area has been surveyed annually since 2001 (except in 2004 and 2011) with prior surveys in 1994-1996. Sanak Trough has been surveyed annually since 2002 (except in 2004 and 2011), and the GOA continental shelf break east of Chirikof Island to Barnabas Trough has been surveyed annually since 2002 (except in 2011). Marmot Bay has been surveyed in the winter six times (1989, 1990, 1992, 2007, 2009, and 2010). This report presents the results from AT surveys conducted in the aforementioned areas of the GOA during February and March 2014.

METHODS

An AT survey of the Shumagin Islands area (comprised of Shumagin Trough, Stepovak Bay, Renshaw Point, Unga Strait, and West Nagai Strait) and Sanak Trough was conducted on 23-27 February (cruise DY2014-01). A second AT survey covered Shelikof Strait, Marmot Bay, and Izhut Bay from 15 to 24 March (cruise DY2014-03). Survey itineraries and scientific personnel are listed in Appendices I and II, respectively. The Shumagins survey started 2 weeks later than planned as the vessel was delayed leaving the dry dock and later experienced mechanical problems. Original plans included acoustic-trawl surveys of Morzhovoi and Pavlof Bays which were not completed due to insufficient time. An acoustic-trawl survey of the Chirikof shelf break was also planned, but this was not completed due to a severe storm on 12-13March. 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], and the acoustic units used here are defined in MacLennan et al. (2002).

Acoustic Equipment, Calibration, and Data Collection

Acoustic measurements were collected with a Simrad EK60 scientific echosounding system (Simrad 2008, 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.

Two standard sphere acoustic system calibrations were conducted to measure acoustic system performance. One calibration was conducted just prior to the surveys and the other immediately following the completion of the final survey. 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 then replaced with a 64 mm diameter copper sphere to calibrate 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 examined by moving each sphere through a grid of angular coordinates and collecting target-strength data using the ER60's calibration utility (Simrad 2008). Acoustic system gain and beam pattern parameters measured during the calibrations were used to provide a final parameter set for data analysis.

Acoustic data were recorded at the five split-beam frequencies using ER60 software (v. 2.2.1) and, as a backup, acoustic telegram data were logged with Myriax EchoLog 500 (v. 4.70.1.14256) software. Acoustic measurements were collected from 16 m below the sea

[1] National Marine Fisheries Service (NMFS) 2013. NOAA protocols for fisheries acoustics surveys and related sampling (Alaska Fisheries Science Center), 23 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/AFSC%20AT%20Survey%20Protocols_Feb%202013.pdf

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 (V. 5.4.90.23788).

Trawl Gear and Oceanographic Equipment

General trawl gear specifications for the sampling of acoustic backscatter are described below. Detailed trawl gear specifications are reported in Guttormsen et al. (2010). Midwater and near-bottom 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). Stretch 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, which was fitted with a single 12 mm (0.5 in) codend liner. Near-bottom and some midwater backscatter was also sampled with a poly Nor'eastern (PNE) bottom trawl, which is a 4-panel high-opening trawl with a 27.2 m (89.1ft) headrope and a 24.9 m (81.6 ft) footrope. The trawl was equipped with roller gear. Mesh sizes ranged from 13 cm (5 in) in the forward portion of the net to 8.9 cm (3.5 in) in the codend, which was fitted with a 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) at an approximate trawling speed of 1.6 m/sec (3.0 knots). A Marinovich midwater box trawl was tested during a single haul with 30 m bridles to determine its performance with the Fishbuster doors. The headrope and footrope each measured 12.2 m (40 ft). Mesh sizes decreased from 6.4 cm (2.5 in.) in the forward portion of the trawl to 1.9 cm (3/4 in.) in the aft section immediately forward of the codend. The 3.8 cm (1.5 in.) mesh codend was fitted with a 3 mm (1/8 in.) mesh liner. All trawl vertical 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 10 to 35 m (33-115 ft) and averaged 24 m (79 ft) while fishing. The PNE vertical mouth opening ranged from 8 to 10 m (20-26 ft) and averaged 9 m (23 ft) while fishing. The Marinovich vertical net opening was 6 m (20 ft) during the single test tow.

All of the AWT trawl hauls conducted in the Gulf of Alaska winter surveys included a Cam-Trawl stereo camera (Williams et al. 2010b) attached to the net forward of the codend. The Cam-Trawl was used to capture stereo images for species identification and length measurement of individual fish as they passed through the net toward the codend. Images were viewed and annotated using procedures described in Williams et al. (2010a). A permanently attached, small-mesh (12 mm) recapture net was affixed to the bottom panel of the AWT to provide an index of trawl escapement relative to fish length (Williams et al. 2011).

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 (SCS). Surface water temperatures were plotted as 1 nautical mile (nmi) averages along the vessel's cruise track.

Survey Design

The survey design consisted of a series of predetermined line transects in each survey area, parallel to one another except in areas where it was necessary to reorient transects to maintain a perpendicular alignment to the isobaths and to navigate around landmasses. Coverage and transect spacing were chosen to be consistent with previous surveys in each area. To add an element of randomization to this systematic transect design, the position of the first transect in each area was randomly jittered by an amount less than or equal to the intertransect distance, and then subsequent transects were laid out from this point (Rivoirard et al. 2000). Survey activities were conducted 24 hours/day.

Trawl hauls were conducted to identify the species composition of fish aggregations, acoustically observed and to determine biological characteristics of walleye pollock specimens. Catches were sorted to species. When large numbers of juvenile and adult walleye pollock were encountered, the predominant size groups were subsampled separately (e.g., age-1 vs. adults). Walleye pollock and other fishes were measured to the nearest 1 mm fork length (FL) using an electronic measuring board (Towler and Williams 2010), except for capelin (*Mallotus villosus*), which were measured to the nearest millimeter standard length. Walleye pollock were sampled to determine sex, body weight, age, and gonad maturity. The ovary weight of mature, pre-spawning females was also measured.

For each trawl in the Shumagins an average of 214 sex and length measurements were collected per haul from randomly sampled walleye pollock, including 11 to 50 individuals sampled for body weight, maturity, and age. In Shelikof and the surrounding areas, an average of 343 sex and length measurements were taken per haul, while as many as 65 individuals were more extensively sampled. 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 of the gonads and was categorized as immature, developing, pre-spawning, spawning, or post-spawning[2]. Trawl station information and biological measurements were electronically recorded to the Catch Logger for Acoustic Midwater Surveys (CLAMS) database. Pocket net contents were logged in a manner similar to, but separate from, the codend contents. Pocket net data were gathered to augment selectivity estimates obtained from previous surveys and will be reported elsewhere.

Data Analysis

Walleye pollock abundance was estimated by combining acoustic and trawl information. Acoustic backscatter was classified as walleye pollock, rockfishes, unidentified fishes, or an undifferentiated mixture of primarily macrozooplankton, based on the depth distribution and appearance of the aggregations and on catch composition in nearby trawl hauls. The sounder-detected bottom was calculated using the mean of sounder-detected bottom lines for all five frequencies (Jones et al. 2011). Although acoustic data were recorded at five frequencies, the results of this report and the survey time series are based on the 38 kHz data. A minimum S_v

[2] ADP Codebook. 2013. 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.

threshold of –70 dB re 1 m^{-1} was applied to the 38 kHz acoustic data, which were then averaged at 0.5 nmi horizontal by 10 m vertical resolution and exported to a database.

Within a survey area (e.g., Shumagin Islands, Sanak, Shelikof, Marmot) the mean fish weight-at-length in each 1 cm length interval was estimated from the trawl information when six or more walleye pollock were measured within a length interval; otherwise, weight-at-length was estimated using a linear regression of the natural logs of all length-weight data (De Robertis and Williams 2008). Walleye pollock length compositions were combined from trawl hauls into regional length strata based on geographic proximity, similarity of length composition, and backscatter characteristics. Survey areas were composed of 1-5 length strata.

Abundance for each length stratum was estimated as follows. The echosounder measures backscattering strength, which is integrated vertically to produce the nautical area scattering coefficient s_A (units of m^2 nmi^{-2}).The acoustic return from an individual fish is referred to as its backscattering cross-section (σ_{bs}, m^2), or in more familiar (logarithmic) terms as its target strength (TS in dB re 1 m^2), with $\log_{10}$, where

$$TS = 10 \log \sigma_{bs}.$$

The estimated TS-to-length relationship for walleye pollock (Foote and Traynor 1988, Traynor 1996) is, where L = fork length (FL) in centimeters.

$$TS = 20 \log L - 66.$$

Biological information available from the trawl hauls includes:

P_i, the proportion of pollock by number at length i,
$\overline{W}_i$, mean weight-at-length i, and
$Q_{i,j}$ is the proportion of j-aged fish of length i.

For a given geographic length stratum, the abundance of pollock in the area (A, nmi^2) is estimated from the mean areal backscatter attributed to walleye pollock ($\bar{s}_A$ m^2 nmi^{-2}), the mean backscattering cross-section ($\bar{\sigma}_{bs}$, m^2) of pollock, and the biological information as follows:

$\bar{\sigma}_{bs} = \Sigma_i (P_i \times \sigma_{bs,i})$, where $\sigma_{bs,i} = 10^{((20 \log L_i - 66)/10)}$

Numbers at length i: $N_i = P_i \times \bar{s}_A \times A / 4\pi\bar{\sigma}_{bs}$

Biomass at length i : $B_i = \bar{W}_i \times N_i$

Numbers at age j : $N_j = \Sigma_i Q_{i,j} \times N_i$

Biomass at age j : $B_j = \Sigma_i Q_{i,j} \times B_i$.

The abundance in each survey area was estimated by adding the estimates for all the length strata in the area. The mean pollock depth for each Elementary Distance Sampling Unit (EDSU) was calculated as:

$$\bar{D} = \frac{\Sigma_D D \cdot B_D}{\Sigma_D B_D},$$

where D is depth (m) and B_D is the biomass in the depth interval from D-1 to D.

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 the transect sampling variability of the acoustic data. Other sources of error (e.g., target strength, trawl sampling) were not evaluated.

Otoliths were used to estimate walleye pollock ages, and were collected from the Shumagins (n = 163), Sanak (n = 39), Shelikof Strait (n = 974) and Marmot (n = 150) areas. The samples were stored in a 50% glycerol/thymol-water solution, and were processed by AFSC Age and Growth Program researchers to determine ages.

RESULTS and DISCUSSION

Calibration

Pre- and post-survey calibration measurements of gain, S_a correction and beam pattern were 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 < 0.1 dB, and the average of all results from both calibrations (averages taken in the linear domain for dB quantities) were used in the final analysis (Table 1).

Shumagin Islands

The Shumagin Islands survey was conducted from 23 to 27 February. Acoustic backscatter was measured along 661 km (357.5 nmi) of transects. The survey transects were spaced 1.9 km (1.0 nmi) apart east of Renshaw Point and in 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 225 m, and transects generally did not extend into waters less than about 50 m depth.

Water Temperature

Surface water temperatures averaged 4.0 °C throughout the Shumagin Islands survey area (Fig. 2), half a degree higher than the 3.4 ° C average of the 14 previous surveys in the area between 1994 and 2013. Water temperature increased approximately 0.5° C from the surface to trawl depth (range 103-185 m) at the nine trawl locations (only eight trawls represented in this figure) (Table 2; Fig. 3).

Trawl Samples

Biological data and specimens were collected in the Shumagin Islands from seven AWT hauls conducted in midwater (one AWT was aborted due to equipment failure and no samples were collected) and one on-bottom PNE haul (Tables 2-5; Fig. 1). Walleye pollock was the most abundant species caught by numbers, contributing 77.7% and 57.1% to the total catch from AWT trawls and the one PNE trawl, respectively (Tables 4 and 5). Walleye pollock also dominated the total weight captured in the AWT (82.8%) and in the PNE (72.1%).

The majority of walleye pollock in the Shumagin Islands in 2014 were between 9 and 15 cm fork length (FL) and 17 and 31 cm FL (Fig. 4a), which is characteristic of age-1 and age-2 walleye pollock, respectively (Figs. 5 and 6). Larger walleye pollock ranged in length from 44 to 79 cm FL, with a mean of 60 cm FL (Fig. 4a). Age-1 fish were much less dominant in 2014 than in 2013 (3% vs. 48% of the total biomass) (Jones et al. 2014; Fig. 7). The dominance of age-2 walleye pollock in the Shumagin Islands area (80% biomass in 2014) suggests the continued success of the 2012 year class.

The maturity composition of males longer than 40 cm FL (n = 117) was 0% immature, 11% developing, 25% pre-spawning, 43% spawning, and 21% spent (Fig. 8a). The maturity composition of females longer than 40 cm FL (n = 105) was 0% immature, 12% developing, 73% pre-spawning, 7% spawning, and 8% spent (Fig. 8a). The high percentage of pre-spawning females and the low percentage of spawning and spent females suggested that the survey timing was likely appropriate to coincide with the onset of spawning for the majority of the population based on findings from the Shelikof Strait pre-spawning pollock survey. Wilson (1994), for example, reported a concomitant decline in estimated pollock biomass with an increase in proportion of adult females in spawning and spent stages of maturity suggesting substantial emigration of adults from the Shelikof area following spawning. A logistic model fit to the female maturity-at-length data predicted that 50% of females were mature (L_{50}) at 46.75 cm FL (Fig. 8b). The average GSI [gonadosomatic index: ovary weight/(ovary weight + body weight)] of pre-spawning females, based on 75 samples, was 0.13 (Fig. 8c), which was the same as the 2012 survey (0.13), higher than the 2009, 2010, and 2013 surveys (0.09, 0.11, and 0.12, respectively), but lower than the historical mean of all surveys between 1994 and 2013 (0.16).

Distribution and Abundance

Most of the walleye pollock biomass in the Shumagin Islands area was from age-2 fish (Fig. 6a), which were abundant throughout the outer portion of Shumagin Trough, off Renshaw Point, and in the West Nagai Strait area (Fig. 10b). Most of the age-1 fish were found in the southern portion of West Nagai Strait (Figs. 9 and 10c). Adults contributed very little to the total overall biomass in the Shumagin Islands area (Fig. 4a). Although adult pollock have historically been detected off Renshaw Point, only a few adults were captured in trawl hauls in this area in 2014 (Fig. 9). Adults were also captured in hauls in Unga Strait and in the northern part of West Nagai Strait (Figs. 9 and 10a). The majority of the pollock (both adults and juveniles) formed dense layers approximately 25 m above the bottom during the day (Fig. 11).

The biomass estimate of 37,346 t is 41% of last year's estimate (91,295) and 46% of the historical mean of 80,550 t for this survey (Table 6; Fig. 12). The relative estimation error of the biomass based on the one-dimensional (1-D) geostatistical analysis was 18.2%.

Sanak Trough

Sanak Trough was surveyed on 26 February. Survey efforts in Sanak were curtailed due to time constraints and it was only possible to perform one trawl. Thus, the biomass estimate from this region has higher uncertainty than in other years. Acoustic backscatter was measured along 67 km (36 nmi) of transect spaced 3.7 km (2 nmi) apart (Fig. 1). Bottom depths ranged from 40 m at the transect end points to 160 m along the deepest part of the southernmost transects.

Water Temperature

Surface water temperatures in the Sanak Trough survey area averaged 3.6 °C overall (Fig. 2) which was several degrees warmer than temperatures recorded in 2013 and above the 3.1 °C average for surveys in this area since 2003. Water temperature ranged 0.5 °C between the surface and deepest trawl depth (Fig. 13), but the average water temperature over the duration of the trawl (mean headrope depth = 107 m) was only 0.1 °C lower than the surface temperature (Table 2).

Trawl Samples

Biological data and specimens were collected in Sanak Trough from one AWT in midwater (Tables 2 and 7; Fig. 1). Walleye pollock was the most abundant species, contributing 99.3% by weight and 99.4% by number. Pacific cod (*Gadus macrocephalus*) was the only other species caught. Adult walleye pollock ranged between 42 and 78 cm FL with a mean of 59 cm FL (Fig. 4b), and were comprised of mostly 8-yr old fish (Fig. 6). This was substantially different from last year's unusual result where the majority of pollock caught in Sanak Trough were age-1 fish (Jones et al. 2014).

The maturity composition for males longer than 40 cm FL (n = 64) was 0% immature, 9% developing, 16% pre-spawning, 16% spawning, and 59% spent (Fig. 14a). The maturity composition for females longer than 40 cm FL (n = 36) was 0% immature, 0% developing, 50% pre-spawning, 6% spawning, and 44% spent (Fig. 14a). The fact that nearly half of the females were already spent indicates that survey timing was likely late as it did not coincide with the onset of spawning for the majority of the population (Wilson 1994). The logistic model fit to the female maturity-at-length data predicted that 50% of females were mature at 50.1 cm FL (Fig. 14b). The average GSI of pre-spawning females was 0.14 (Fig. 14c) and was lower than the long-term mean value of 0.16.

Distribution and Abundance

The majority of the walleye pollock biomass was located over the central portion of the Trough (Fig. 10). Most of the walleye pollock backscatter was located in small schools at depths between 75 m and 150 m over bottom depths of ~100-150 m (Fig. 15).

The biomass estimate of 7,319 t is approximately one-sixth of the historic mean of 45,632 t for this survey and the lowest in the survey's history (Table 6; Fig. 16). The relative estimation error based on the 1-D geostatistical analysis of the biomass was 9%.

Shelikof Strait

The Shelikof Strait sea valley was surveyed from 15 to 22 March at a transect spacing of 13.9 km (7.5 nmi). Acoustic backscatter was measured along 1,445 km (780 nmi) of transect (Fig. 17). Bottom depths in the survey area ranged from 50 to 325 m.

Water Temperature

Surface water temperatures in Shelikof Strait averaged 4.1 ° C overall and 4.0 ° C at trawl locations (Table 8 and Fig. 18), 0.4 degrees higher than last year and slightly higher than the historic mean (3.7 °C) of the 29 surveys between 1981 and 2014 in this area. Temperatures at trawl locations increased with depth down to approximately 250 m, rising to an average of 5.2 ° C (Fig. 19).

Trawl Samples

Biological data and specimens were collected in the Shelikof Strait area from 19 AWT hauls in midwater and 2 near bottom PNE hauls (Tables 8-11; Fig. 17). Walleye pollock and eulachon (*Thaleichthys pacificus*) were the most abundant species by weight and numbers in AWT hauls, contributing 90.0% and 7.9% by weight, and 58.6% and 39.4% by numbers, respectively (Table 10). Walleye pollock and eulachon were also the most abundant species in the PNE hauls, accounting for 96.0% and 2.6% by weight, and 61.3% and 35.7% by number, respectively (Table 11). However, eulachon, which comprised 7% of the overall catch by weight, were less prevalent than in previous years where they have ranged up to 47% of the total catch by weight (e.g., 2008; mean 17% since 2003).

The maturity composition in the Shelikof Strait area for males longer than 40 cm FL (n = 366) was 1% immature, 34% developing, 24% mature pre-spawning, 39% spawning, and 1% spent (Fig. 20a). The maturity composition of females longer than 40 cm FL (n = 372) was 0% immature, 61% developing, 30% pre-spawning, 7% spawning, and 1% spent (Fig. 20a). The small fraction of spawning and spent females relative to pre-spawning females suggests that the survey was reasonably well-timed to coincide with the onset of spawning for the majority of the population, based on findings from earlier Shelikof Strait pre-spawning surveys (Wilson, 1994). The relatively high number of developing females is likely due to the large numbers from the 2010 year class, represented by fish with fork lengths in the mid-40s (Figs. 20, 21, and 22). The female L_{50} of 47.2 cm FL (Fig. 20b, n = 894) was similar to that in 2007 and 2008 and was the same as last year. The average GSI from 111 pre-spawning females was 0.14 (Fig. 20c) and is equal to the historical mean.

Distribution and Abundance

As in previous years, the highest walleye pollock biomass was observed along the northwest side of the Strait near Kukak Bay (Fig. 21a). Within this deepest section of the Strait along the steep banks of the Alaska Peninsula , we found dense aggregations of pre-spawning adult fish primarily in the 40- 60 cm FL range (Figs. 22b and 22c). Mid-sized fish (16 – 40 cm) were observed in the central portion of the Shelikof Strait north of Chirikof Island to Kukak Bay (Figs. 21b and 22b), and a small amount of biomass represented by age-1 pollock was present in the north and central part of the Strait (Figs. 21c, 22b and 22e). Discrete, dense midwater pollock schools ("cherry balls") were occasionally encountered throughout the survey area consisting mostly of fish with an average FL of 21 cm. Historically, pollock forming these types of aggregations in this area have consisted of juvenile fish (i.e., age-1 or age-2; Jones et al. 2014). Most adult fish were distributed within the bottom 50 m in waters from 150 to 300 m deep (Fig. 24). Fish < 40 cm were distributed throughout the water column or within 50 m of the bottom in water over 250 m deep (Fig. 24).

The majority of pollock biomass within Shelikof Strait was characterized by three length modes: one mode at 21 cm FL representing age-2 fish from the 2012 year class, a second mode at 44 cm FL consisting of age-4 fish from the 2010 year class, and a third mode at 56 cm FL (Figs. 25-27). The Shelikof Strait biomass estimate of 842,138 t is the second largest reported for the region since 1985, and similar to the 2013 estimate of 891,261 t. The 2014 estimate is 1.28 times the historic mean of 659,493 t for this survey (Table 6; Fig. 28). The relative estimation error of the biomass based on the 1-D geostatistical analysis was 4.7%. Walleye pollock larger than 40 cm made up 72% of the biomass and 13% of the numbers in Shelikof Strait in 2014, and fish less than 18 cm made up only 1% of the biomass and 12% of the numbers (Fig. 25a; Tables 12 and 13). This is in sharp contrast to 2013 when pollock less than

18 cm FL (i.e., age-1 fish) made up 7% of the biomass and 81% of the numbers (Jones et al. 2014). The strong 2012 year class, as demonstrated by the high numbers of age -1 fish in 2013 (Jones et al. 2014), is reflected in the large numbers of age-2 fish (3.64×10^9) this year; more than four times the historical mean (Table 17). This strong 2012 year class is also evident in the biomass of age-2 fish (211 thousand metric tons (t), Table 18), also more than four times the historical average. McKelvey (1996) showed that there was a strong relationship between the number of age-1 fish in acoustic-trawl surveys in Shelikof Strait and year-class strength. The 2013 year class, age-1 fish this year, fall under the category of “Medium” relative abundance according to the McKelvey Index, where the 2012 year class was considered “High” (McKelvey 1996).

Marmot Bay

Marmot Bay was surveyed from 22 to 24 March along transects spaced 3.7 km (2.0 nmi) apart in the outer Bay and 1.9 km (1.0 nmi) apart in the Spruce Island Gully and inner Bay. Acoustic backscatter was measured along 281 km (152 nmi) of transects (Fig. 29). Bottom depths ranged from 80 to 350 m.

Water Temperature

Surface water temperatures averaged 4.6 ° C throughout the Marmot Bay survey area and at trawl locations (Table 8; Fig. 30), warmer than last year’s mean of 4.2 ° C. Temperatures at depths where most adult walleye pollock biomass occurred (50-180 m) averaged 4.5 ° C (Fig. 31), which were similar to temperatures in 2013 and 2010, and 1.6 ° C higher than in 2007 and 2009 when the coldest surface temperatures were recorded for this survey.

Trawl Samples

Biological data and specimens were collected in Marmot Bay from 4 AWT hauls in midwater, one on-bottom PNE haul (haul 27), and one midwater PNE haul (haul 24; Table 8). A test haul was also conducted in Marmot Bay with a “Marinovich” net to determine the vertical opening of the net and its ability to capture walleye pollock (haul 28, Table 8). Walleye pollock was the most abundant species caught by weight and numbers in each net type (Tables 14-16). No hauls were conducted in Izhut Bay.

Walleye pollock ranged from 10 to 71 cm FL with modes at 12 cm, 25 cm, and 45 cm FL (Fig. 25b), The maturity composition in Marmot Bay for males > 40 cm FL (n = 118) was 0% immature, 30% developing, 18% pre-spawning, 20% spawning, and 32% spent (Fig. 32a). The maturity composition of females > 40 cm FL (n = 110) was 0% immature, 37% developing, 63% pre-spawning, 0% spawning, and 0% spent (Fig. 32a). The high percentage of pre-spawning adult females suggests that peak spawning had not occurred and that survey timing was likely appropriate (Wilson 1994). The female L_{50} was 45.75 cm FL (Fig. 32b). The average GSI for pre-spawning females was 0.13, right at the historical mean (Fig. 32c).

Distribution and Abundance

Dense walleye pollock schools comprising the majority of pollock biomass in Marmot were primarily in the 16 to 40 cm FL range (Fig. 25b) and found north of Spruce Island and in Spruce Island Gully (Fig. 33b). These fish were likely 2-year-olds (Fig. 26) and were found shallower in the water column than the larger fish (Fig. 34). Adult fish were also primarily found north of Spruce Island and in the inner bay (Fig. 32a), while those fish < 16 cm FL (i.e., 1-year-olds; Fig. 26) were primarily found in the outer bay (Fig. 32c). The biomass estimate for Marmot Bay was 14,992 t (Table 6). This estimate is 5,000 t less than the 2013 estimate but almost 5,000 t higher than the historic mean for this survey (10,260 t). The relative estimation error of the biomass based on the 1-D geostatistical analysis was 9.4 %. A survey of Izhut Bay detected very little acoustic backscatter (Figs. 33 a-c). Steep bathymetry and bad weather prevented trawling on the only transect where moderate backscatter of suspected pollock was detected.

Special Projects

Several collections of specimens were made to support studies by other investigators. Pacific ocean perch ovaries and otoliths were collected to support a rockfish maturity study (Christina.Conrath@noaa.gov). Ovaries were collected from pre-spawning walleye pollock to investigate interannual variation in fecundity of mature females (Sandi.Neidetcher@noaa.gov), Ovaries were also collected from female walleye pollock of all maturity stages for a histological study (Martin.Dorn@noaa.gov). Cephalopods of all species and size ranges encountered were collected for use in identifying cephalopod beaks in fish stomachs (Elaina.Jorgensen@noaa.gov). Spawning walleye pollock were collected and spawned, and the fertilized eggs were transported to Seattle to examine genomic evidence of localized adaptation and for developing a model to estimate the growth of walleye pollock larvae (Annette.Dougherty@noaa.gov). Finally, pollock ovaries were collected for a study of RNA (brian.wimberly@ucdenver.edu). Results for all special projects will be reported elsewhere.

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TABLES AND FIGURES

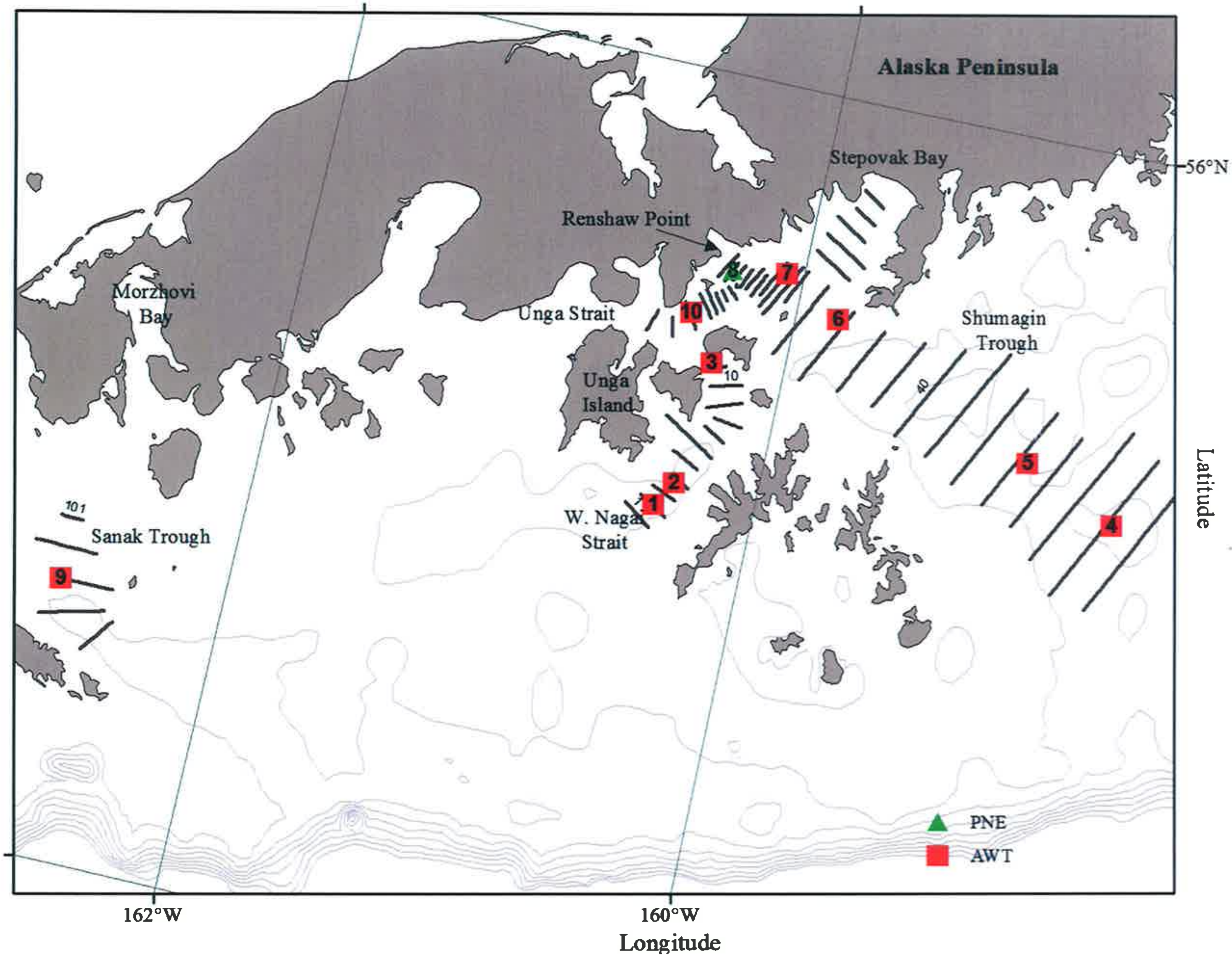

Figure 1. -- Transect lines and locations of Aleutian-wing trawl (AWT) and poly-Nor'eastern trawl (PNE) hauls during the winter 2014 acoustic-trawl survey of walleye pollock in the Shumagin Islands and Sanak Trough.

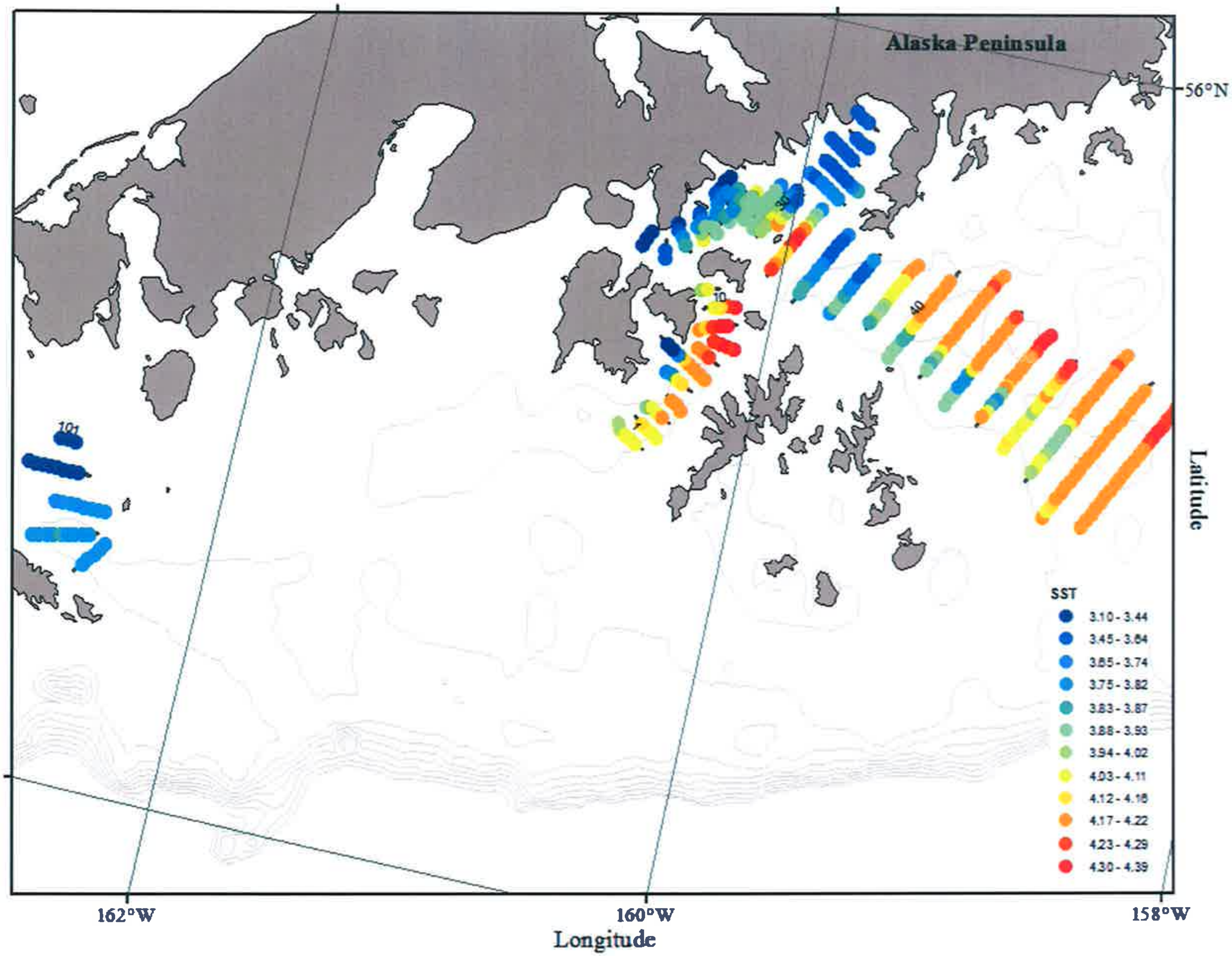

Figure 2. -- Surface water temperatures (°C) recorded from the ship's Furuno T-2000 temperature probe located 1.4 m below the surface during the DY1401 acoustic-trawl survey of the Shumagin Islands and Sanak Trough.

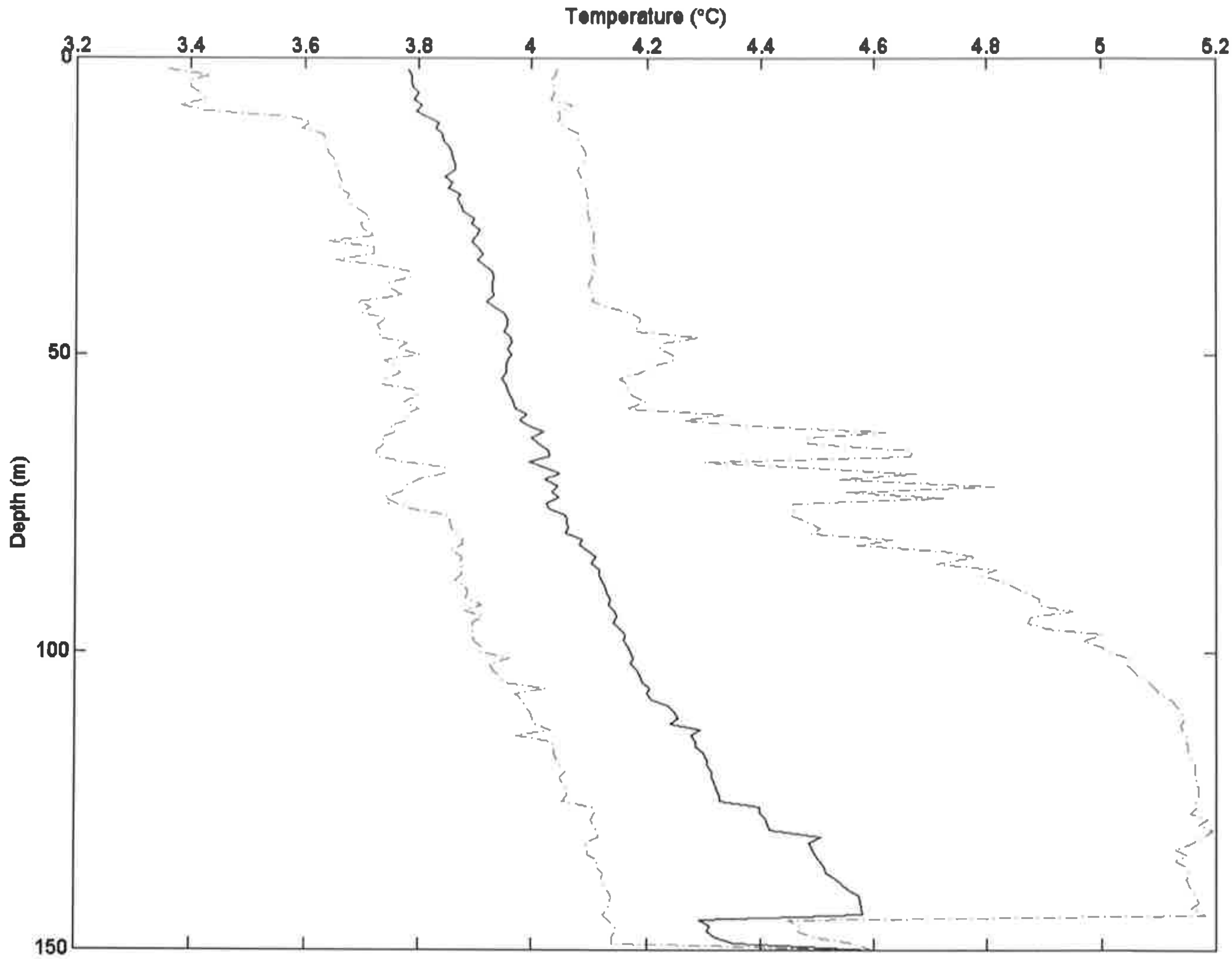

Figure 3. -- Mean water temperature (°C; solid line) by 1-m depth intervals for the trawl haul locations observed during the winter 2014 acoustic-trawl survey of walleye pollock in the Shumagin trough, W. Nagai Strait, Unga Strait, and Stepovak Bay. Dashed-lines represent minimum and maximum temperatures observed.

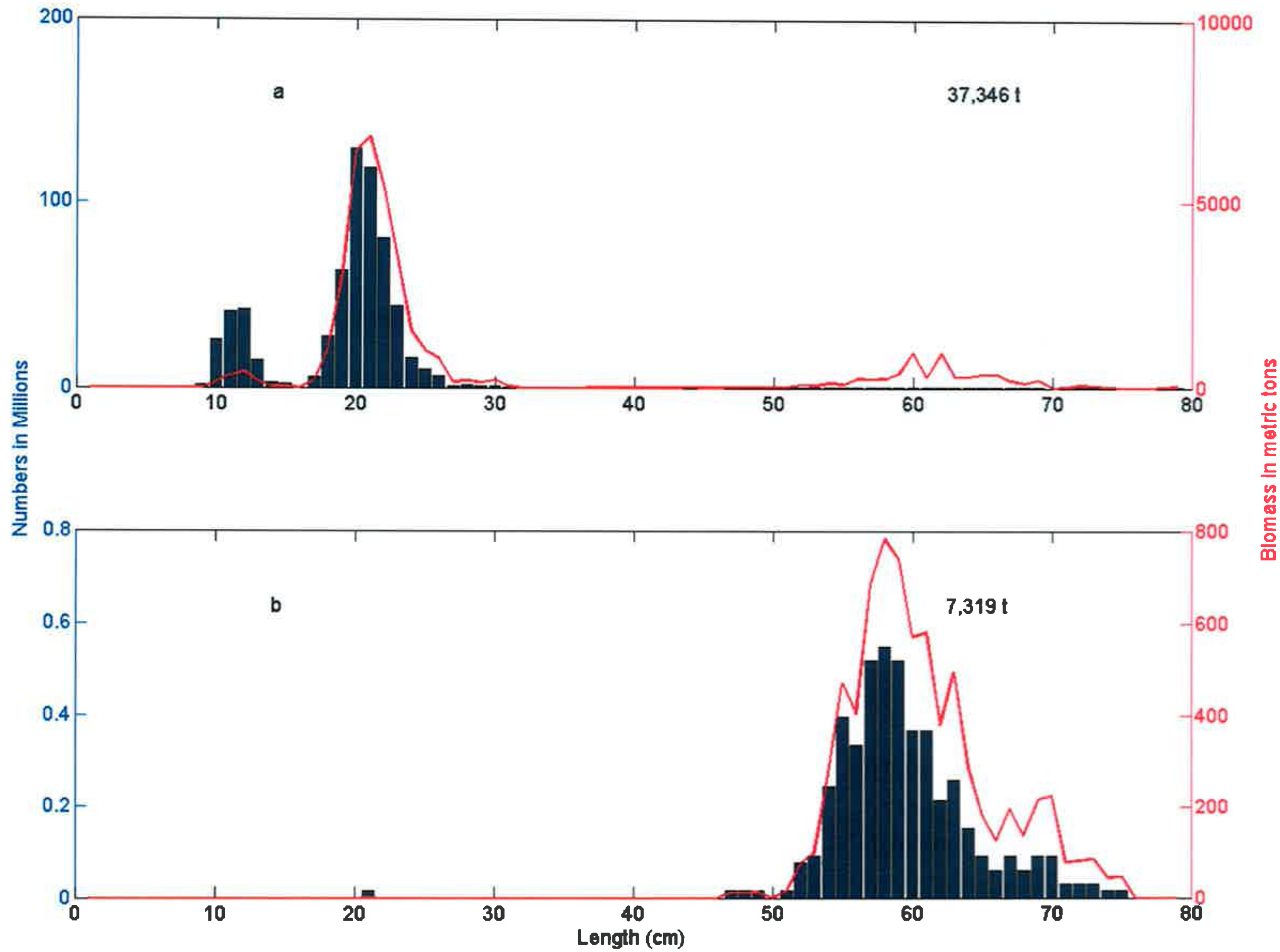

Figure 4. -- Length distribution of walleye pollock are shown with bars (numbers) and biomass estimate shown with solid red line (metric tons, t) for the 2014 acoustic-trawl survey of Shumagin Islands (a) and Sanak (b).

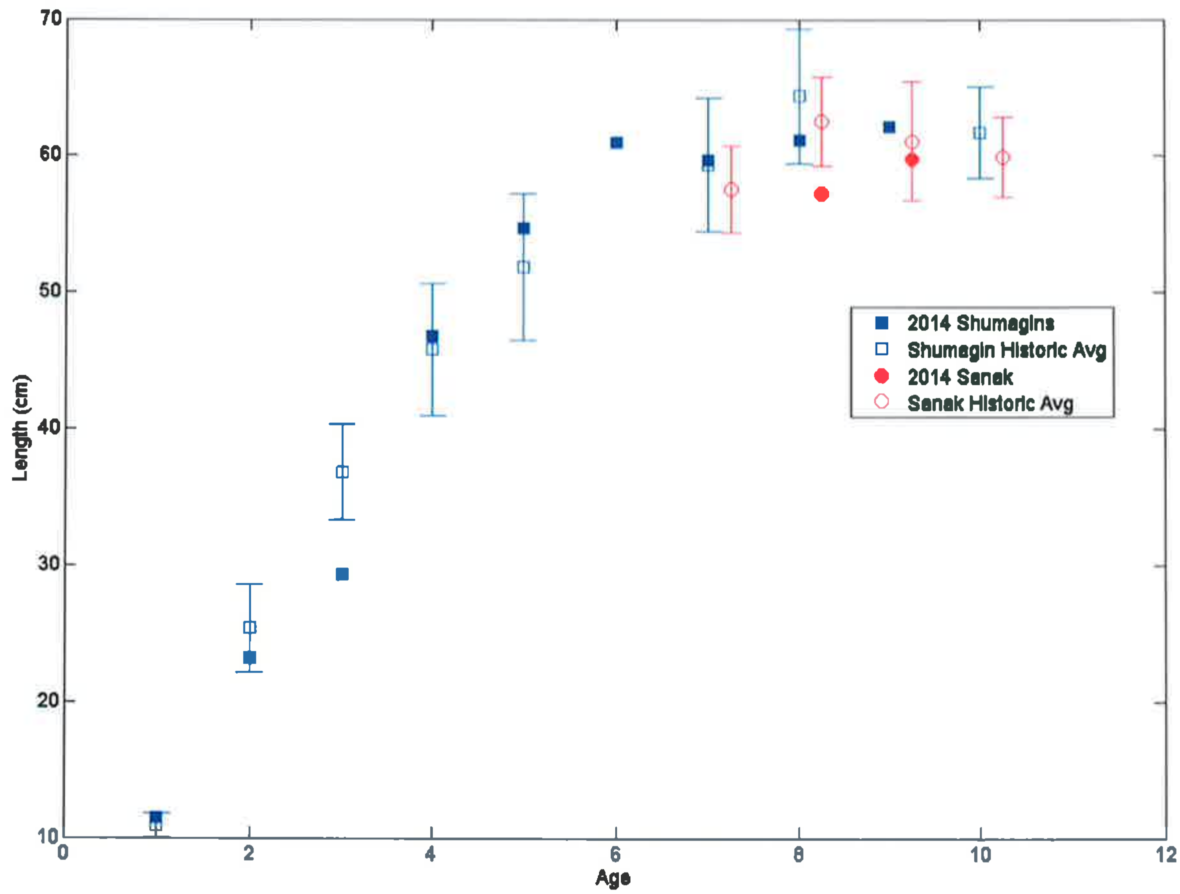

Figure 5. -- Walleye pollock average length at age from historic winter Shumagin and Sanak acoustic-trawl surveys (2009) compared with walleye pollock average length at age for winter 2014. Results are for midwater tows where at least five fish were measured. Bars show +/- 1 standard deviation for the 2009 data.

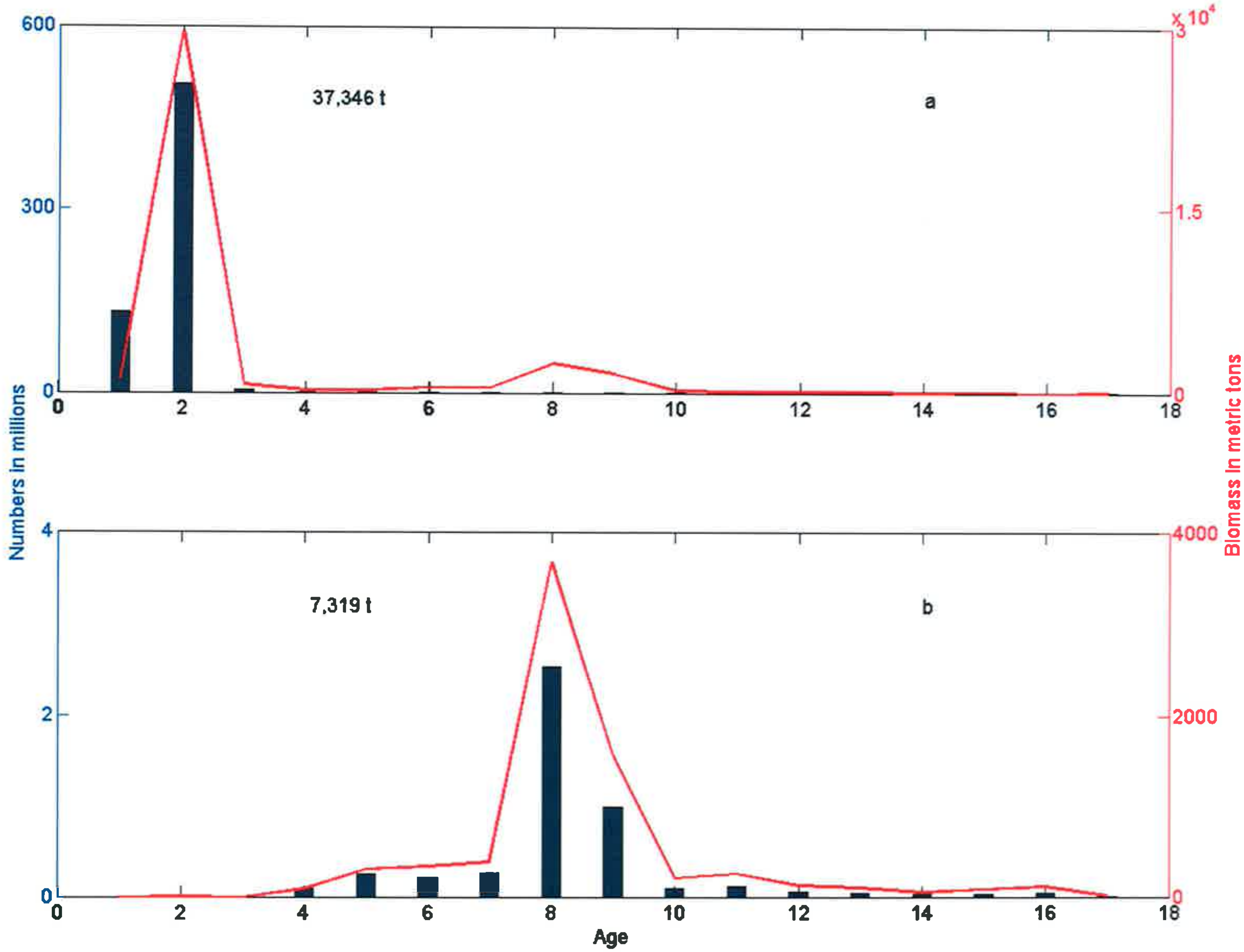

Figure 6. -- Age distribution of walleye pollock are shown with bars (numbers) and biomass estimate shown with solid red line (metric tons, t) for the 2014 acoustic-trawl survey of Shumagin Islands (a) and Sanak (b).

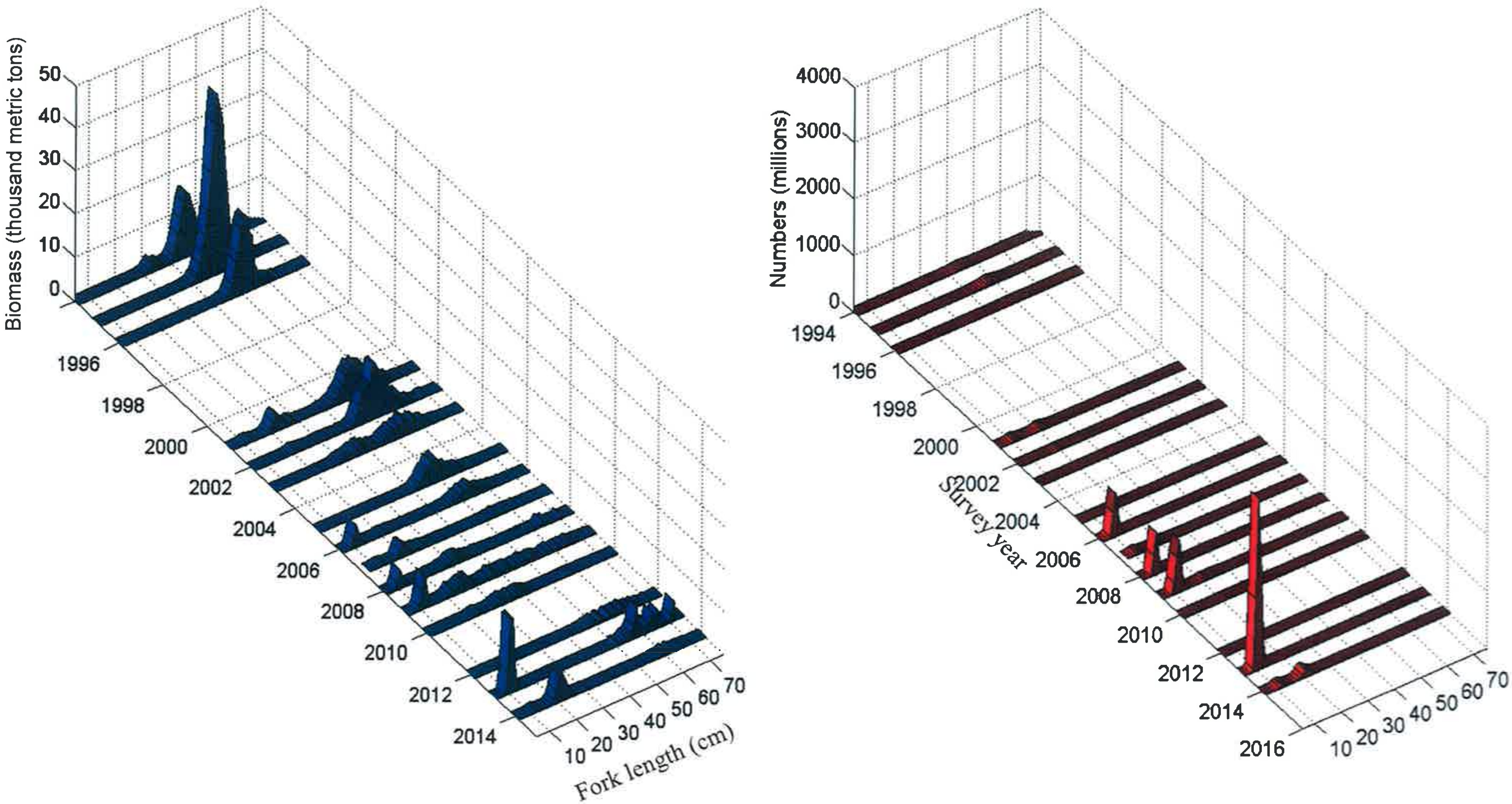

Figure 7. -- Walleye pollock biomass in thousands of metric tons (left) and numbers in millions (right) at length from the Shumagin Islands acoustic-trawl surveys since 1994. No surveys were conducted in 1997-2000, 2004, or 2011.

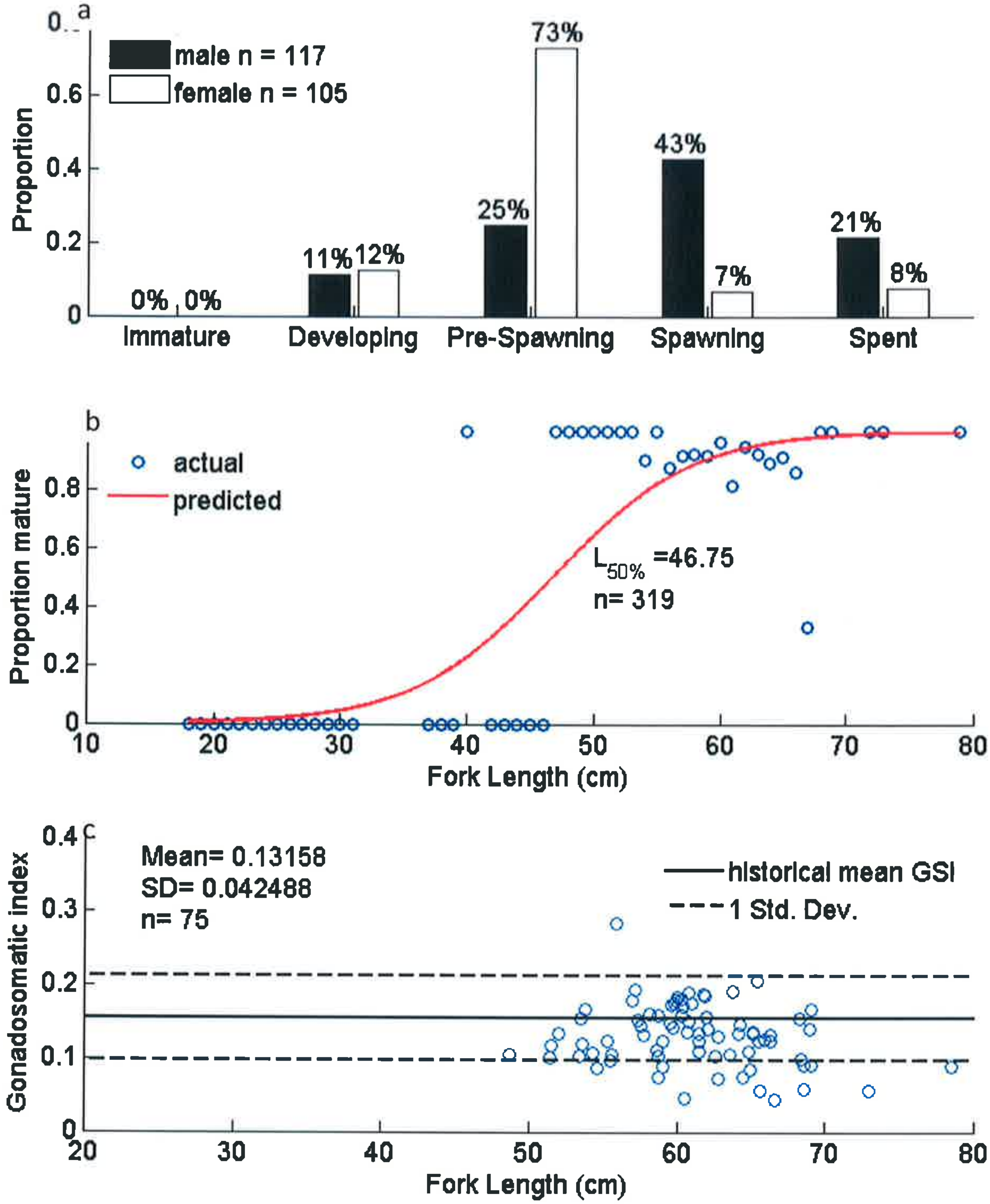

Figure 8. -- Maturity composition for male and female walleye pollock greater than 40 cm FL within each stage (a); proportion mature (i.e. pre-spawning, spawning, or spent) by 1-cm size group for female walleye pollock (b); gonadosomatic index (with historic survey mean ± 1 std. dev.) for pre-spawning females examined during the 2014 acoustic-trawl survey of the Shumagin Islands (c). Note: these graphs do not include data from age-1 fish.

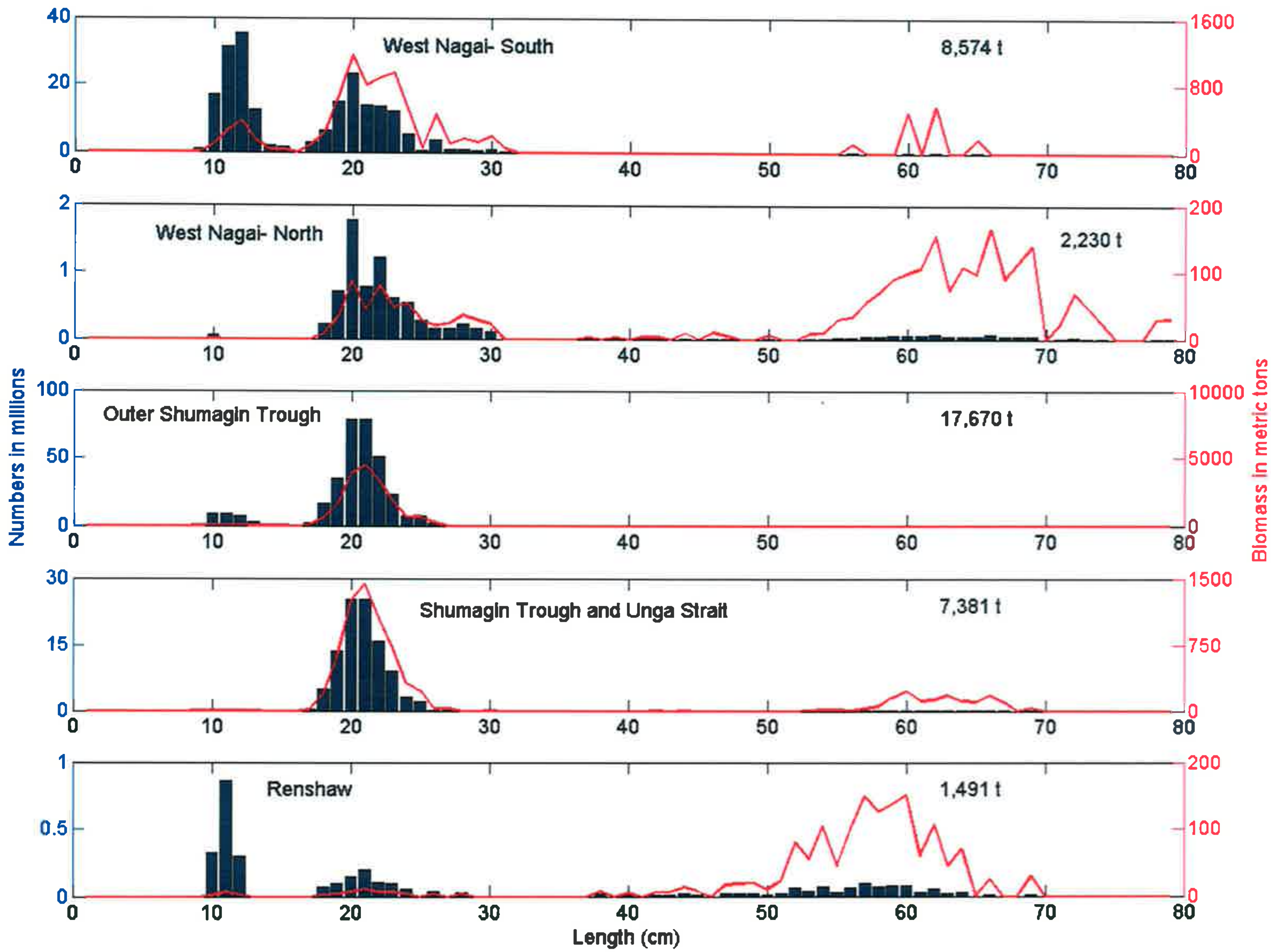

Figure 9. -- Length distribution of walleye pollock are shown with bars (numbers) and biomass estimate shown with solid red line (metric tons, t) for the 2014 acoustic-trawl survey of the Shumagin Islands. Plots represent different length keys.

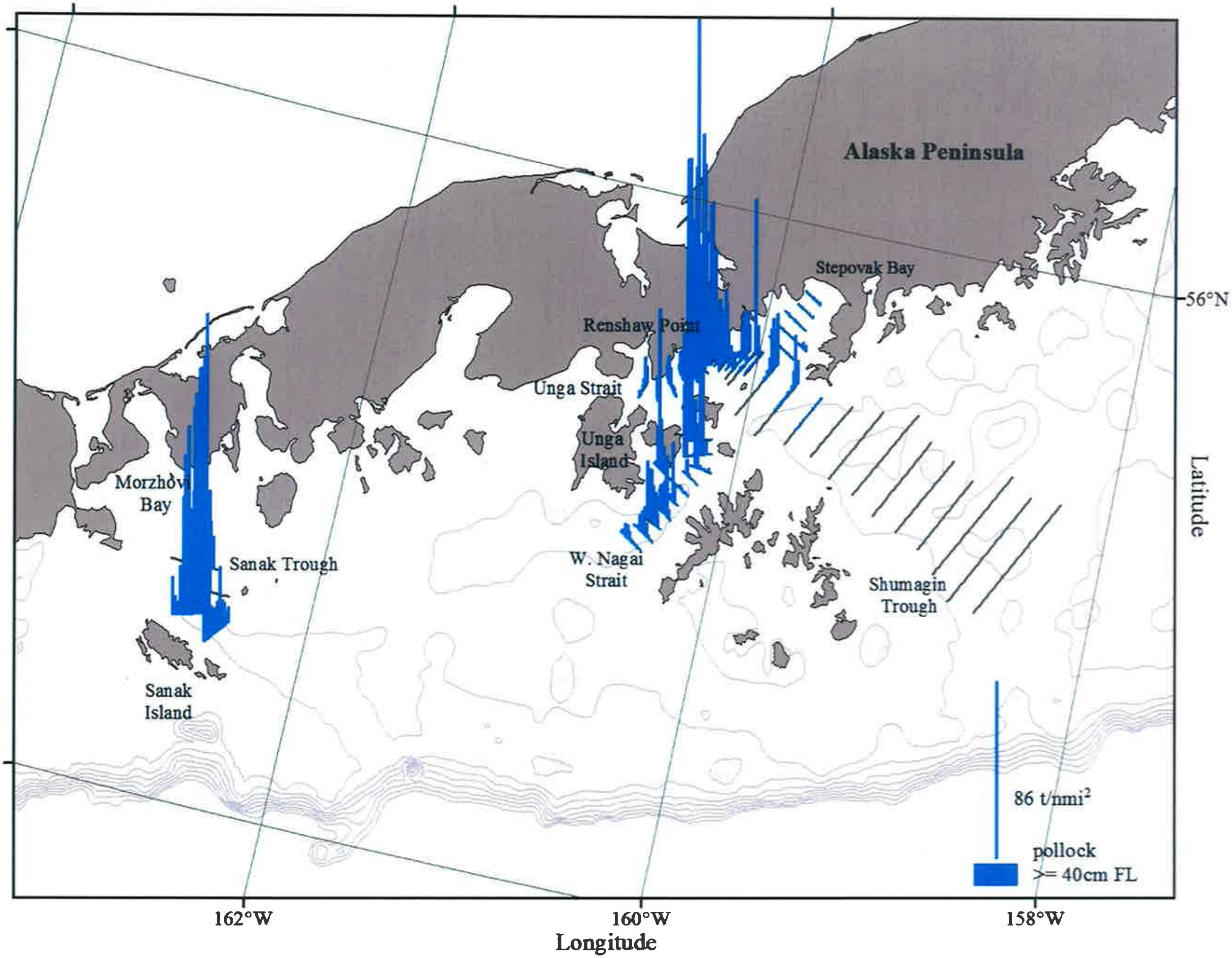

Figure 10a. -- Biomass (t/nmi^2) attributed to walleye pollock $\geq$ 40 cm FL (vertical lines) along tracklines surveyed during the winter 2014 acoustic-trawl survey of the Shumagin Islands and Sanak Trough.

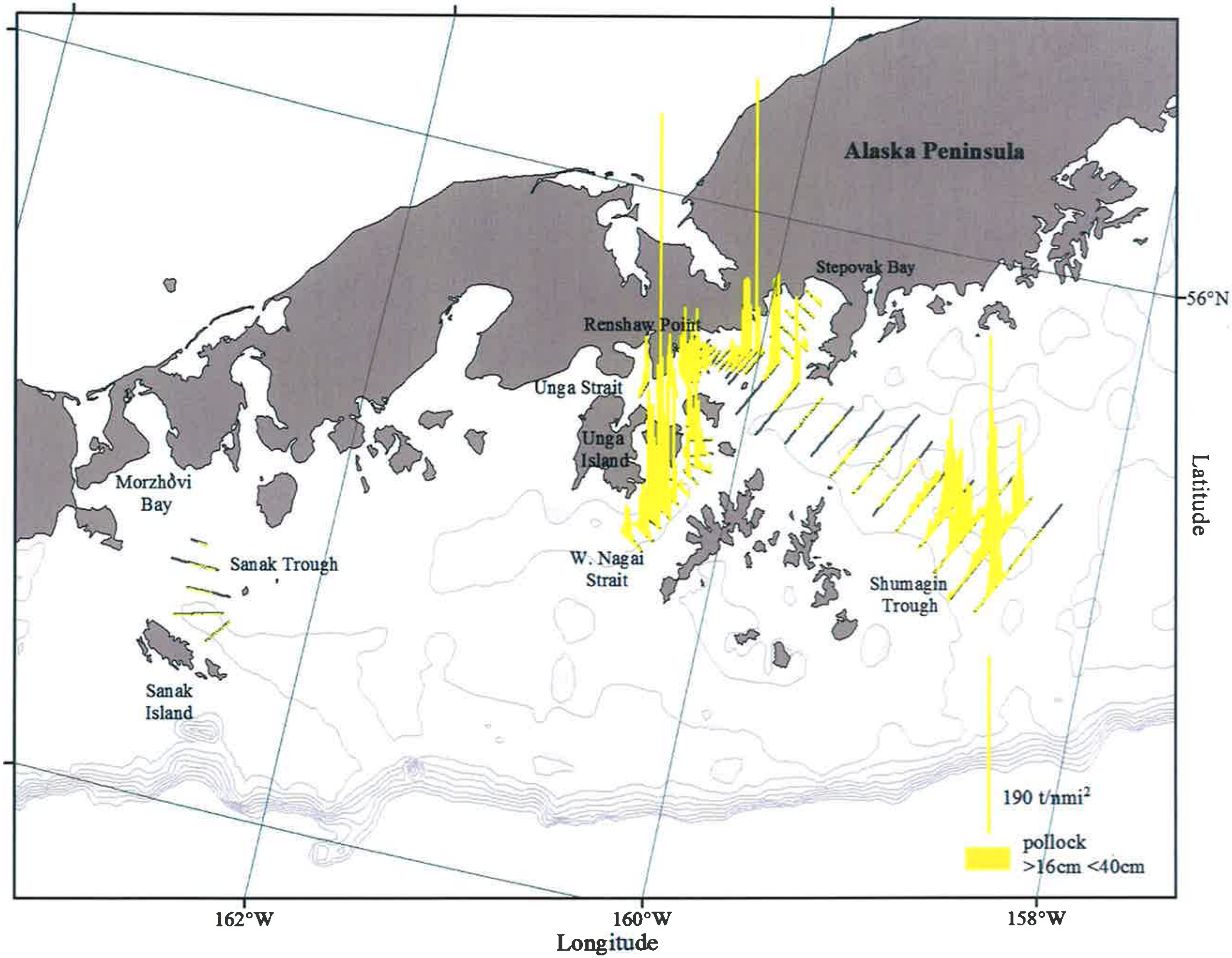

Figure 10b. -- Biomass (t/nmi^2) attributed to walleye pollock >16 cm FL and < 40 cm FL (vertical lines) along tracklines surveyed during the winter 2014 acoustic-trawl survey of the Shumagin Islands and Sanak Trough.

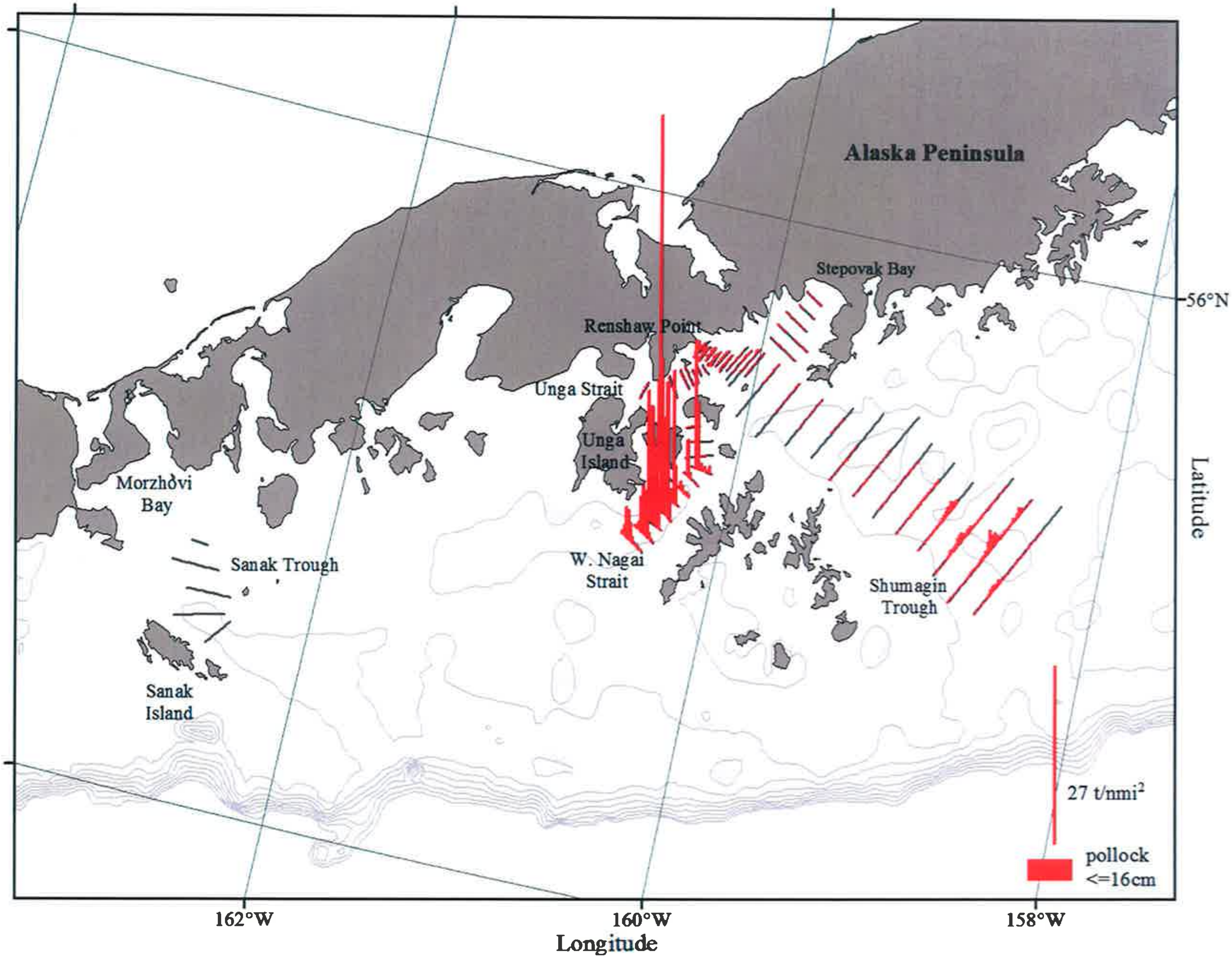

Figure 10c. -- Biomass (t/nmi^2) attributed to walleye pollock $\leq$ 16 cm FL (vertical lines) along tracklines surveyed during the winter 2014 acoustic-trawl survey of the Shumagin Islands and Sanak Trough.

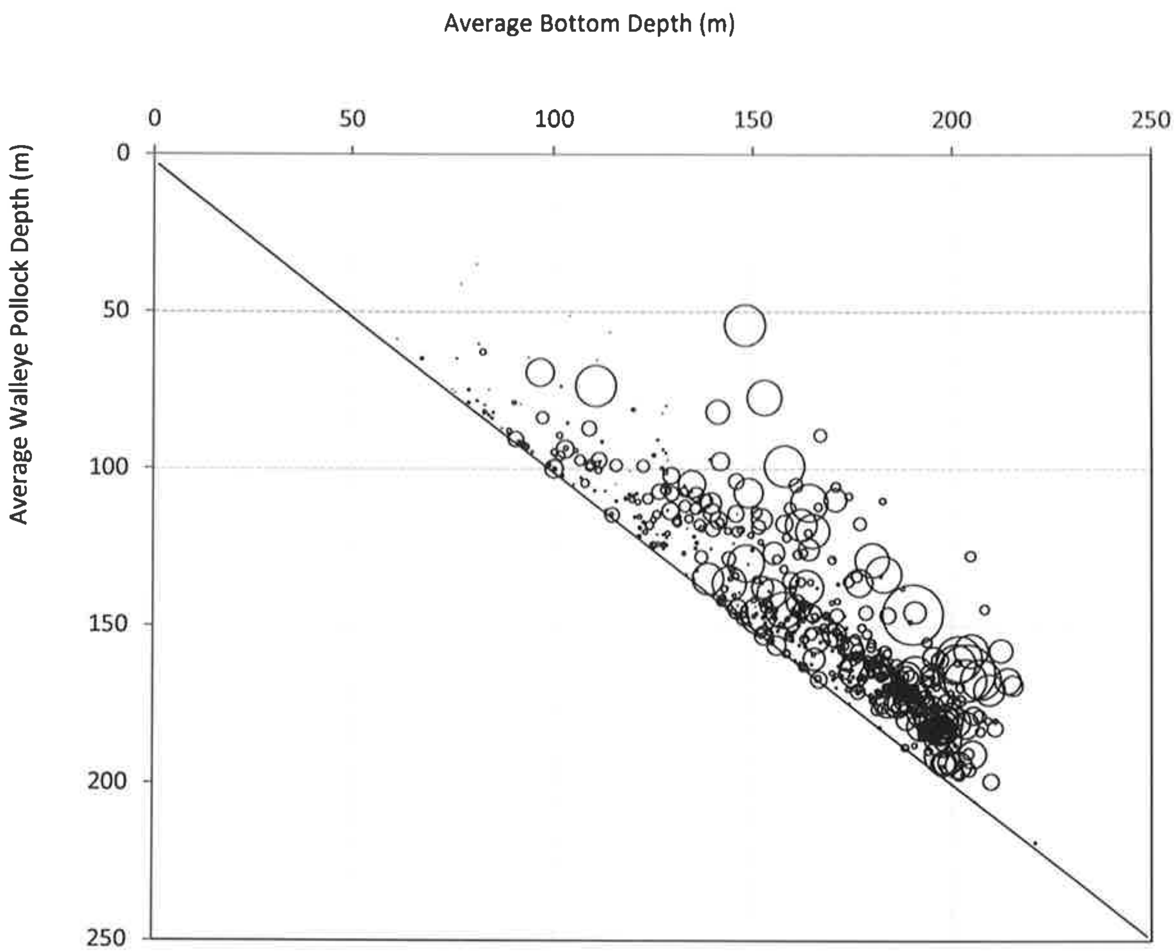

Figure 11. -- Average walleye pollock depth (weighted by biomass) versus bottom depth (m) during the winter 2014 acoustic-trawl survey of the Shumagin Islands area. Circle size is scaled to the maximum biomass per 0.5 nautical mile survey track interval. The diagonal line indicates where the average pollock depth equals bottom depth.

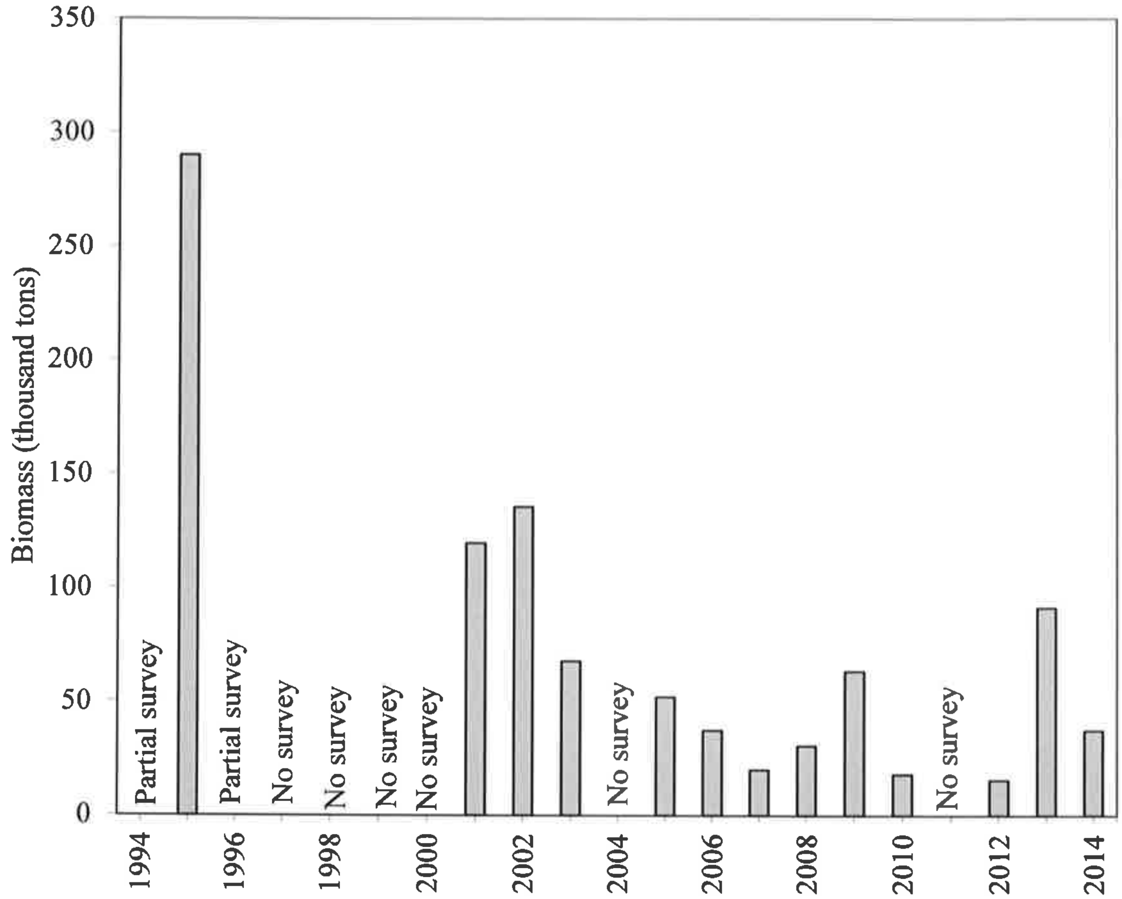

Figure 12. -- Summary of walleye pollock biomass estimates (thousand metric tons) based on acoustic-trawl surveys of the Shumagin Islands area.

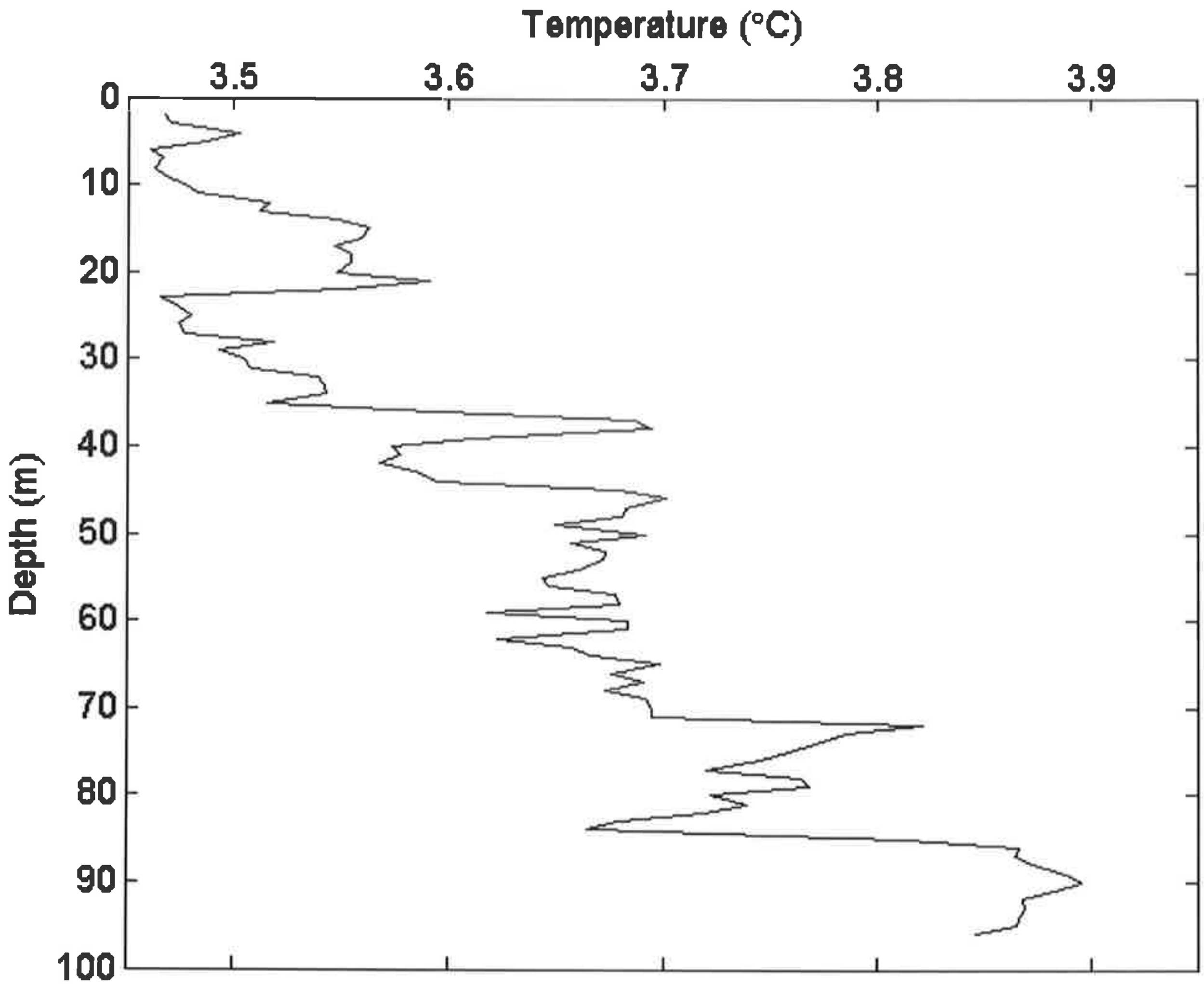

Figure 13. -- Water temperature (°C) by 1-m depth intervals for the one trawl haul location observed during the winter 2014 acoustic-trawl survey of walleye pollock in Sanak Trough.

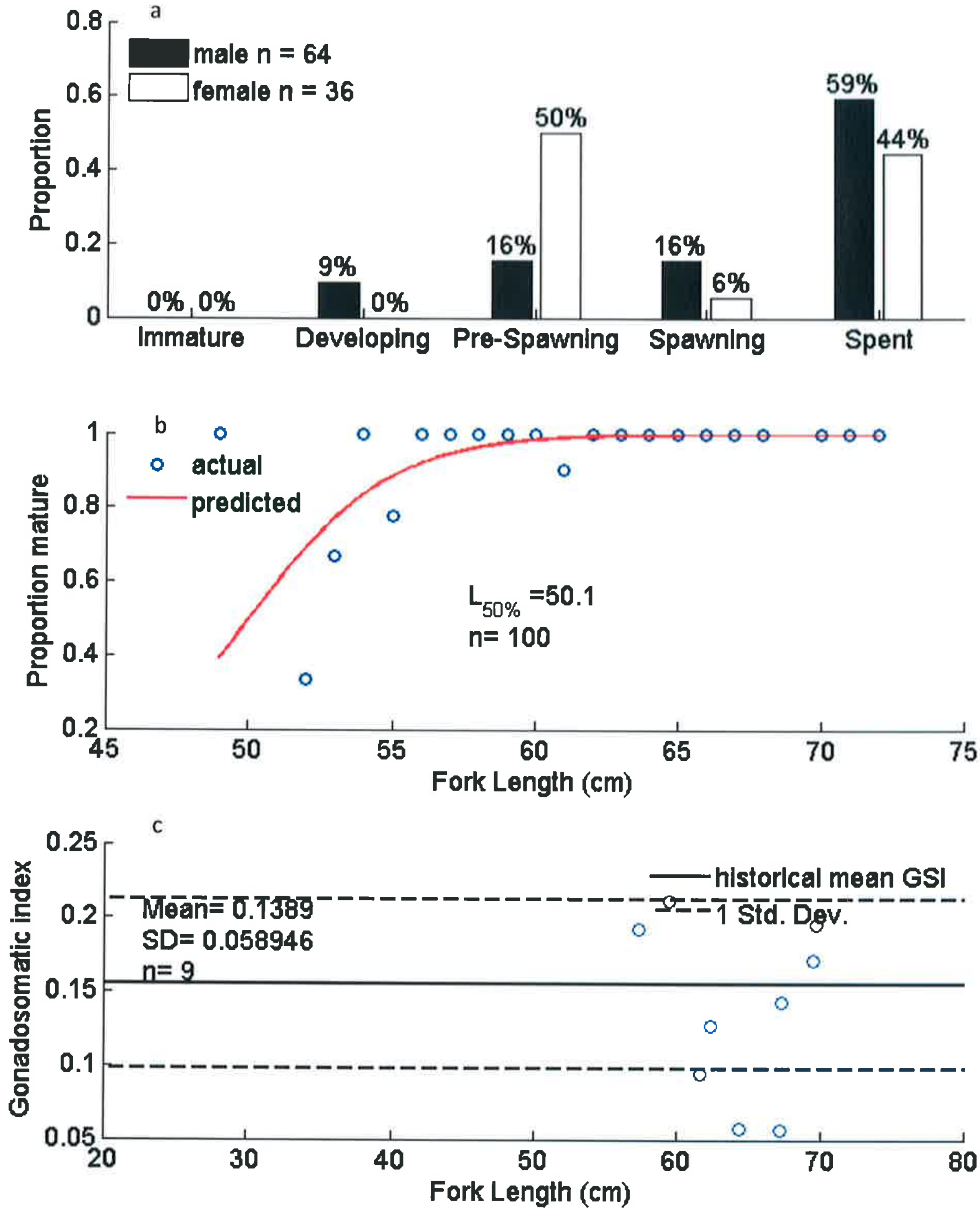

Figure 14. -- Maturity composition for male and female walleye pollock greater than 40 cm FL within each stage (a); proportion mature (i.e. pre-spawning, spawning, or spent) by 1-cm size group for female walleye pollock (b); gonadosomatic index (with historic survey mean ± 1 std. dev.) for pre-spawning females examined during the 2014 acoustic-trawl survey of the Sanak Trough (c). Note: these graphs do not include data from age-1 fish.

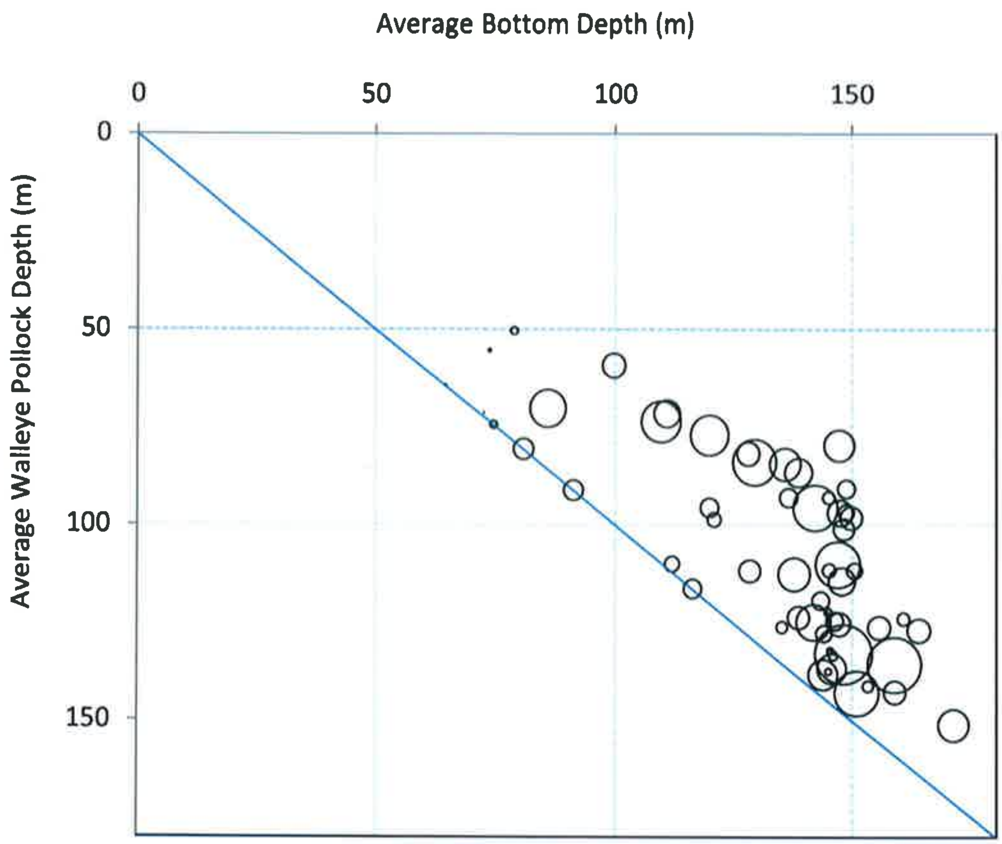

Figure 15. -- Average walleye pollock depth (weighted by biomass) versus bottom depth (m) during the winter 2014 acoustic-trawl survey of Sanak Trough. Circle size is scaled to the maximum biomass per 0.5 nmi interval. The diagonal line indicates where the average pollock depth equals bottom depth.

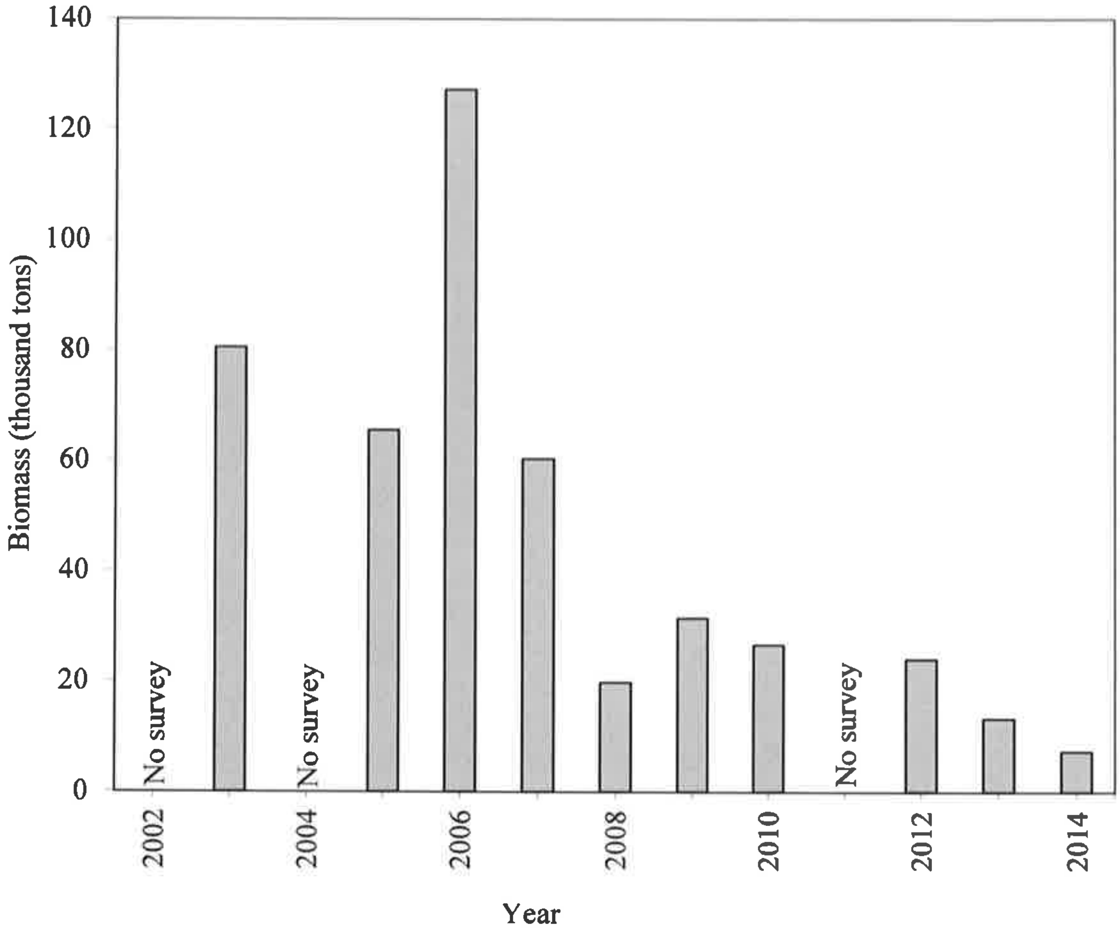

Figure 16. -- Summary of walleye pollock biomass estimates (thousand metric tons) based on acoustic-trawl surveys of the Sanak area.

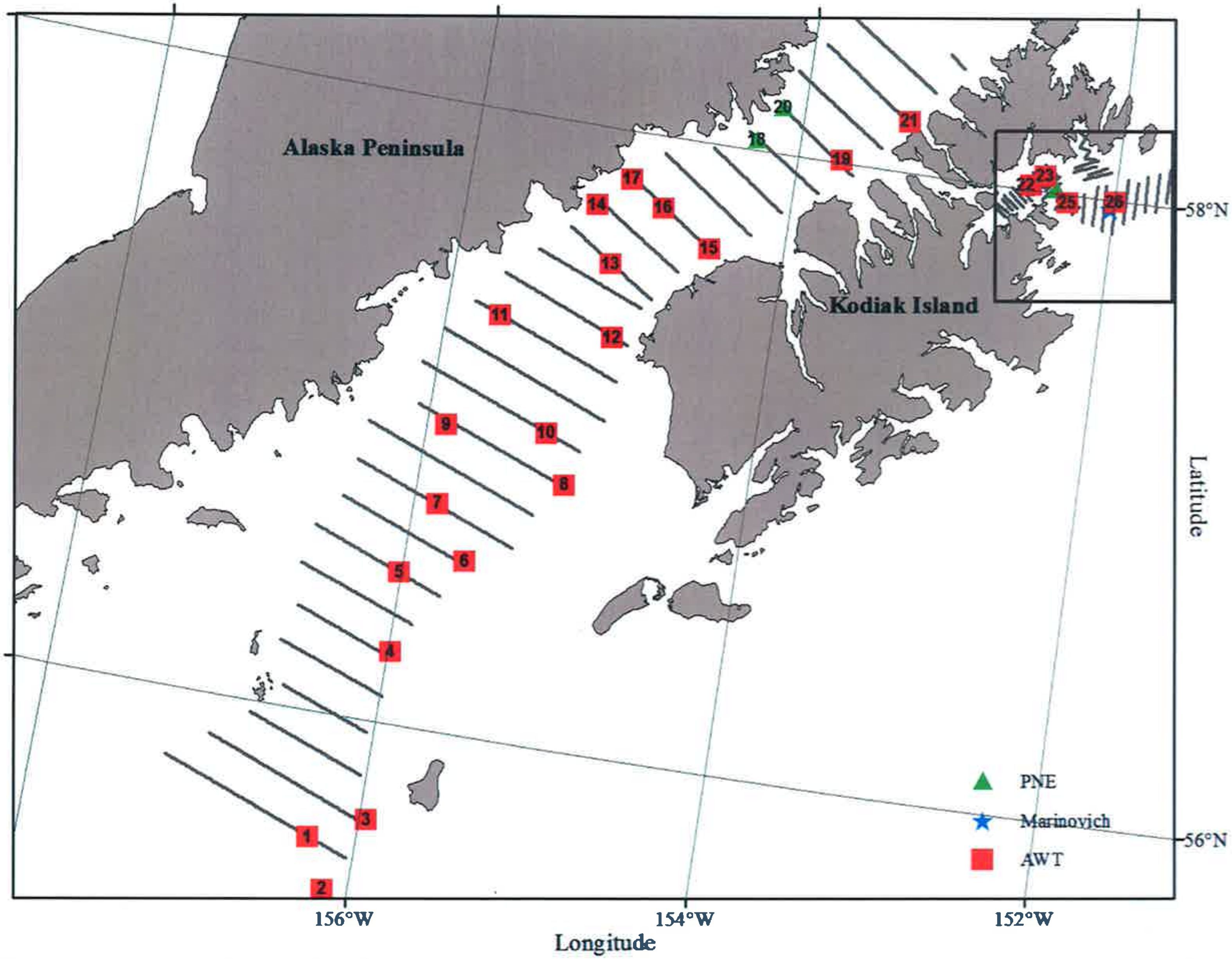

Figure 17. -- Transect lines and locations of Aleutian-wing trawl (AWT), poly-Nor'eastern trawl (PNE), and Marinovich hauls during the winter 2014 acoustic-trawl survey of walleye pollock in Marmot Bay, Izhut Bay, and Shelikof Strait. Haul numbers are on top of haul symbols. Box indicates area enlarged in figure 29.

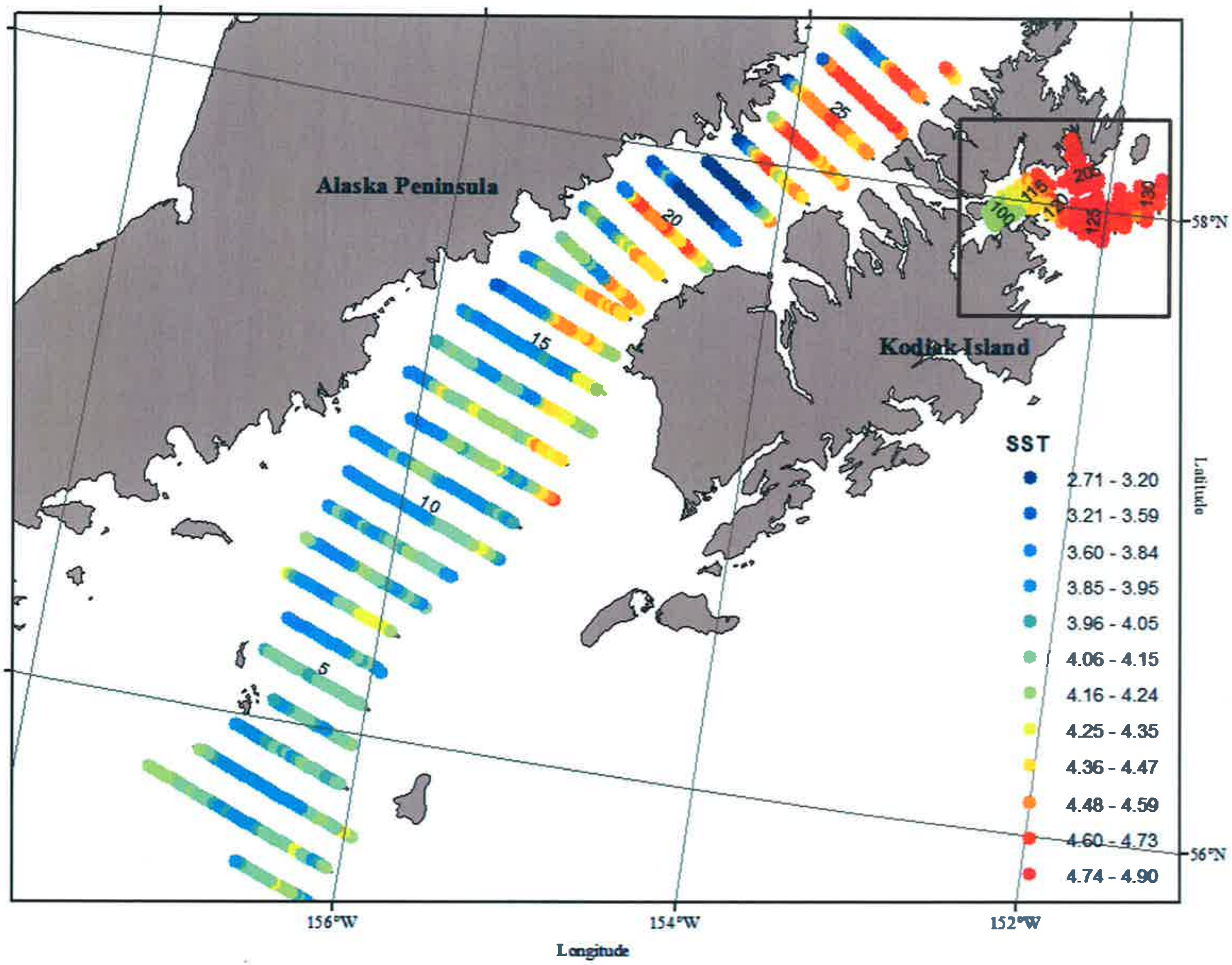

Figure 18. -- Surface water temperatures (°C) during the 2014 acoustic-trawl survey of Shelikof Strait and Marmot Bay recorded from the ship's Furuno T-2000 temperature probe located 1.4 m below the surface. Box indicates area enlarged in Figure 30.

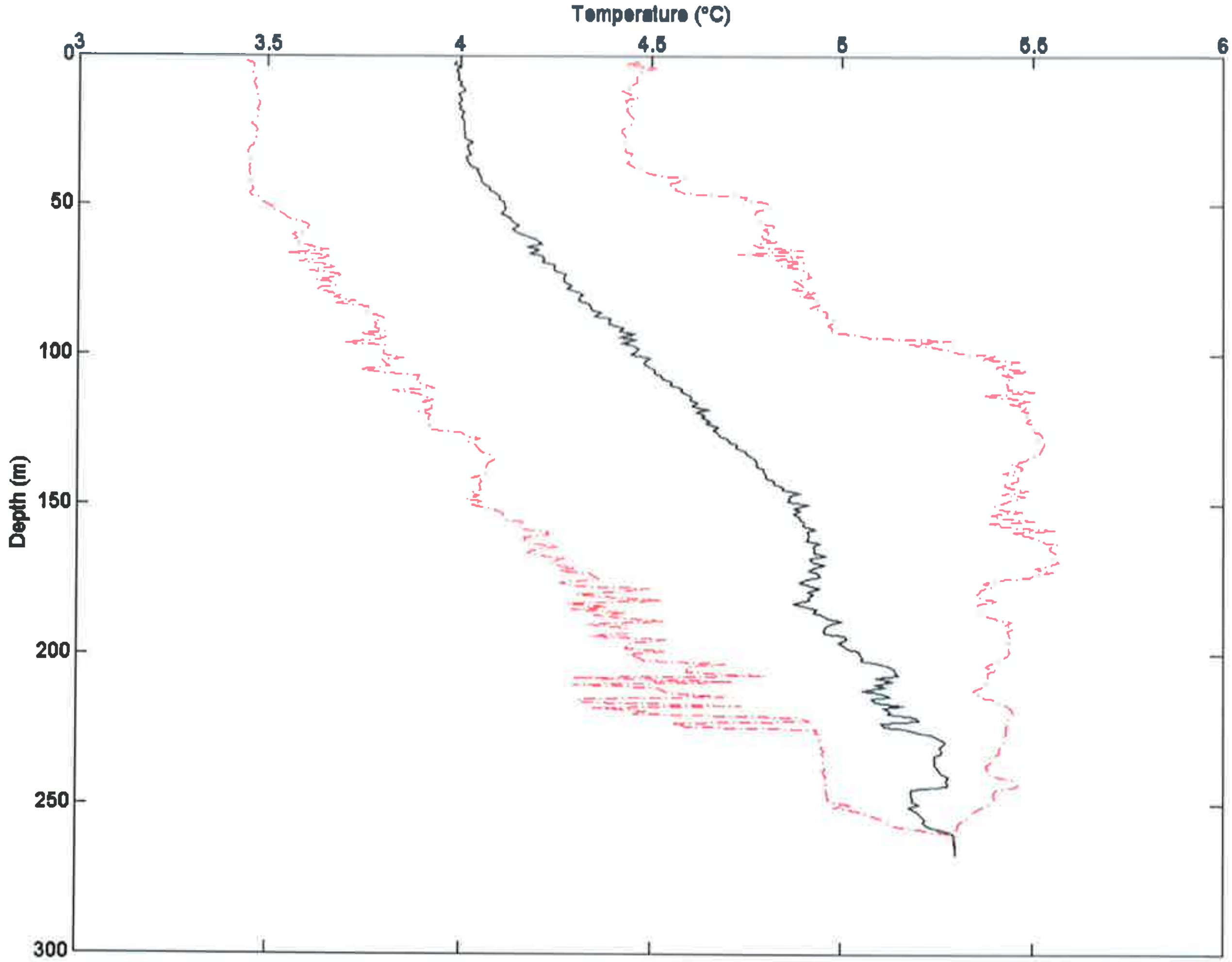

Figure 19. -- Mean water temperature (°C; solid line) by 1-m depth intervals for the 21 trawl haul locations observed during the winter 2014 acoustic-trawl survey of walleye pollock in Shelikof strait.

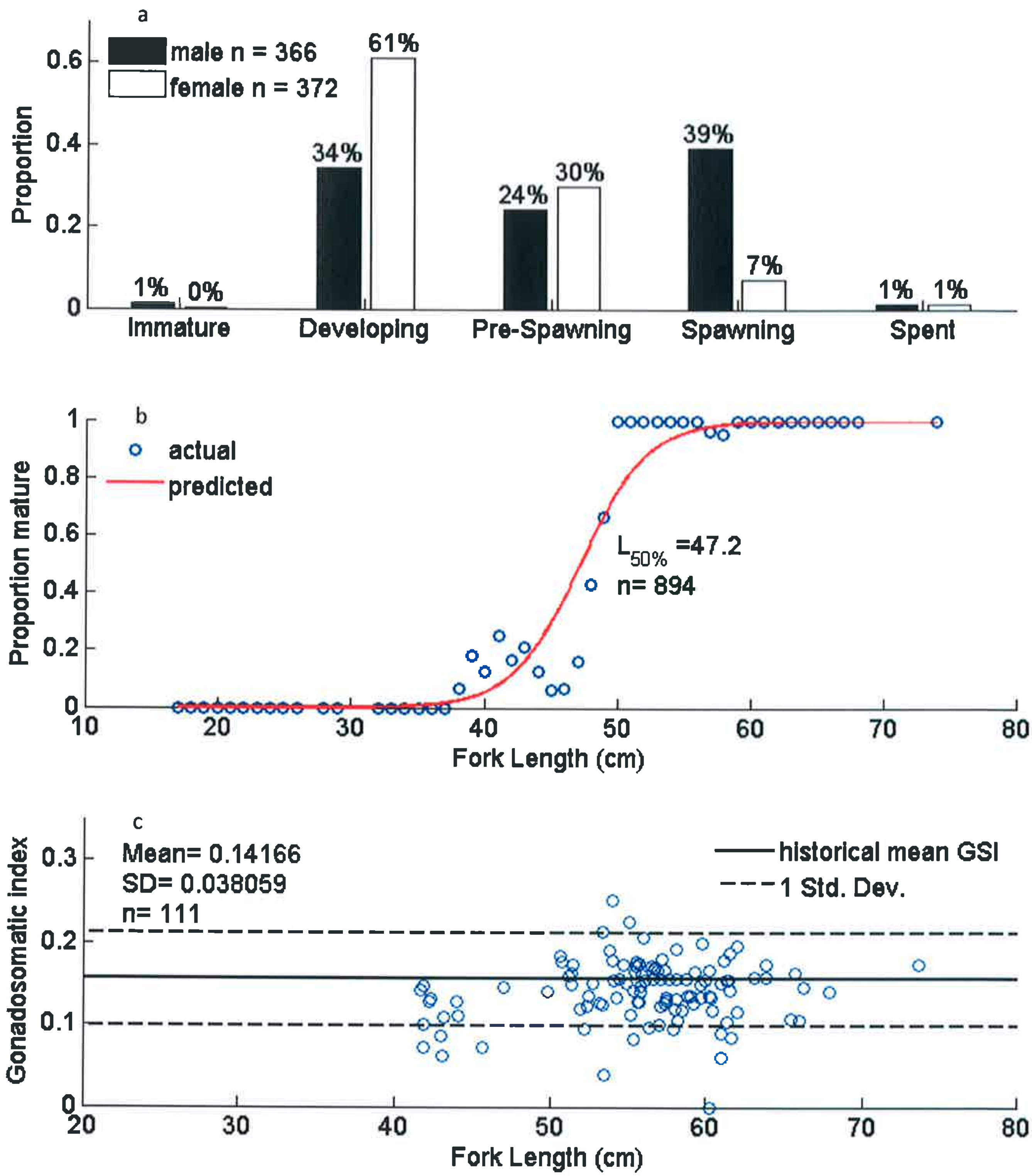

Figure 20. -- Maturity composition for male and female walleye pollock greater than 40 cm FL within each stage (a); proportion mature (i.e. pre-spawning, spawning, or spent) by 1-cm size group for female walleye pollock (b); gonadosomatic index (with historic survey mean ± 1 std. dev.) for pre-spawning females examined during the 2014 acoustic-trawl survey of the Shelikof region (c). Note: these graphs do not include data from age-1 fish.

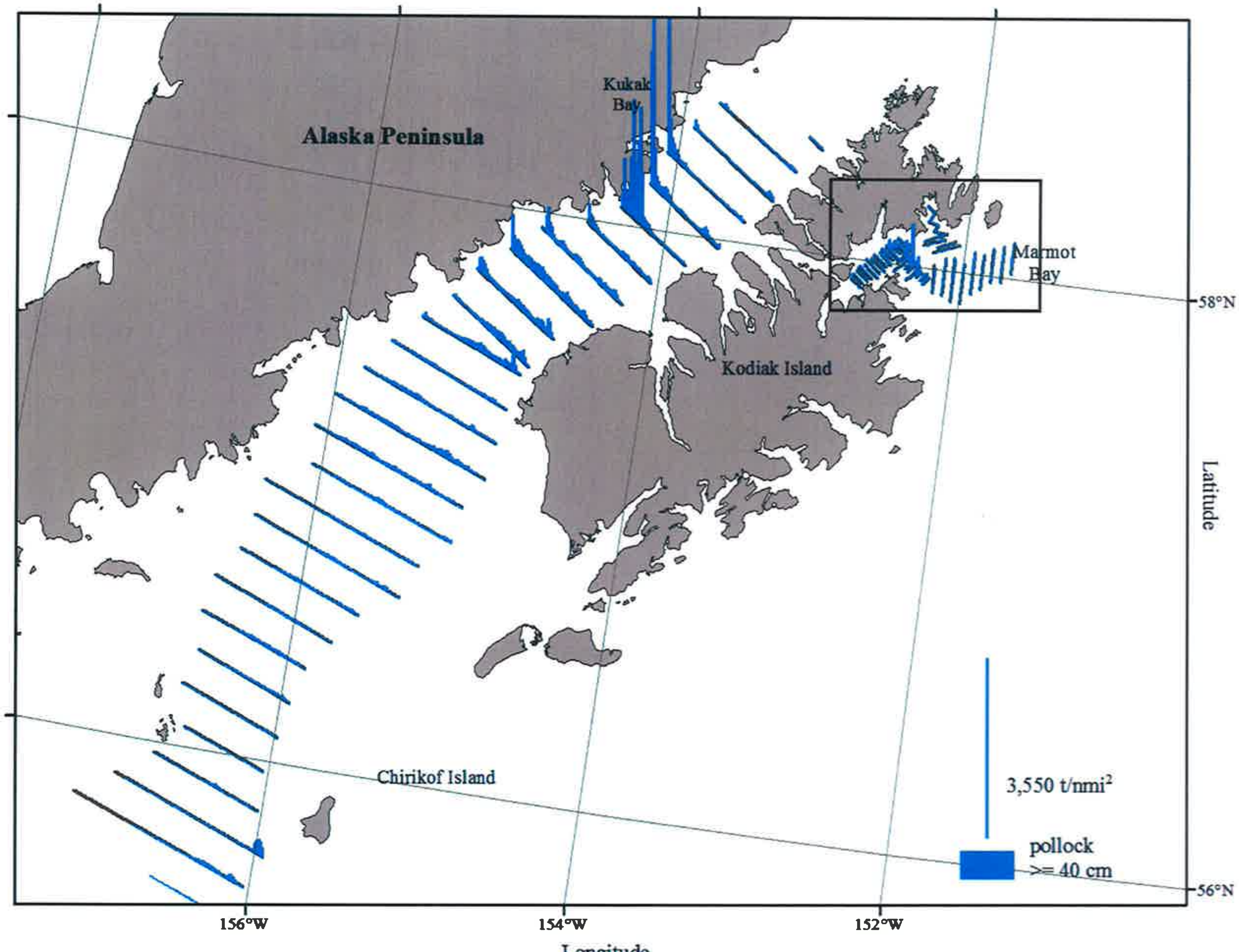

Figure 21a. -- Biomass (t/nmi^2) attributed to walleye pollock ≥ 40 cm FL (vertical lines) along tracklines surveyed during the winter 2014 acoustic-trawl survey of Shelikof Strait and Marmot Bay. Box indicates area enlarged in Figure 33.

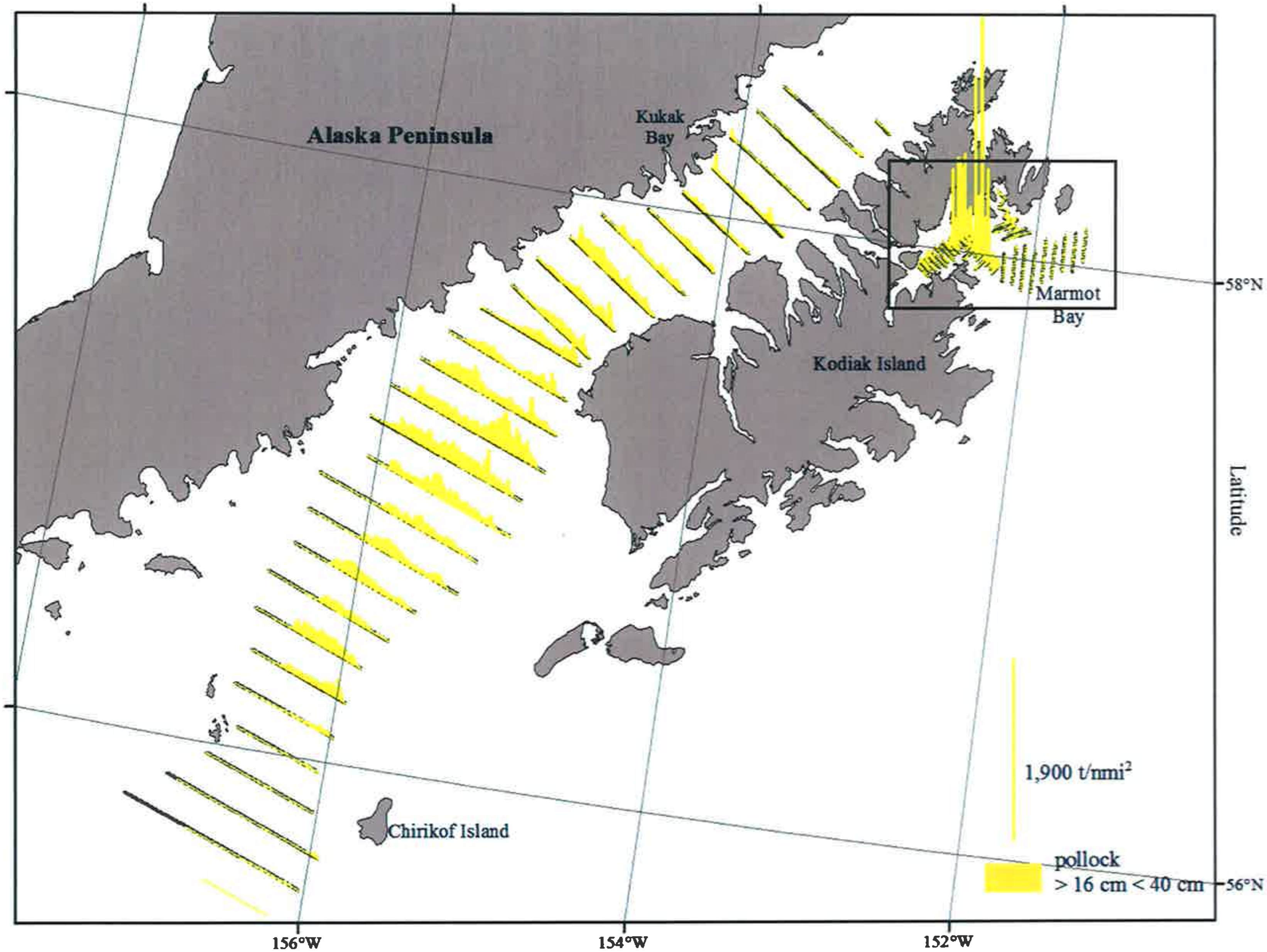

Figure 21b. -- Biomass (t/nmi^2) attributed to walleye pollock >16 cm FL and < 40 cm FL (vertical lines) along tracklines surveyed during the winter 2014 acoustic-trawl survey of Shelikof Strait and Marmot Bay. Box indicates area enlarged in Figure 33b.

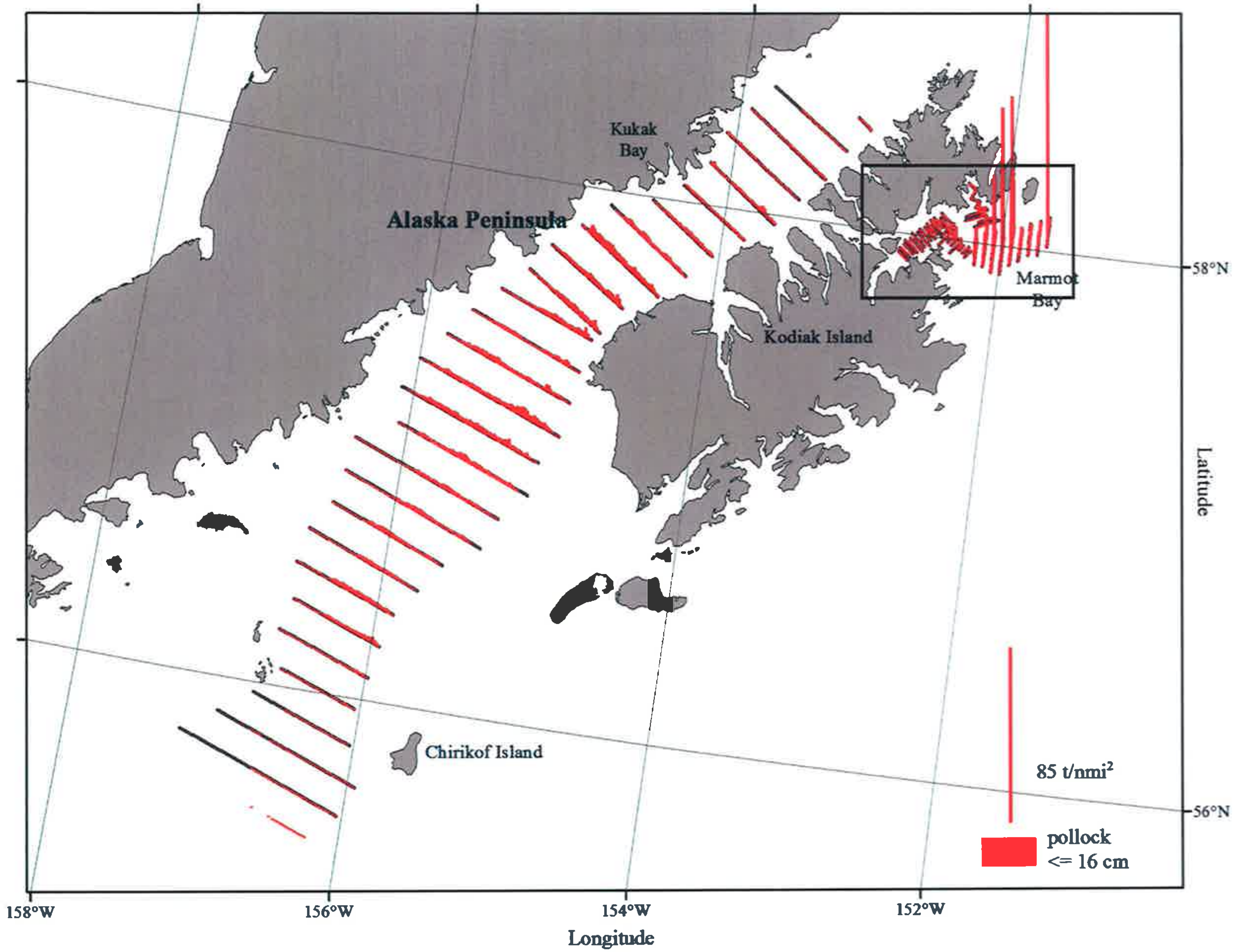

Figure 21c. -- Biomass (t/nmi^2) attributed to walleye pollock ≤ 16 cm FL (vertical lines) along tracklines surveyed during the winter 2014 acoustic-trawl survey of Shelikof Strait and Marmot Bay. Box indicates area enlarged in Figure 33c.

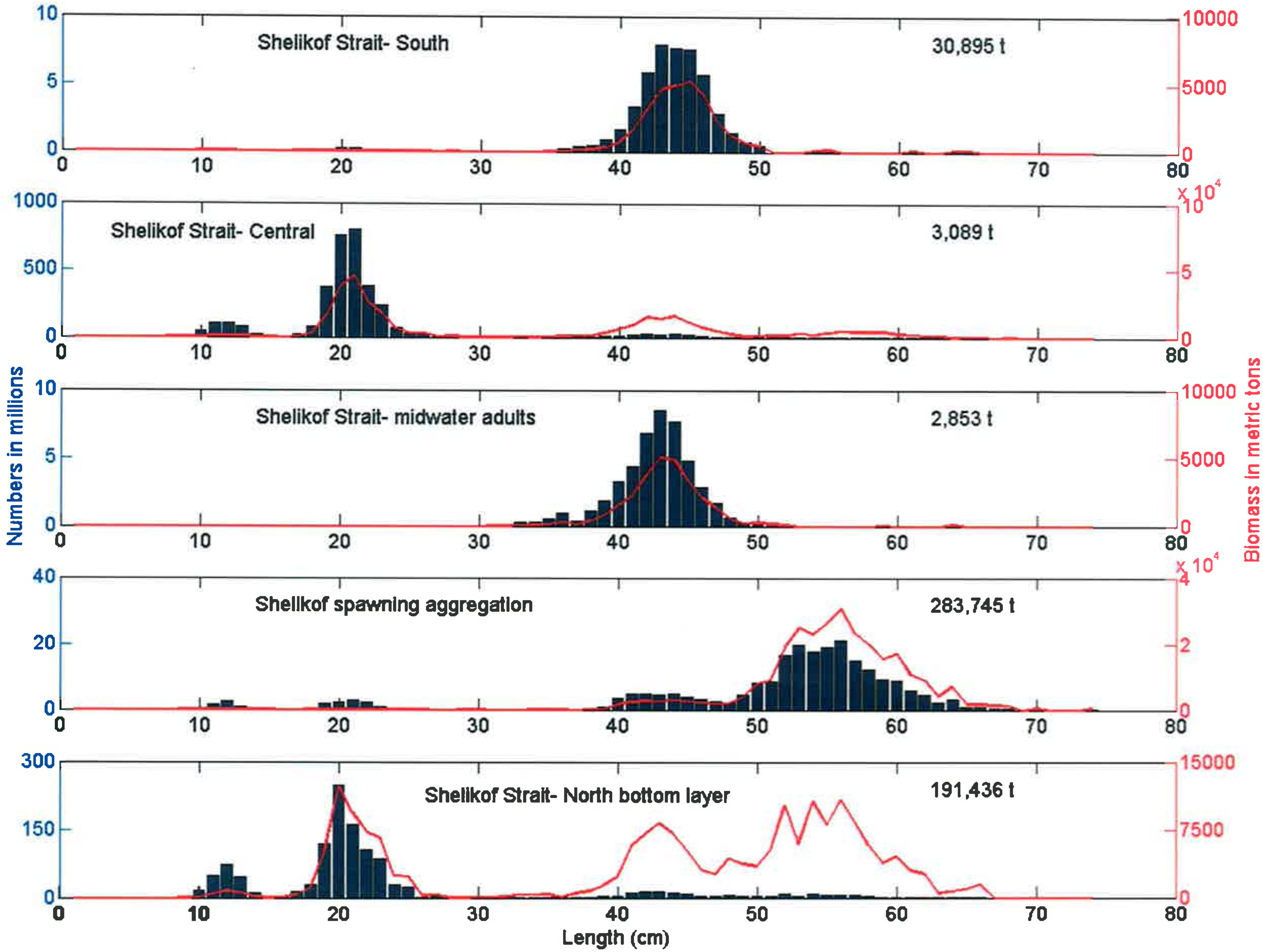

Figure 22. -- Length distribution of walleye pollock shown with blue bars (numbers) and biomass estimate in red line (metric tons, t) for the 2014 acoustic-trawl survey of the Shelikof Strait; broken down by length keys.

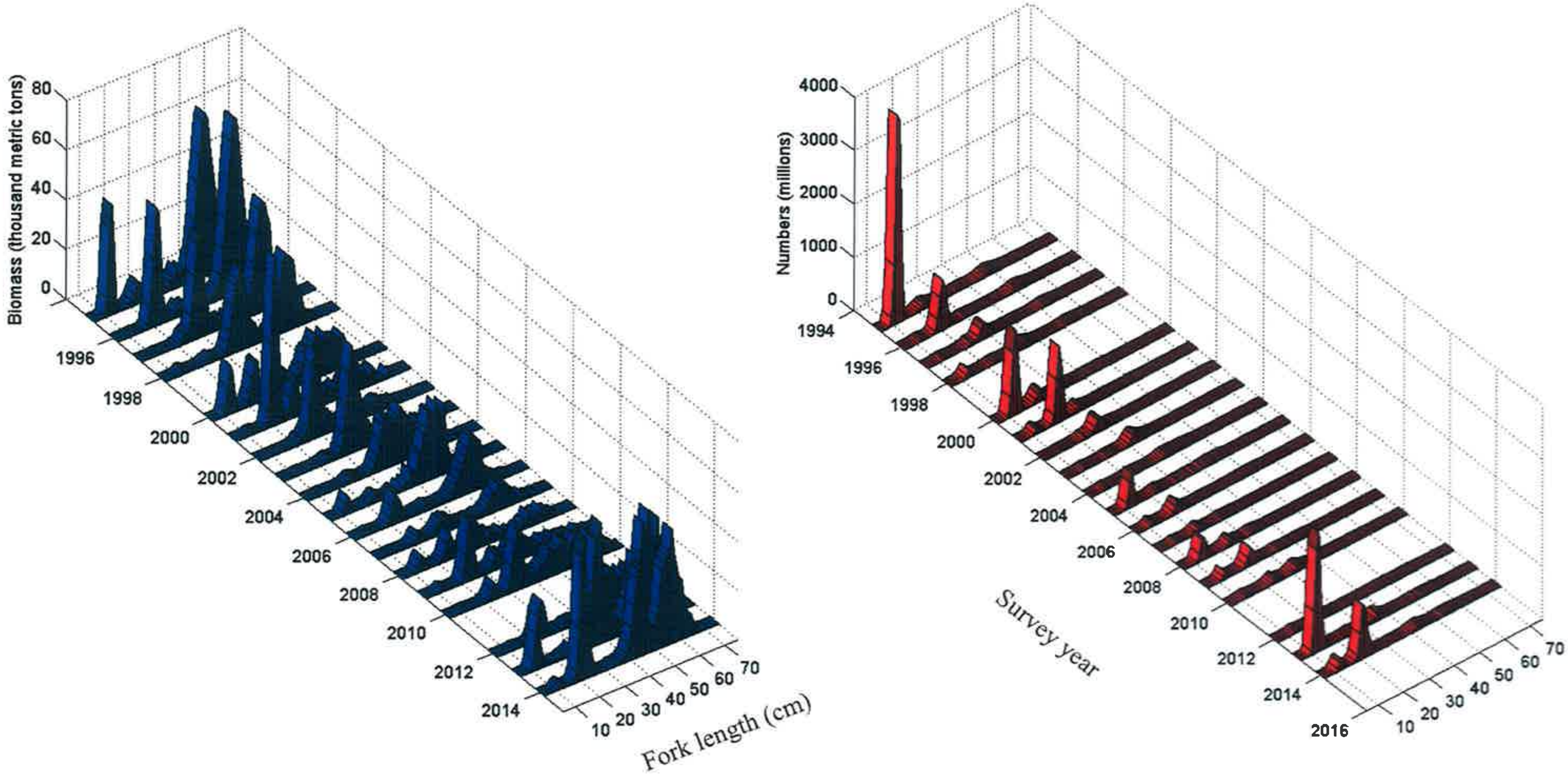

Figure 23. -- Walleye pollock numbers in millions (right) and biomass in thousands of metric tons (left) at length from the Shelikof Strait acoustic-trawl surveys since 1994. No surveys were conducted in 1999 or 2011.

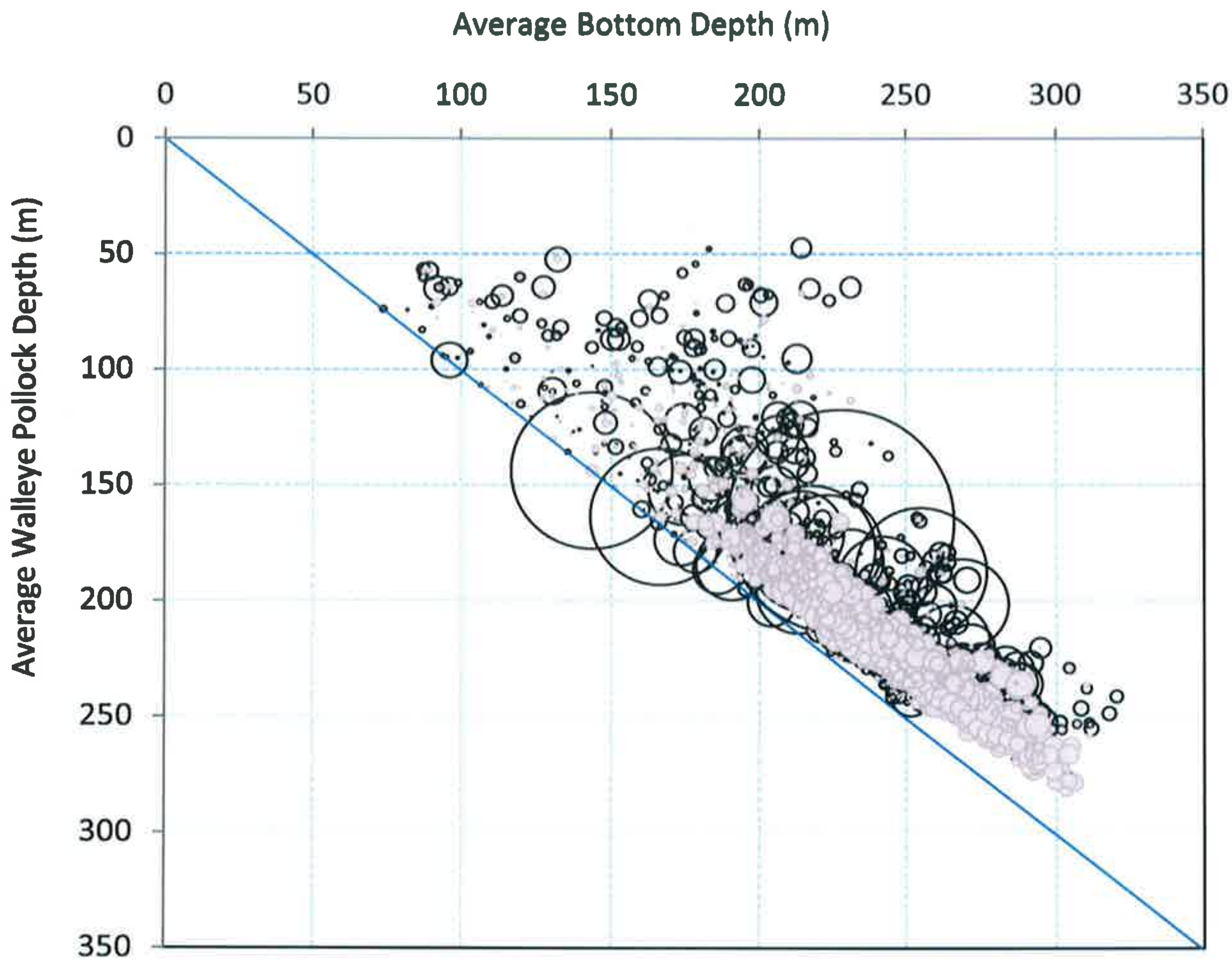

Figure 24. -- Average pollock depth (weighted by biomass) versus bottom depth (m) for walleye pollock < 40 cm length (grey circles) and walleye pollock ≥ 40 cm (open circles) observed during the winter 2014 acoustic-trawl survey of Shelikof Strait area. Circle size is scaled to the maximum biomass per 0.5 nautical mile survey track interval. The diagonal line indicates where the average fish depth equals bottom depth.

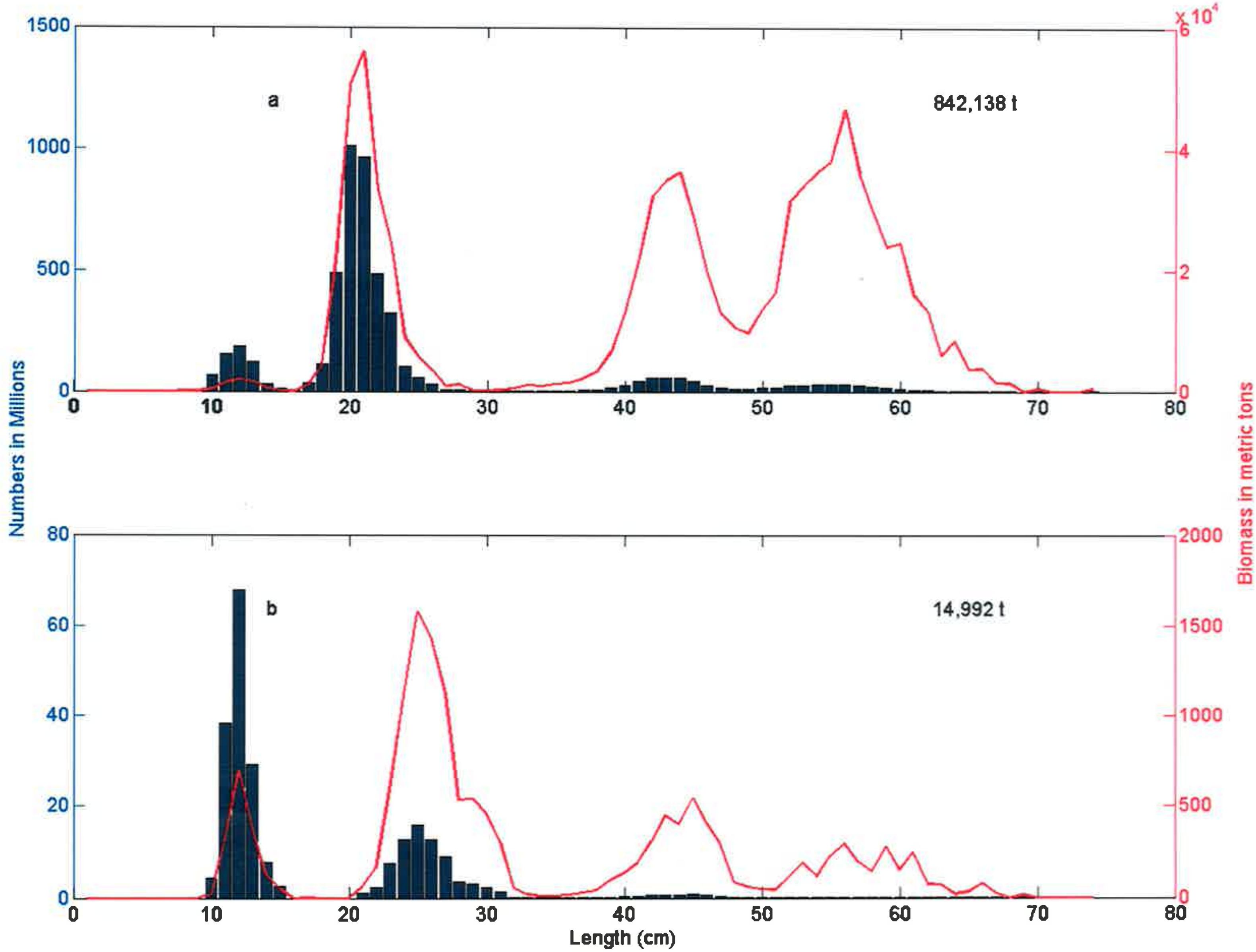

Figure 25. -- Length distribution of walleye pollock shown with blue bars (numbers) and biomass estimate in red line (metric tons, t) for the 2014 acoustic-trawl survey of the Shelikof Strait (a) and Marmot (b).

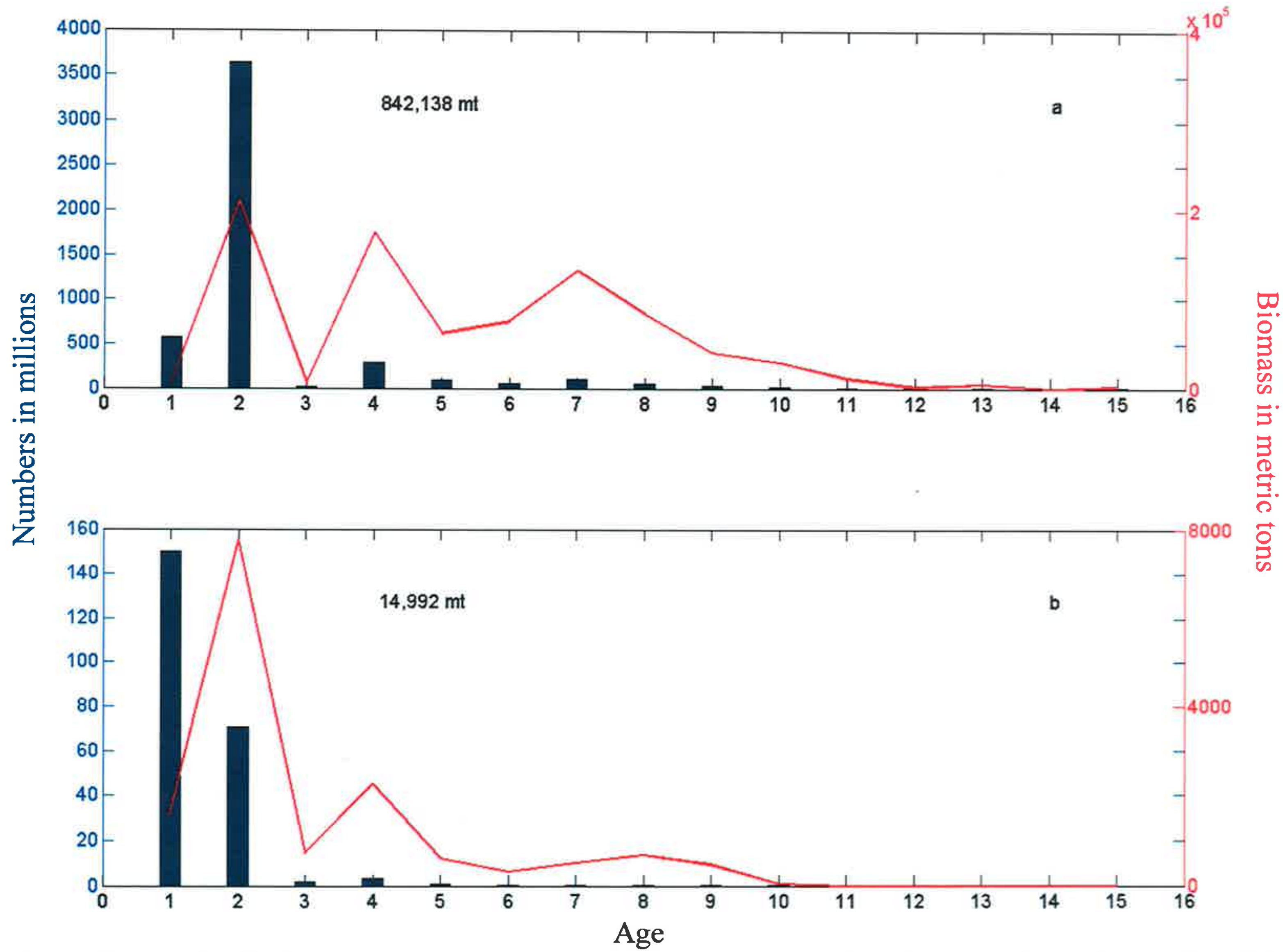

Figure 26. -- Age distribution of walleye pollock are shown with bars (numbers) and biomass estimate shown with solid red line (metric tons, t) for the 2014 acoustic-trawl survey of Shelikof Strait (a) and Marmot (b).

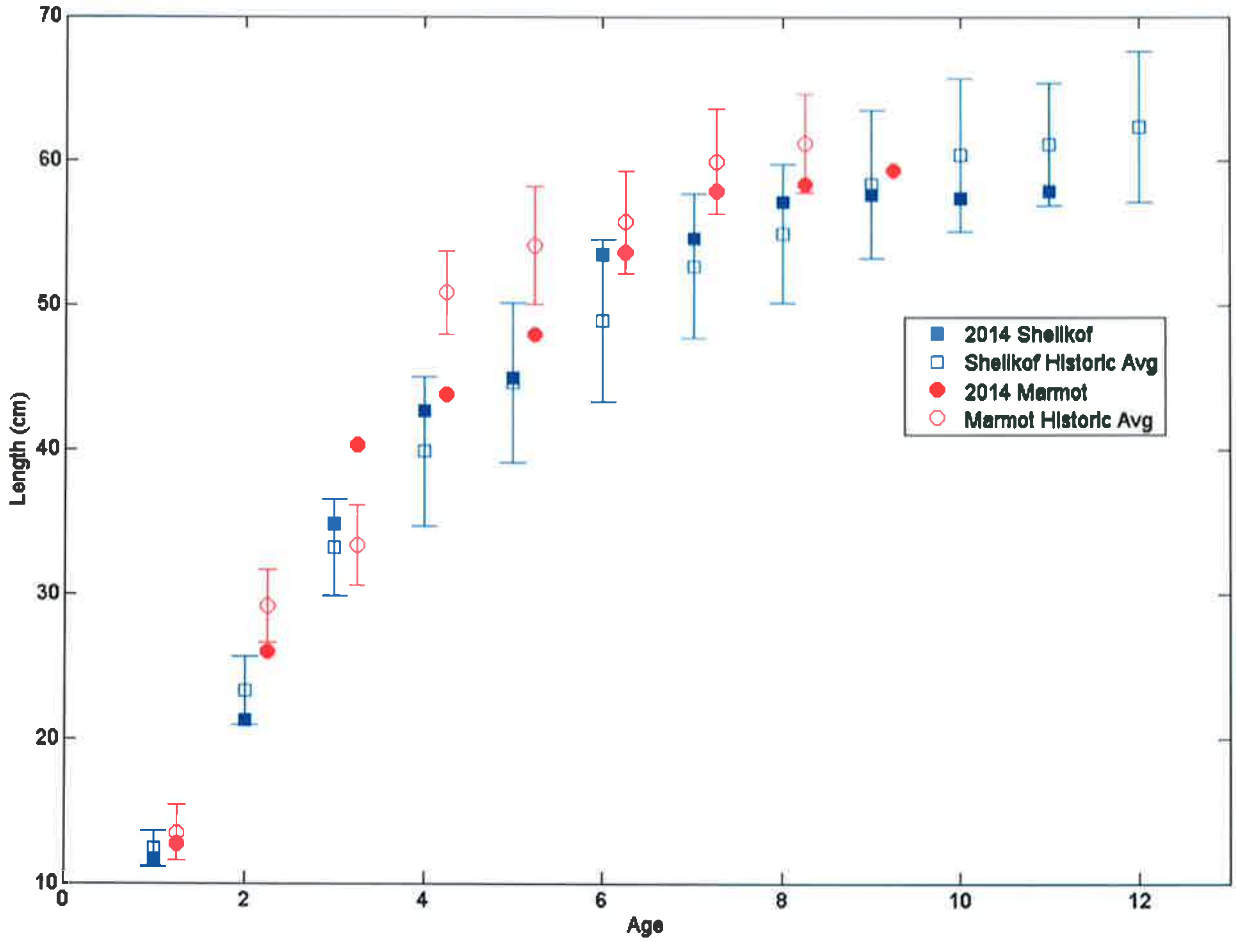

Figure 27. -- Walleye pollock average length at age from historic winter Shelikof (2003-2010, 2012, 2013) and Marmot (2008, 2013) acoustic-trawl surveys compared with walleye pollock average length at age for winter 2014. Results are for midwater tows where at least five fish were measured in the U.S. Exclusive Economic Zone (EEZ). Bars show +/- 1 standard deviation for the historic data.

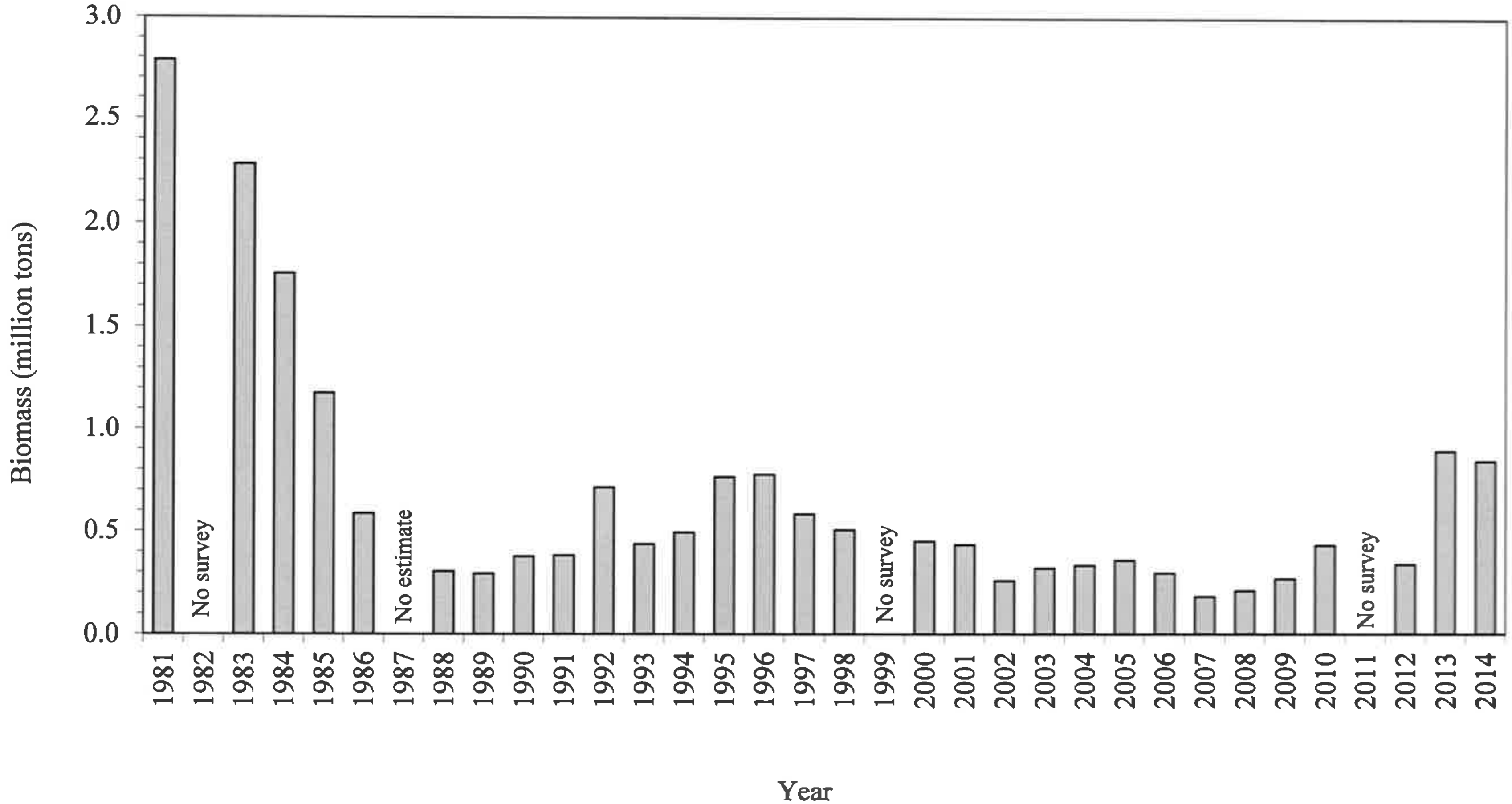

Figure 28. -- Summary of walleye pollock biomass estimates (million metric tons) based on acoustic-trawl surveys of the Shelikof Strait area.

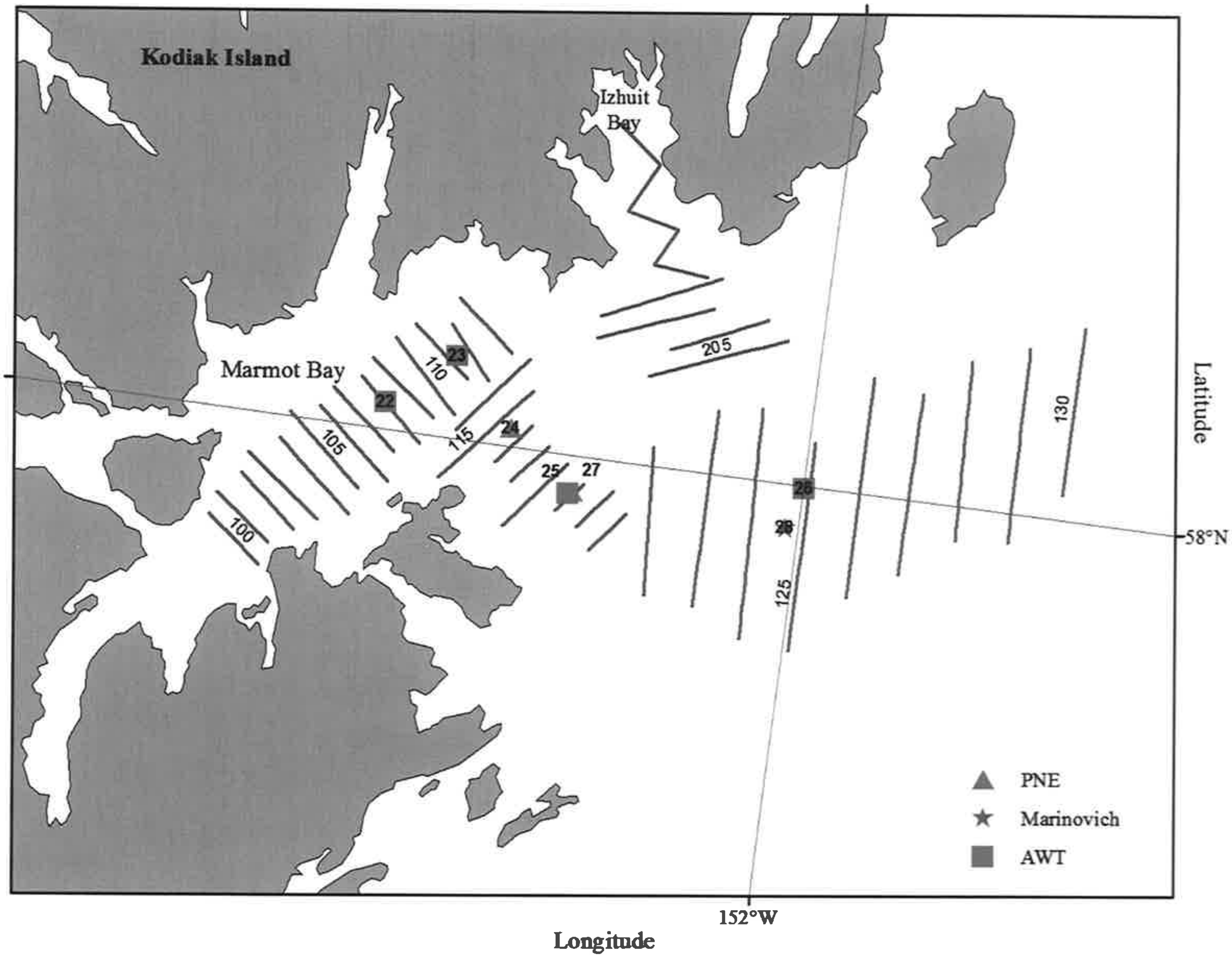

Figure 29. -- Transect lines and locations of Aleutian-wing trawl (AWT), poly-Nor'eastern trawl (PNE), and Marinovich hauls during the winter 2014 acoustic-trawl survey of walleye pollock in Marmot Bay and Izhut Bay. Haul numbers are on top of haul symbols, except for hauls 25 and 27, which overlap. Figure represents area enlarged from Figure 17.

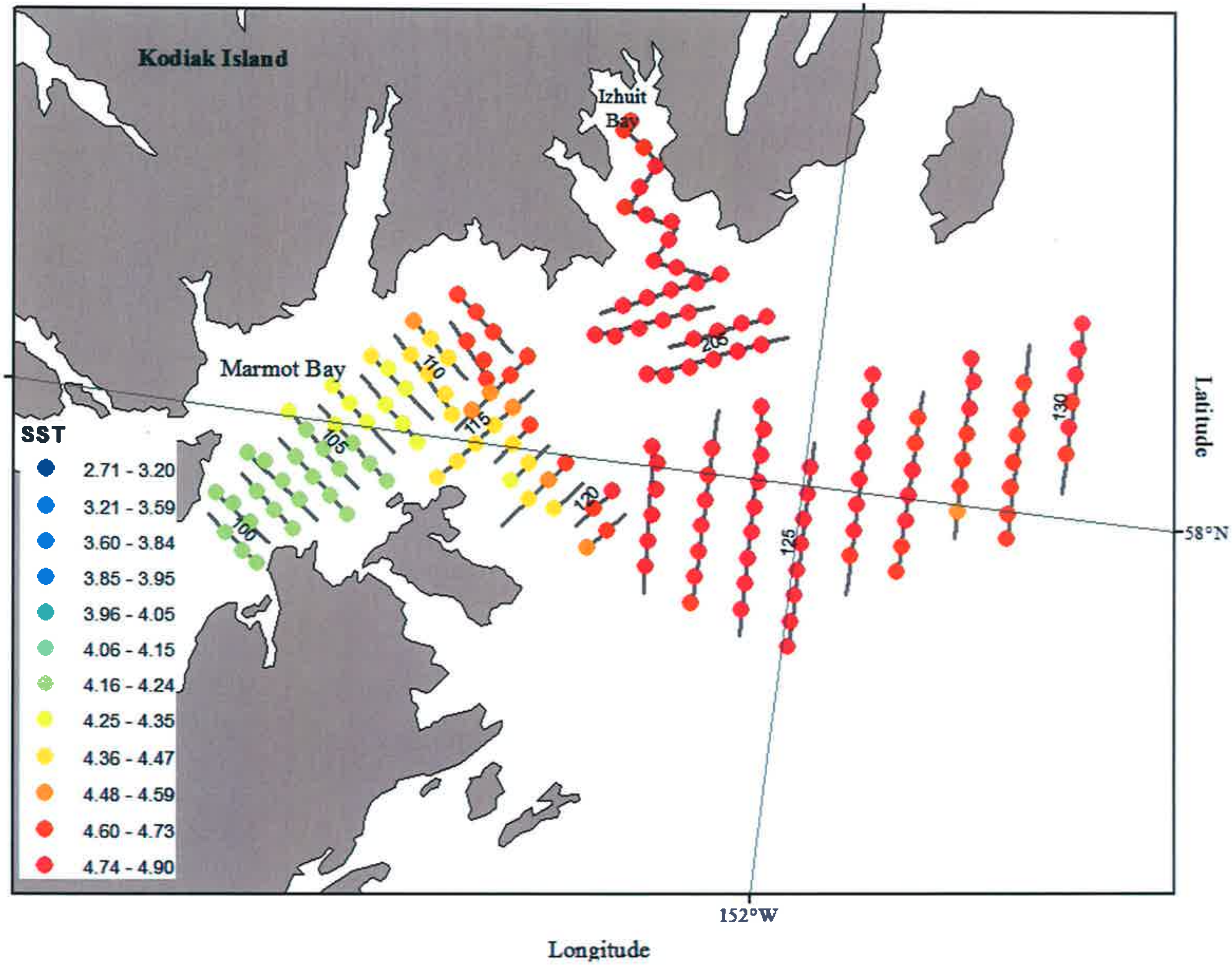

Figure 30. -- Surface water temperatures (°C) during the 2014 acoustic-trawl survey of Marmot Bay and Shelikof Strait recorded from the ship's Furuno T-2000 temperature probe located 1.4 m below the surface.

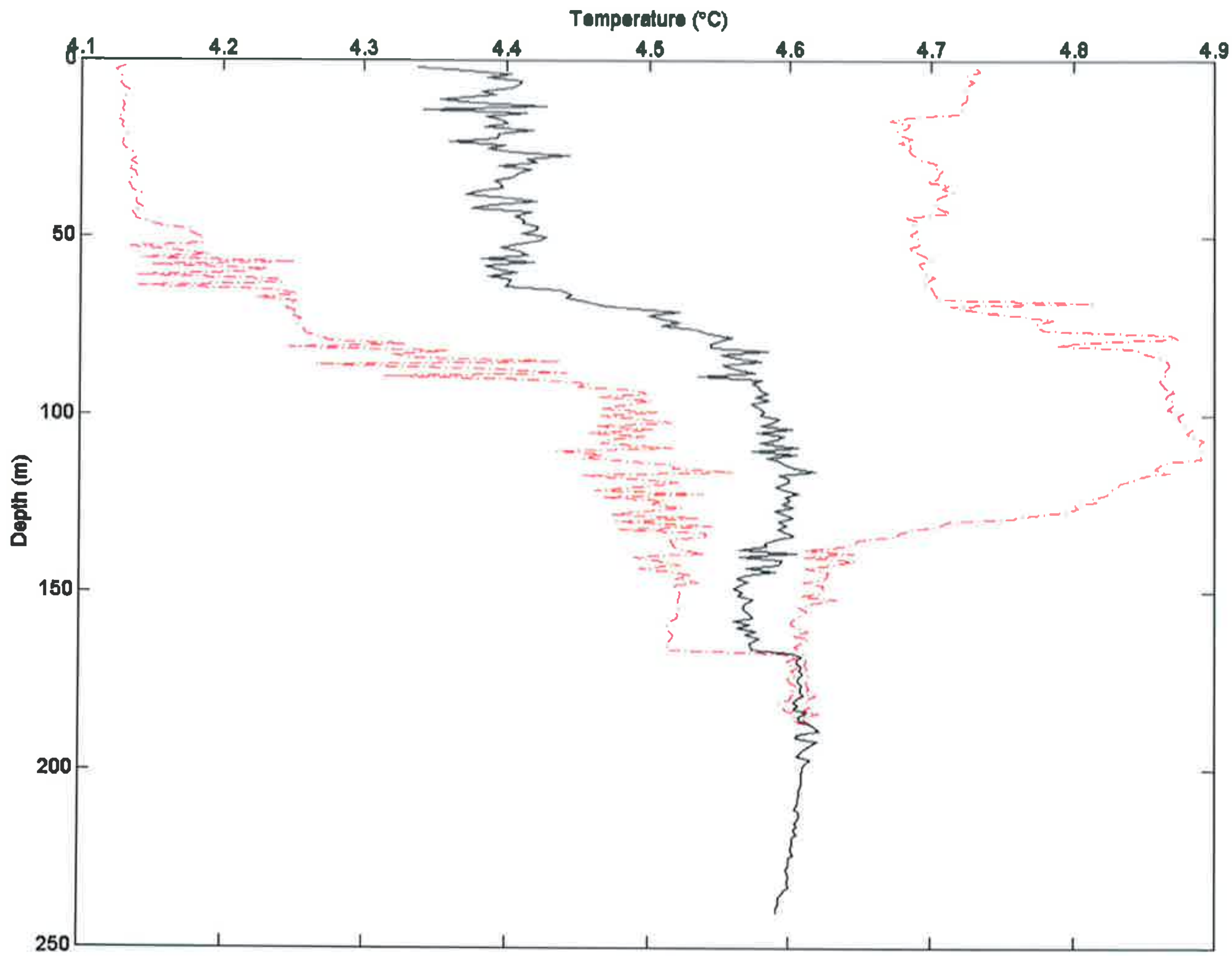

Figure 31. -- Mean water temperature (°C; solid line) by 1-m depth intervals for the six trawl haul locations observed during the winter 2014 acoustic-trawl survey of walleye pollock in Marmot Bay.

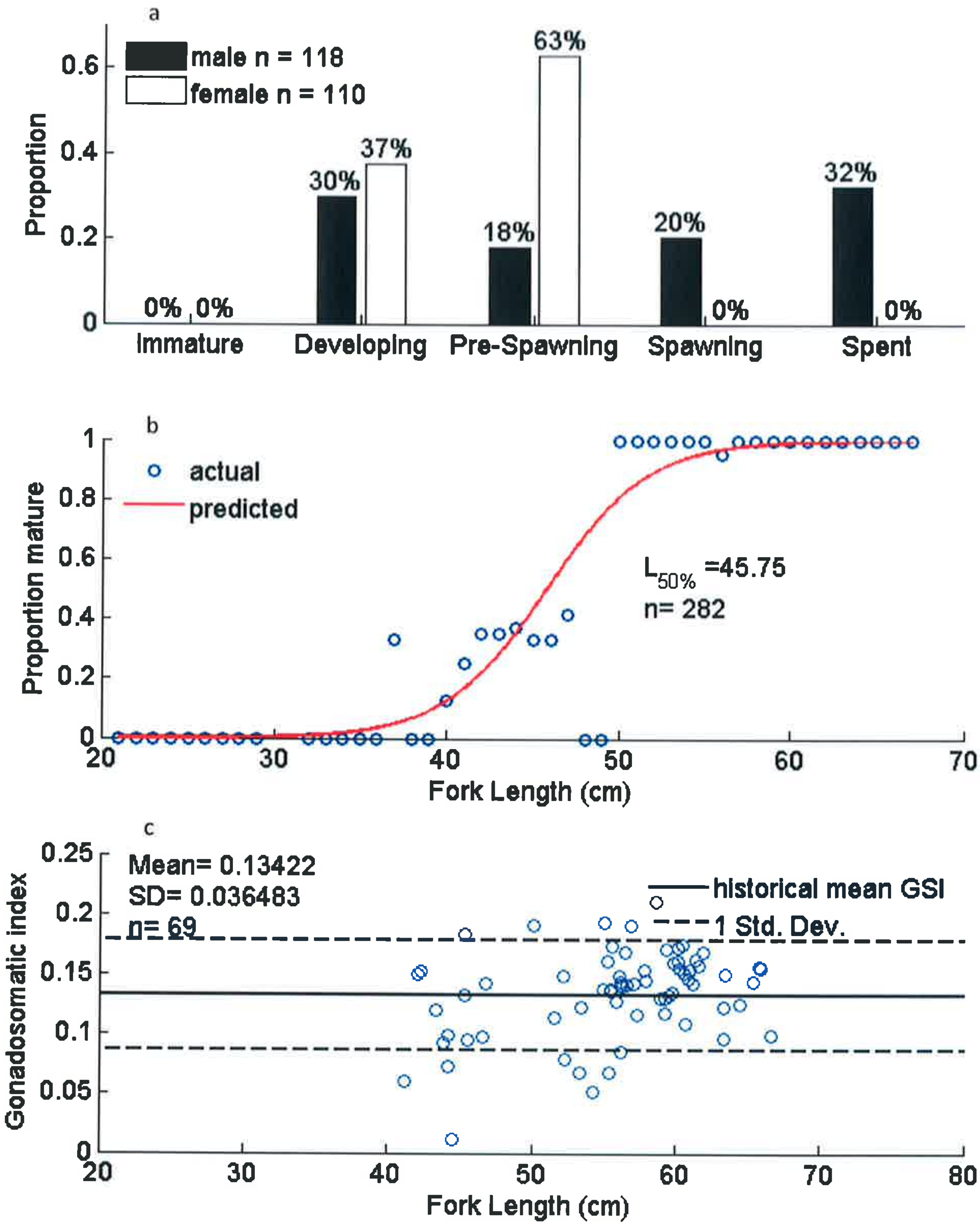

Figure 32. -- Maturity stages and percentage of fish greater than 40 cm FL within each stage for (a) male and female walleye pollock; (b) proportion mature (i.e. pre-spawning, spawning, or spent) by 1-cm size group for female walleye pollock; (c) gonadosomatic index (with historic survey mean, and minimum and maximum of historic survey means) for pre-spawning females examined during the 2014 acoustic-trawl survey of the Marmot region. Note: these graphs do not include data from age-1 fish.

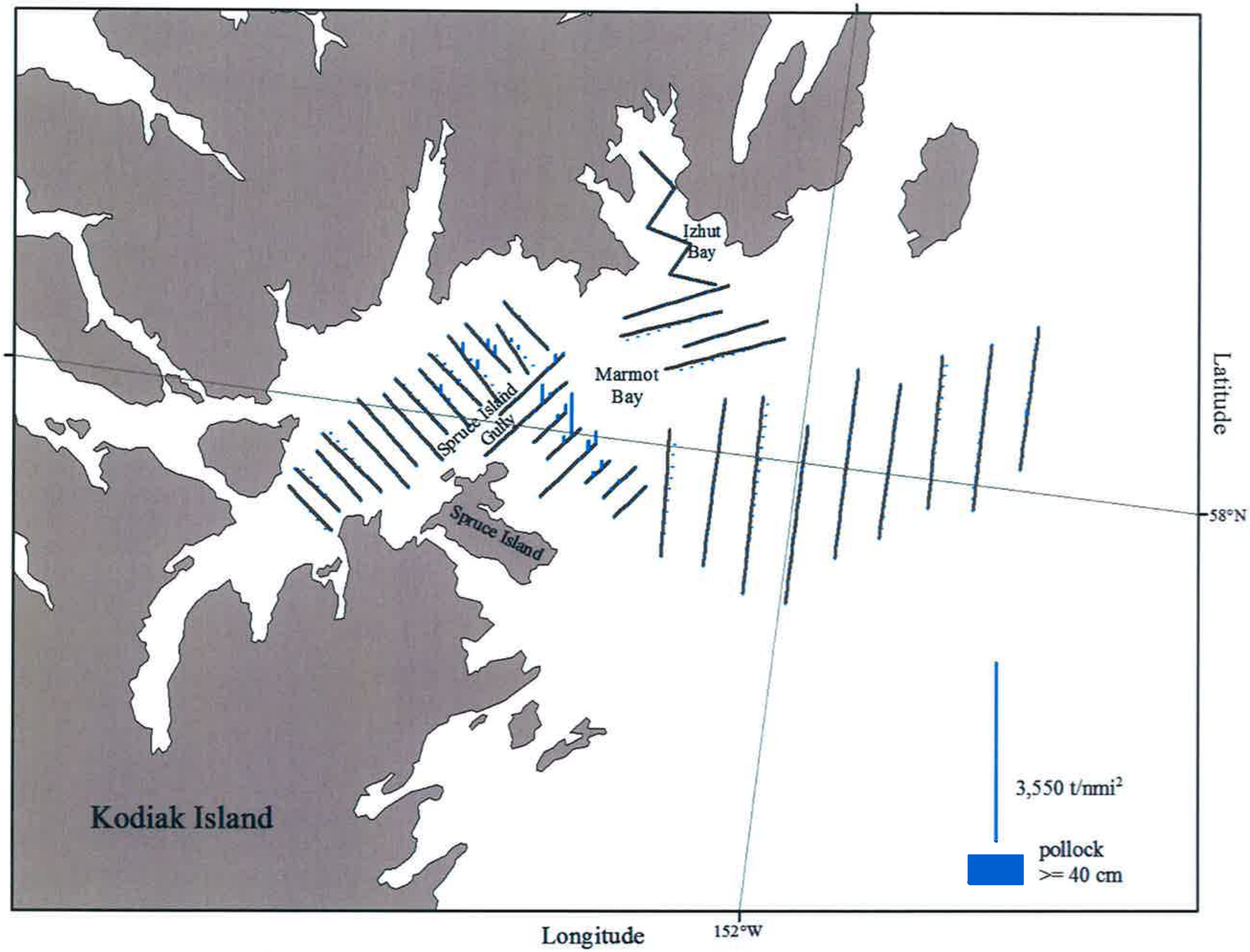

Figure 33a. -- Biomass (t/nmi^2) attributed to walleye pollock $\geq$ 40 cm FL (vertical lines) along tracklines surveyed during the winter 2014 acoustic-trawl survey of Marmot Bay.

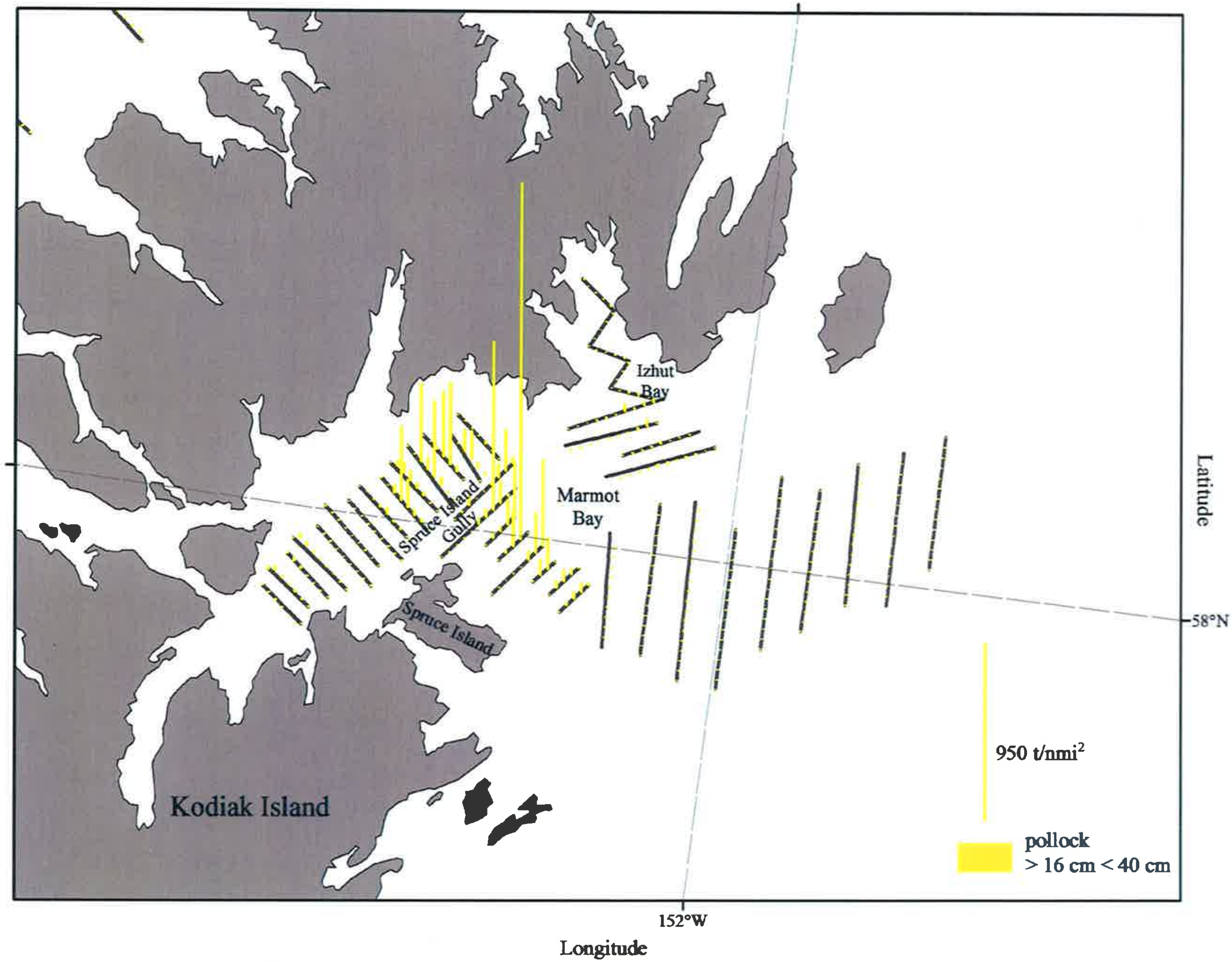

Figure 33b. -- Biomass (t/nmi^2) attributed to walleye pollock >16 cm FL and < 40 cm FL (vertical lines) along tracklines surveyed during the winter 2014 acoustic-trawl survey of Marmot Bay.

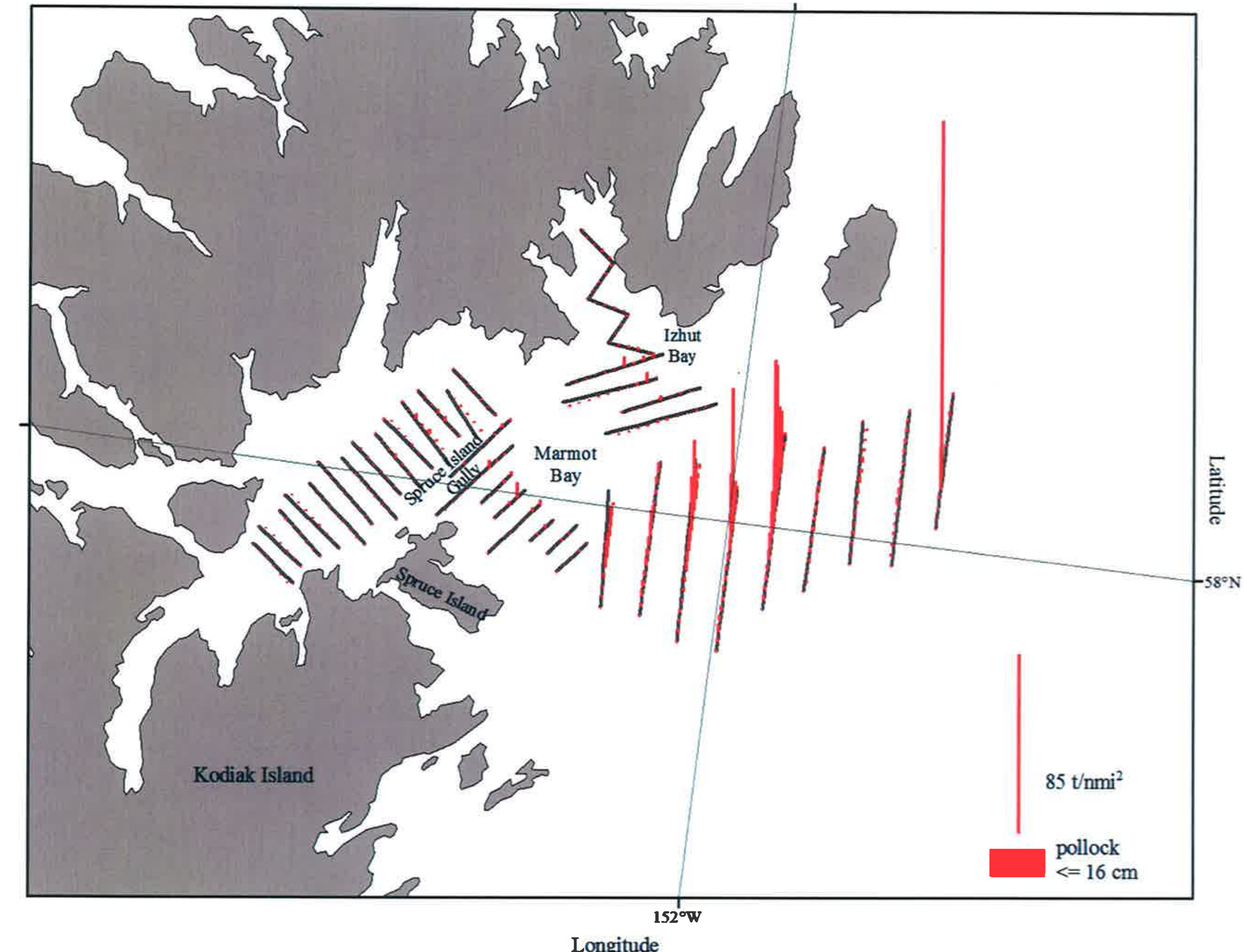

Figure 33c. -- Biomass (t/nmi^2) attributed to walleye pollock $\leq$ 16 cm FL (vertical lines) along tracklines surveyed during the winter 2014 acoustic-trawl survey of Marmot Bay.

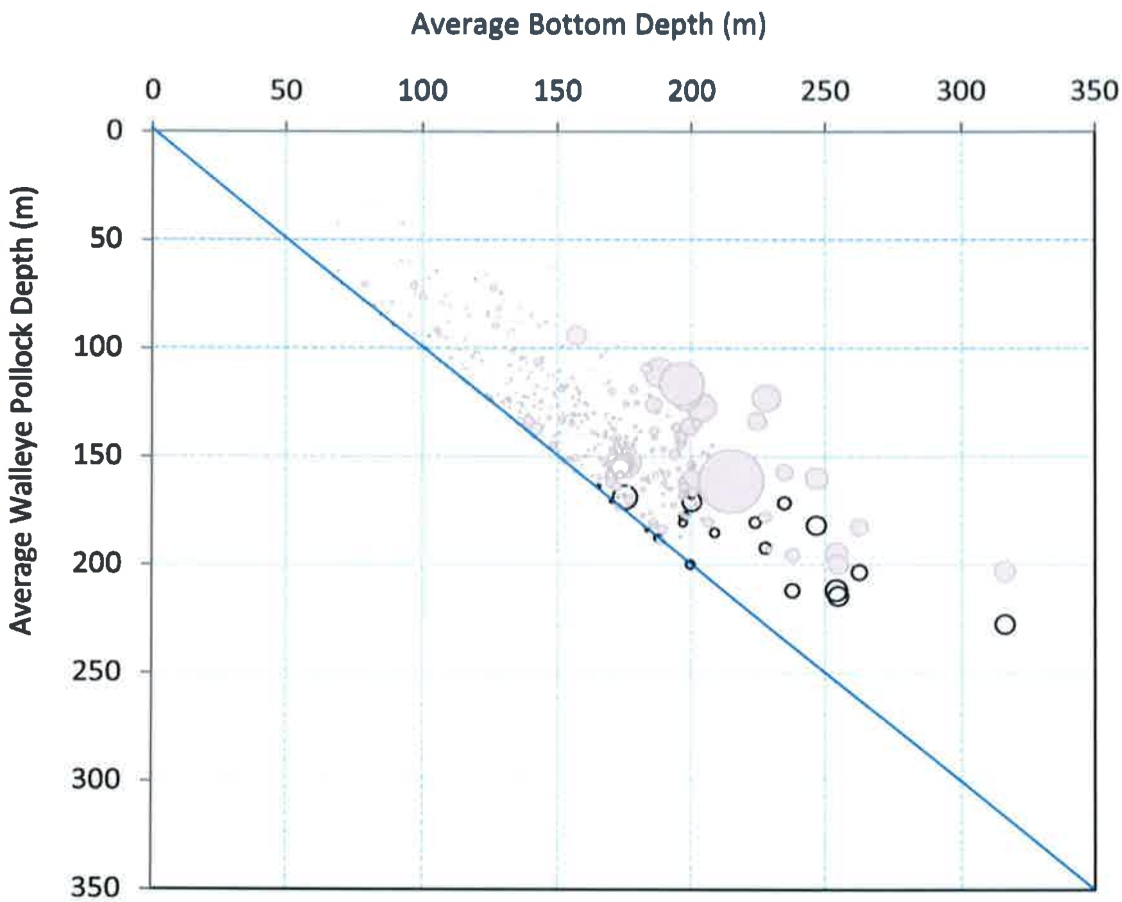

Figure 34. -- Average pollock depth (weighted by biomass) versus bottom depth (m) for walleye pollock < 40 cm in length (grey circles) and those ≥ 40 cm (open circles) observed during the winter 2014 acoustic-trawl survey of Marmot Bay area. Circle size is scaled to the maximum biomass per 0.5 nautical mile survey track interval. The diagonal line indicates where the average pollock depth equals bottom depth.

Table 1. -- Simrad EK60 38 kHz acoustic system description and settings used during the winter 2014 Gulf of Alaska acoustic-trawl surveys of walleye pollock. Also presented are results from standard sphere acoustic system calibrations conducted in association with the survey, and final values used to calculate biomass and abundance data.

	Winter 2014 system settings	21 Feb Uyak Bay Alaska	23 Mar Izhut Bay Alaska	Final analysis parameters
Echosounder	Simrad EK60	--	--	Simrad EK60
Transducer	ES38B	--	--	ES38B
Frequency (kHz)	38	--	--	38
Transducer depth (m)	9.15	--	--	9.15
Pulse length (ms)	1.024	--	--	1.024
Transmitted power (W)	2000	--	--	2000
Angle sensitivity along	22.83	--	--	22.83
Angle sensitivity athwart	21.43	--	--	21.43
2-way beam angle (dB re 1 steradian)	-20.77	--	--	-20.77
Gain (dB)	22.75	22.75	22.73	22.74
Sa correction (dB)	-0.62	-0.62	-0.63	-0.63
Integration gain (dB)	22.13	22.13	22.10	22.11
3 dB beamwidth along	6.74	6.74	6.74	6.74
3 dB beamwidth athwart	7.15	7.15	7.12	7.14
Angle offset along	-0.05	-0.05	-0.07	-0.06
Angle offset athwart	-0.04	-0.04	-0.06	-0.05
Post-processing S_v threshold (dB re 1 m^{-1})	-70	--	--	-70
Standard sphere TS (dB re 1 m^2)	--	-42.49	-42.21	--
Sphere range from transducer (m)	--	21.72	24.86	--
Absorption coefficient (dB/m)	0.0099	0.0099	0.0100	0.0099
Sound velocity (m/s)	1466[1]	1462.3	1462.3	1466
Water temp. at transducer (°C)	--	3.2	4.5	--

[1]The sound speed setting in Shumagins and Sanak was 1,462.3 m/s.

Note: Gain and beam pattern terms are defined in the Operator Manual for Simrad EK60 Scientific echosounder application, which is available from Simrad Strandpromenaden 50, Box 111, N-3191 Horten, Norway.

Table 2.--Trawl station and catch data summary from the winter 2014 acoustic-trawl survey of walleye pollock in Shumagins Islands and Sanak Trough.

Haul			Date	Time	Duration	Start position		Depth (m)		Water temp. (°C)		Catch			
												Pollock		Eulachon	Other
No.	Area	Gear type[1]	(GMT)	(GMT)	(minutes)	Latitude (N)	Longitude (W)	Footrope	Bottom	Headrope	Surface[2]	(kg)	Number	(kg)	(kg)
1	Shumagins	AWT	23-Feb	14:30	21	55° 2.87'	160° 23.80'	103	155	4.2	3.9	12	378	0	5.6
2	Shumagins	AWT	23-Feb	19:54	2	55° 6.24'	160° 20.28'	155	182	4.1	3.8	80	1,524	1	3.1
3	Shumagins	AWT	24-Feb	03:25	12	55° 22.56'	160° 17.45'	136	161	4.2	3.9	327	1,148	3	281.9
4	Shumagins	AWT	24-Feb	17:11	11	55° 12.39'	158° 33.87'	163	204	5.2	4.2	731	13,582	94	4.6
5[3]	Shumagins	AWT	25-Feb	02:56	2	55° 18.30'	158° 57.02'	-	193	-	-	-	-	-	-
6	Shumagins	AWT	25-Feb	17:16	28	55° 31.51'	159° 49.58'	10	149	3.8	3.5	432	7137	0	0
7	Shumagins	AWT	25-Feb	22:18	6	55° 35.94'	160° 04.01'	145	163	4.2	3.9	72	1,017	0	0.1
8	Shumagins	PNE	26-Feb	03:49	10	55° 34.77'	160° 17.21'	185	191	4.6	3.7	149	313	3	54.9
9	Sanak	AWT	27-Feb	00:00	38	54° 36.01'	162° 39.01'	107	140	3.8	3.7	480	313	0	3.5
10	Shumagins	AWT	27-Feb	13:30	8	55° 25.07'	160° 25.07'	143	181	4.0	3.8	451	5,341	21	22.4

[1]Gear type: AWT = Aleutian wing trawl, PNE = poly NorEastern bottom trawl

[2]Temperature from hull-mounted sensor, may differ from SBE readings

[3]Third wire was not working properly, so the tow was aborted.

Table 3.–Numbers of walleye pollock measured and biological samples collected during the winter 2014 acoustic-trawl surveys of Shumagin Islands and Sanak Trough (haul 9).

Haul	Walleye pollock				
no.	Lengths	Weights	Maturities	Otoliths	Ovary weights
1	154	31	8	13	4
2	176	76	45	50	4
3	246	60	47	47	24
4	185	27	6	11	0
5	-	-	-	-	-
6	166	35	24	24	1
7	165	35	11	16	4
8	220	115	94	45	34
9	313	100	100	40	16
10	301	109	84	33	31
Totals	1,926	588	419	279	118

Table 4.--Catch by species, and numbers of length and weight measurements taken from individuals, during the seven completed AWT midwater trawl hauls during the winter 2014 acoustic-trawl survey of walleye pollock in the Shumagin Islands.

Species name	Scientific name	Catch Weight (kg)	%	Number	%	Individual Measurements Length	Weight
walleye pollock	*Gadus chalcogrammus*	2,103.6	82.8	30,127	77.7	1,393	373
Pacific cod	*Gadus macrocephalus*	300.9	11.8	85	0.2	52	31
eulachon	*Thaleichthys pacificus*	118.1	4.7	8,422	21.7	240	23
smooth lumpsucker	*Aptocyclus ventricosus*	11.9	0.5	8	0.0	8	0
Chinook salmon	*Oncorhynchus tshawytscha*	2.8	0.1	2	0.0	2	0
arrowtooth flounder	*Atheresthes stomias*	0.9	0.0	3	0.0	3	0
flathead sole	*Hippoglossoides elassodon*	0.6	0.0	2	0.0	1	0
squid unidentified	Teuthoidea (order)	0.3	0.0	7	0.0	4	0
comb jelly unidentified	Ctenophora (phylum)	0.0	0.0	1	0.0	0	0
capelin	*Mallotus villosus*	0.0	0.0	6	0.0	2	0
salps unidentified	Salpidae (family)	0.0	0.0	1	0.0	0	0
shrimp unidentified	Decapoda (order)	0.5	0.0	113	0.3	0	0
Total		2,539.4		38,777		1,705	427

Table 5.--Catch by species, and numbers of length and weight measurements taken from individuals, during the one PNE bottom trawl haul during the winter 2014 acoustic-trawl survey of walleye pollock in the Shumagin Islands.

		Catch				Individual Measurements	
Species name	Scientific name	Weight (kg)	%	Number	%	Length	Weight
walleye pollock	*Gadus chalcogrammus*	149.4	72.1	313	57.1	220	115
smooth lumpsucker	*Aptocyclus ventricosus*	36.2	17.5	21	3.8	10	0
Pacific cod	*Gadus macrocephalus*	18.7	9.0	6	1.1	6	0
eulachon	*Thaleichthys pacificus*	3.0	1.4	191	34.9	35	11
capelin	*Mallotus villosus*	0.0	0.0	12	2.2	0	0
shrimp unidentified	Decapoda (order)	0.0	0.0	5	0.9	3	0
Total		207.4		548		274	126

Table 6. -- Estimates of walleye pollock biomass (in metric tons) and relative estimation error for the Shelikof Strait, Shumagin Islands, Sanak Trough, and Marmot Bay acoustic-trawl surveys.

Year	Shelikof Strait		Shumagin Islands		Chirikof shelf break		Sanak Trough		Marmot Bay	
	Biomass	Est. error	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								2,400	no est.
1990	374,700								no estimate	--
1991	380,300								no survey	--
1992	713,400	3.6%							no estimate	--
1993	435,800	4.6%							no survey	--
1994	492,600	4.5%	112,000 [2]						no survey	--
1995	763,600	4.5%	290,100						no survey	--
1996	777,200	3.7%	117,700 [3]						no survey	--
1997	583,000	3.7%	no survey						no survey	--
1998	504,800	3.8%	no survey						no survey	--
1999	no survey	--	no survey						no survey	--
2000	448,600	4.6%	no survey						no survey	--
2001	432,800	4.5%	119,600						no survey	--
2002	256,700	6.9%	135,600	27.1%	82,100	12.2%			no survey	--
2003	316,500	5.2%	67,700	17.2%	30,900	20.7%	80,500	21.6%	no survey	--
2004	326,800	9.2%	no survey	--	30,400	20.4%	no survey	--	no survey	--
2005	356,100	4.1%	52,000	11.4%	77,000	20.7%	65,500	7.4%	no survey	--
2006	293,600	4.0%	37,300	10.1%	69,000	11.0%	127,200	10.4%	no survey	--
2007	180,900	5.8%	20,000	8.6%	36,600	6.7%	60,300	5.7%	3,600	5.0%
2008	208,000	5.6%	30,600	9.8%	22,100	9.6%	19,800	6.7%	no survey	--
2009	266,000	5.9%	63,300	10.8%	400	32.3%	31,400	17.4%	19,800	no est.
2010	429,700	2.6%	18,200	11.6%	9,300	15.0%	26,700	11.6%	5,600	no est.
2011	no survey	--	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%	no survey	--
2013	891,261	5.3%	91,300	17.3%	63,000	31.4%	13,300	5.1%	19,900	4.1%
2014	**842,138**	**4.7%**	**37,346**	**18.2%**	**no survey**	**--**	**7,319**	**9.0%**	**14,992**	**9.4%**

[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 7.--Catch by species, and numbers of length and weight measurements taken from individuals, during the one AWT midwater trawl haul during the winter 2014 acoustic-trawl survey of walleye pollock in Sanak Trough.

		Catch				Individual Measurements	
Species name	Scientific name	Weight (kg)	%	Number	%	Length	Weight
walleye pollock	*Gadus chalcogrammus*	479.8	99.3	313	99.4	313	100
Pacific cod	*Gadus macrocephalus*	3.5	0.7	2	0.6	2	0
Total		483.3		315		315	100

Table 8.--Trawl station and catch data summary from the winter 2014 acoustic-trawl survey of walleye pollock in Shelikof Strait and Marmot Bay.

Haul No.	Area	Gear type[1]	Date (GMT)	Time (GMT)	Duration (minutes)	Start position Latitude (N)	Start position Longitude (W)	Depth (m) Footrope	Depth (m) Bottom	Water temp. (°C) Headrope	Water temp. (°C) Surface[2]	Catch Pollock (kg)	Catch Pollock Number	POP (kg)	Eulachon (kg)	Capelin (kg)	Other (kg)
1	Shelikof	AWT	15-Mar	13:23	30	55° 36.70'	-156° 16.68'	242	256	5.3	4.1	884.8	1,477	3.9	49.8	0	25
2	Shelikof	AWT	15-Mar	19:37	10	55° 27.31'	-156° 08.58'	200	217	5.3	4.1	5.2	4	343.6	3.8	0	7.8
3	Shelikof	AWT	16-Mar	02:18	2	55° 41.77'	-155° 57.01'	137	162	4.7	4.3	2,267.0	3,645	0	0	0	1
4	Shelikof	AWT	17-Mar	02:13	10	56° 13.90'	-155° 58.73'	191	221	5.4	4.1	537.7	5,005	0	103.5	0	13.9
5	Shelikof	AWT	17-Mar	11:37	6	56° 29.25'	-156° 00.53'	226	255	5.3	4.1	382.2	3,651	0	66.7	0	4.4
6	Shelikof	AWT	17-Mar	20:06	4	56° 33.47'	-155° 37.86'	86	178	3.6	3.9	2,654.0	4,914	0	0	0	0
7	Shelikof	AWT	18-Mar	02:01	5	56° 43.51'	-155° 51.21'	257	288	5.4	3.9	714.9	6,042	0	75.8	0	19.0
8	Shelikof	AWT	18-Mar	10:38	10	56° 50.96'	-155° 06.53'	84	109	4.4	4.6	1,905.0	3,247	0	0	0	0
9	Shelikof	AWT	18-Mar	16:35	9	56° 58.54'	-155° 52.75'	280	307	5.3	3.8	520.7	6,478	0	143.1	0	16.7
10	Shelikof	AWT	18-Mar	23:48	5	57° 00.19'	-155° 15.97'	239	248	5.4	4.4	999.4	12,740	0	155.8	0	23.8
11	Shelikof	AWT	19-Mar	09:31	10	57° 20.84'	-155° 40.20'	256	277	5.3	3.8	276.3	3,403	0	13.1	0	5.4
12	Shelikof	AWT	19-Mar	15:35	10	57° 20.08'	-154° 57.82'	195	213	5.3	4.2	2,328.6	33,216	0	444.7	0	8.7
13	Shelikof	AWT	20-Mar	01:57	4	57° 34.02'	-155° 02.69'	225	238	5.3	3.9	346.0	2,147	0	255.3	0	6.5
14	Shelikof	AWT	20-Mar	05:56	6	57° 44.88'	-155° 11.18'	226	280	4.6	3.9	1,290.7	929	0	4.5	0	19.8
15	Shelikof	AWT	20-Mar	11:49	5	57° 39.93'	-154° 27.66'	187	197	5.2	4.5	438.9	2,314	0	345.6	0	5.3
16	Shelikof	AWT	20-Mar	15:55	4	57° 46.32'	-154° 46.64'	225	239	5.2	4.5	1,368.5	5,983	0	201.8	0	5.7
17	Shelikof	AWT	20-Mar	21:22	4	57° 50.86'	-155° 00.11'	221	234	5.0	3.6	1,715.1	1,747	0	39.9	0	0
18	Shelikof	PNE	21-Mar	05:55	6	58° 02.16'	-154° 16.04'	269	273	5.2	3.6	433.5	422	0	16	0	8.3
19	Shelikof	AWT	21-Mar	11:39	5	58° 00.83'	-153° 43.65'	199	230	5.2	4.5	887.9	9,423	0	51.4	0	10.1
20	Shelikof	PNE	21-Mar	16:08	1	58° 09.06'	-154° 08.30'	192	226	4.9	4.4	180.3	141	0	0.3	0	0.8
21	Shelikof	AWT	21-Mar	22:10	5	58° 10.17'	-153° 20.42'	103	195	4.5	4.6	2,767.0	4,828	0	0	0	0
22	Marmot	AWT	22-Mar	17:41	2	58° 01.07'	-152° 31.88'	155	203	4.6	4.3	727.4	5,311	0	0.7	0	2.3
23	Marmot	AWT	22-Mar	21:49	4	58° 03.23'	-152° 27.06'	148	215	4.6	4.7	3,075.2	18,295	0	0	0	8.8
24	Marmot	PNE	23-Mar	02:39	4	58° 00.75'	-152° 22.33'	116	256	4.5	4.4	252.8	1,728	0	0	0	0
25	Marmot	Camtrawl	23-Mar	06:30	14	57° 58.57'	-152° 17.46'	198	272	4.6	4.6	-	-	-	-	-	-
26	Marmot	AWT	23-Mar	12:41	4	57° 59.95'	-151° 59.95'	162	173	4.5	4.8	179.5	8,298	0	1	10.7	3.1
27	Marmot	PNE	24-Mar	12:58	8	57° 58.65'	-152° 17.12'	230	288	4.6	4.4	186.1	930	0	1.1	0	7.9
28	Marmot	M	24-Mar	20:01	1	57° 58.40'	-152° 01.00'	149	180	4.5	4.8	39.0	3,504	0	0	0	1

[1]Gear type: AWT = Aleutian wing trawl, PNE = poly Nor'Eastern bottom trawl, Camtrawl = open codend AWT trawl with camera; M = Marinovich midwater trawl

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

Table 9.–Numbers of walleye pollock measured and biological samples collected during the winter 2014 acoustic-trawl surveys of Shelkof Straight (hauls 1-21) and Marmot Bay (hauls 22-28).

Haul	Walleye pollock				
no.	Lengths	Weights	Maturities	Otoliths	Ovary weights
1	491	73	51	52	1
2	4	4	4	4	4
3	304	40	40	40	5
4	391	74	59	56	4
5	474	108	54	59	13
6	432	53	53	53	0
7	341	86	51	56	8
8	439	54	54	54	1
9	481	90	54	59	8
10	283	79	51	51	7
11	237	62	32	27	7
12	437	86	51	56	9
13	283	46	26	26	6
14	327	65	41	41	31
15	469	40	5	10	0
16	566	85	54	54	17
17	531	89	55	60	16
18	400	103	92	35	13
19	604	35	0	0	0
20	141	48	48	48	13
21	372	19	19	19	10
22	496	76	41	46	6
23	435	74	53	53	5
24	195	107	80	46	25
25	-	-	-	-	-
26	153	82	60	65	26
27	289	78	48	48	10
28	30	20	0	0	0
Totals	9,605	1,776	1,176	1,118	245

Table 10.--Catch by species, and numbers of length and weight measurements taken from individuals, during the 20 midwater AWT trawl hauls during the winter 2014 acoustic-trawl survey of walleye pollock in Shelikof Strait.

		Catch				Individual Measurements	
Species name	Scientific name	Weight (kg)	%	Number	%	Length	Weight
walleye pollock	*Gadus chalcogrammus*	22,290.5	90.0	111,249	58.6	7466	1188
eulachon	*Thaleichthys pacificus*	1,954.9	7.9	74,740	39.4	1153	203
Pacific ocean perch	*Sebastes alutus*	347.5	1.4	498	0.3	233	55
squid unidentified	Teuthoidea (order)	53.4	0.2	2,237	1.2	176	0
Chinook salmon	*Oncorhynchus tshawytscha*	39.8	0.2	34	0.0	32	0
smooth lumpsucker	*Aptocyclus ventricosus*	34.6	0.1	28	0.0	17	0
Pacific cod	*Gadus macrocephalus*	19.8	0.1	4	0.0	2	0
Berry armhook squid	*Gonatus berryi*	7.0	0.0	8	0.0	7	0
Pacific lamprey	*Lampetra tridentata*	4.1	0.0	2	0.0	2	0
northern smoothtongue	*Leuroglossus schmidti*	3.0	0.0	295	0.2	34	0
magistrate armhook squid	*Berryteuthis magister*	2.2	0.0	2	0.0	1	0
shrimp unidentified	Decapoda (order)	1.6	0.0	598	0.3	20	0
rougheye rockfish	*Sebastes aleutianus*	1.5	0.0	1	0.0	1	0
jellyfish unitentified	*Scyphozoa* (class)	1.4	0.0	2	0.0	1	0
northern sea nettle	*Chrysaora melanaster*	1.2	0.0	3	0.0	2	1
chum salmon	*Oncorhynchus keta*	1.1	0.0	1	0.0	1	0
Aurelia jellyfish unidentified	Aurelia (family)	0.8	0.0	2	0.0	0	0
flathead sole	*Hippoglossoides elassodon*	0.7	0.0	2	0.0	1	0
arrowtooth flounder	*Atheresthes stomias*	0.3	0.0	5	0.0	1	0
rex sole	*Glyptocephalus zachirus*	0.2	0.0	1	0.0	1	0
Pacific sand lance	*Ammodytes hexapterus*	0.1	0.0	1	0.0	0	0
Pacific herring	*Clupea pallasi*	0.0	0.0	1	0.0	1	0
Total		24,765.4		189,714		9152	1447

Table 11.--Catch by species, and numbers of length and weight measurements taken from individuals, during the two PNE bottom trawl hauls during the winter 2014 acoustic-trawl survey of walleye pollock in Shelikof Strait.

		Catch				Individual Measurements	
Species name	Scientific name	Weight (kg)	%	Number	%	Length	Weight
walleye pollock	*Gadus chalcogrammus*	613.8	96.0	563	61.3	541	151
eulachon	*Thaleichthys pacificus*	16.3	2.6	328	35.7	99	22
arrowtooth flounder	*Atheresthes stomias*	4.3	0.7	3	0.3	3	0
Bering skate	Rajidae (family)	2.1	0.3	1	0.1	0	0
smooth lumpsucker	*Aptocyclus ventricosus*	1.0	0.2	1	0.1	1	0
flathead sole	*Hippoglossoides elassodon*	0.8	0.1	3	0.3	3	0
jellyfish unidentified	*Scyphozoa* (class)	0.8	0.1	2	0.2	0	0
shrimp unidentified	Decapoda (order)	0.2	0.0	16	1.7	16	0
capelin	*Mallotus villosus*	0.0	0.0	1	0.1	1	0
Tanner crab	*Chionoecetes bairdi*	0.0	0.0	1	0.1	0	0
Total		639.3		919		664	173

Table 12.--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	2013	2014
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	27	28
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	16	42
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	13	59
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	11	59
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	13	57
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	5	42
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	7	27
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	9	17
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	14	13
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	15	11
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	15	14
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	27	15
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	19	27
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	23	27
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	31	28
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	23	28
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	31	32
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	22	24
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	19	19
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	19	14
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	22	13
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	10	9
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	10	7
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	14	3
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	3	4
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	2	2
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	3	2
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	<1	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	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	0	<1
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	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	1	<1
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	0	<1
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	<1	<1
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	<1	<1
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	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	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	7,668	4,885

Table 12. – 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	2013	2014
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	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	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	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	0	1
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	82	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	36	4	25	16	10	2	801	65
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	1,935	152
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	2,240	185
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	800	122
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	321	32
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	104	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	34	3
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	8	35
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	<1	114
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	1	492
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	2	1,014
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	4	967
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	13	488
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	11	326
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	15	102
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	19	58
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	29	29
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	12	6
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	11	8
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	9	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	29	1
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	46	1
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	49	2
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	80	4
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	89	3
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	133	4
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	124	4
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	127	6
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	68	8
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	49	15

Table 13. -- 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	2013	2014
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	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	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	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	0	<1
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	<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	5	<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	15	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	21	2
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	10	2
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	5	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	2	<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	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	<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	< 1	< 1	<1	<1	<1	0	<1	4
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	<1	22
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	<1	50
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	<1	56
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	1	33
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	1	25
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	1	9
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	2	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	3	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	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	2	1
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	2	<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	6	<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	10	<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	12	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	21	1
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	26	1
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	43	1
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	43	1
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	49	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	29	3
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	22	7

Table 13.– 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	2013	2014
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	17	13
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	9	21
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	8	32
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	7	35
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	9	36
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	4	29
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	5	20
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	8	13
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	13	11
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	15	10
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	16	14
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	30	16
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	24	32
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	30	34
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	43	36
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	33	38
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	46	47
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	34	36
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	33	30
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	33	24
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	42	25
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	19	16
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	21	13
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	31	6
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	7	8
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	6	4
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	7	4
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	1	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	2	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	0	<1
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	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	4	<1
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	0	<1
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	1	<1
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	1	<1
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	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	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	335.8	891.3	842

Table 14.--Catch by species, and numbers of length and weight measurements taken from individuals, during the four midwater AWT trawl hauls during the winter 2014 acoustic-trawl survey of walleye pollock in Marmot Bay.

		Catch				Individual Measurements	
Species name	Scientific name	Weight (kg)	%	Number	%	Length	Weight
walleye pollock	*Gadus chalcogrammus*	4,021.1	99.3	35,408	95.4	1,114	252
capelin	*Mallotus villosus*	10.7	0.3	1,568	4.2	73	21
arrowtooth flounder	*Atheresthes stomias*	8.8	0.2	6	0.0	1	0
Pacific cod	*Gadus macrocephalus*	2.3	0.1	1	0.0	0	0
smooth lumpsucker	*Aptocyclus ventricosus*	2.3	0.1	2	0.0	0	0
Chinook salmon	*Oncorhynchus tshawytscha*	1.6	0.0	1	0.0	0	0
eulachon	*Thaleichthys pacificus*	1.7	0.0	73	0.2	35	35
flathead sole	*Hippoglossoides elassodon*	0.1	0.0	1	0.0	0	0
shrimp unident.	Decapoda (order)	0.2	0.0	58	0.2	0	0
Total		4,048.7		37,118		1,223	308

Table 15.--Catch by species, and numbers of length and weight measurements taken from individuals, during the two PNE bottom trawl hauls during the winter 2014 acoustic-trawl survey of walleye pollock in Marmot Bay.

		Catch				Individual Measurements	
Species name	Scientific name	Weight (kg)	%	Number	%	Length	Weight
walleye pollock	*Gadus chalcogrammus*	438.9	98.0	2,658	96.8	484	185
smooth lumpsucker	*Aptocyclus ventricosus*	7.9	1.8	5	0.2	0	0
eulachon	*Thaleichthys pacificus*	1.1	0.2	84	3.1	84	23
Total		447.8		2,747		568	208

Table 16.--Catch by species, and numbers of length and weight measurements taken from individuals, during the one Marinovich midwater trawl haul during the winter 2014 acoustic-trawl survey of walleye pollock in Marmot Bay.

Species name	Scientific name	Catch Weight (kg)	%	Number	%	Individual Measurements Length	Weight
walleye pollock	*Gadus chalcogrammus*	39.0	97.4	3,504	100.0	30	20
smooth lumpsucker	*Aptocyclus ventricosus*	1.0	2.6	1	0.0	0	0
Total		40.1		3,505		30	20

Table 17. -- 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
1	78	1	62	2,092	575	17	399	49	22	228	63	186	10,690	56	70
2	3,481	902	58	544	2,115	110	90	1,210	174	34	76	36	510	3,307	183
3	1,511	380	324	123	184	694	90	72	550	74	37	49	79	119	1,247
4	769	1,297	142	315	46	322	216	63	48	188	72	32	78	25	80
5	2,786	1,171	635	181	75	78	249	116	65	368	233	155	103	54	18
6	1,052	698	988	347	49	17	43	180	70	84	126	84	245	71	44
7	210	599	450	439	86	6	14	46	116	85	27	42	122	201	52
8	129	132	224	167	149	6	4	22	24	171	36	27	54	119	98
9	79	14	41	43	60	4	2	8	29	33	39	44	17	40	53
10	25	12	3	6	11	9	1	8	2	56	16	48	11	13	14
11	2	4	0	2	1	2	10	1	4	2	8	15	15	11	2
12	0	2	1	1	0	2	1	3	1	15	3	7	6	5	3
13	0	0	0	0	0	< 1	< 1	2	4	1	2	1	2	3	1
14	0	0	0	0	0	0	0	1	0	< 1	< 1	2	< 1	< 1	< 1
15	0	0	0	0	0	0	0	< 1	0	0	1	< 1	0	0	0
16	0	0	0	0	0	0	0	< 1	0	0	1	0	0	< 1	0
17	0	0	0	0	0	0	0	0	0	0	< 1	< 1	0	0	0
18	0	0	0	0	0	0	0	< 1	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

Age	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2012	2013	2014	Mean
1	395	4,484	289	8	48	53	1,626	162	54	1,368	332	90	95	6,324	576	1,032
2	89	755	4,104	163	94	94	157	836	232	391	1,205	306	852	149	3,640	767
3	126	217	352	1,107	205	58	56	41	175	250	110	532	43	803	19	331
4	474	16	61	97	800	159	35	12	30	53	99	84	77	61	295	198
5	136	67	42	16	56	357	173	17	10	12	60	79	96	69	87	258
6	14	132	23	16	8	48	162	56	17	2	10	29	46	114	58	165
7	32	17	35	8	4	3	36	75	34	4	3	12	29	65	100	98
8	36	13	13	7	2	3	4	32	21	11	1	5	4	49	55	54
9	74	10	6	1	1	3	2	7	2	7	5	5	1	12	26	22
10	26	8	3	1	< 1	< 1	0	< 1	1	2	6	11	< 1	5	18	10
11	14	14	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1	9	< 1	6	7	4
12	7	7	2	< 1	0	0	0	< 1	0	0	< 1	3	1	1	1	2
13	< 1	2	1	< 1	< 1	< 1	0	0	0	0	0	0	0	2	2	1
14	1	1	< 1	< 1	0	0	0	0	0	0	0	0	0	5	0	0
15	1	0	< 1	0	0	0	0	0	0	0	0	0	0	3	1	0
16	0	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	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	1,425	5,743	4,932	1,424	1,220	777	2,252	1,240	576	2,100	1,832	1,165	1,245	7,668	4,885	

Table 18. -- 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	2013	2014	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	59	7	11
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	19	211	54
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	279	6	73
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	38	175	77
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	80	62	133
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	157	76	117
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	104	133	83
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	87	84	54
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	22	41	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	11	29	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	13	11	7
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	2	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	4	5	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	11	0	1
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	6	1	< 1
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	0	< 1
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	0	< 1
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	0	< 1
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	891.3	842	

APPENDIX I. ITINERARY

DY2014-01

Shumagin Islands\Sanak Trough

21 Feb.	Depart Kodiak, AK.
21 Feb.	Acoustic sphere calibration in Uyak Bay, Kodiak Island, AK.
23-26 Feb.	Acoustic-trawl survey of Shumagin Islands.
26 Feb.	Acoustic-trawl survey of Sanak Trough.
28 Feb.	Arrive Kodiak, AK. End cruise.

DY2014-03

Shelikof Strait\Marmot Bay

13 Mar.	Depart Dutch Harbor, AK.
15-22 Mar.	Acoustic-trawl survey of Shelikof Strait.
22-24 Mar.	Acoustic-trawl survey of Marmot Bay and Izhut Bay
23-24 Mar.	Acoustic sphere calibration in Izhut Bay, Kodiak, AK.
25 Mar.	Arrive Kodiak, AK. End cruise.

APPENDIX II. SCIENTIFIC PERSONNEL

DY2014-01

Shumagin Islands\Sanak Trough

Name	Position	Organization
Darin Jones	Chief Scientist	AFSC
Alex De Robertis	Fishery Biologist	AFSC
Scott Furnish	Computer Spec.	AFSC
Denise McKelvey	Fishery Biologist	AFSC
Nate Lauffenburger	Fishery Biologist	AFSC
William Floering	Fishery Biologist	AFSC

DY2014-03

Shelikof Strait\Marmot Bay

Name	Position	Organization
Chris Wilson	Chief Scientist	AFSC
Darin Jones	Fishery Biologist	AFSC
Scott Furnish	Computer Spec.	AFSC
Kresimir Williams	Fishery Biologist	AFSC
William Floering	Fishery Biologist	AFSC
Annette Dougherty	Fishery Biologist	AFSC
Ben Williams	Fishery Biologist	UAF

AFSC – Alaska Fisheries Science Center, Seattle, WA

UAF– University of Alaska, Fairbanks, AK