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Results of the Acoustic-trawl Surveys of Walleye Pollock (*Gadus chalcogrammus*) |in the Gulf of Alaska, February-March 2015 (DY2015-02 and DY2015-03)

by

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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 and 2014). Marmot Bay has been surveyed in the winter seven times (1989, 1990, 1992, 2007, 2009, 2010, and 2014). This was the second winter in which the bays on the Kenai Peninsula were surveyed (the first was during the winter of 2010). This report presents the results from AT surveys conducted in the aforementioned areas of the GOA during February and March 2015.

METHODS

Two AT surveys were conducted. The first (cruise DY2015-02) surveyed the Shumagin Islands area (comprised of Shumagin Trough, Stepovak Bay, Renshaw Point, Unga Strait, and West Nagai Strait), Sanak Trough, and the Kenai Peninsula Bays (i.e., Resurrection Bay, Day Harbor, Port Bainbridge, Aialik Bay, Harris Bay, Nuka Bay, Nuka Passage, Port Dick). The Shumagin Islands area and Sanak Trough were surveyed on 13, 20-24 February, and the Kenai Peninsula Bays were surveyed 27 February - 1 March. The Shumagins survey was halted 13-19 February due to vessel mechanical problems. Acoustic-trawl surveys of Morzhovoi Bay, Pavlof Bay, and Prince William Sound were planned, but were not completed due to these mechanical issues. A second AT survey (cruise DY2015-03) covered Shelikof Strait (17-23 March), Marmot Bay (15-16 March), and the Chirikof shelf break (23-24 March). Finally, three trawl-resistant bottom-mounted (TRBM) echosounders were deployed in Shelikof Strait and TRBM sounder AT survey

assessment work was conducted on 11-12 February, 25-26 February, 2 March, and March 27-30. Results from the mooring work will be reported elsewhere. All 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). Survey itineraries and scientific personnel are listed in Appendices I and II, respectively.

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's surface.

Two standard sphere acoustic system calibrations were conducted to measure acoustic system performance. The calibrations were conducted just prior to the start of cruise DY2015-02 and immediately following the completion of cruise DY2015-03. During calibrations, the ship was anchored at the bow and stern. Initially, the calibration was attempted using the vessel dynamic positioning system, but winds from several directions ($\geq$ 20 kts) required anchors to be set. 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).

[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

Acoustic data were recorded at five split-beam frequencies using ER60 software (version 2.2.1) and, as a backup, acoustic telegram data were logged with Echoview EchoLog 500 (version 4.70.1.14256) software. 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 Echoview post-processing software (version 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). 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 13 to 33 m (43-108 ft) and averaged 24 m (79 ft) while fishing. The PNE vertical mouth opening ranged from 7.5 to 8 m (25-26 ft) and averaged 7.8 m (26 ft) while fishing.

Thirty-two percent of the AWT trawl hauls conducted in the Gulf of Alaska winter surveys included a CamTrawl 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 with uniform spacing from this point (Rivoirard et al. 2000). Survey activities were conducted 24 hours/day.

Trawl hauls were conducted to identify the species composition of acoustically observed fish aggregations 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), or for capelin (*Mallotus villosus*) to the nearest 1 mm standard length (SL), with an electronic measuring board (Towler and Williams 2010). Walleye pollock were sampled to determine sex, body weight, age, and gonad maturity. Gonadosomatic index [GSI : ovary weight/(ovary weight + body weight)] was calculated for pre-spawning females. Maturity was determined by visual

inspection of the gonads and was categorized as immature, developing, pre-spawning, spawning, or post-spawning[2]. The ovary weight was determined for mature, pre-spawning females. An electronic motion-compensating scale (Marel M60) was used to weigh individual walleye pollock and selected ovaries to the nearest 2 g. Trawl station information and biological measurements were electronically recorded to the Catch Logger for Acoustic Midwater Surveys (CLAMS). 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.

For each trawl in the Shumagins, sex and length measurements from an average of 313 randomly selected walleye pollock were collected, with an average of 52 individuals more extensively sampled for body weight, maturity, and age. For each haul in Shelikof and the surrounding areas, sex and length measurements from an average of 367 randomly selected walleye pollock were collected, with an average of 91 individuals more extensively sampled for body weight, maturity, and age.

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 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 surveyed area (e.g., Shumagin Islands, Sanak Trough, Shelikof Strait, Marmot Bay) the mean fish weight-at-length in each 1 cm length interval was estimated from the trawl information

[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.

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. Surveyed areas were composed of 2-8 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 (dB re 1 m^2), where

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

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

$$TS = 20 \log_{10} L - 66.$$

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 ($\overline{s}_A$, m^2 nmi^{-2}), the mean backscattering cross-section ($\overline{\sigma}_{bs}$, m^2) of pollock, and the biological information as follows:

$\overline{\sigma}_{bs} = \Sigma_i (P_i \times \sigma_{bs,i})$, where $\sigma_{bs,i} = 10^{((20 \log_{10} Li - 66)/10)}$

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

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

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 0.5 nmi horizontal sampling interval was calculated as:

$$\overline{D} = \frac{\sum_D D \cdot B_D}{\sum_D B_D},$$

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

In all areas except for the Kenai Peninsula bays, relative estimation 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). A two-dimensional (2-D) geostatistical method (Petitgas 1993, Rivoirard et al. 2000) was used for the Kenai Peninsula Bays as zig-zag transects were used there. 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 selectivity, species classification) were not evaluated.

Otoliths were used to estimate walleye pollock ages, and were collected from the Shumagin Islands (n = 306), Sanak Trough (n = 77), the Kenai Peninsula bays (n = 315), Shelikof Strait (n = 602), Chirikof shelf break (n = 226), and Marmot Bay (n = 125) areas. The samples were stored in a 50% glycerol/thymol-water solution. Only otoliths from the Shelikof Strait survey area (Shelikof, Marmot, and Chirikof) were processed by the AFSC's 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 calculated in the linear domain for dB quantities) were used in the final analysis (Table 1).

Shumagin Islands

Acoustic backscatter was measured along 756 km (408 nmi) of transects. The survey transects were spaced 1.9 km (1.0 nmi) apart directly south and east of Renshaw Point and in the eastern half of Unga Strait, 4.6 km (2.5 nmi) apart in Stepovak Bay and West Nagai Strait, and 3.7 km (2.0 nmi) 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 5.5 °C throughout the Shumagin Islands survey area (Fig. 2), a degree and a half higher than last year's average of 4.0 °C. Water temperature increased approximately 0.6 °C from the surface to the depth range (100-188 m) at the eight trawl locations where temperature data were successfully collected (Table 2; Fig. 3).

Trawl Samples

Biological data and specimens were collected in the Shumagin Islands from eight AWT hauls conducted in midwater and one on-bottom PNE haul (Tables 2-5; Fig. 1). Walleye pollock was the most abundant species caught by numbers in the AWT hauls, contributing 89.7% to the total catch, while shrimp (order Decapoda) were the most abundant in the one PNE trawl, contributing 30.8% (Tables 4 and 5). Walleye pollock also dominated the total weight captured in the AWT (98.5%), while Pacific cod (*Gadus macrocephalus*) composed the most weight in the PNE

(32.0%). There was an unusually large catch of Pacific herring (*Clupea pallasii*) in one AWT haul (haul 4) in Stepovak Bay which made up the entire Pacific herring catch in the Shumagin Islands region (Table 4).

In 2015, the majority of walleye pollock in the Shumagin Islands were between 10 and 15 cm fork length (FL) and 20 and 45 cm FL (Fig. 4), which is characteristic of age-1 and age-2-4 walleye pollock, respectively. Smaller fish (10-15 cm FL) made up a very small portion of the biomass (2.5%), which was similar to 2014 (3% of the total biomass), and much less than 2013 (48% of the total biomass; Jones et al. 2014; Fig. 5). Large adults ($\geq$ 40 cm) contributed little to overall biomass in 2015, as well (Fig. 4). The dominance of walleye pollock with lengths representative of age-3 fish in the Shumagin Islands area (85% biomass in 2015) suggests the continued success of the 2012 year class.

The maturity composition of males > 40 cm FL (n = 34) was 3% immature, 9% developing, 82% pre-spawning, 0% spawning, and 6% spent (Fig. 6a). The maturity composition of females longer than 40 cm FL (n = 105) was 0% immature, 11% developing, 86% pre-spawning, 0% spawning, and 4% spent (Fig. 6a). Findings from the 1994 Shelikof survey indicated that estimated walleye pollock biomass declined as the proportion of adult females in spawning and spent stages of maturity increased, suggesting substantial emigration of adults from the surveyed area following spawning and resulted in a negative bias to abundance estimates (Wilson 1994). However, the high percentage of pre-spawning females and the low percentage of spawning and spent females suggested that the 2015 Shumagin survey timing was appropriate and coincided with the onset of spawning for fish that likely spawn in this area. A logistic model fit to the female maturity-at-length data predicted that 50% of females were mature (L_{50}) at 46.45 cm FL (Fig. 6b). The average GSI of pre-spawning females, based on 29 samples, was 0.09 (Fig. 6c). The estimate was generally lower than recent surveys: 0.13 (2014), 0.11 (2013), 0.13 (2012), 0.11 (2010), and much lower than the historical mean of all surveys between 1994 and 2013 (0.126).

Distribution and Abundance

Age-2 and -3 walleye pollock were abundant throughout the outer portion of Shumagin Trough, off Renshaw Point, and in the West Nagai Strait area (Fig. 7b). Although adult pollock have

historically been detected off Renshaw Point, only a few large adults were captured in trawl hauls in this area in 2015 (Fig. 7a). The majority of the pollock (mainly age-3 fish with fewer age 1-2 year olds) formed dense layers approximately 25 m above the bottom during the day (Fig. 8).

The biomass estimate of 61,369 t is nearly twice last year's estimate (37,346) and 81% of the historical mean of 75,269 t for this survey (Table 6; Fig. 9). The relative estimation error of the biomass based on the one-dimensional (1-D) geostatistical analysis was 17.1%.

Sanak Trough

Sanak Trough was surveyed on 22-23 February. Acoustic backscatter was measured along 196 km (105.5 nmi) of transects spaced 3.7 km (2 nmi) apart (Fig. 1). Bottom depths ranged from 45 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 5.1 °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. Mean water temperature ranged 0.5 °C between the surface and deepest trawl depth (Fig. 10), but the average water temperature over the duration of the three trawls (mean headrope depth = 98 m) was only 0.2 °C higher than the surface temperature (Table 2).

Trawl Samples

Biological data and specimens were collected in Sanak Trough from three AWTs (Tables 2 and 7; Fig. 1). Walleye pollock was the most abundant species, contributing 99.3% by weight and 99.9% by number. Walleye pollock ranged between 25 and 75 cm FL with two modes at 34 and 60 cm FL (Fig. 4b). The mode at 34 cm likely represents age-3 fish. The majority of pollock in Sanak Trough in 2014 were between 42 and 78 cm FL with a mean of 59 cm FL (mostly age-8 fish), which was similar to this year (2015) except for the mode at 34 cm (McCarthy et al. 2015).

The maturity composition for males > 40 cm FL (n = 32) was 0% immature, 6% developing, 13% pre-spawning, 3% spawning, and 78% spent (Fig. 11a). The maturity composition for females longer than 40 cm FL (n = 57) was 2% immature, 7% developing, 33% pre-spawning, 5% spawning, and 53% spent (Fig. 11a). The fact that over half of the females were already spent indicates that survey timing was likely late, and did not coincide with the onset of spawning for the majority of fish that spawn in Sanak. The logistic model fit to the female maturity-at-length data predicted that 50% of females were mature at 48.7 cm FL (Fig. 11b). The average GSI of pre-spawning females was 0.13 (Fig. 11c), lower than the mean of 0.15 for the entire time series.

Distribution and Abundance

The majority of walleye pollock biomass for fish ≥ 40 cm was generally located in the northwestern portion of the Trough (Fig. 7b); whereas most biomass for fish < 40 cm was located along the eastern side of the Trough (Fig. 7a). Fish ≥ 40 cm were found between 45 and 75 m deep in areas with seafloor depths between 50-100 m; whereas fish < 40 cm were found deeper: around 100 m deep in areas with seafloor depths between 100 and 150 m (Fig. 12). The biomass estimate of 17,863 t is 39% of the historic mean of 45,604 t for this survey and more than twice last year's biomass estimate (7,319 t) (Table 6; Fig. 13). The relative estimation error based on the 1-D geostatistical analysis of the biomass was 10.0%.

Kenai Bays

The Kenai bays, specifically Port Dick, Nuka Passage, Nuka Bay, Harris Bay, Aialik Bay, Resurrection Bay, Day Harbor, and Port Bainbridge, were surveyed from 27 February to March 1 (Fig. 14). This was the second winter in which bays on the Kenai Peninsula were surveyed (the first was winter 2010). Acoustic backscatter was measured along 405.6 km (219 nautical miles (nmi)) of zig-zag transects (Fig. 14). Bottom depths ranged from 65 m at the transect end points to 295 m along the deepest part of the southernmost transects.

Water Temperature

Surface water temperatures as measured by the ship's sensors in the surveyed Kenai bays averaged 5.1 °C overall, and ranged from 2.5 °C to 5.8 °C (Fig. 15). This was 0.6 °C warmer

than temperatures recorded during winter 2010. Water temperature at trawl locations ranged 1.5 °C between the surface and deepest trawl depth (Fig. 16), and averaged 6.6 °C (Table 2).

Trawl Samples

Biological data and specimens were collected in the Kenai bays from one PNE and eight AWTs (Tables 2, 8 and 9; Fig. 16). In the AWTs, walleye pollock was the most abundant species, contributing 98.8% by weight and 80.2% by number. Eulachon (*Thaleichthys pacificus*) was the second most commonly caught species both by weight (0.7%) and by number (13.2%). Capelin (*Mallotus villosus*) were the most abundant species caught in the single PNE haul both by weight (49.3%) and number (88.2%). Walleye pollock ranged between 22 and 69 cm FL with a mean of 52 cm FL (Fig. 4c), and the majority of the biomass in this region was composed of fish with lengths characteristic of fish 7-10 years old (McCarthy et al. 2015).

The maturity composition for males > 40 cm FL (n = 218) was 1% immature, 1% developing, 33% pre-spawning, 61% spawning, and 4% spent (Fig. 20a). The maturity composition for females longer than 40 cm FL (n = 206) was 0% immature, 5% developing, 93% pre-spawning, 1% spawning, and 0% spent (Fig. 17a). The fact that almost all of the females were prespawning indicates that survey timing was appropriate as it coincided with the onset of spawning for the majority of the fish that likely spawn in this area. The logistic model fit to the female maturity-at-length data predicted that 50% of females were mature at 39.6 cm FL (Fig. 17b). The average GSI of pre-spawning females was 0.11 (Fig. 17c), like the mean GSI in 2010 (0.10).

Distribution and Abundance

The majority of the adult walleye pollock biomass (FL ≥ 40 cm) was located in Aialik Bay, Resurrection Bay, and Port Bainbridge, with as much as 28% in Resurrection Bay alone (Fig. 18a). The small amount of biomass observed for fish < 40 cm FL was located in a small area of the west arm of Nuka Bay (Fig. 21b). Most of the walleye pollock backscatter was located in schools between 75 m and 200 m deep. Fish < 40 cm FL were observed much shallower in waters around 50 m deep (Fig. 22). Fish of all sizes were observed over seafloor depths of ~150-300 m (Fig. 19).

The biomass estimate of 80,965 t is less than the estimate from the winter 2010 GOA survey estimate of 111,200 t (Guttormsen et al. 2010). The relative estimation error based on the 2-D geostatistical analysis of the biomass was 15.3%.

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 1,355 km (731.5 nmi) of transect (Fig. 20). Bottom depths in the survey area ranged from 47 to 335 m.

Water Temperature

Surface water temperatures in Shelikof Strait averaged 4.9 °C overall (Table 12 and Fig. 21), 0.9 degrees higher than last year and 1.4 °C higher than the historic mean of the 31 surveys conducted in this area since 1981. Average surface temperature at trawl locations was 4.9 °C, and temperatures at these locations increased with depth down to approximately 250 m (Fig. 22).

Trawl Samples

Biological data and specimens were collected in the Shelikof Strait area from 26 AWT hauls, 8 of which were part of additional survey work conducted in the vicinity of TRBM moorings (Tables 12-15; Fig. 20). Walleye pollock and eulachon were the most abundant species by weight and numbers in AWT hauls, contributing 88.8% and 5.9% by weight, and 60.4% and 30.1% by numbers, respectively (Table 14). However, eulachon were less prevalent than in previous years where they have ranged up to 47% of the total catch by weight (e.g., in 2008).

The maturity composition in the Shelikof Strait area for males longer than 40 cm FL (n = 690) was 5% immature, 1% developing, 6% pre-spawning, 87% spawning, and 1% spent (Fig. 23a). The maturity composition of females longer than 40 cm FL (n = 724) was 7% immature, 4% developing, 78% pre-spawning, 10% spawning, and 2% spent (Fig. 23a). 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 fish that spawn in Shelikof. The female L_{50} of 42.3 cm FL (n = 2,166; Fig. 23b) was much smaller than last year

(47.2 cm FL) and smaller than 2013 (47 cm FL). The average GSI from 34 pre-spawning females was 0.13 (Fig. 23c) and is slightly less than the historical mean (0.14).

Distribution and Abundance

As in previous years, the highest walleye pollock biomass was observed along the northwest side of the Strait near Kukak Bay, although dense aggregations of 40-60 cm FL fish also extended southward into the center of the Strait as far as Agripina Bay (Fig. 24a). This is in contrast with 2014, where the majority of the adult biomass was in the area between Kukak Bay and Dakavak Bay (McCarthy et al. 2015). Smaller fish (< 40 cm) were primarily observed in the central portion of the Shelikof Strait from Wide Bay to Kiligak Bay (Fig. 24b). Discrete, dense midwater pollock schools ("cherry balls") were occasionally encountered throughout the survey area, especially on the northern and southern transects in the Strait, consisting mostly of fish with an average FL of 30 cm. Historically, pollock forming these types of aggregations in the southern Strait area have consisted of juvenile fish less than 30 cm FL (Jones et al. 2014). Most adult pollock were distributed within the bottom 50 m in areas with seafloor depths ranging 200-300 m deep; juvenile pollock were higher in the water column between 75 and 150 m off bottom (Fig. 25).

The majority of pollock biomass within Shelikof Strait was characterized by two length modes: one clear mode at 30 cm FL representing age-3 fish from the 2012 year class, and second mode consisting of fish > 40 cm FL (Figs. 26, 27b, 28b). The Shelikof Strait biomass estimate of 845,306 t is the second largest reported for the region since 1985, and similar to the 2014 estimate of 842,138 t. The 2015 estimate is 1.28 times the historic mean of 659,635 t (Table 6; Fig. 29). The relative estimation error of the biomass based on the 1-D geostatistical analysis was 4.3%.

Walleye pollock ≥ 40 cm FL made up 59% of the biomass and 19% of the numbers in Shelikof Strait in 2015, and fish < 18 cm FL made up less than 1% of the biomass or numbers (Fig. 27b; Tables 16 and 17). This is similar to 2014, when larger fish made up 72% of the biomass, and fish < 18 cm made up 1% of the biomass, and different from 2013 when pollock < 18 cm FL (i.e., age-1 fish) made up 7% of the biomass and 81% of the numbers and larger fish made up 62% of the biomass (Jones et al. 2014). The strong 2012 year class continues to be well represented in the population as 3-year-olds (1.38×10^6 fish) since it was first detected as a strong cohort in 2013 (Fig 28; Jones et al. 2014). The age-3 fish constituted nearly three times the

historical mean for numbers of fish at age 3, and was the highest number of age-3 fish detected since the survey began in 1981 (Tables 18 and 19). The progression of the strong 2012 year class is clearly visible in both biomass and length of fish in the Shelikof Strait between 2012 and 2015 (Fig. 30). 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 for GOA pollock. The 2014 year class (i.e., age-1 fish) is considered of weak relative abundance, whereas the 2012 year class was considered high in the context of the McKelvey relationship (Figs. 28, 30; Table 18; McKelvey 1996).

Marmot Bay

Marmot Bay was surveyed from 15 to 16 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 315 km (170 nmi) of transects (Fig. 31). Bottom depths ranged from 70 to 275 m.

Water Temperature

Surface water temperatures averaged 5.2 °C throughout the Marmot Bay survey area (Fig. 32) and 5.35 °C at trawl locations (Table 12; Fig. 32), much warmer than last year's mean of 4.5 °C. Temperatures at depths where most adult walleye pollock biomass occurred (100 m) averaged 5.5 °C (Fig. 33), a full degree warmer than 2014, 2013, and 2010, and 2.6 °C higher than in 2007 and 2009 when the coldest temperatures were recorded for this survey.

Trawl Samples

Biological data and specimens were collected in Marmot Bay from two AWT hauls in midwater, and two PNE trawl hauls (Table 12, Fig. 31). Walleye pollock was the most abundant species caught by weight in each trawl, contributing 97.1% and 92.1% for the AWT and the PNE, respectively (Tables 20-21). Walleye pollock was also the most abundant species by numbers caught with the PNE (69.3%; Table 21). Eulachon was the most common by numbers (55.6%) in the AWT hauls (Table 20). No hauls were conducted in Izhut Bay.

Walleye pollock ranged from 20 to 70 cm FL with a clear mode at 27 cm FL and two weaker modes at 46 and 60 cm FL (Fig. 27a). There were no age-1 pollock seen in Marmot Bay, unlike

in 2013 (Fig. 28a, McCarthy et al. 2015). The maturity composition in Marmot Bay for males > 40 cm FL (n = 125) was 4% immature, 1% developing, 35% pre-spawning, 58% spawning, and 2% spent (Fig. 34a). The maturity composition of females > 40 cm FL (n = 90) was 0% immature, 1% developing, 92% pre-spawning, 3% spawning, and 3% spent (Fig. 34a). The high percentage of pre-spawning adult females suggests that peak spawning had not occurred and that survey timing was likely appropriate. The female L_{50} was 38.6 cm FL, which was 8 cm smaller than last year (Fig. 34b). The average GSI for pre-spawning females was 0.11 and was slightly below the historical mean (Fig. 34c).

Distribution and Abundance

The majority of the pollock biomass occurred in aggregations between Whale and Spruce Islands and in inner Marmot Bay (Figs. 34a and 34b). The aggregations included pollock both from 20 to 40 cm FL and pollock ≥ 40 cm FL, and were vertically stratified with smaller fish higher in the water column (Fig. 35). These smaller fish were 2- and 3-year-olds from the 2011 and 2012 year classes (Figs. 26 and 28a). The biomass estimate for Marmot Bay was 22,470 t (Table 6). This estimate is the highest in the history of the Marmot survey and 11,400 t higher than the historic mean for this survey (11,049 t). The relative estimation error of the biomass based on the 1-D geostatistical analysis was 3.1%.

Chirikof

Chirikof was surveyed from 23 to 24 March along transects spaced between 7.4 km (4.0 nmi) and 11.1 km (1.0 nmi) apart. Acoustic backscatter was measured along 324 km (174.5 nmi) of transects (Fig. 20). Bottom depths ranged from 60 to 910 m.

Water Temperature

Surface water temperatures averaged 5.5 °C throughout the Chirikof survey area (Table 12; Fig. 21), and were warmer than last year's mean of 4.6 °C. Temperatures at fishing depths averaged 5.1 °C , but temperatures at depths where most biomass for pollock ≥ 40 cm FL occurred (200-400 m) averaged 4.8 °C (Figs. 36 and 37).

Trawl Samples

Biological data and specimens were collected on the Chirikof shelf break from 5 AWTs (Table 12). Walleye pollock was the most abundant species caught by weight (75.5%) and numbers (87.5%) in these hauls, with POP (Pacific ocean perch, *Sebastes alutus*) the second most common in both weight (17.9 %) and numbers (7.6%) (Table 22).

Walleye pollock ranged from 27 to 70 cm FL with a clear mode at 31 cm FL (Fig. 27c). The maturity composition in Chirikof for males > 40 cm FL (n = 10) was 30% immature, 0% developing, 10% pre-spawning, 60% spawning, and 0% spent (Fig. 38a). The maturity composition of females > 40 cm FL (n = 27) was 15% immature, 19% developing, 67% pre-spawning, 0% spawning, and 0% spent (Fig. 38a). The high percentage of pre-spawning adult females suggests that peak spawning had not occurred, and that survey timing was likely appropriate. The female L_{50} was 47.3 cm FL (Fig. 38b). The average GSI for pre-spawning females was 0.14, lower than the historical mean (0.16, Fig. 38c).

Distribution and Abundance

Walleye pollock schools comprising the majority of pollock biomass in Chirikof were mixed lengths and scattered sparsely along the shelf break (Figs. 24a and 24b), though fish smaller than 40 cm FL were found both higher in the water column (Fig. 37) and slightly more frequently along the eastern transects (Fig. 24b). The biomass estimate for Chirikof was 12,685 t (Table 6). This estimate is 50,000 t less than the 2013 estimate and much less than the historic mean for this survey (40,182 t). The relative estimation error of the biomass based on the 1-D geostatistical analysis was 14.2 %.

Special Projects

Three trawl-resistant bottom- mounted moorings (TRBM) instrumented with newly developed autonomous battery powered 70 kHz split-beam echosounders were deployed in Shelikof Strait, Alaska (Fig. 39) to observe pollock abundance over the spawning season. The moorings were deployed from the NOAA ship *Oscar Dyson* 12-19 February, and recovered from a chartered fishing vessel 5-10 May 2015. The mooring locations were visited by survey vessels on four occasions to conduct mooring-related AT survey work (25-36 February, 17-21 March, 27-30 March, and 5-10 May). A large-scale acoustic survey of Shelikof Strait (Fig. 20) was conducted

on each occasion to establish the abundance and distribution of pollock over a broader area. Small-scale acoustic surveys (Fig. 39) and midwater trawl hauls (Tables 3, 10 and 11) were conducted in the vicinity of the moorings during each visit. The observations from the moorings and survey vessels will be compared to establish the spatial relationship and associated uncertainty between the mooring measurements and the ship-based acoustic-trawl survey data. In addition, movements of fish within Shelikof Strait during the spawning season and their behavior will be investigated. Analysis of these data is ongoing, and the results will be reported elsewhere.

Several collections of specimens were made to support studies by other investigators. Pacific ocean perch ovaries and otoliths were collected to support a rockfish (*Sebastes* spp.) 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). Walleye pollock, Pacific cod, Arrowtooth flounder (*Atheresthes stomias*), Pacific halibut (*Hippoglossus stenolepis*), several species of rockfishes, and *Myoxocephalus* spp. (sculpins in the family Cottidae) stomachs were collected in support of a winter food habits study (Troy.Buckley@noaa.gov). Fin clips were collected from spawning or near-spawning Pacific cod in the Shumagins to use as genetic baseline data for a proposed study (Mike.canino@noaa.gov). Whole pollock specimens were also collected for use in observer training (Brian.mason@noaa.gov) and the AFSC education program (Pamela.goddard@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 (Steve.porter@noaa.gov). Finally, age-1 pollock were collected whole for (Annette.Dougherty@noaa.gov). Results for all special projects will be reported elsewhere.

ACKNOWLEDGMENTS

The authors would like to thank the officers and crew of the NOAA ship *Oscar Dyson* for their dedication and contribution to the successful completion of this work. Thanks also to AFSC scientists Alex De Robertis, Scott Furnish, Taina Honkalehto, Heather Kenney, Nate Lauffenburger, Alison Vijgen, Chris Wilson, Steve Porter, and Kresimir Williams, Wess Strasburger, and Michael Gallagher from NMFS' Assessment and Monitoring Division.

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TABLES AND FIGURES

APPENDIX I. ITINERARY

DY2015-02

Shumagin Islands\Sanak Trough

10 Feb.	Acoustic sphere calibration in Uganik Bay, Kodiak Island, AK.
11 Feb.	Depart Kodiak, AK.
11-12 Feb.	Deploy two trawl-resistant bottom mounted (TRBM) sounders in Shelikof Strait
13 Feb.	Begin acoustic-trawl survey of Shumagin Islands. Halted due to mechanical issues.
18 Feb.	Acoustic-trawl survey of Shumagin Islands resumes.
19 Feb.	Deploy 1 TRBM sounder in Shelikof Strait
20-24 Feb.	Acoustic-trawl survey of Shumagin Islands
22-23 Feb.	Acoustic-trawl survey of Sanak.
23-24 Feb.	Acoustic-trawl survey of Shumagin Trough.
27 Feb.-1 Mar.	Kenai Peninsula Bays (i.e., Resurrection Bay, Day Harbor, Port Bainbridge, Aialik Bay, Harris Bay, Nuka Bay, Nuka Passage, Port Dick) surveyed.
2 Mar.	Small-scale TRBM survey in Shelikof Strait
2 Mar.	Arrive Kodiak, AK. End cruise.

DY2015-03

Shelikof Strait\Marmot Bay\Chirikof Shelfbreak

13 Mar.	Depart Kodiak, AK.
15-16 Mar.	Acoustic-trawl survey of Marmot Bay.
17-23 Mar.	Acoustic-trawl survey of Shelikof Strait.
23-24 Mar.	Acoustic trawl survey of Chirikof Shelfbreak.
24 Mar.	Acoustic sphere calibration in Three Saints Bay, AK.
26-27 Mar.	Fishing Chirikof shelfbreak
27-30 Mar.	Survey of TRBM areas in Shelikof Strait, fishing operations.
31 Mar.	Arrive Kodiak, AK. End cruise.

APPENDIX II. SCIENTIFIC PERSONNEL

DY2015-02

Shumagin Islands\Sanak Trough

Name	Position	Organization
Darin Jones	Chief Scientist	AFSC-RACE
Alex De Robertis	Fishery Biologist	AFSC-RACE
Heather Kenney	Fishery Biologist	AFSC-RACE
Scott Furnish	Computer Spec.	AFSC-RACE
Alison Vijgen	Fishery Biologist	AFSC-RACE
Michael Gallagher	Fishery Biologist	OST
Robert Levine	Fishery Biologist	AFSC-RACE

DY2015-03

Shelikof Strait\Marmot Bay

Name	Position	Organization
Darin Jones	Chief Scientist	AFSC-RACE
Taina Honkalehto	Fishery Biologist	AFSC-RACE
Scott Furnish	Computer Spec.	AFSC-RACE
Nathan Lauffenburger	Fishery Biologist	AFSC-RACE
Steve Porter	Fishery Biologist	AFSC-RACE
Sandi Neidetcher	Fishery Biologist	AFSC-REFM
Wess Strasburger	Fishery Biologist	AFSC-ABL
Robert Levine	Fishery Biologist	AFSC-RACE

AFSC – Alaska Fisheries Science Center, NOAA, NMFS

RACE – Resource Assessment and Conservation Engineering Division, AFSC

REFM – Resource Ecology and Fisheries Management Division, AFSC

ABL – Auke Bay Laboratories, AFSC

OST – Office of Science and Technology

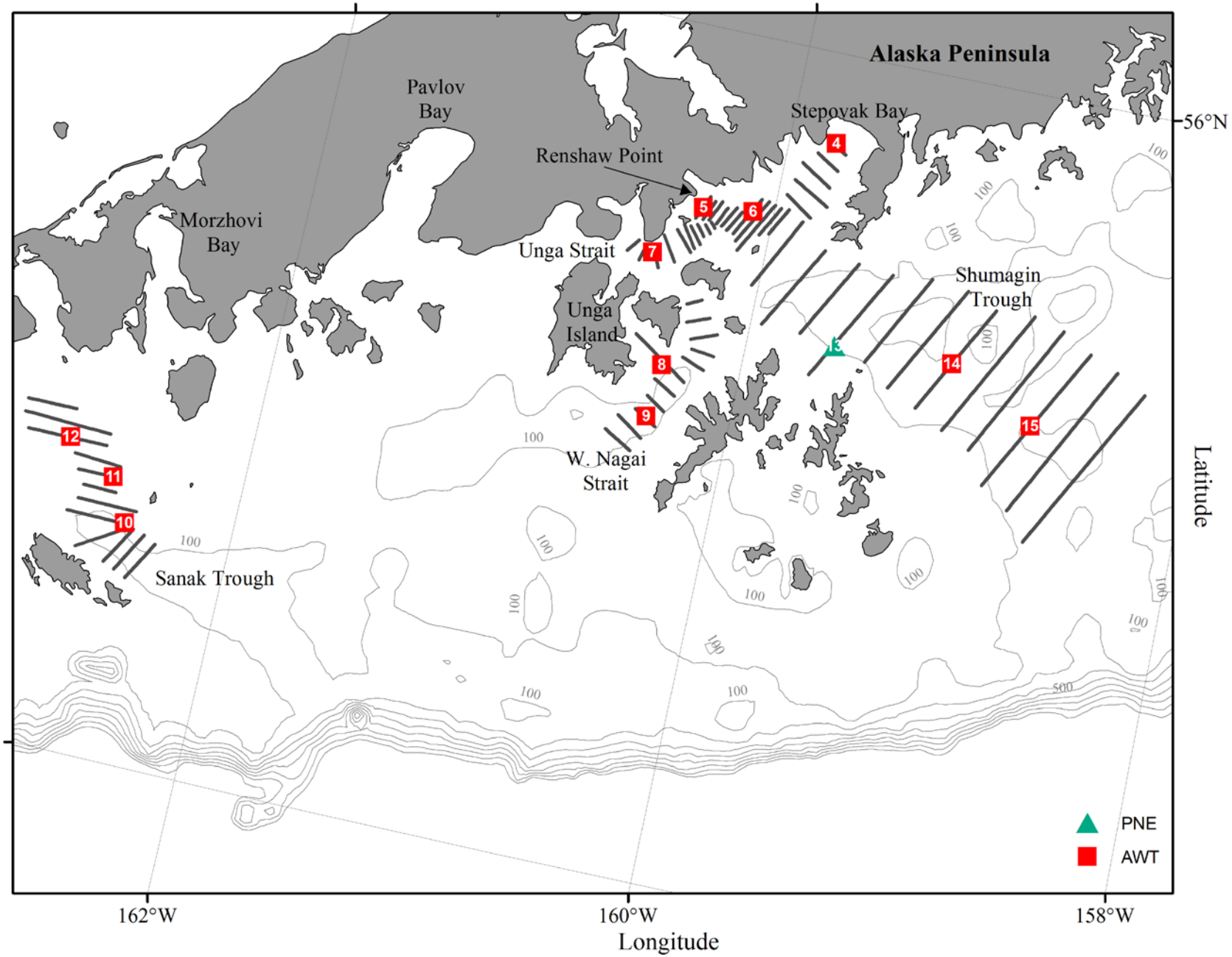

Figure 1. -- Transect lines and locations of Aleutian-wing trawl (AWT) and poly-Nor'eastern trawl (PNE) hauls during the winter 2015 acoustic-trawl survey of walleye pollock in the Shumagin Islands and Sanak Trough.

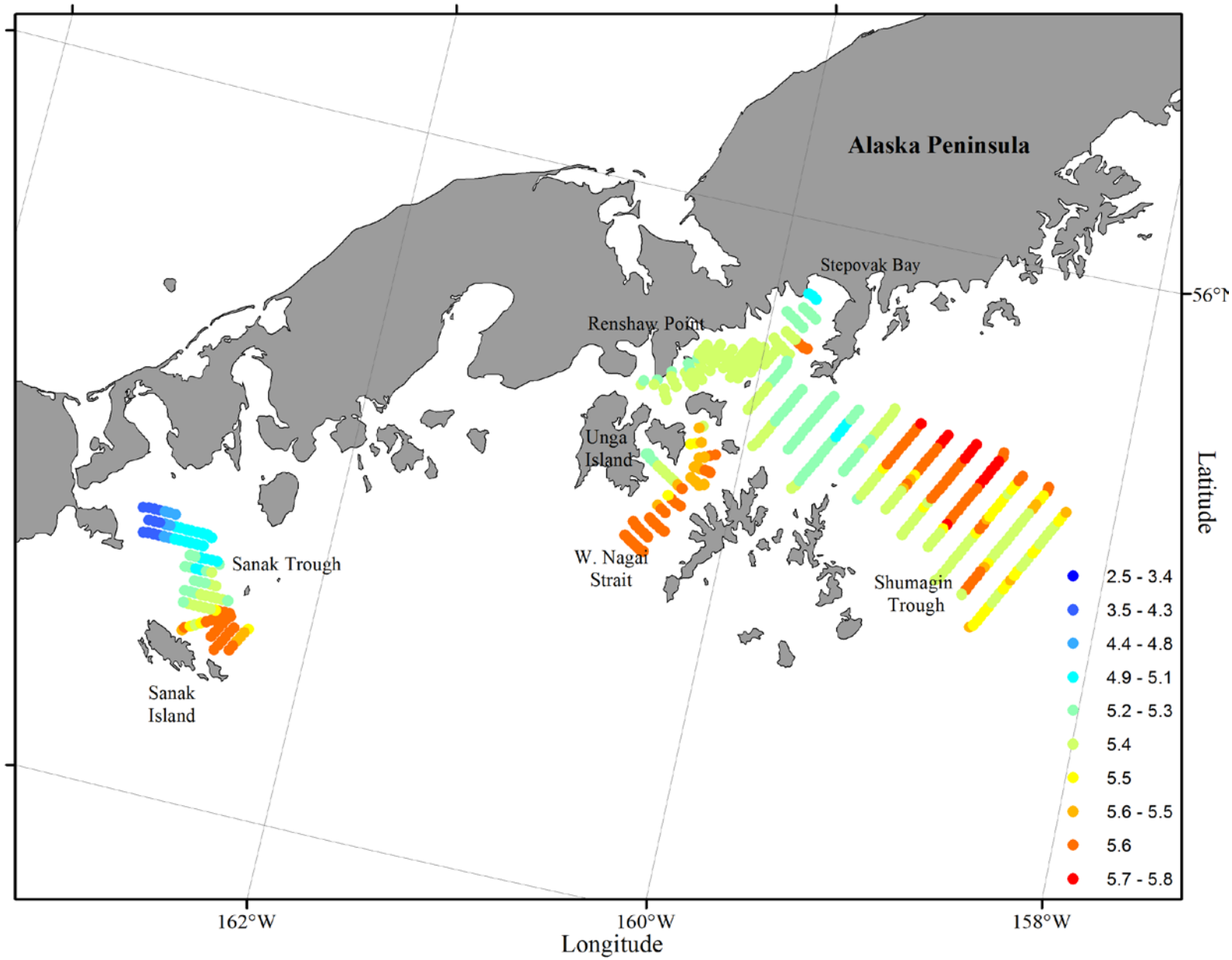

Figure 2. -- Surface water temperatures (°C) recorded from the ship's Furuno T-2000 temperature probe located 1.4 m below the surface during the DY1502 acoustic-trawl survey of the Shumagin Islands and Sanak Trough.

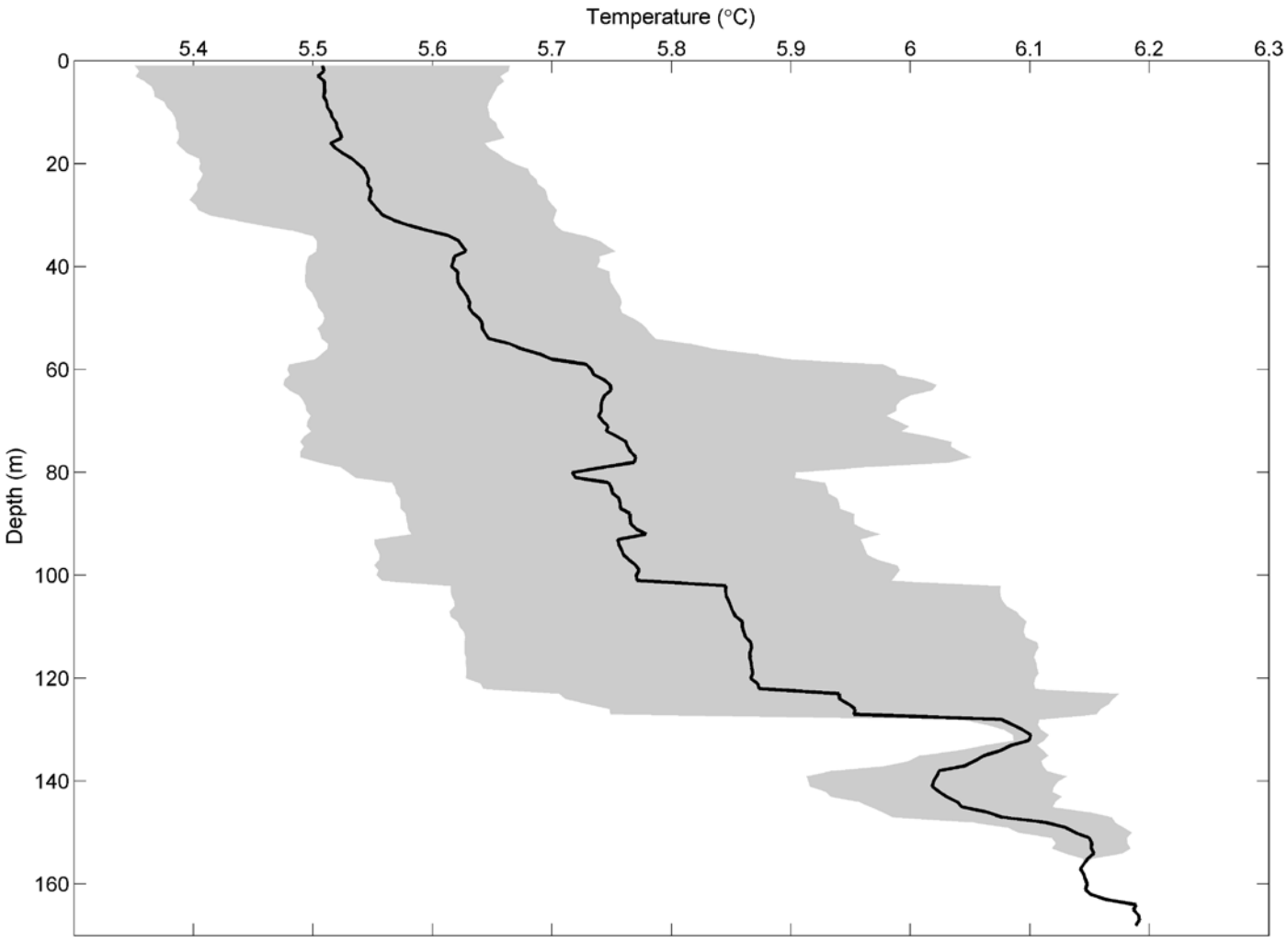

Figure 3. -- Mean water temperature (°C; solid line) by 1-m depth intervals for the eight trawl haul locations for which temperature data were collected during the winter 2015 acoustic-trawl survey of walleye pollock in the Shumagin trough, W. Nagai Strait, Unga Strait, and Stepovak Bay. Shaded area represents one standard deviation.

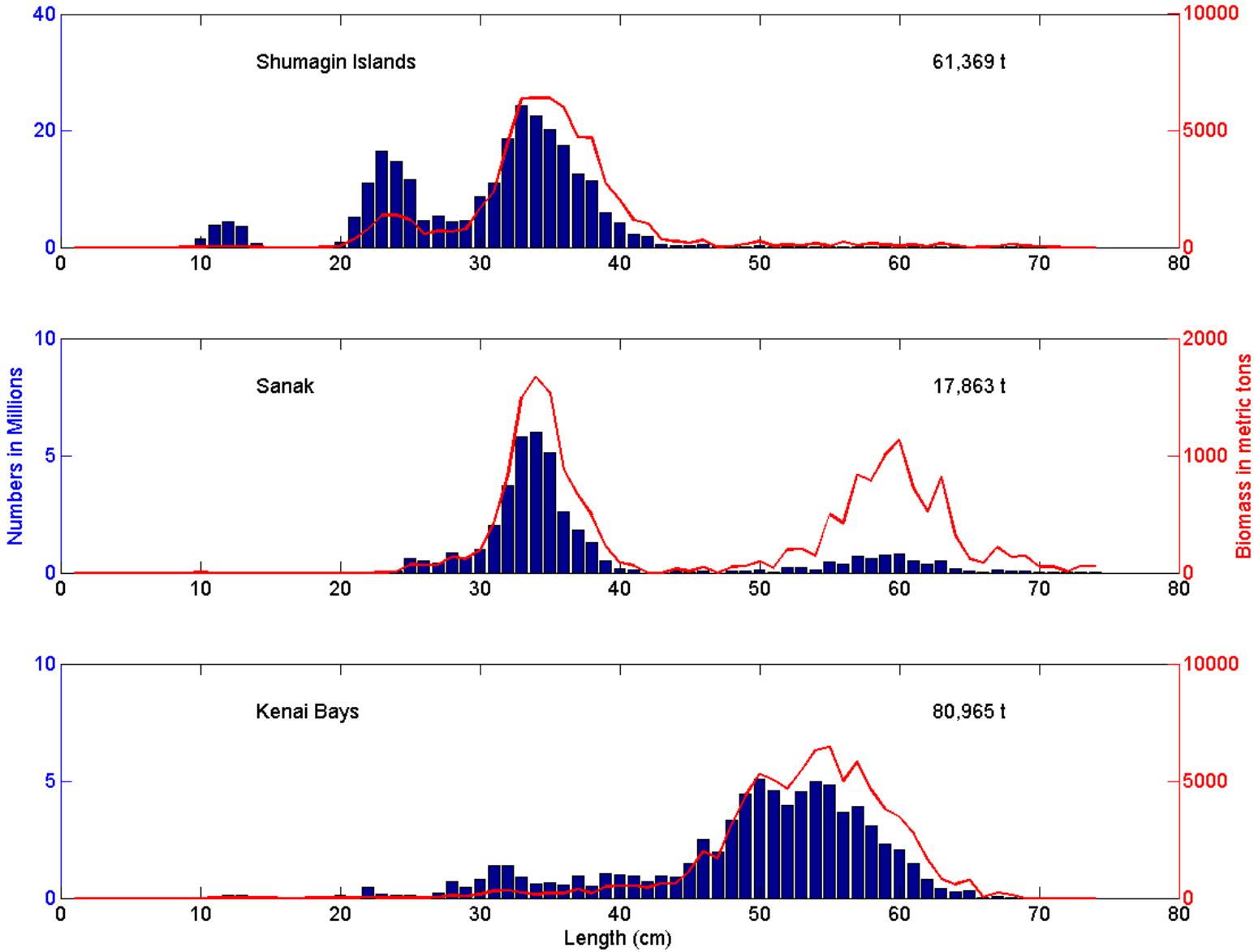

Figure 4. -- Length distribution of walleye pollock are shown with bars (numbers) and biomass estimate shown with solid red line (metric tons, t) for the 2015 acoustic-trawl survey of Shumagin Islands, Sanak, and the Kenai bays.

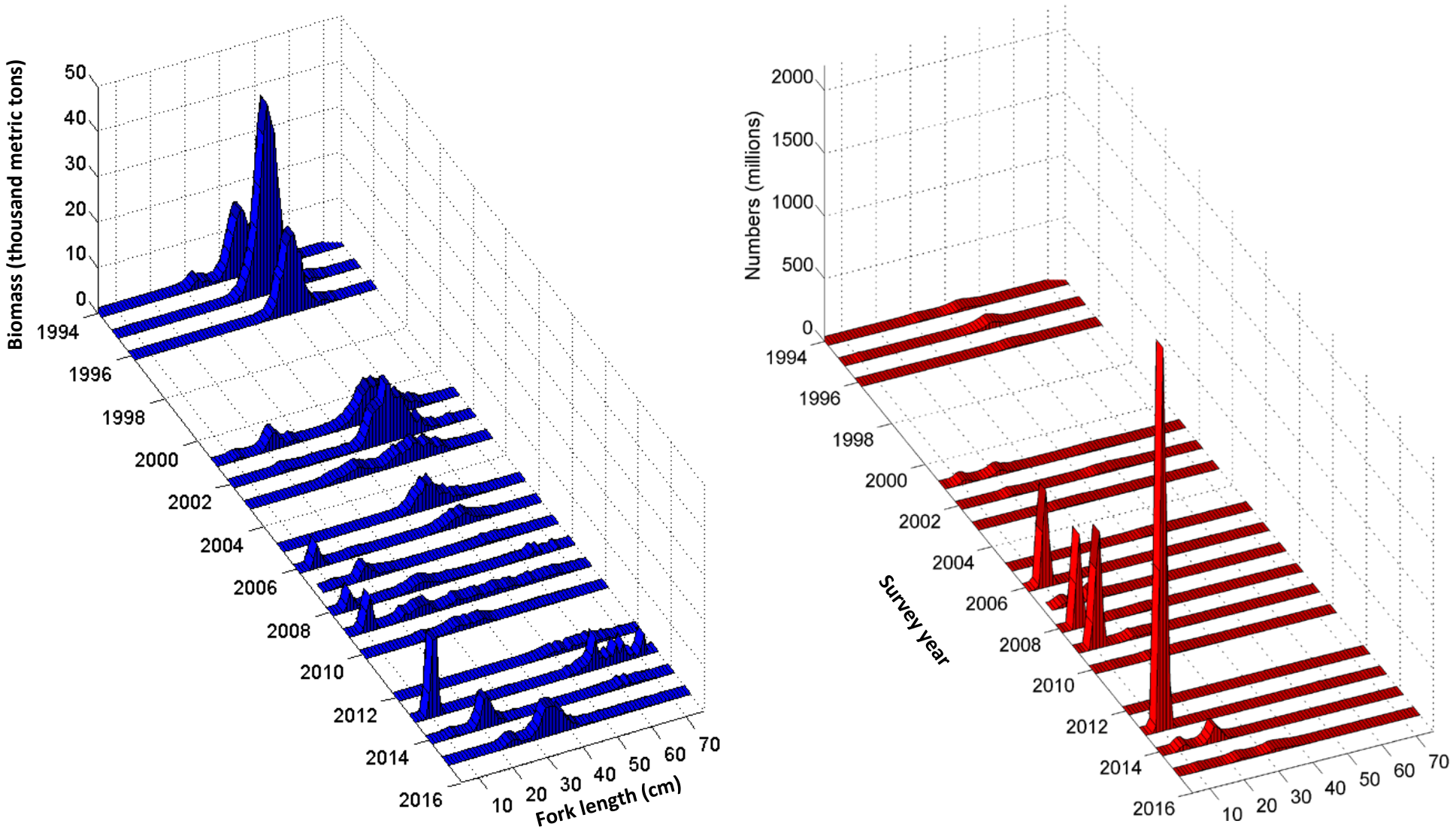

Figure 5. -- Walleye pollock biomass in thousands of metric tons (left) and numbers in millions (right) at length from the Shumagin Islands acoustic-trawl surveys since 1994. No surveys were conducted in 1997-2000, 2004, or 2011.

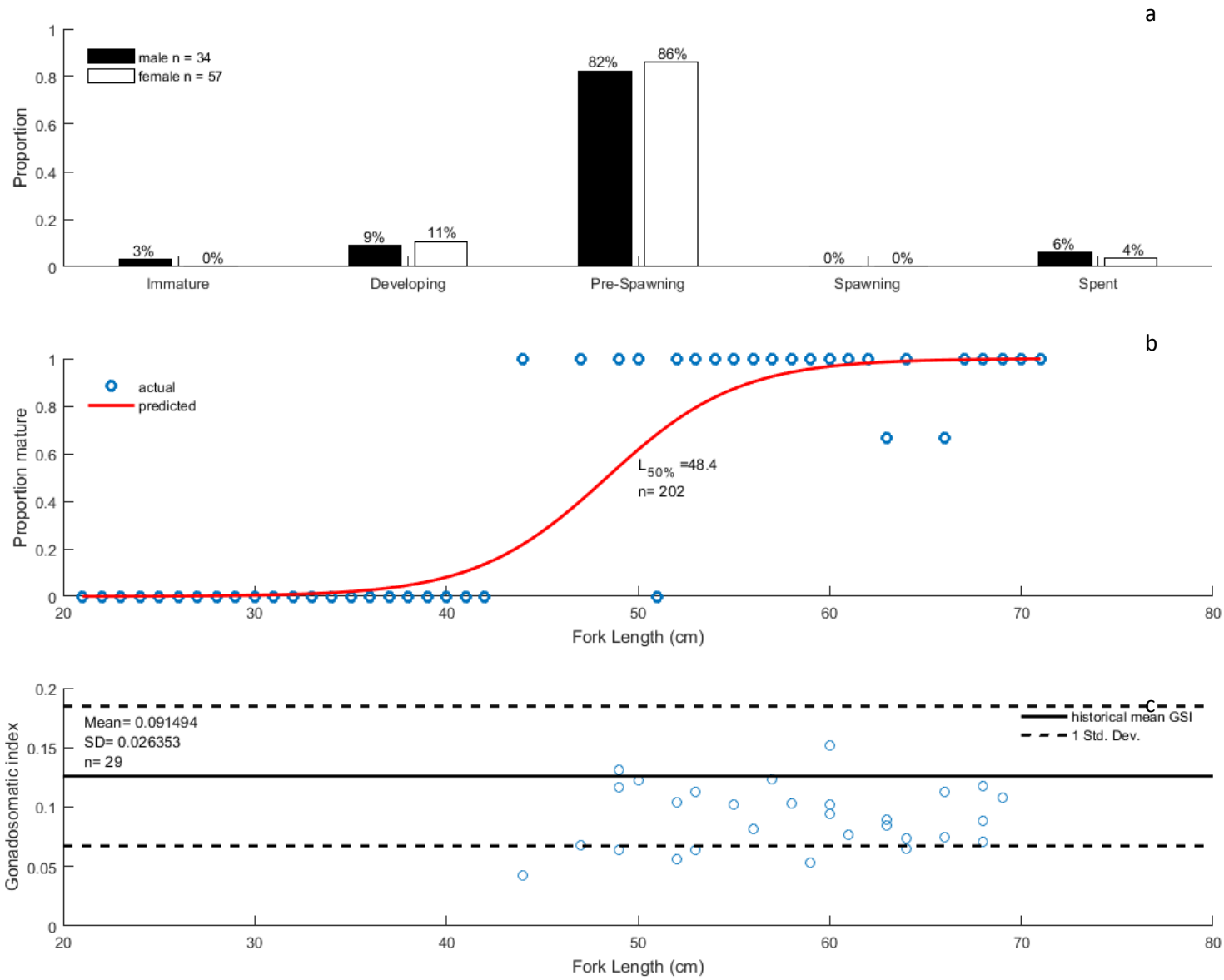

Figure 6. -- Maturity composition for male and female walleye pollock greater than 40 cm FL within each stage (a); proportion mature (i.e. pre-spawning, spawning, or spent) by 1-cm size group for female walleye pollock (b); gonadosomatic index (with historic survey mean ± 1 std. dev.) for pre-spawning females examined during the 2015 acoustic-trawl survey of the Shumagin Islands (c). Note: these graphs do not include data from age-1 fish.

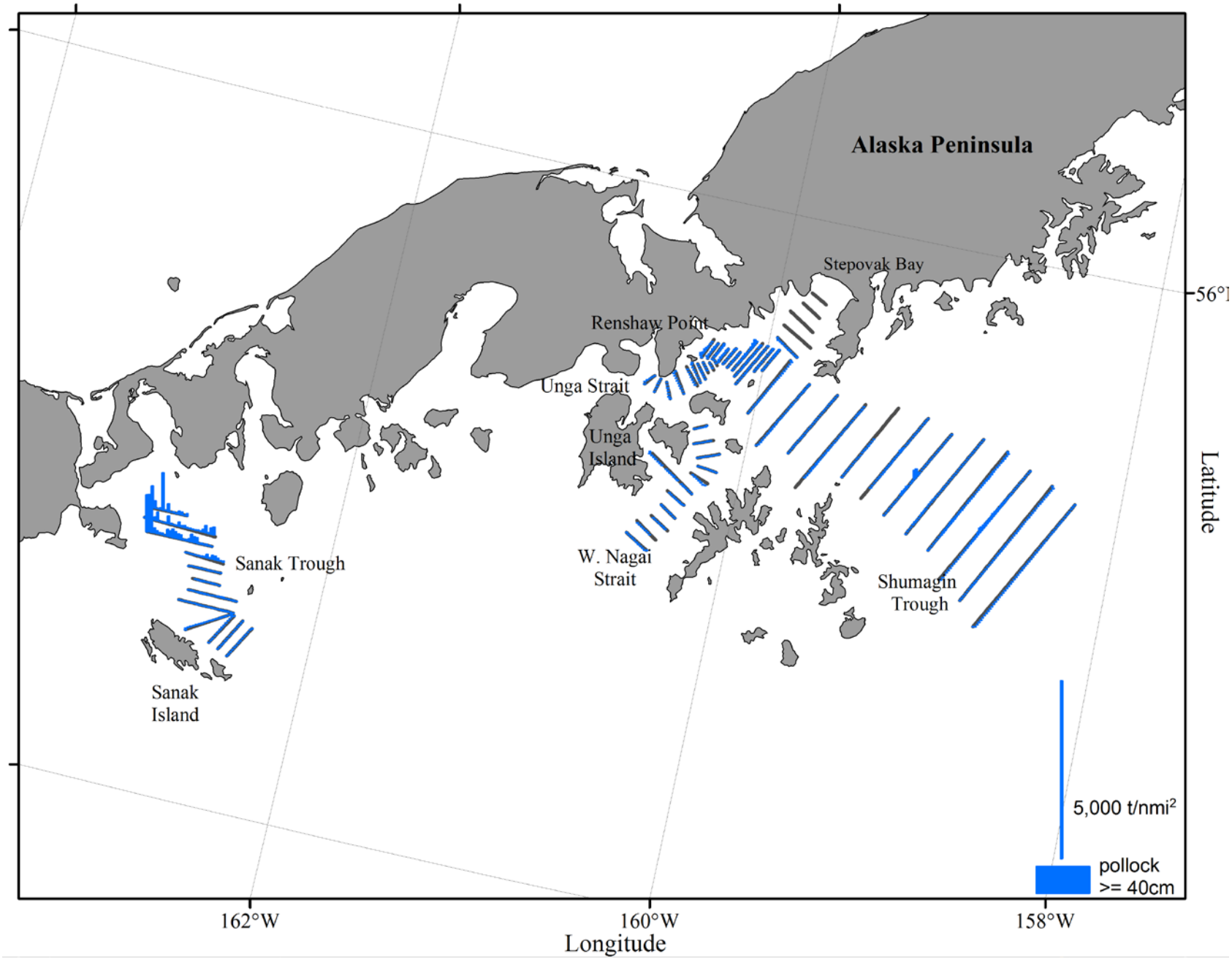

Figure 7a. -- Biomass (t/nmi^2) attributed to walleye pollock ≥ 40 cm FL (vertical lines) along tracklines surveyed during the winter 2015 acoustic-trawl survey of the Shumagin Islands and Sanak Trough.

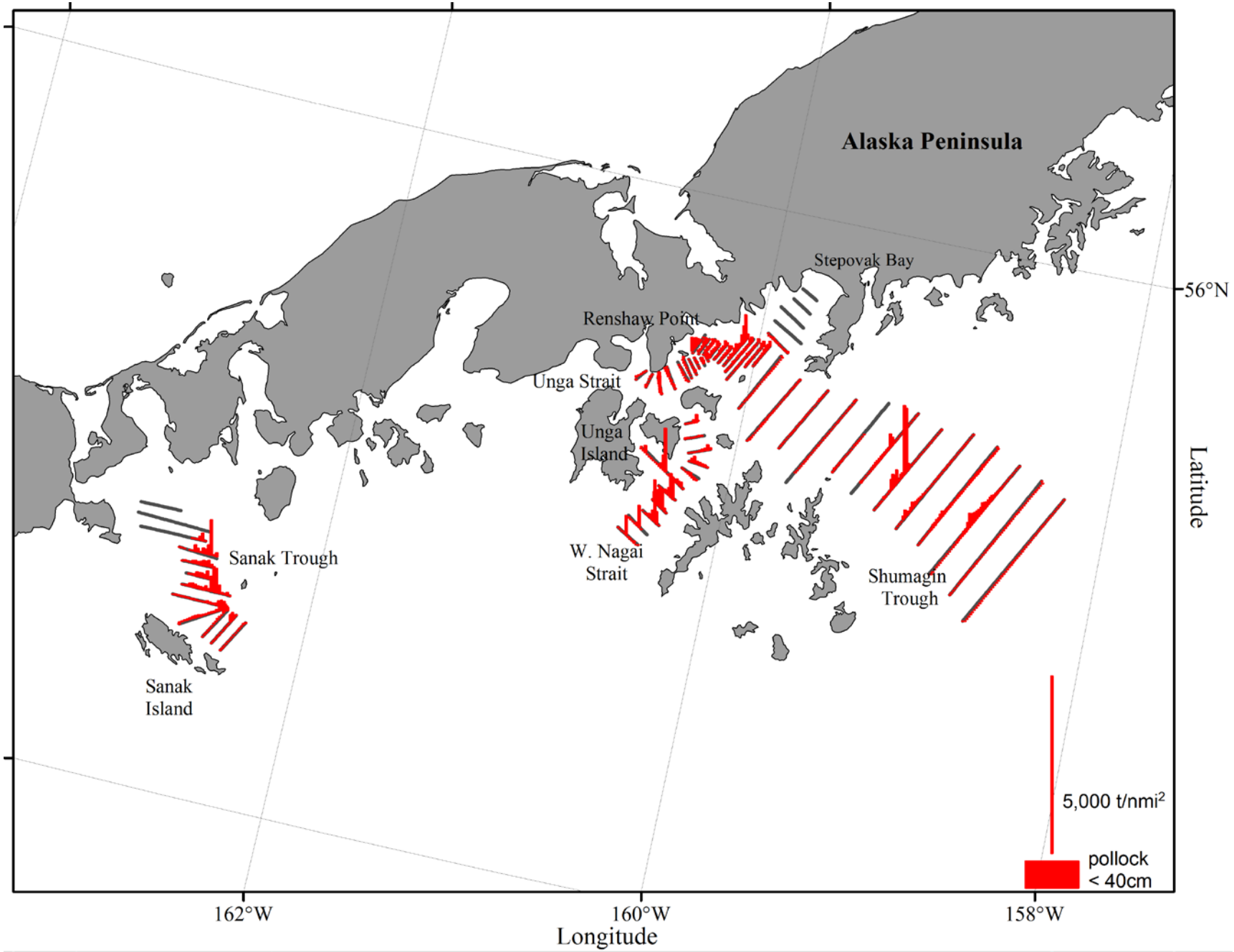

Figure 7b. -- Biomass (t/nmi^2) attributed to walleye pollock < 40 cm FL (vertical lines) along tracklines surveyed during the winter 2015 acoustic-trawl survey of the Shumagin Islands and Sanak Trough.

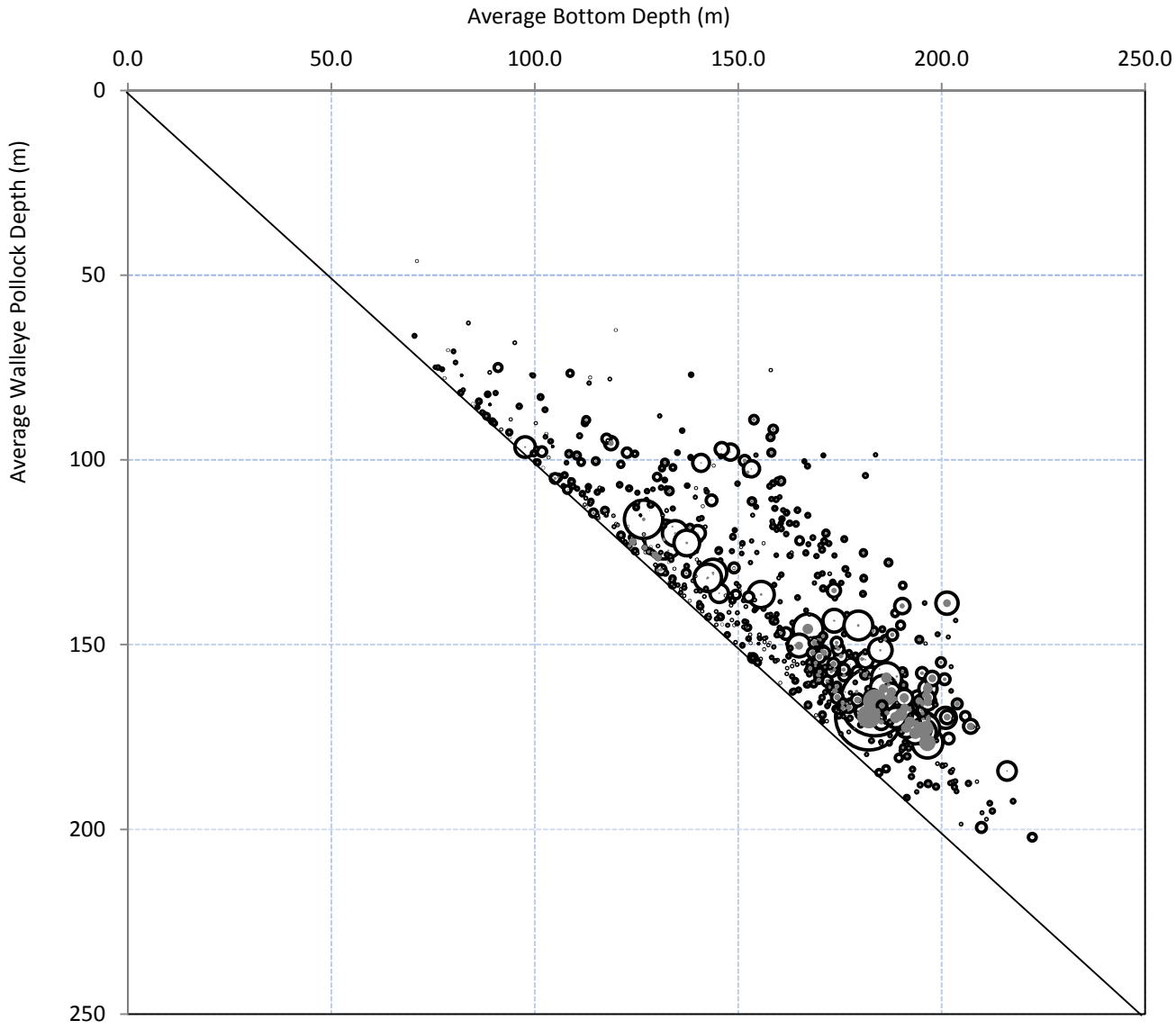

Figure 8. -- Average walleye pollock depth (weighted by biomass) versus bottom depth (m) during the winter 2015 acoustic-trawl survey of the Shumagin Islands area. Circle size is scaled to the maximum biomass per 0.5 nautical mile survey track interval. The diagonal line indicates where the average pollock depth equals bottom depth. Adult fish (≥ 40 cm FL) are represented with grey circles, juvenile fish with white circles.

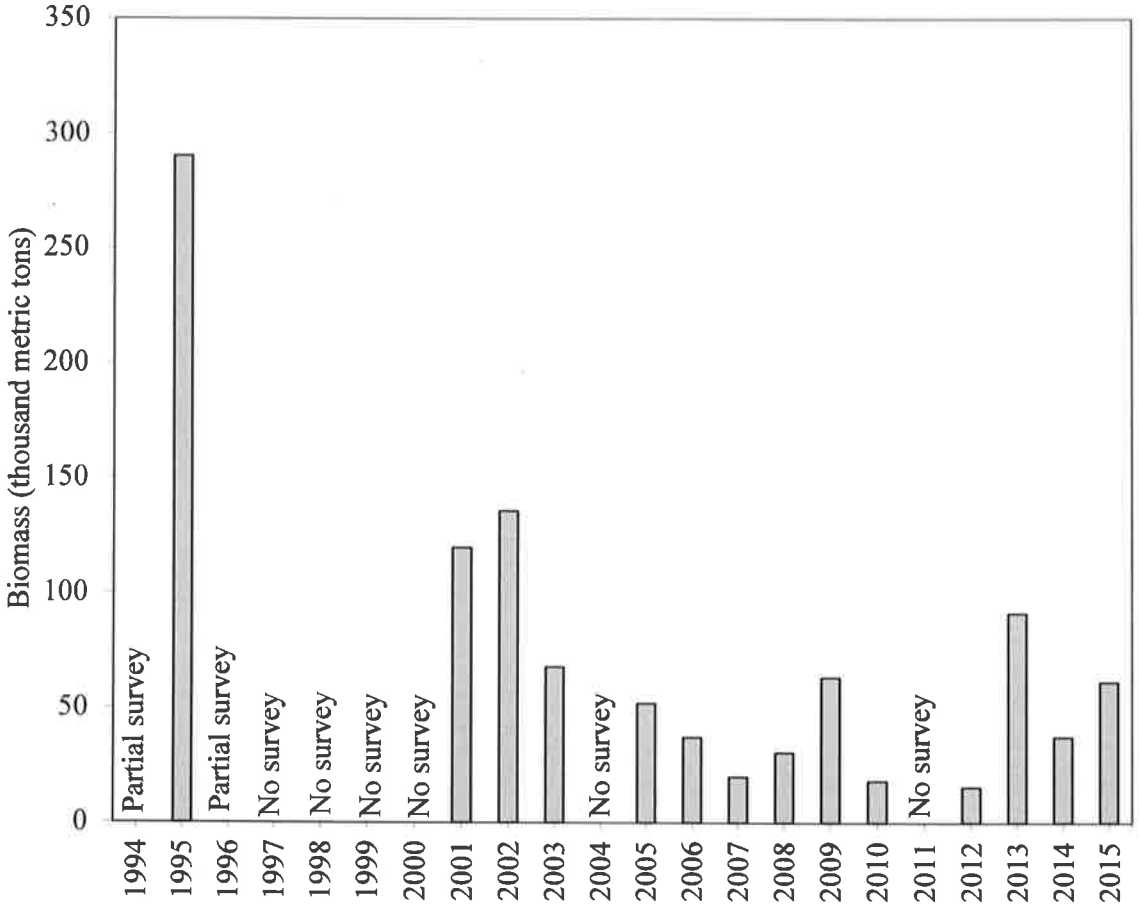

Figure 9. -- Summary of walleye pollock biomass estimates (thousand metric tons) based on acoustic-trawl surveys of the Shumagin Islands area.

Figure 10. -- Water temperature (°C) by 1-m depth intervals for the three trawl haul locations observed during the winter 2015 acoustic-trawl survey of walleye pollock in Sanak Trough, shaded area represents one standard deviation.

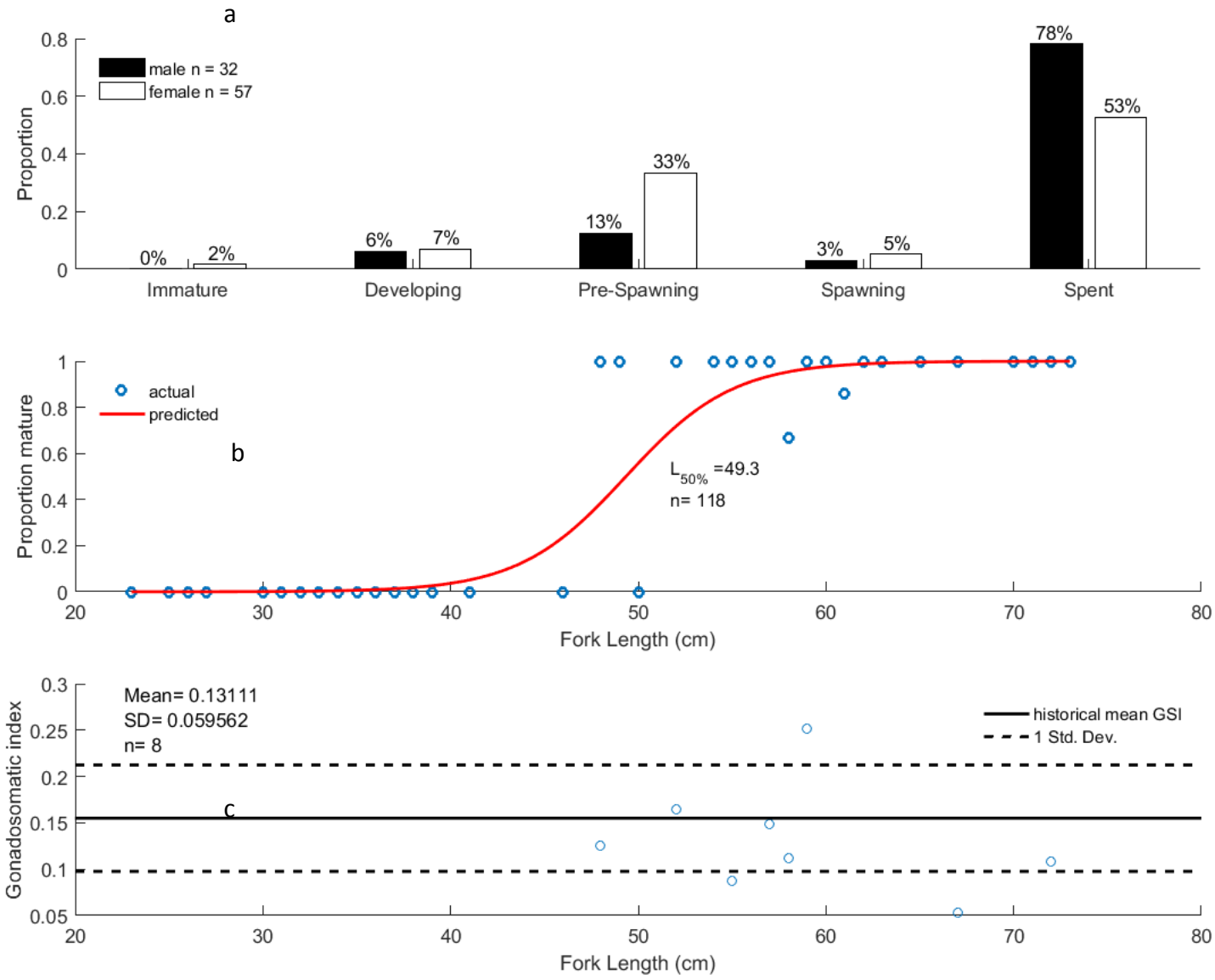

Figure 11. -- Maturity composition for male and female walleye pollock > 40 cm FL within each stage (a); proportion mature (i.e. pre-spawning, spawning, or spent) by 1-cm size group for female walleye pollock (b); gonadosomatic index (with historic survey mean ± 1 std. dev.) for pre-spawning females examined during the 2015 acoustic-trawl survey of the Sanak Trough (c). Note: these graphs do not include data from age-1 fish.

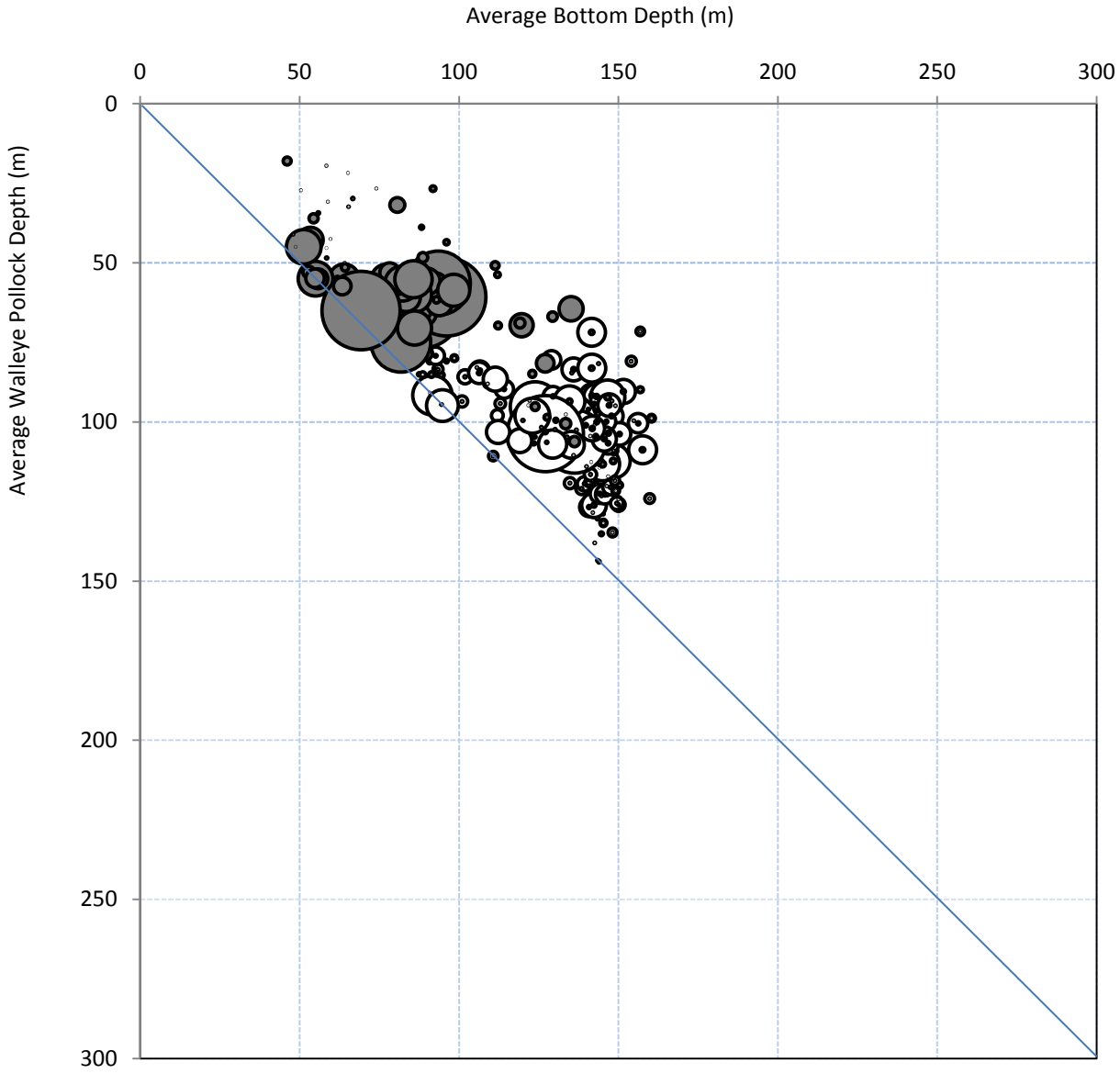

Figure 12. -- Average walleye pollock depth (weighted by biomass) versus bottom depth (m) during the winter 2015 acoustic-trawl survey of Sanak Trough. Circle size is scaled to the maximum biomass per 0.5 nmi interval. The diagonal line indicates where the average pollock depth equals bottom depth. Adult pollock ($\geq$ 40 cm FL) are represented by the gray circles, juvenile pollock by the white.

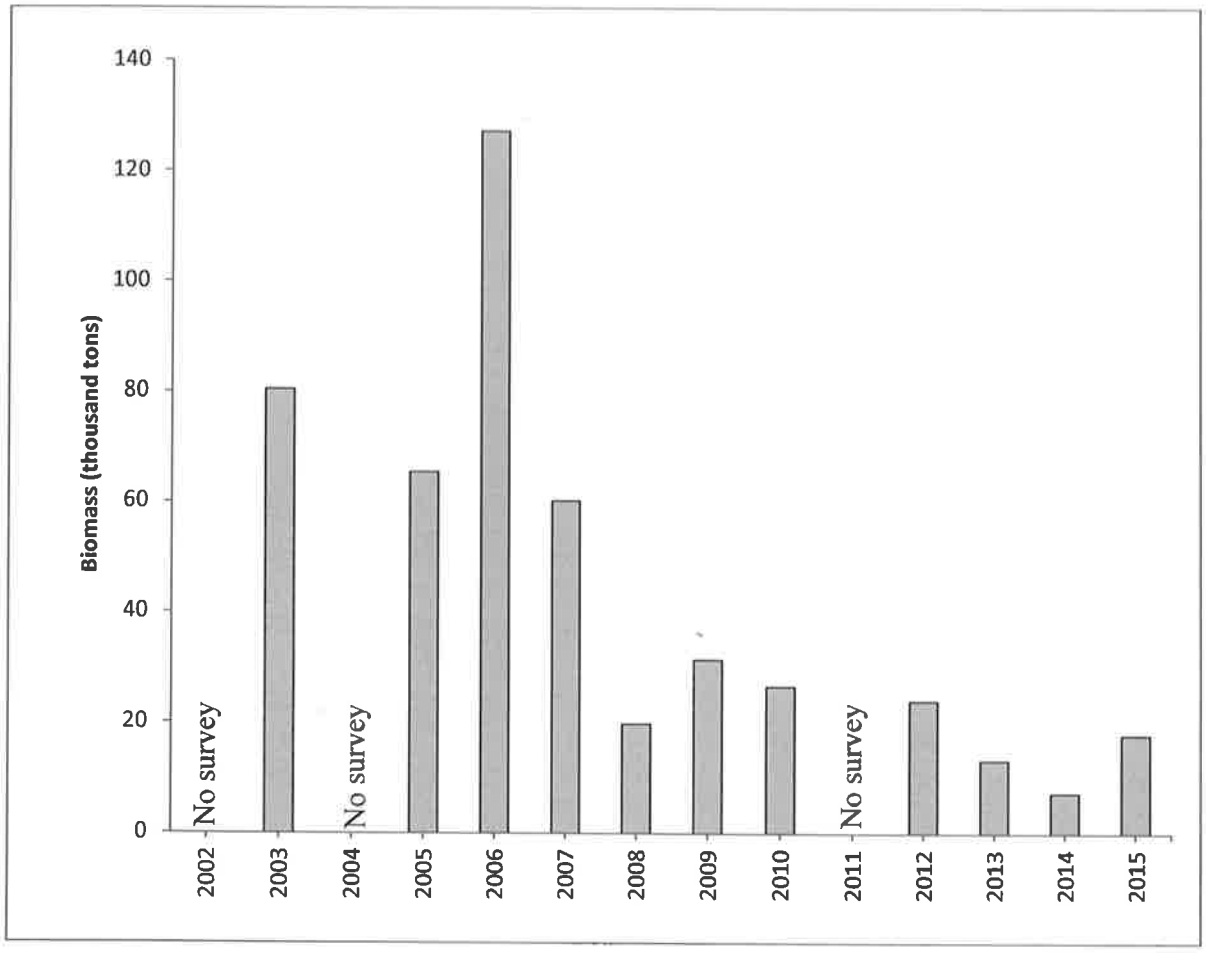

Figure 13. -- Summary of walleye pollock biomass estimates (thousand metric tons) based on acoustic-trawl surveys of the Sanak area.

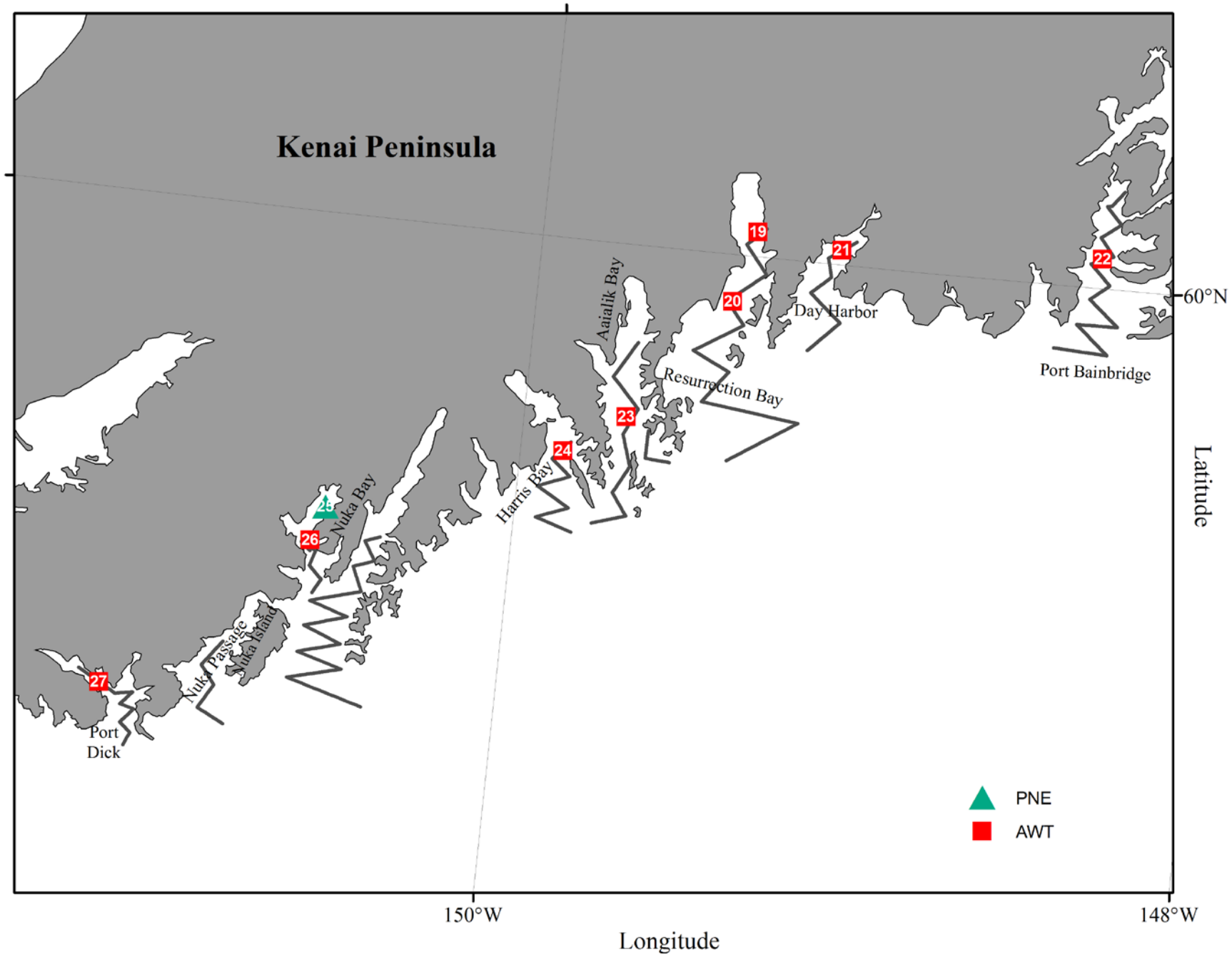

Figure 14. -- Transect lines and locations of Aleutian-wing trawl (AWT) and poly-Nor'eastern trawl (PNE) hauls during the winter 2015 acoustic-trawl survey of walleye pollock in the Kenai bays.

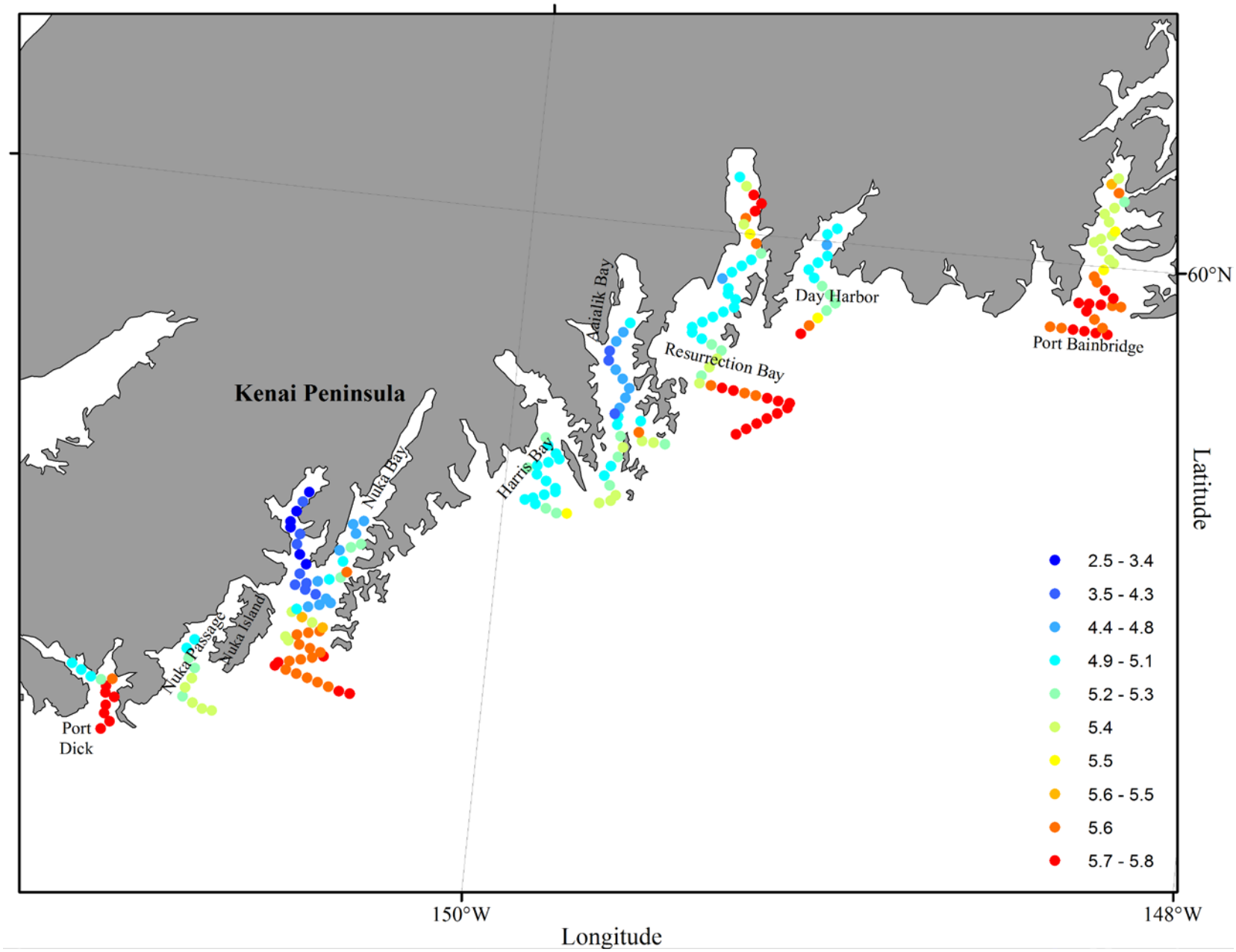

Figure 15. -- Surface water temperatures (°C) recorded from the ship's Furuno T-2000 temperature probe located 1.4 m below the surface during the DY1502 acoustic-trawl survey of the Kenai Bays.

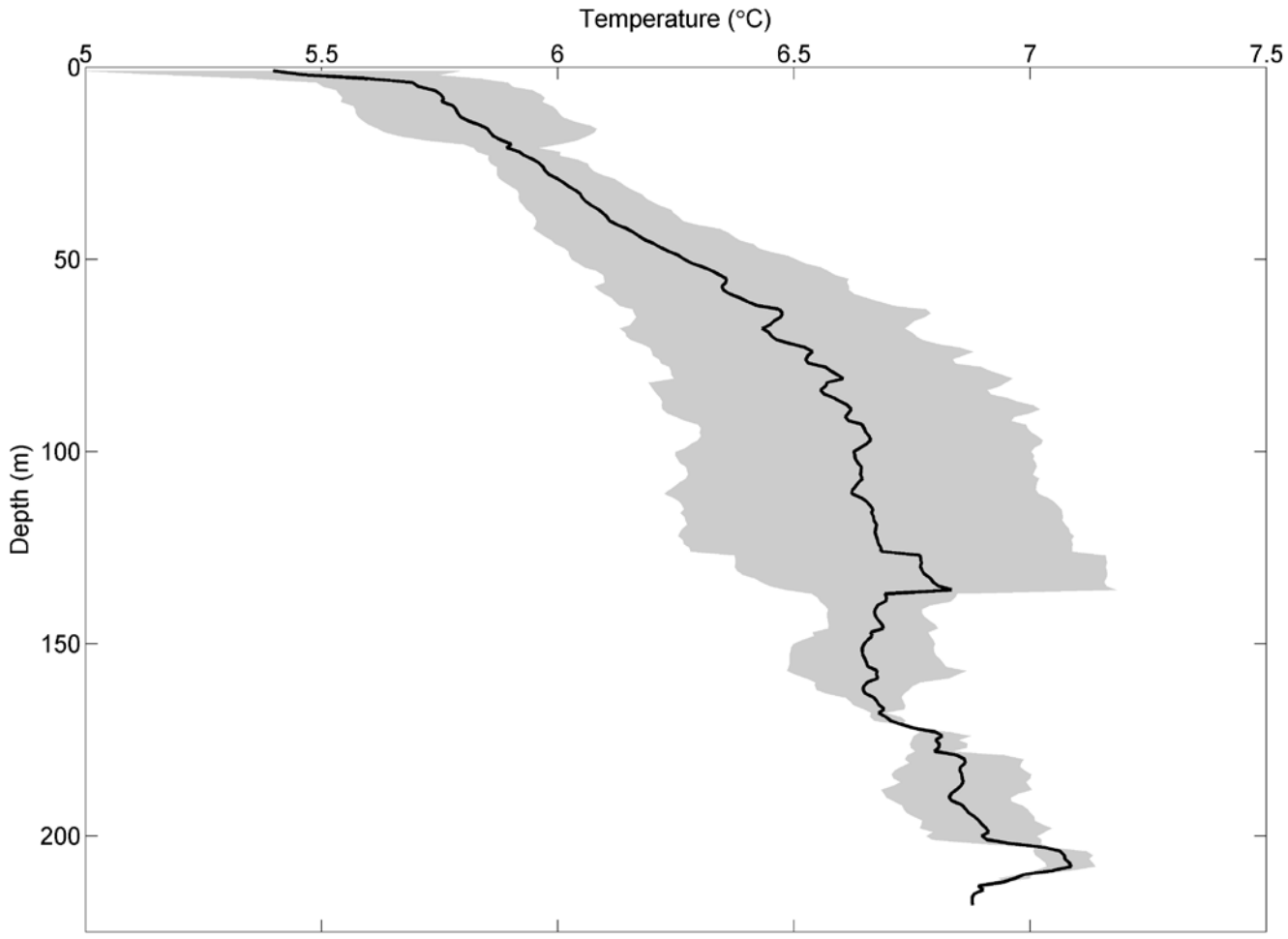

Figure 16. -- Mean water temperature (°C; solid line) by 1-m depth intervals for the 9 trawl haul locations for which temperature data were collected during the winter 2015 acoustic-trawl survey of walleye pollock in the Kenai bays. Shaded area represents one standard deviation.

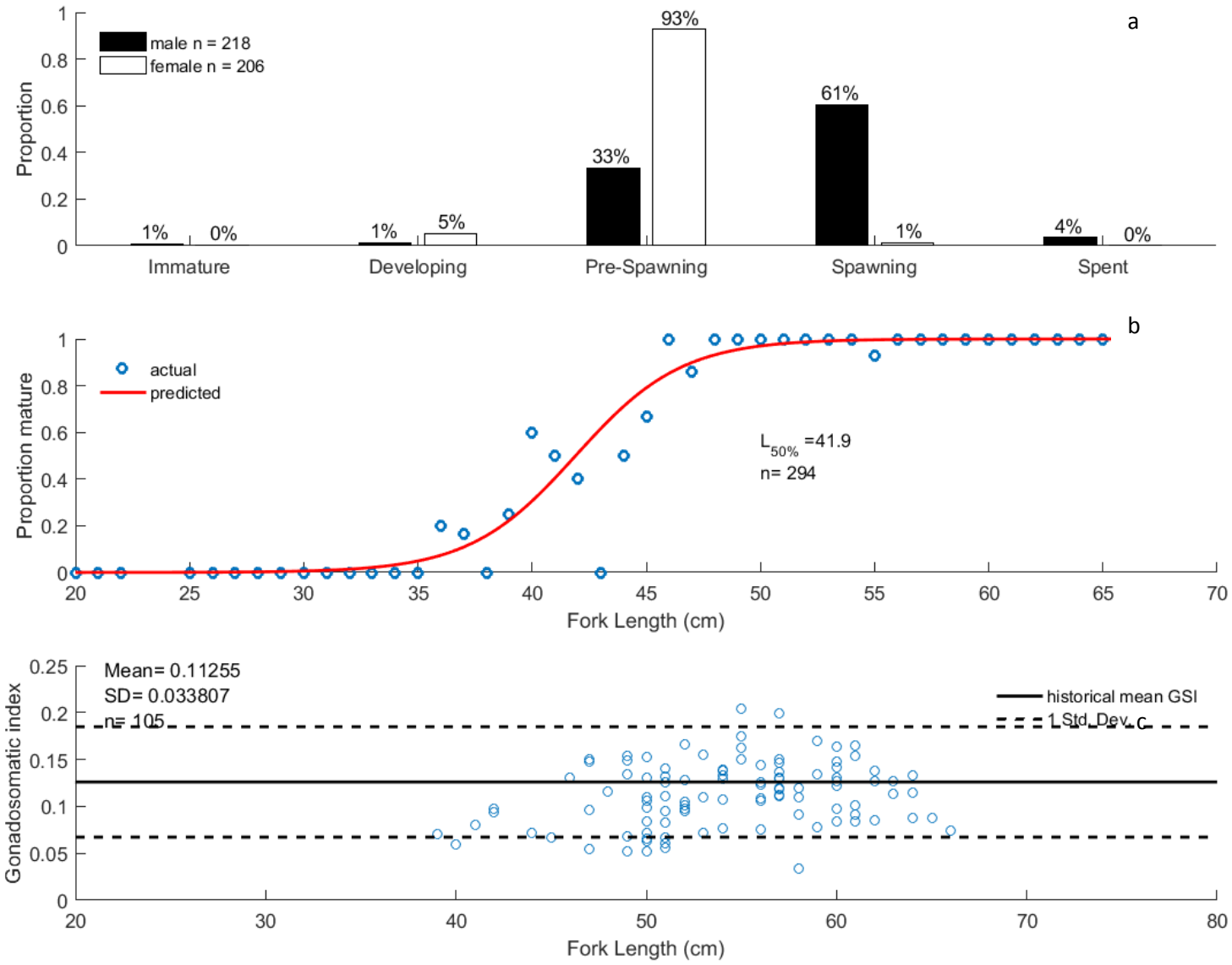

Figure 17. -- Maturity composition for male and female walleye pollock > 40 cm FL within each stage (a); proportion mature (i.e. pre-spawning, spawning, or spent) by 1-cm size group for female walleye pollock (b); gonadosomatic index (with historic survey mean ± 1 std. dev.) for pre-spawning females examined during the 2015 acoustic-trawl survey of the Kenai bays (c). Note: these graphs do not include data from age-1 fish.

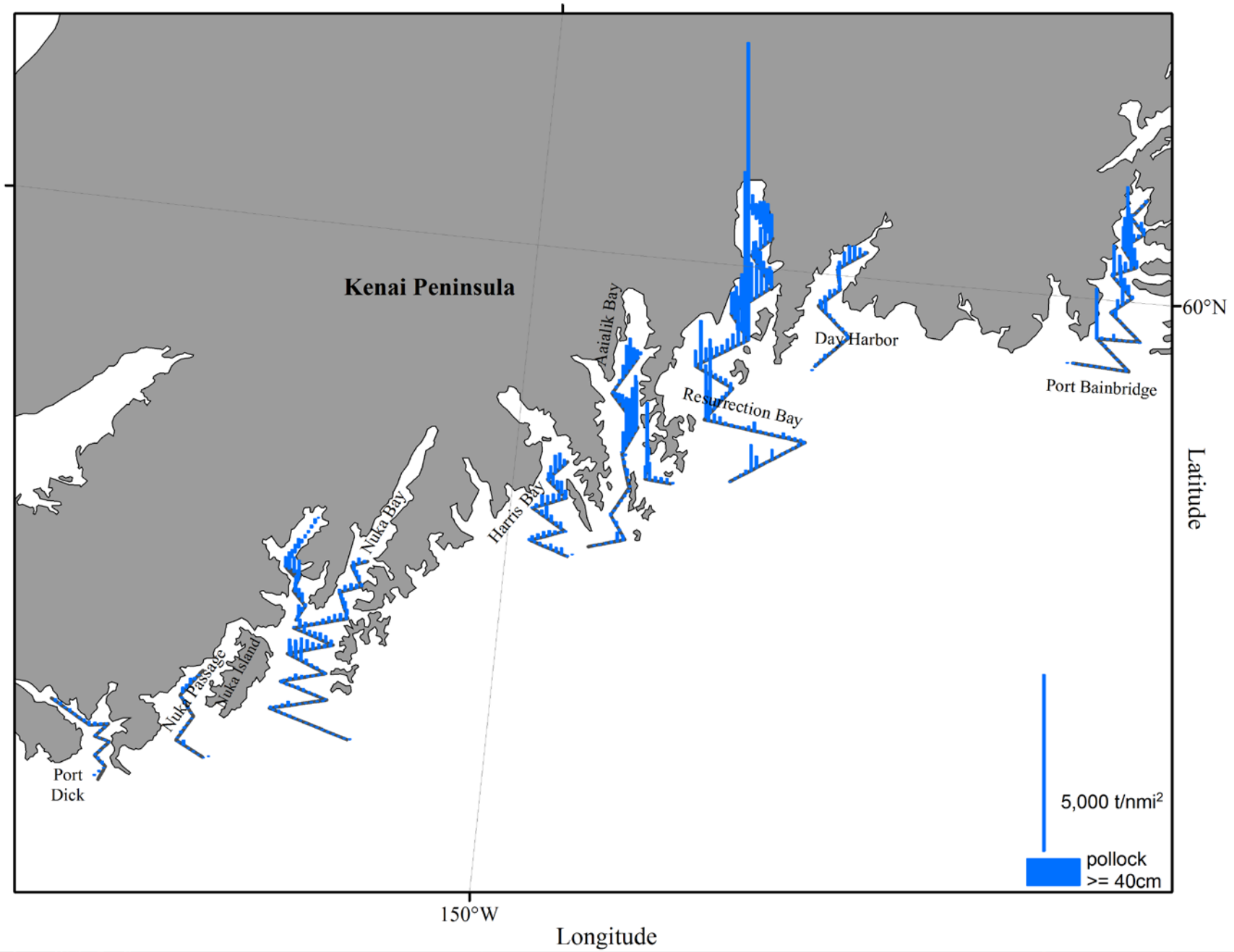

Figure 18a. -- Biomass (t/nmi^2) attributed to walleye pollock ≥ 40 cm FL (vertical lines) along tracklines surveyed during the winter 2015 acoustic-trawl survey of the Kenai Bays.

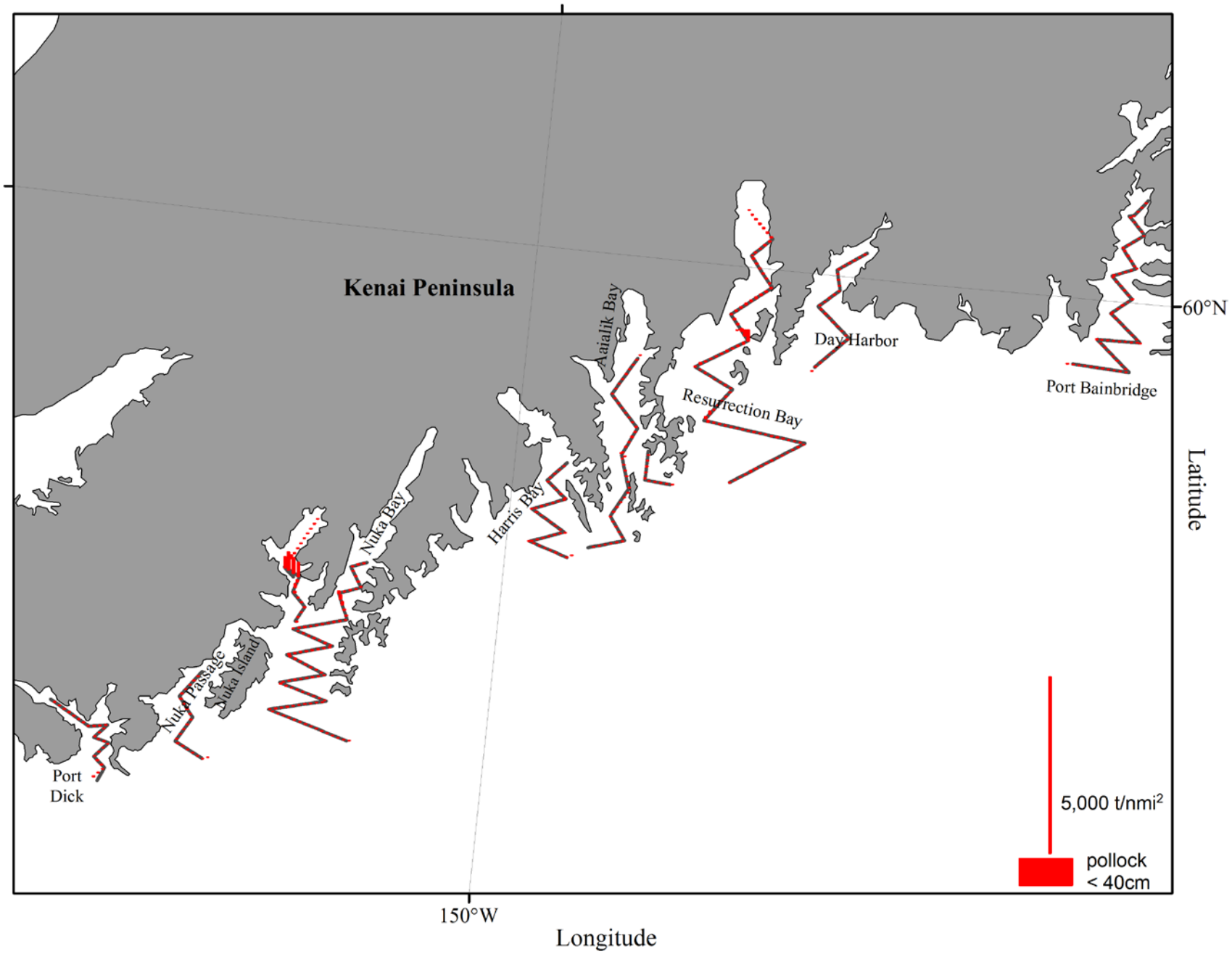

Figure 18b. -- Biomass (t/nmi^2) attributed to walleye pollock < 40 cm FL (vertical lines) along tracklines surveyed during the winter 2015 acoustic-trawl survey of the Kenai Bays.

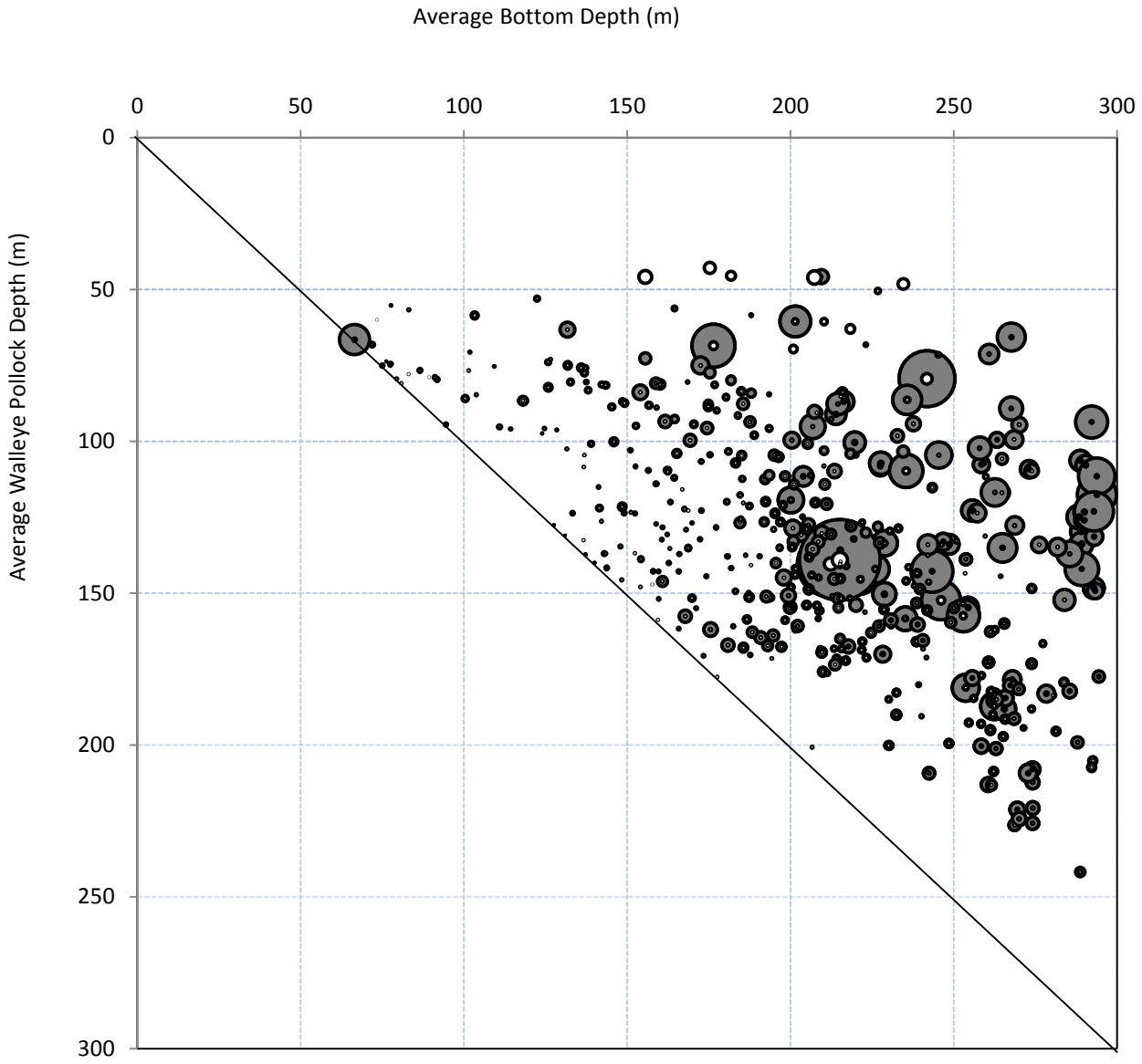

Figure 19. -- Average walleye pollock depth (weighted by biomass) versus bottom depth (m) during the winter 2015 acoustic-trawl survey of the Kenai bays. Circle size is scaled to the maximum biomass per 0.5 nmi interval. The diagonal line indicates where the average pollock depth equals bottom depth. Adult fish (≥ 40 cm FL) are represented with grey circles, juvenile fish with white circles.

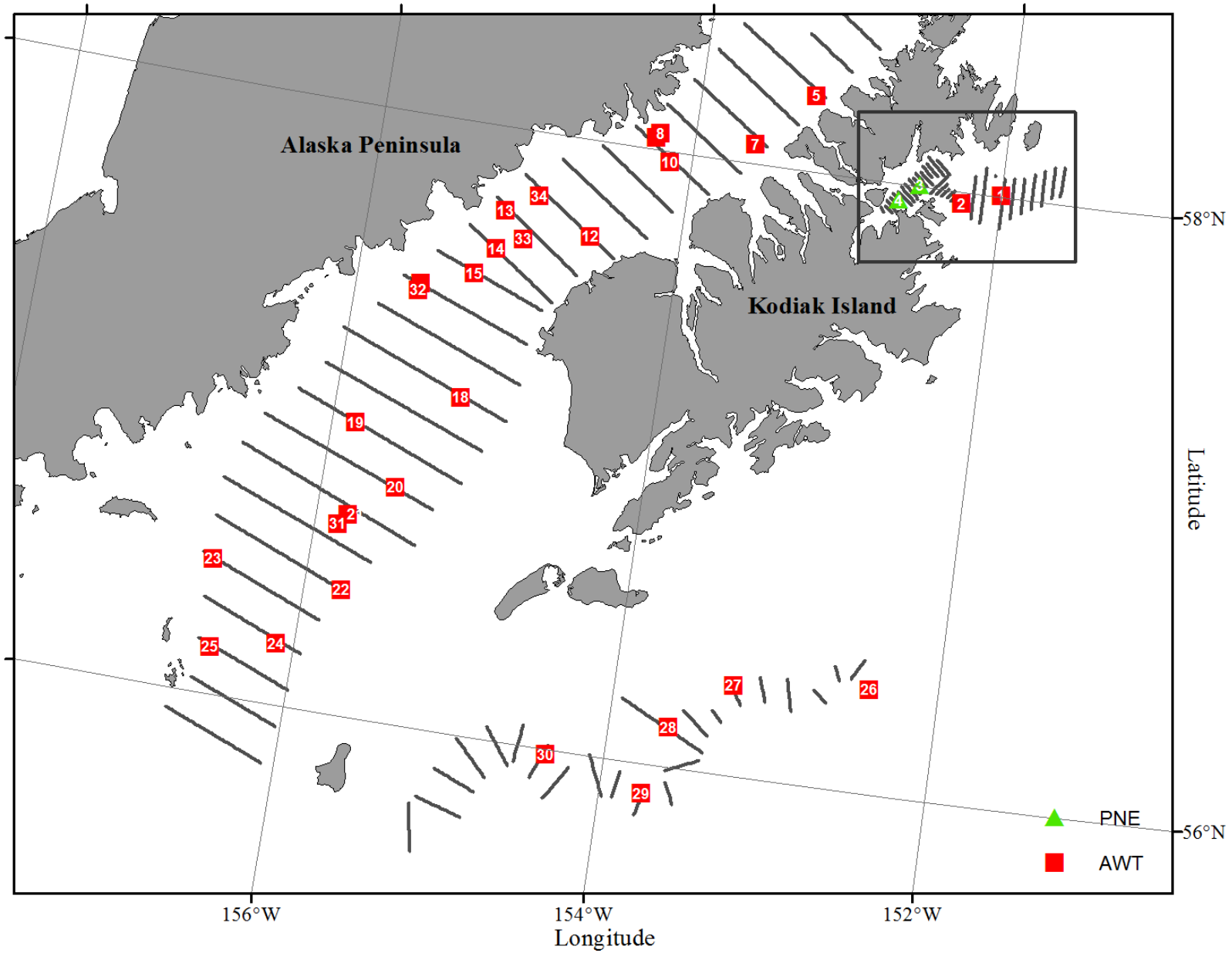

Figure 20. -- Transect lines and locations of Aleutian-wing trawl (AWT) and poly-Nor'eastern trawl (PNE) hauls during the winter 2015 acoustic-trawl survey of walleye pollock in Marmot Bay, Shelikof Strait, and the Chirikof shelf break. Haul numbers are on top of haul symbols. Box indicates area enlarged in Figure 26.

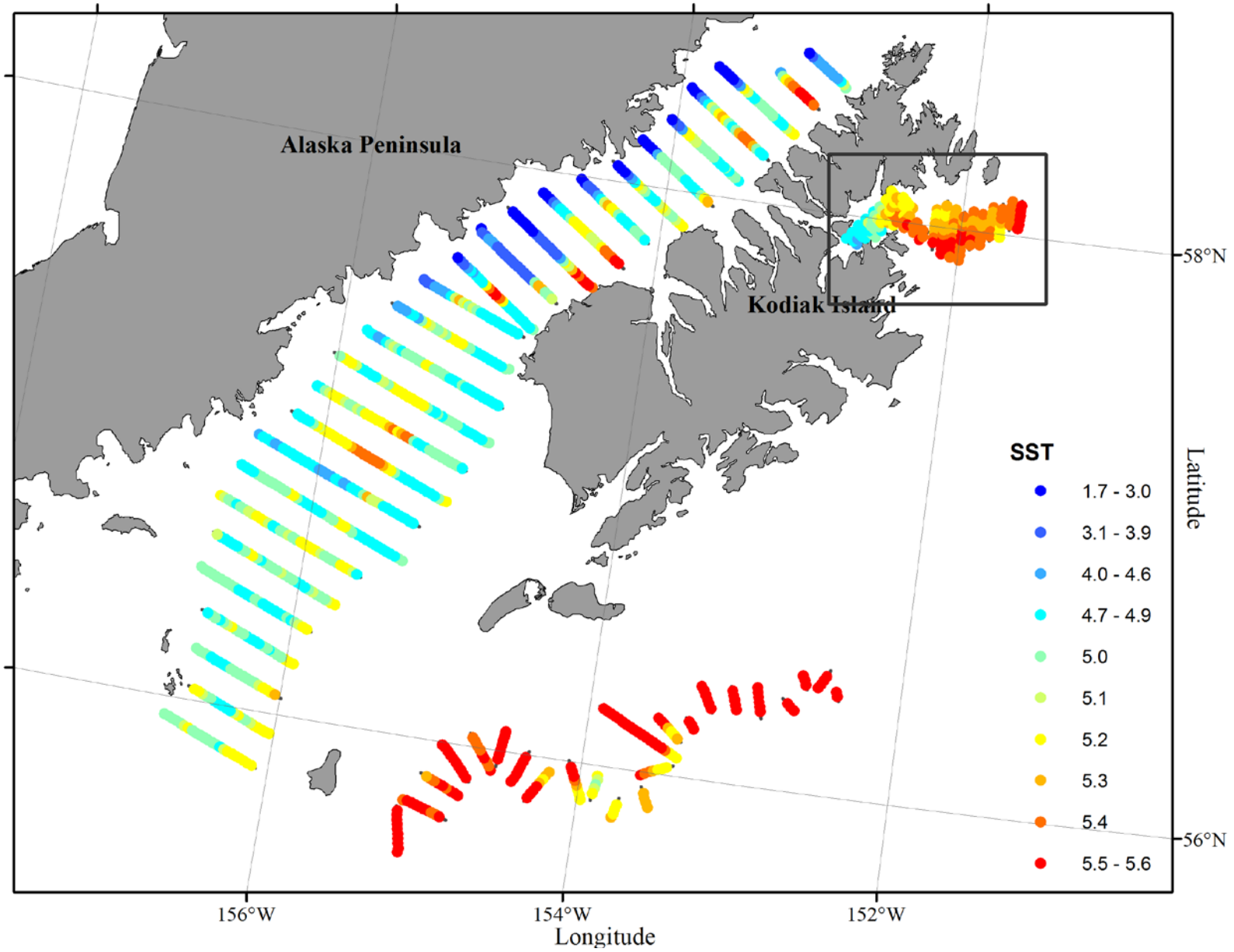

Figure 21. -- Surface water temperatures (°C) during the 2015 acoustic-trawl survey of Shelikof Strait, Chirikof shelf break, and Marmot Bay recorded from the ship's Furuno T-2000 temperature probe located 1.4 m below the surface. Box indicates area enlarged in Figure 30.

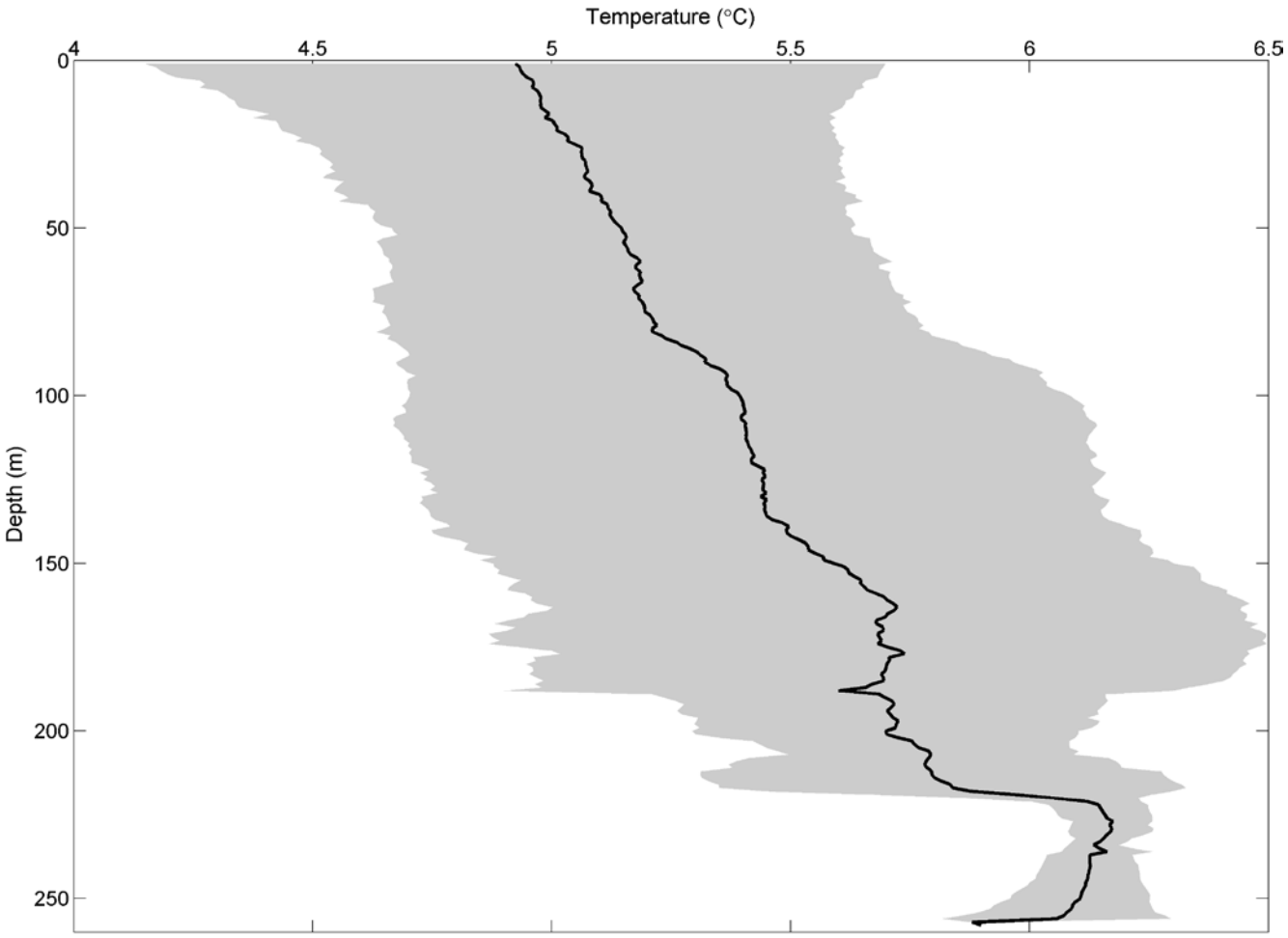

Figure 22. -- Mean water temperature (°C; solid line) by 1-m depth intervals for the 25 trawl haul locations observed during the winter 2015 acoustic-trawl survey of walleye pollock in Shelikof strait, shaded area represents one standard deviation.

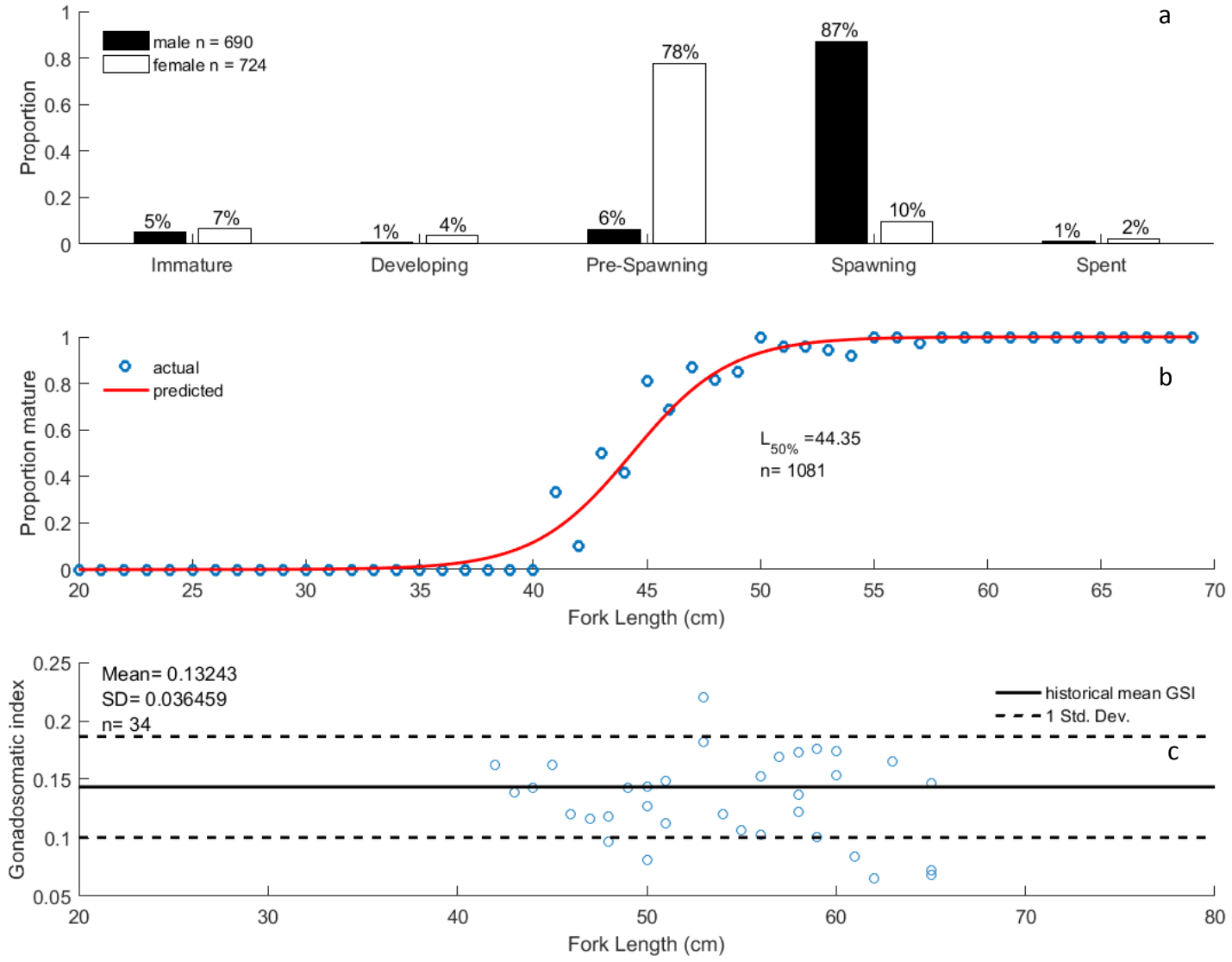

Figure 23. -- Maturity composition for male and female walleye pollock greater than 40 cm FL within each stage (a); proportion mature (i.e. pre-spawning, spawning, or spent) by 1-cm size group for female walleye pollock (b); gonadosomatic index (with historic survey mean ± 1 std. dev.) for pre-spawning females examined during the 2015 acoustic-trawl survey of the Shelikof region (c). Note: these graphs do not include data from age-1 fish.

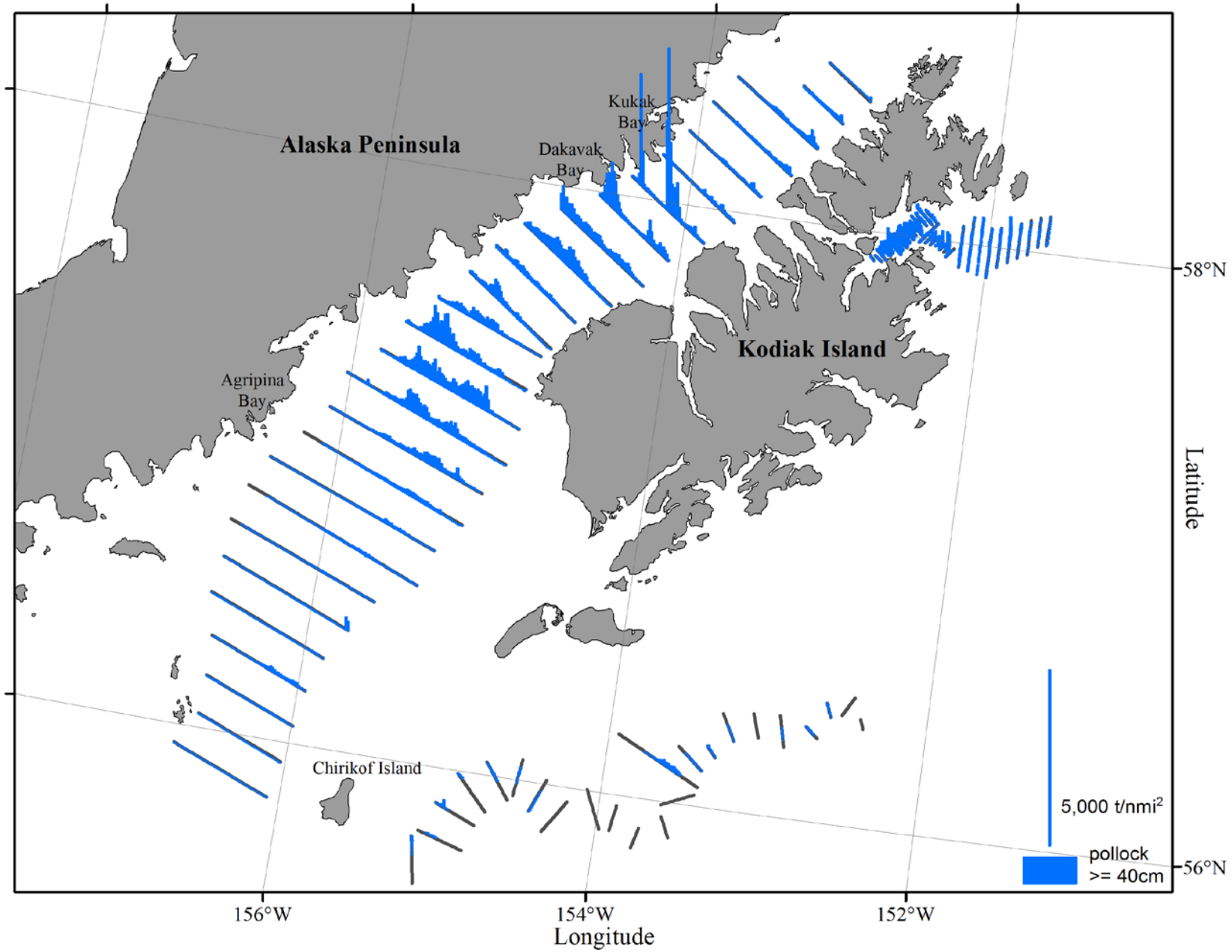

Figure 24a. -- Biomass (t/nmi^2) attributed to walleye pollock ≥ 40 cm FL (vertical lines) along tracklines surveyed during the winter 2015 acoustic-trawl survey of Shelikof Strait, Chirikof shelf break, and Marmot Bay.

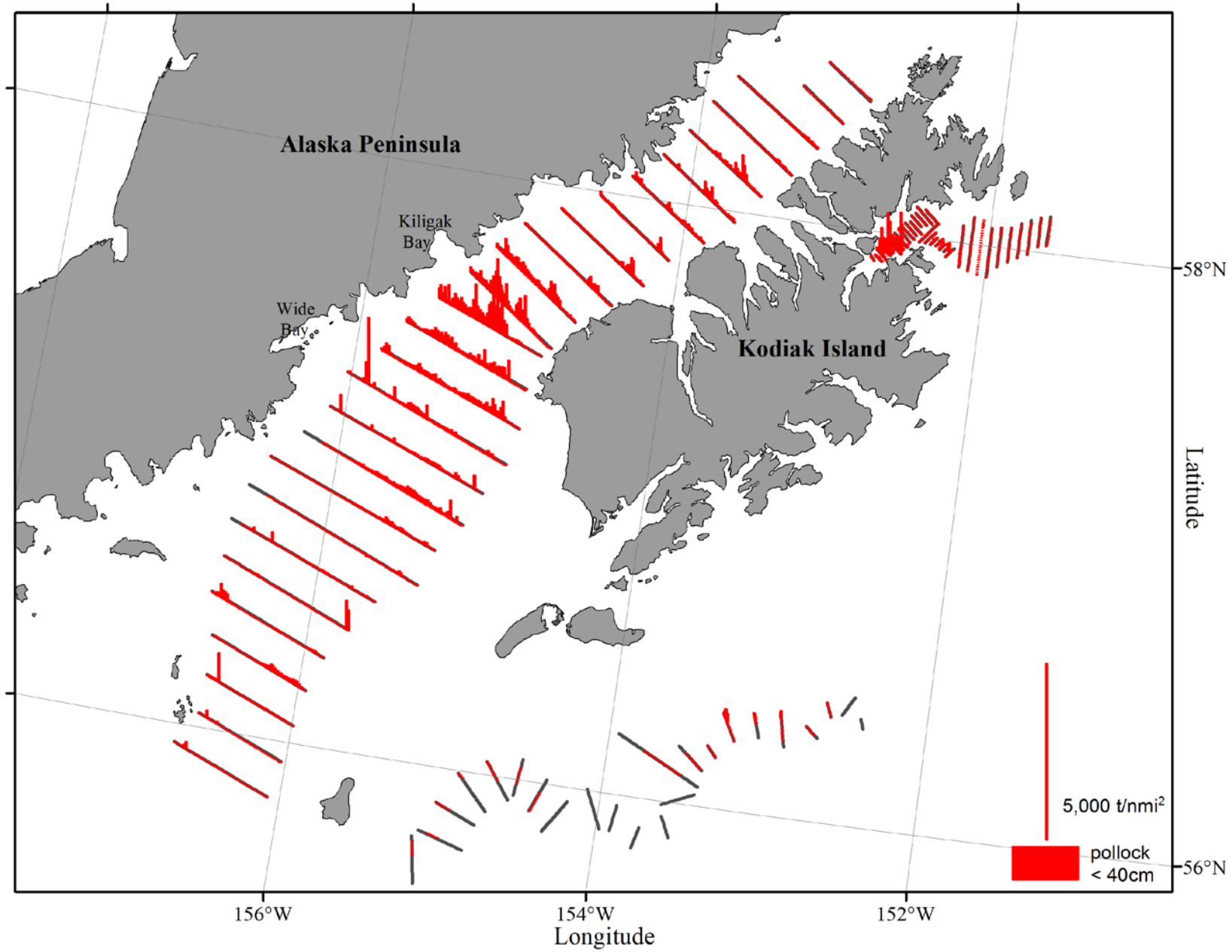

Figure 24b. -- Biomass (t/nmi^2) attributed to walleye pollock < 40 cm FL (vertical lines) along tracklines surveyed during the winter 2015 acoustic-trawl survey of Shelikof Strait, Chirikof shelf break, and Marmot Bay.

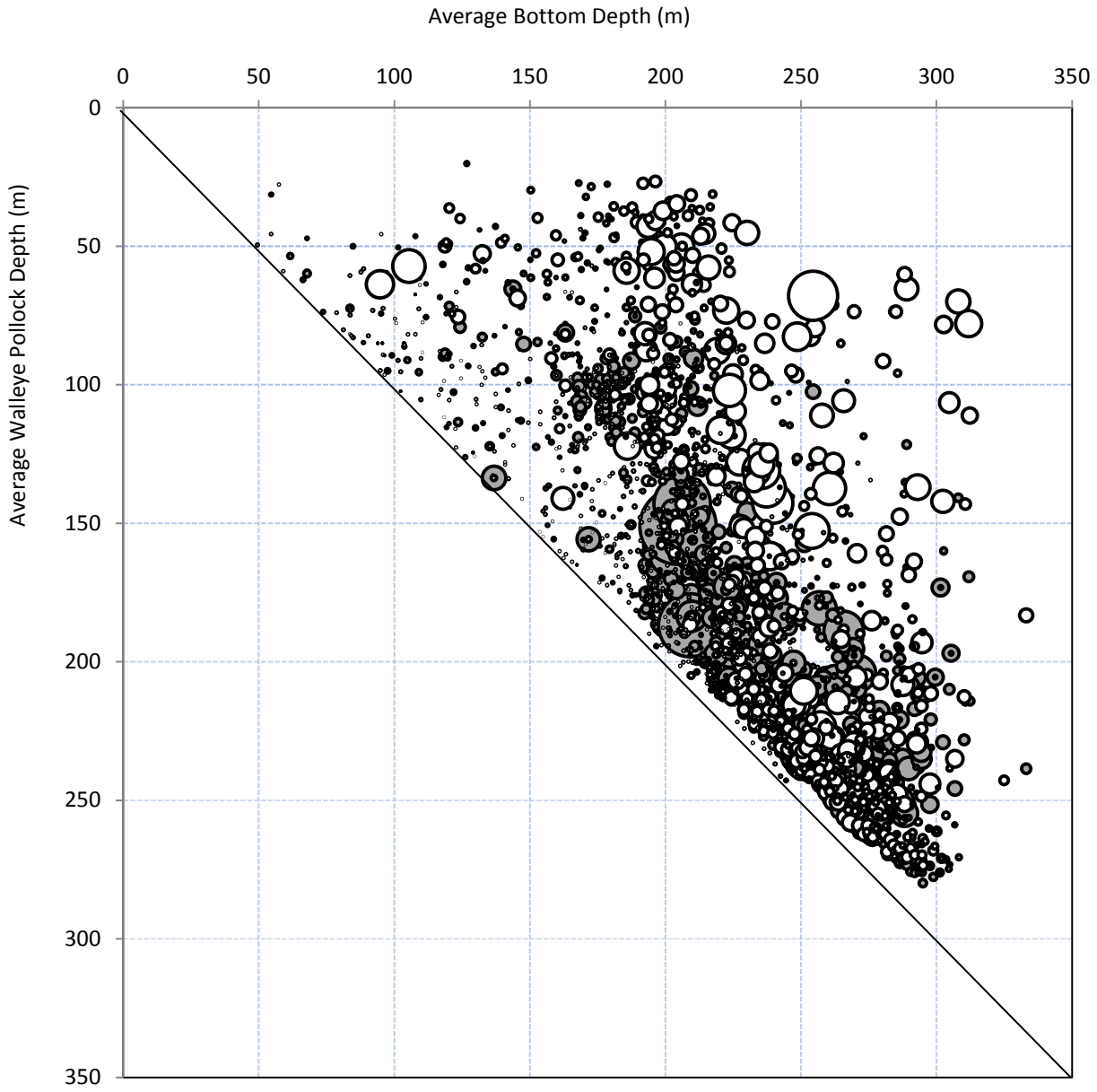

Figure 25. -- Average pollock depth (weighted by biomass) versus bottom depth (m) for walleye pollock observed during the winter 2015 acoustic-trawl survey of Shelikof Strait area. Circle size is scaled to the maximum biomass per 0.5 nautical mile survey track interval. The diagonal line indicates where the average fish depth equals bottom depth. Adult fish (≥ 40 cm) are represented with grey circles, juvenile fish with white circles.

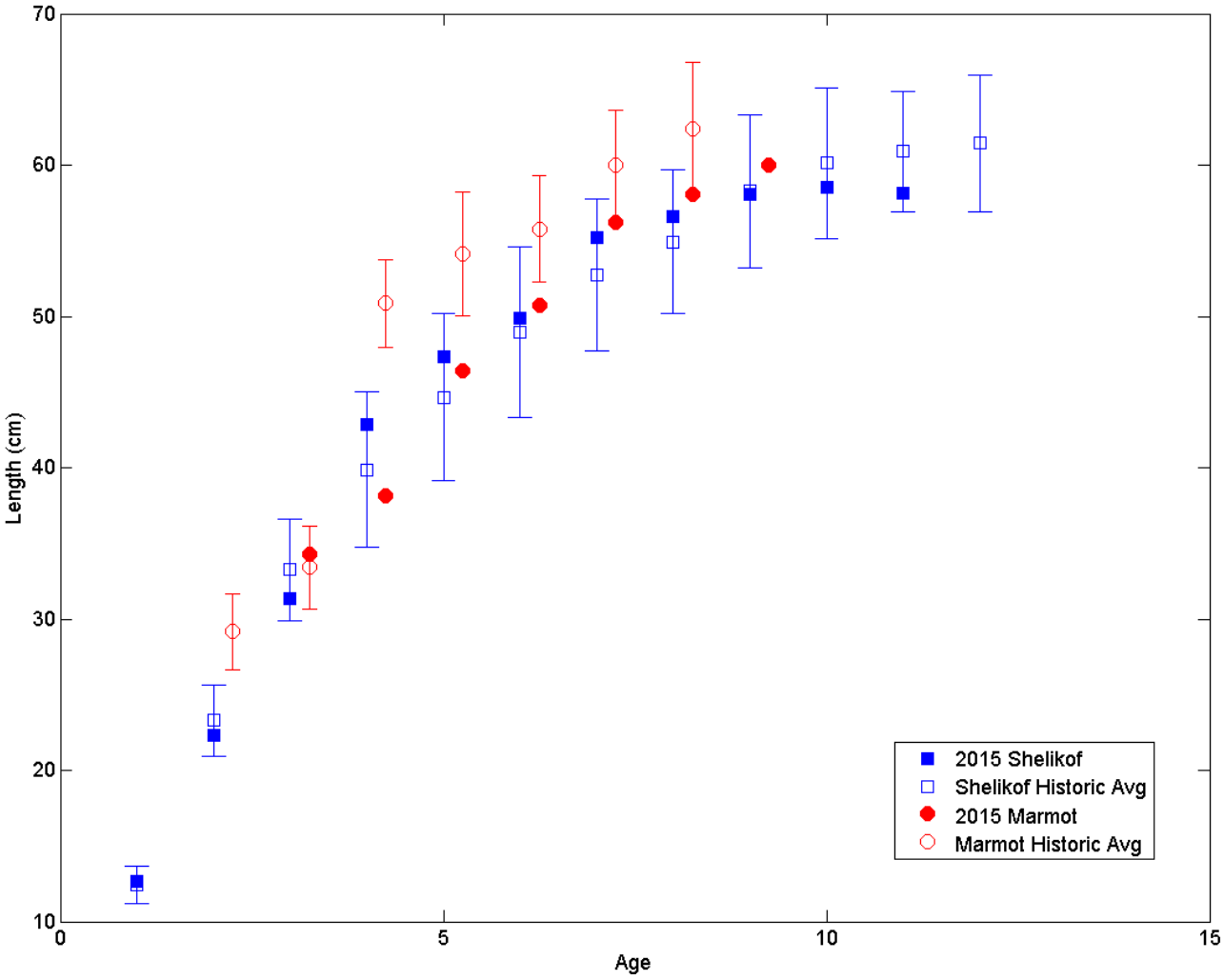

Figure 26. -- Walleye pollock average length at age from historic winter Shelikof (2003-2010, 2012-2014) and Marmot (2008, 2013, 2014) acoustic-trawl surveys compared with walleye pollock average length at age for winter 2015. Results are for midwater tows where at least five fish were measured. Bars show +/- 1 standard deviation for the historic data.

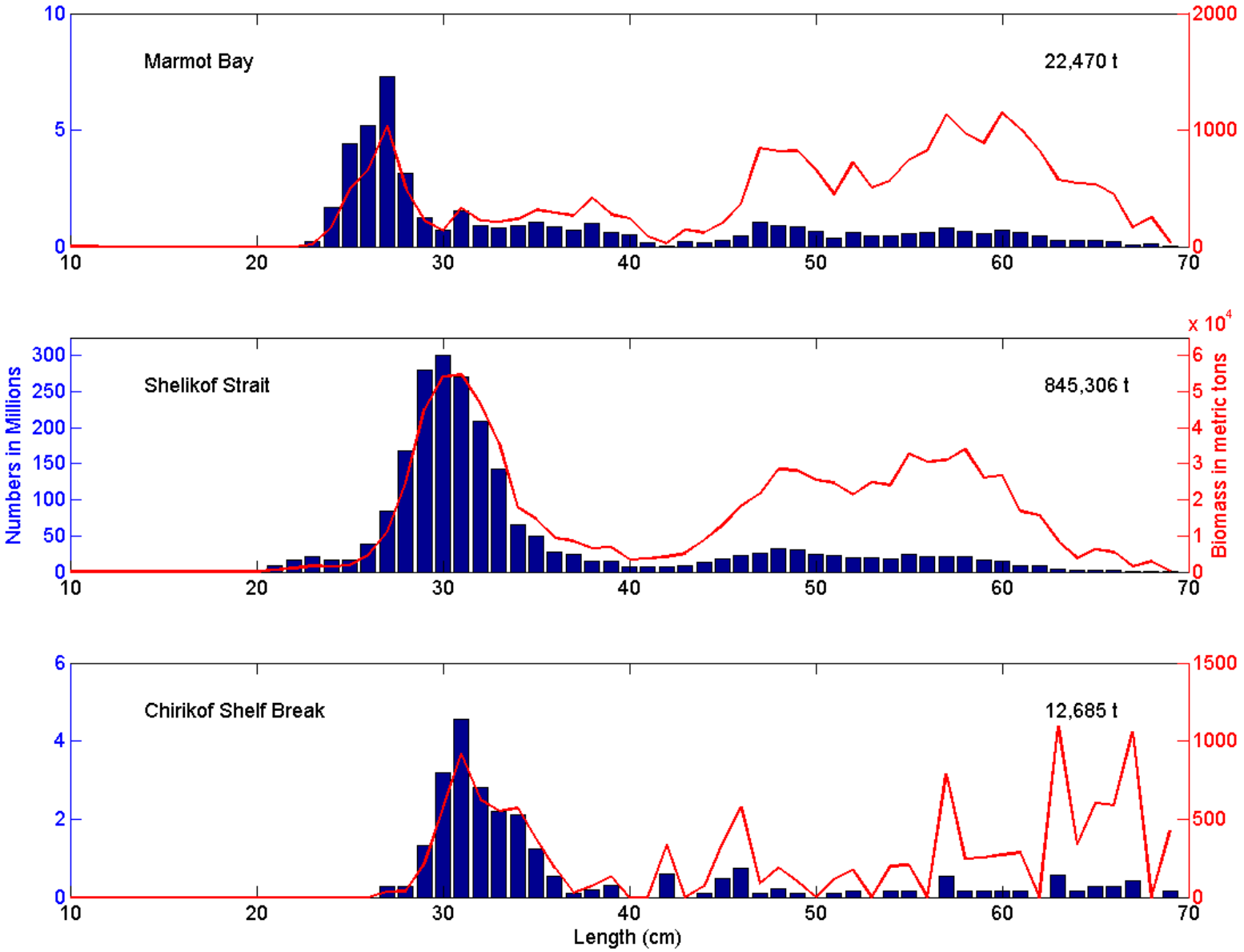

Figure 27. -- Length distribution of walleye pollock shown with blue bars (numbers) and biomass estimate in red line (metric tons, t) for the 2015 acoustic-trawl survey of the Shelikof Strait, Marmot Bay, and the Chirikof shelf break.

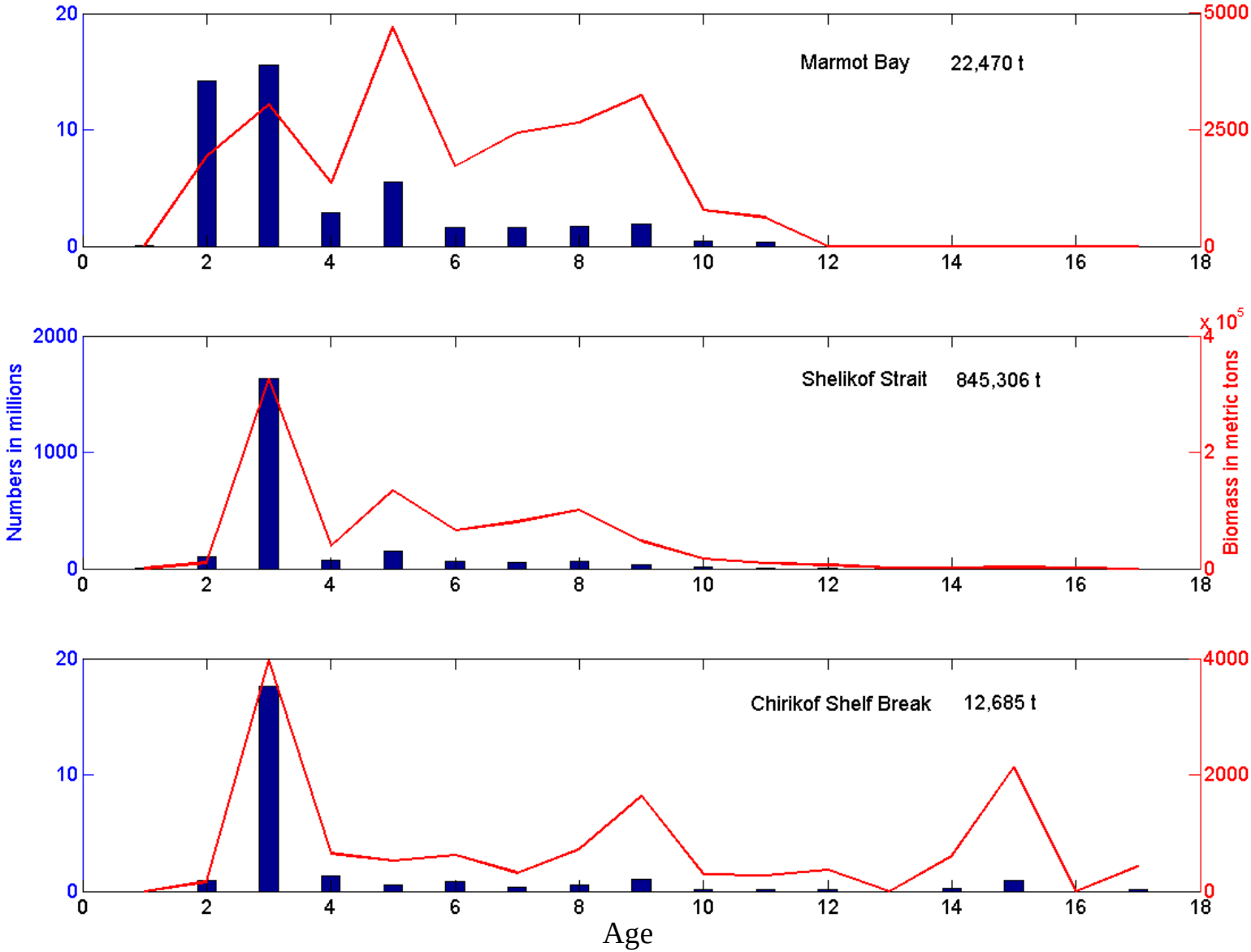

Figure 28. -- Age distribution of walleye pollock are shown with bars (numbers) and biomass estimate shown with solid red line (metric tons, t) for the 2015 acoustic-trawl survey of Marmot Bay, Shelikof Strait, and the Chirikof shelf break.

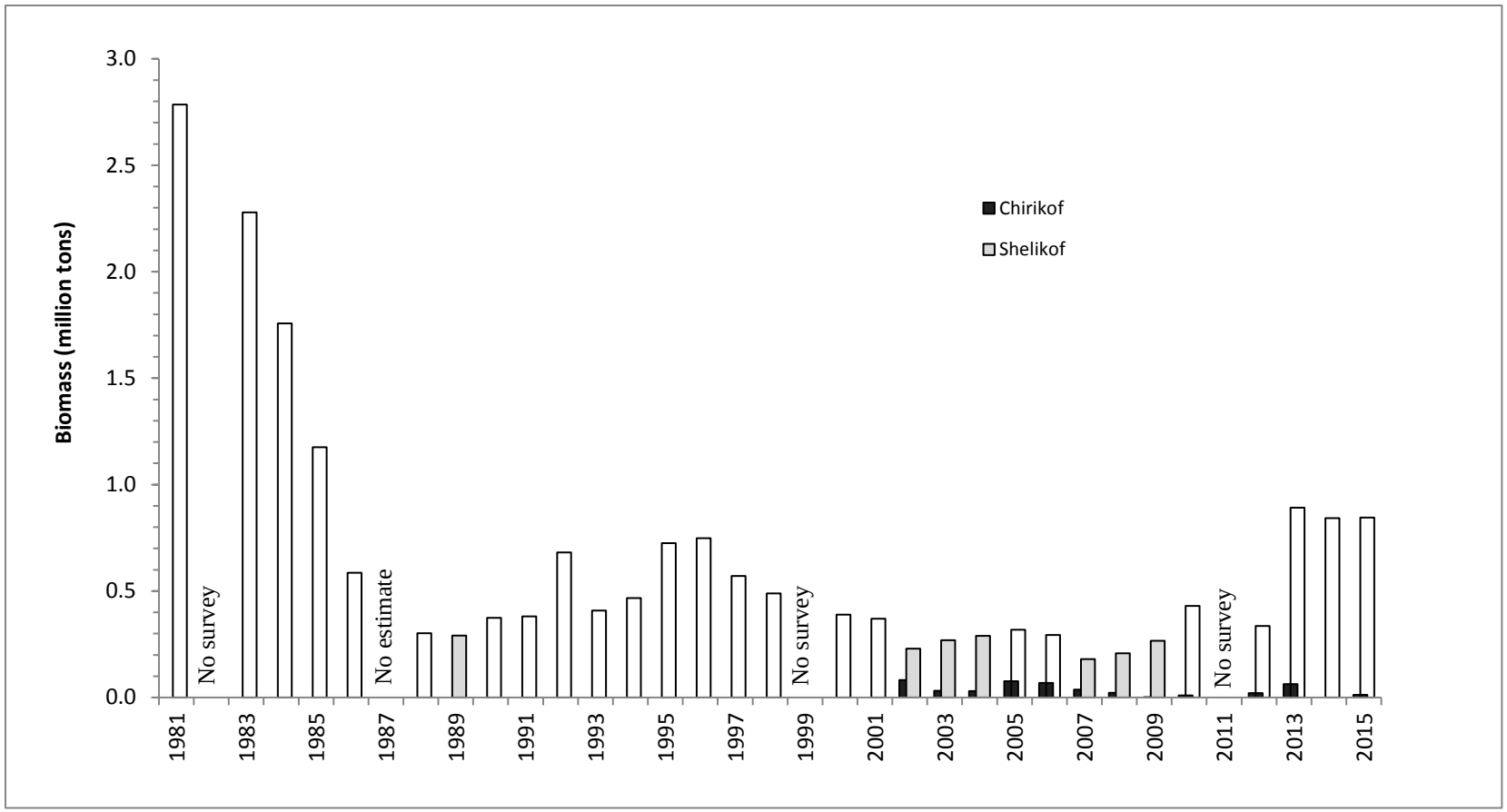

Figure 29. -- Summary of walleye pollock biomass estimates (million metric tons) for Shelikof Strait and Chirikof Island shelfbreak based on acoustic-trawl surveys.

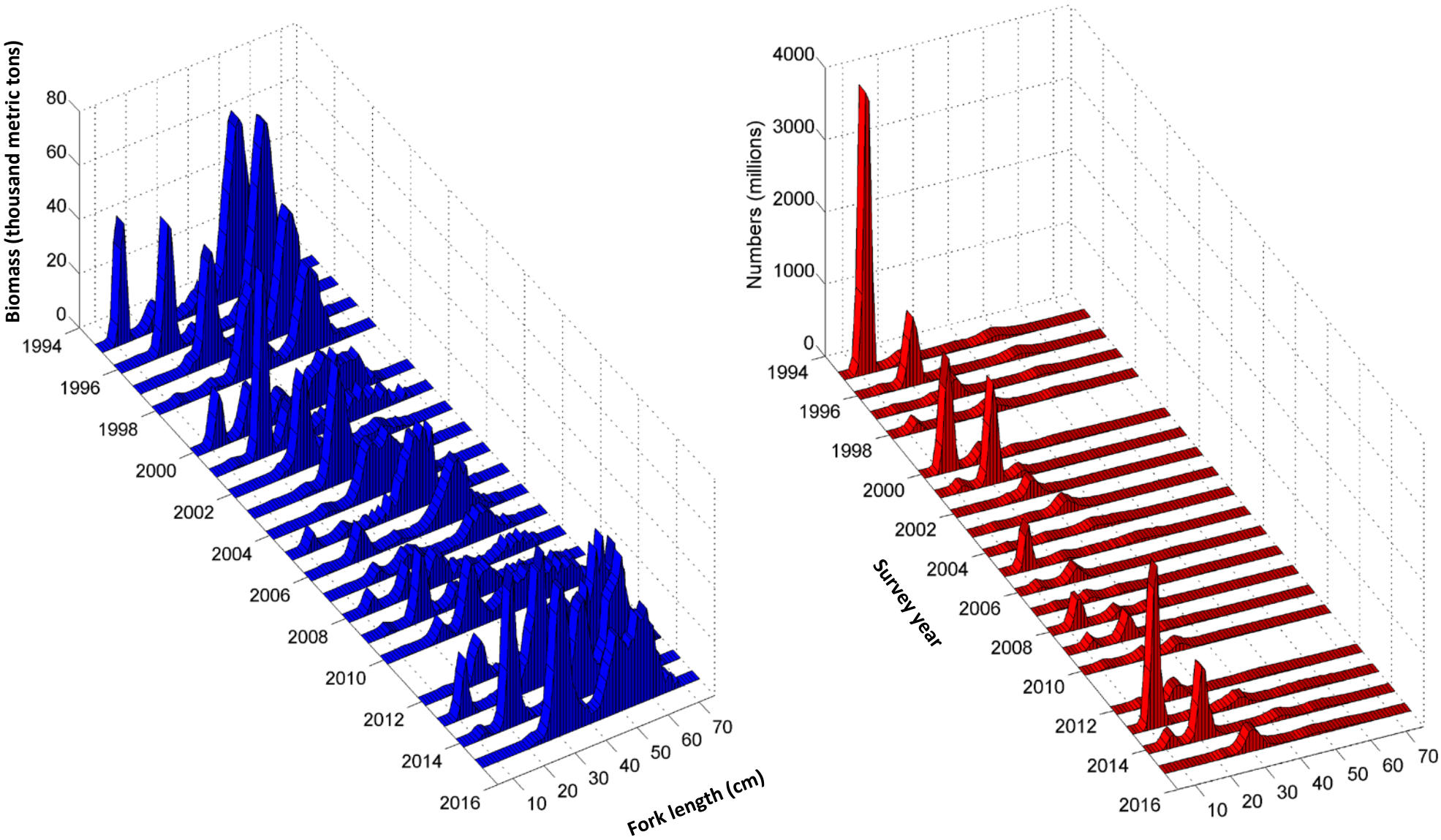

Figure 30. -- Walleye pollock biomass in thousands of metric tons (left) and numbers in millions (right) at length from the Shelikof Strait acoustic-trawl surveys since 1995. No surveys were conducted in 1999 or 2011.

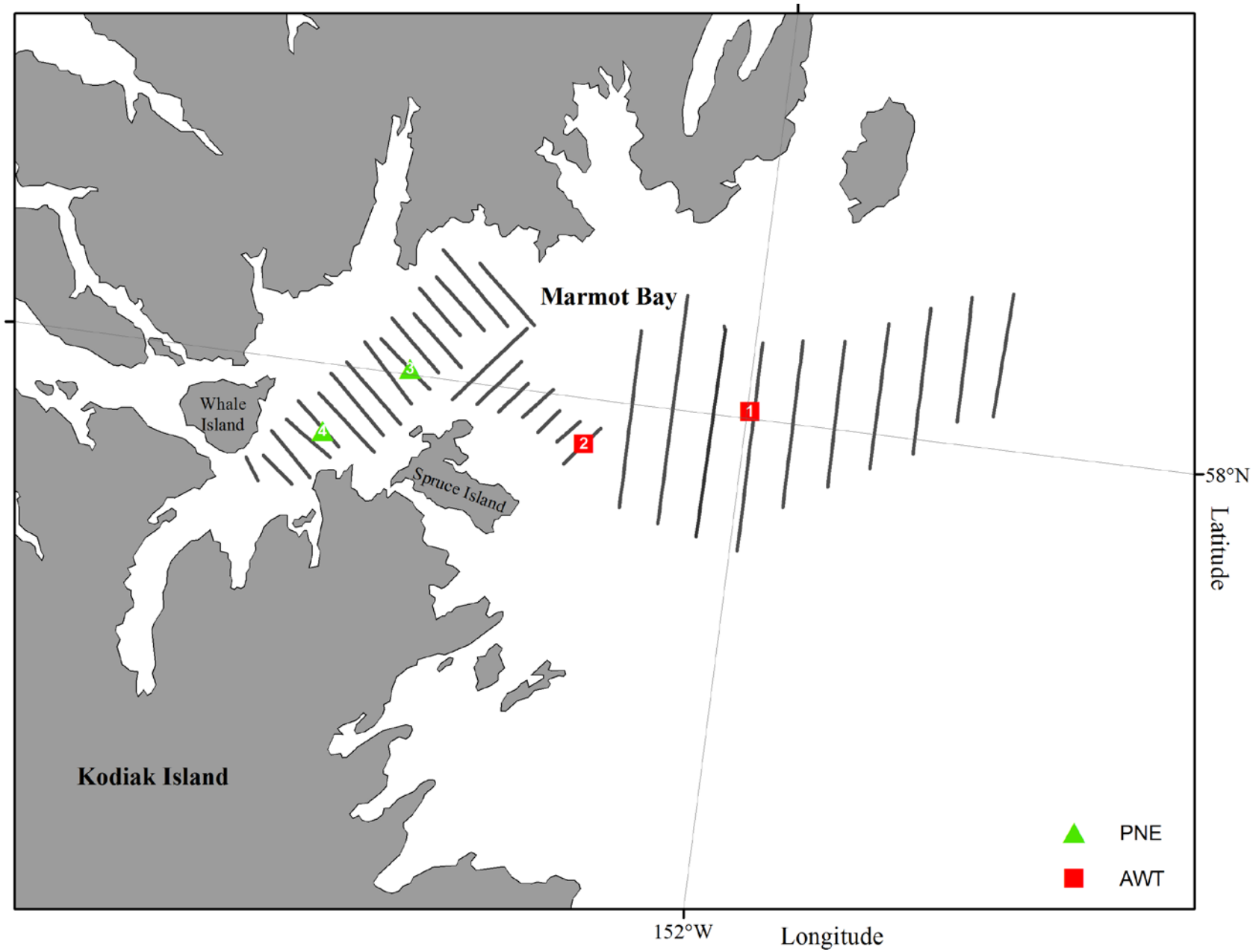

Figure 31. -- Transect lines and locations of Aleutian-wing trawl (AWT) and poly-Nor'eastern trawl (PNE) hauls during the winter 2015 acoustic-trawl survey of walleye pollock in Marmot Bay and Izhut Bay. Figure represents area enlarged from Figure 17.

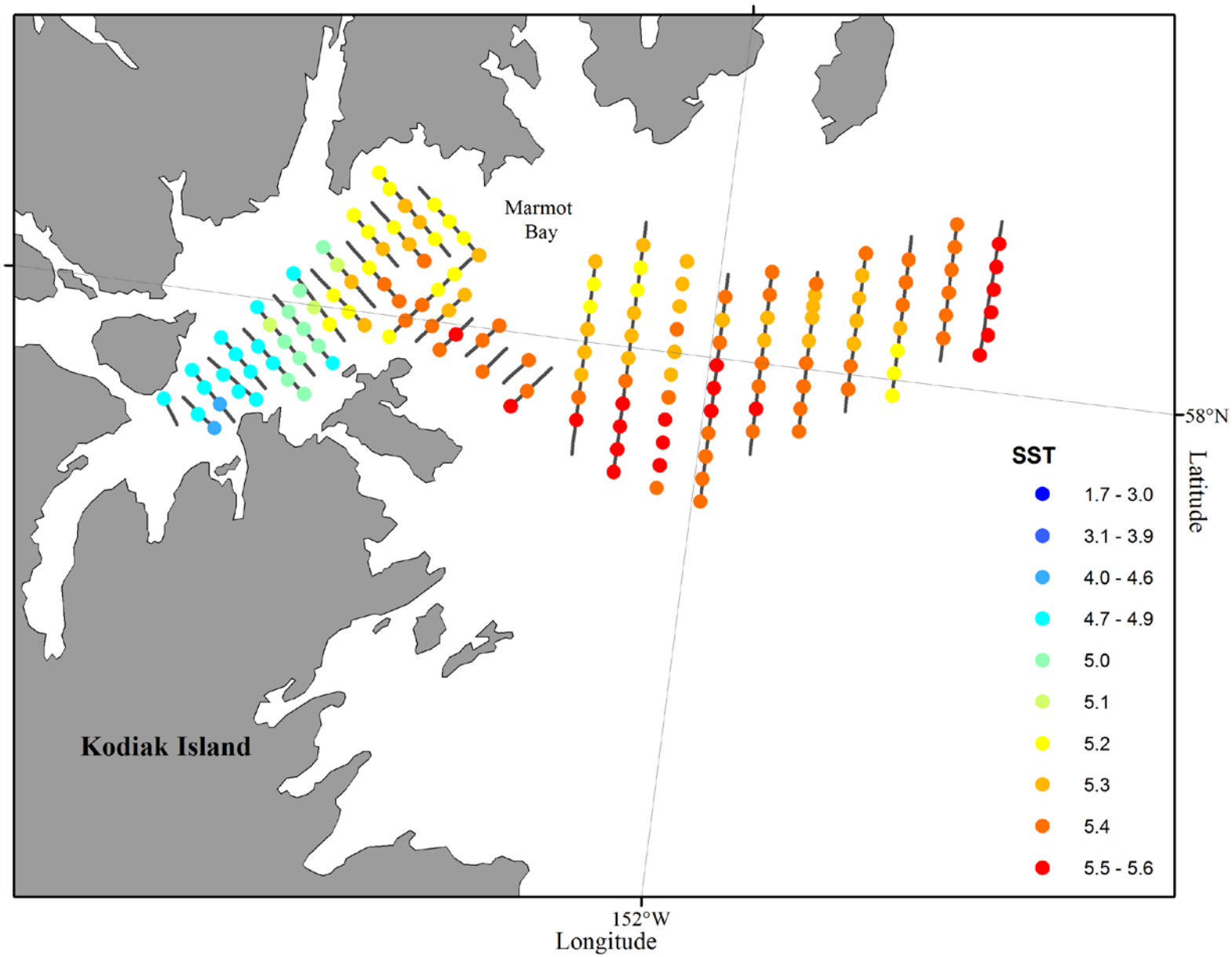

Figure 32. -- Surface water temperatures (°C) during the 2015 acoustic-trawl survey of Marmot Bay and Shelikof Strait recorded from the ship's Furuno T-2000 temperature probe located 1.4 m below the surface.

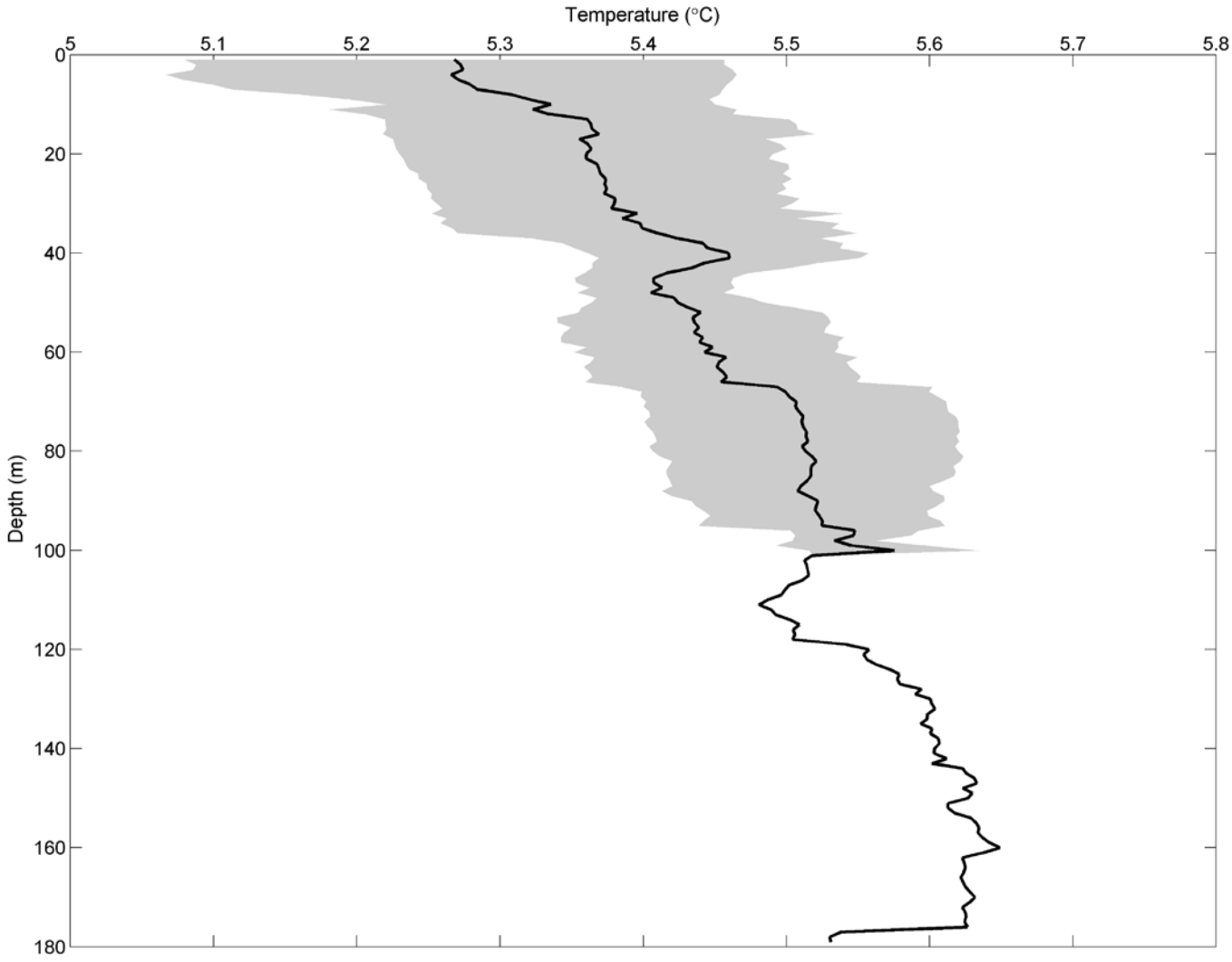

Figure 33. -- Mean water temperature (°C; solid line) by 1-m depth intervals for the four trawl haul locations observed during the winter 2015 acoustic-trawl survey of walleye pollock in Marmot Bay, shaded area represents one standard deviation.

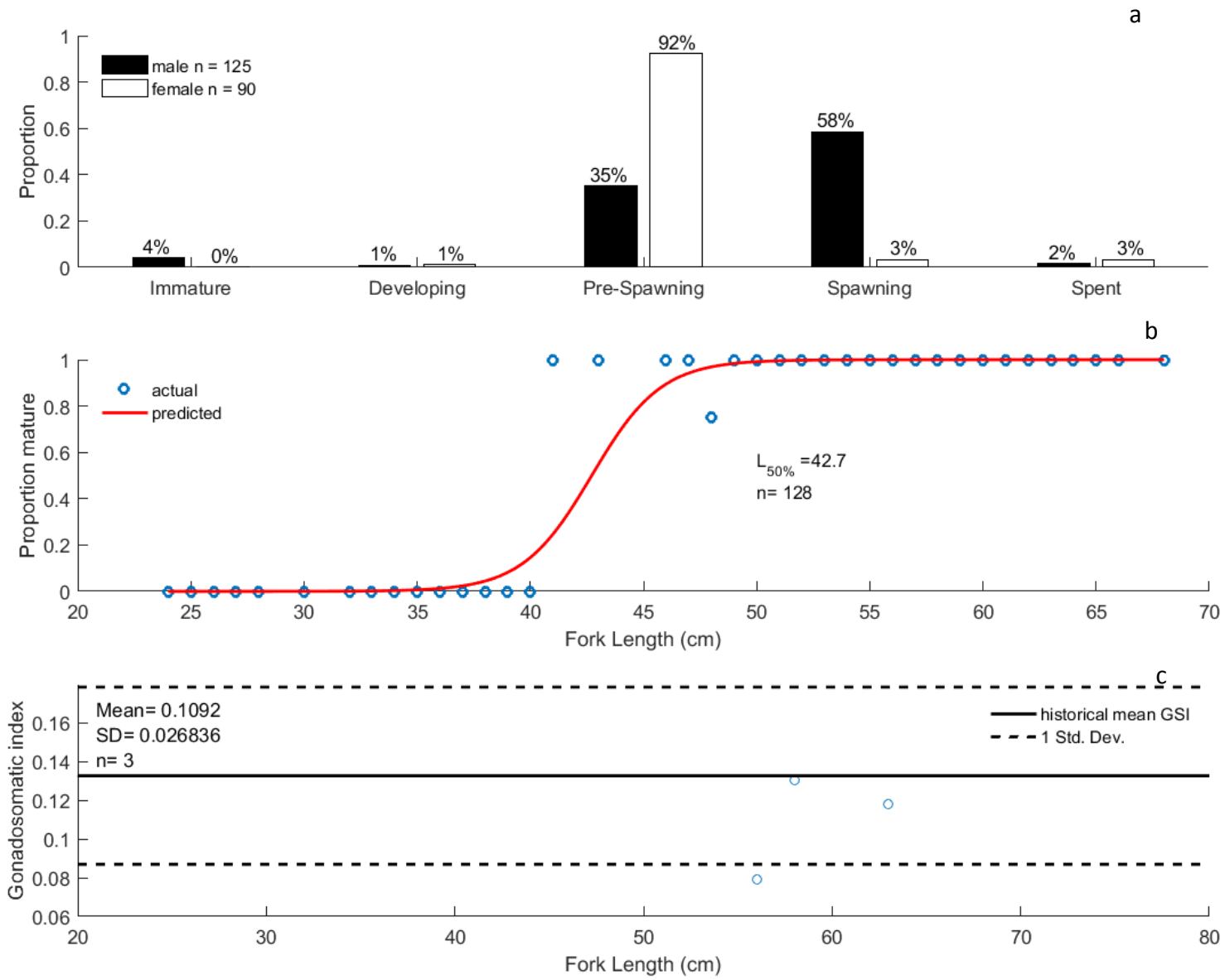

Figure 34. -- Maturity stages and percentage of fish > 40 cm FL within each stage for (a) male and female walleye pollock; (b) proportion mature (i.e. pre-spawning, spawning, or spent) by 1-cm size group for female walleye pollock; (c) gonadosomatic index (with historic survey mean, and minimum and maximum of historic survey means) for pre- spawning females examined during the 2015 acoustic-trawl survey of the Marmot region. Note: these graphs do not include data from age-1 fish.

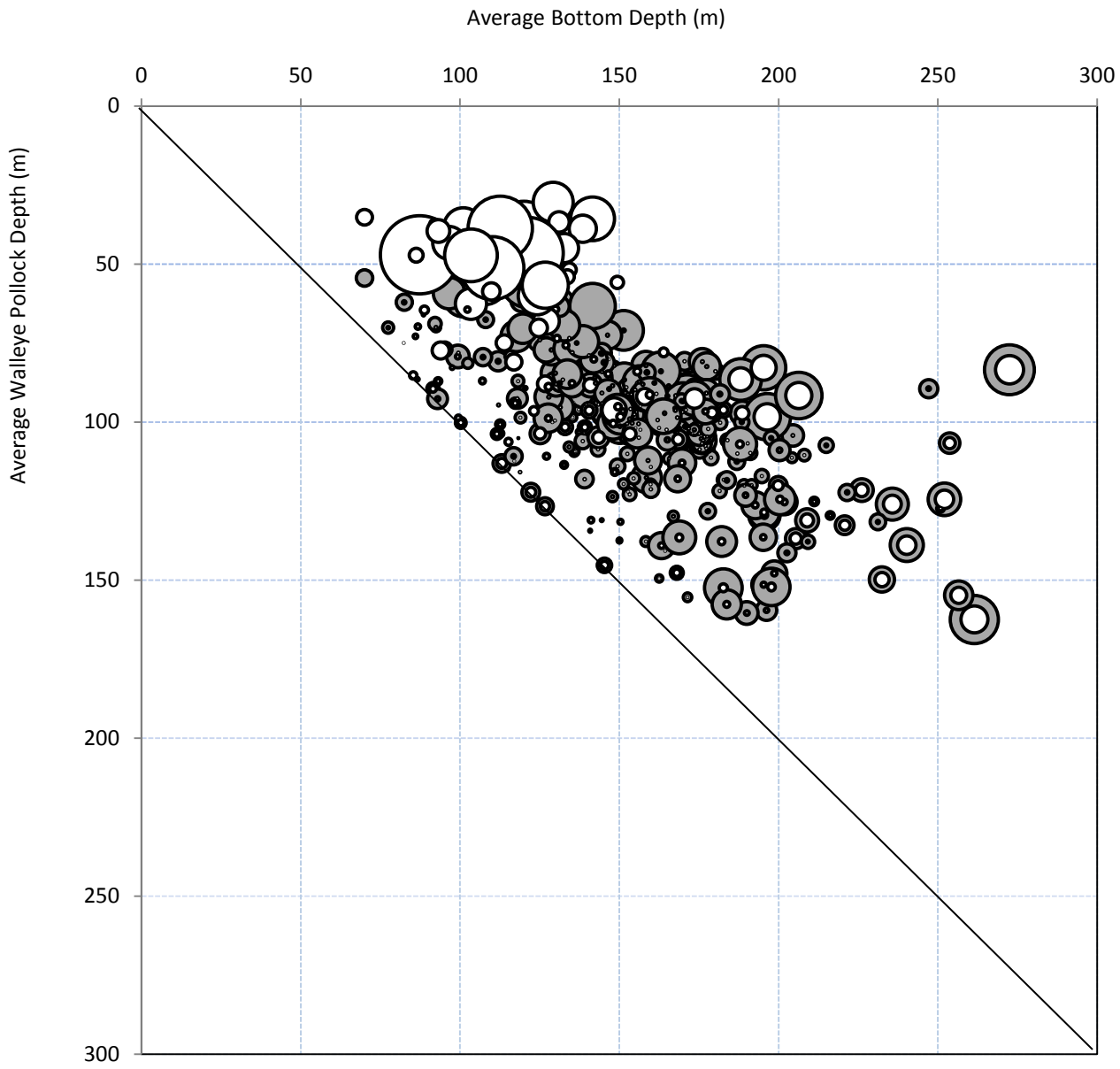

Figure 35. -- Average pollock depth (weighted by biomass) versus bottom depth (m) for walleye pollock observed during the winter 2015 acoustic-trawl survey of Marmot Bay area. Circle size is scaled to the maximum biomass per 0.5 nautical mile survey track interval. The diagonal line indicates where the average pollock depth equals bottom depth. Grey circles are adults, white circles are juvenile fish.

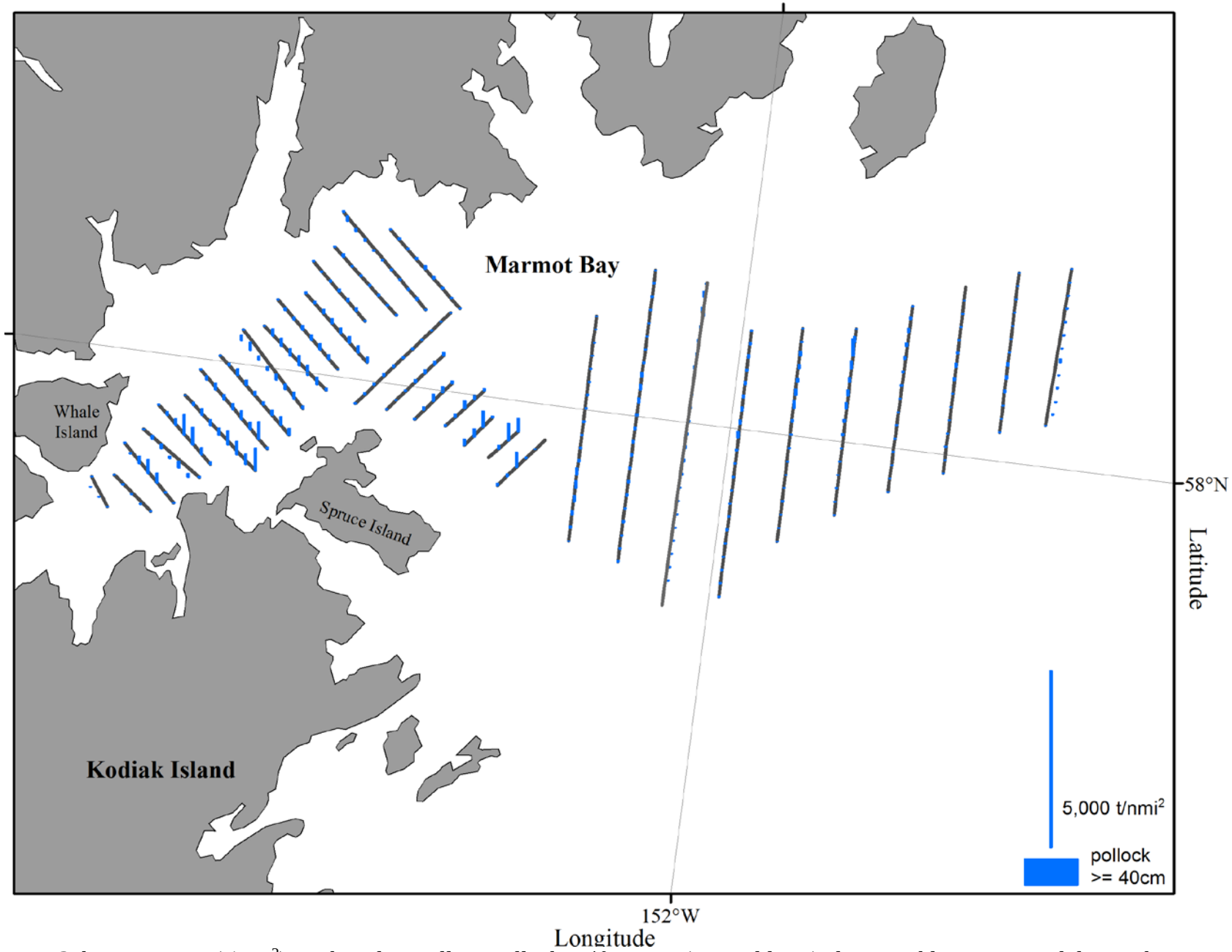

Figure 35b. -- Biomass (t/nmi^2) attributed to walleye pollock ≥ 40 cm FL (vertical lines) along tracklines surveyed during the winter 2014 acoustic-trawl survey of Marmot Bay.

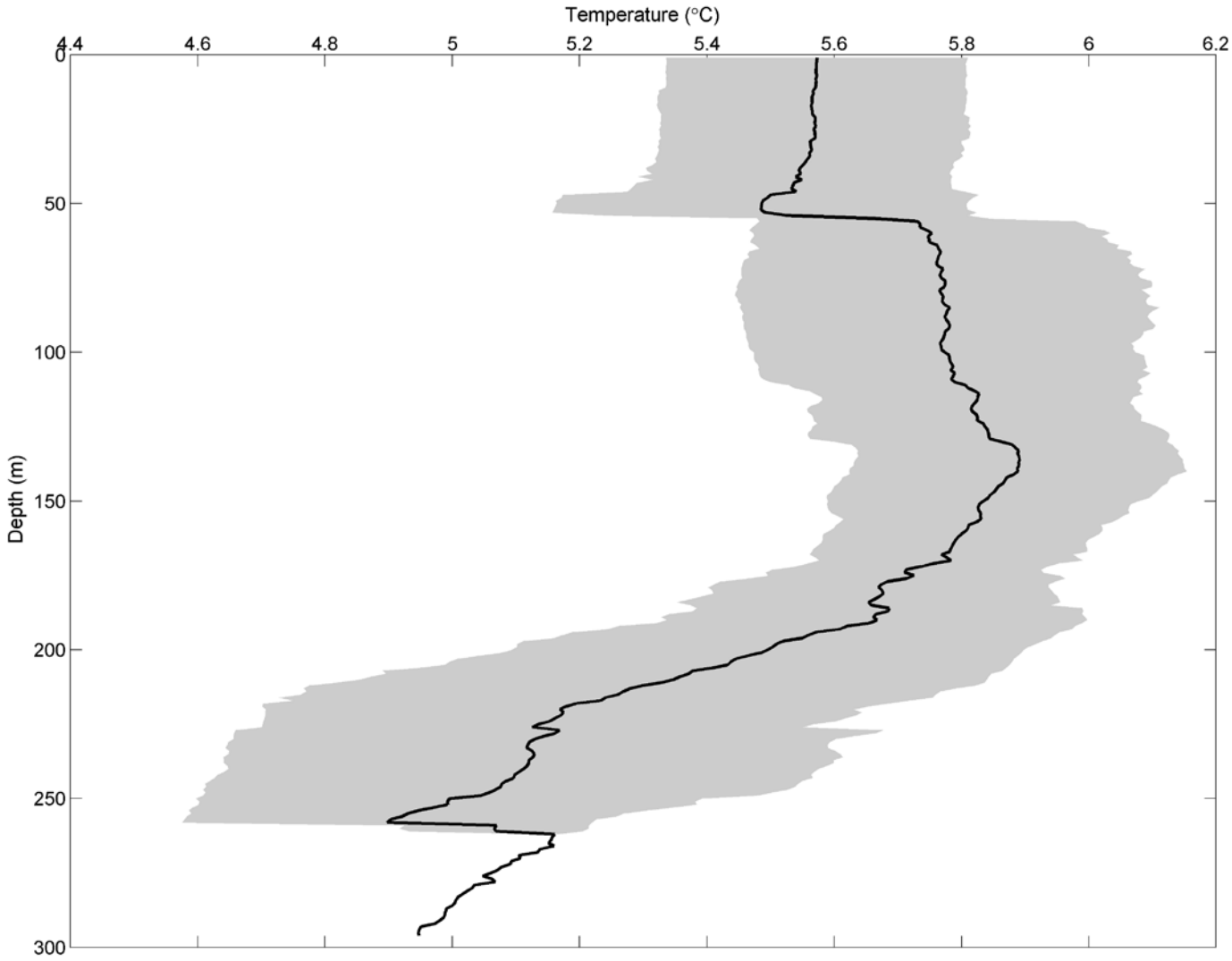

Figure 36. -- Mean water temperature (°C; solid line) by 1-m depth intervals for the five trawl haul locations observed during the winter 2015 acoustic-trawl survey of walleye pollock on the Chiniak shelf region, shaded area represents one standard deviation.

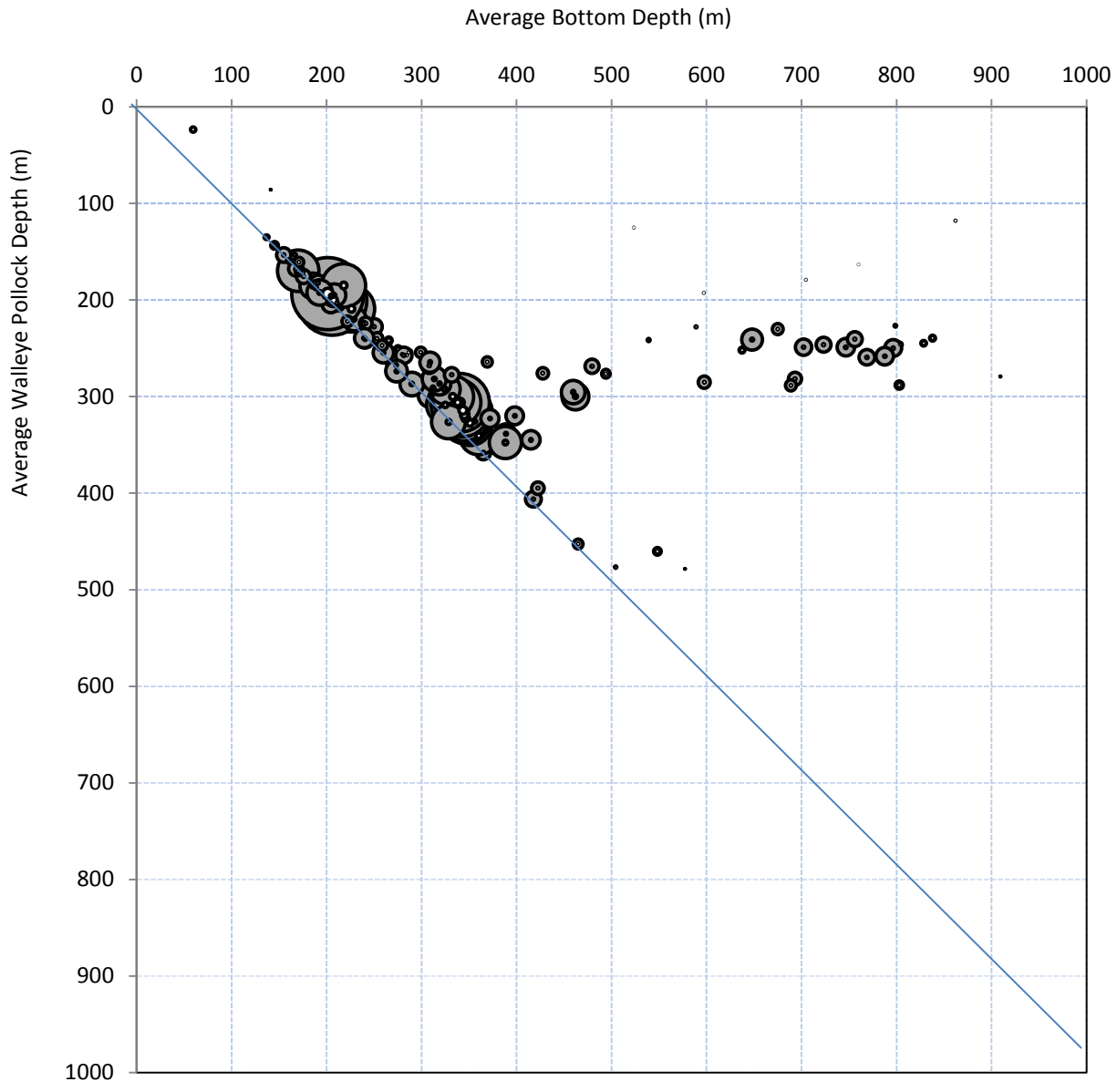

Figure 37. -- Average pollock depth (weighted by biomass) versus bottom depth (m) for walleye pollock observed during the winter 2015 acoustic-trawl survey of the Chirikof shelf area. Circle size is scaled to the maximum biomass per 0.5 nautical mile survey track interval. The diagonal line indicates where the average pollock depth equals bottom depth. Grey circles are adults (≥ 40 cm FL), empty circles are juvenile fish.

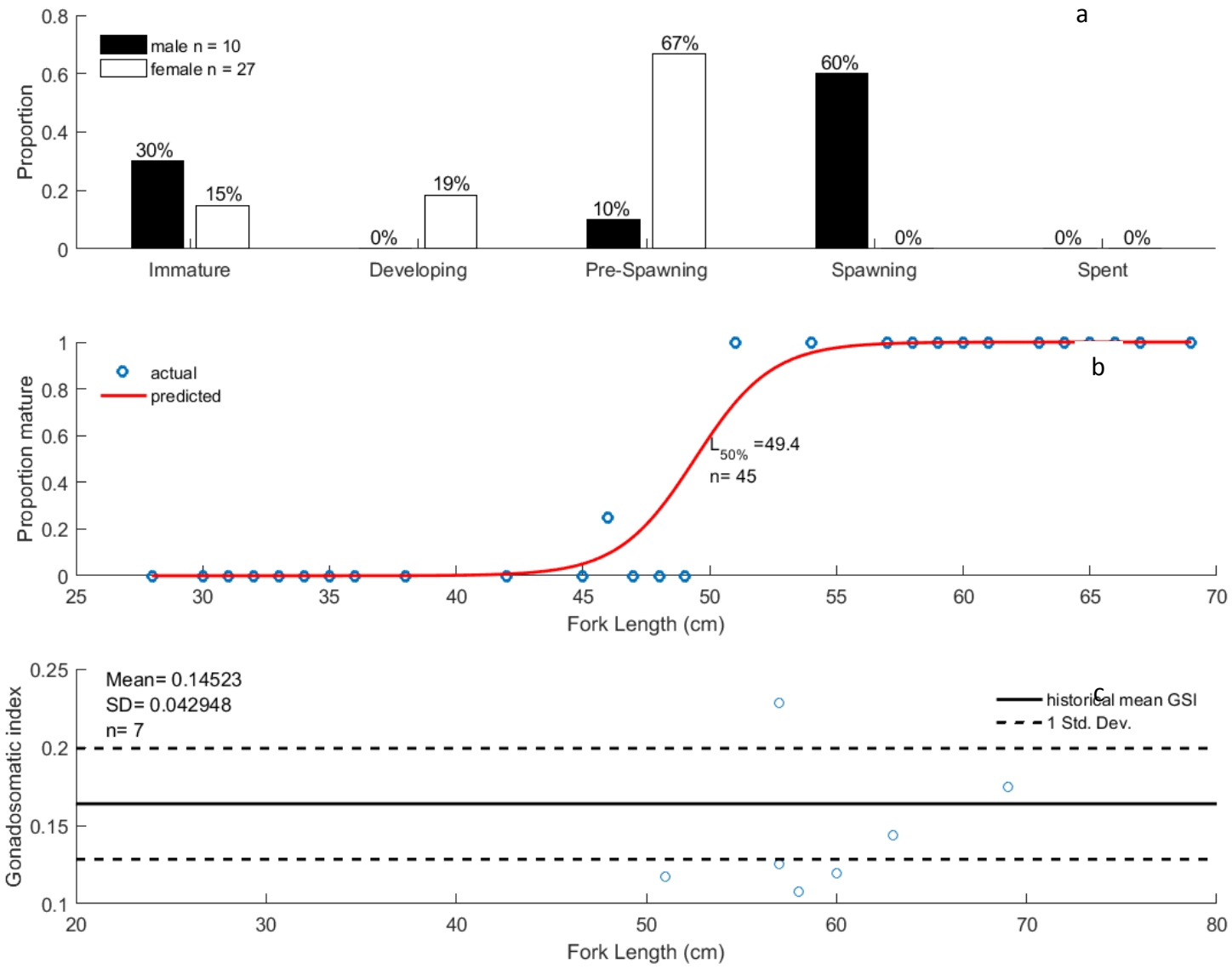

Figure 38. -- Maturity stages and percentage of fish > 40 cm FL within each stage for (a) male and female walleye pollock; (b) proportion mature (i.e. pre-spawning, spawning, or spent) by 1-cm size group for female walleye pollock; (c) gonadosomatic index (with historic survey mean, and minimum and maximum of historic survey means) for pre- spawning females examined during the 2015 acoustic-trawl survey of the Chirikof shelfbreak region. Note: these graphs do not include data from age-1 fish.

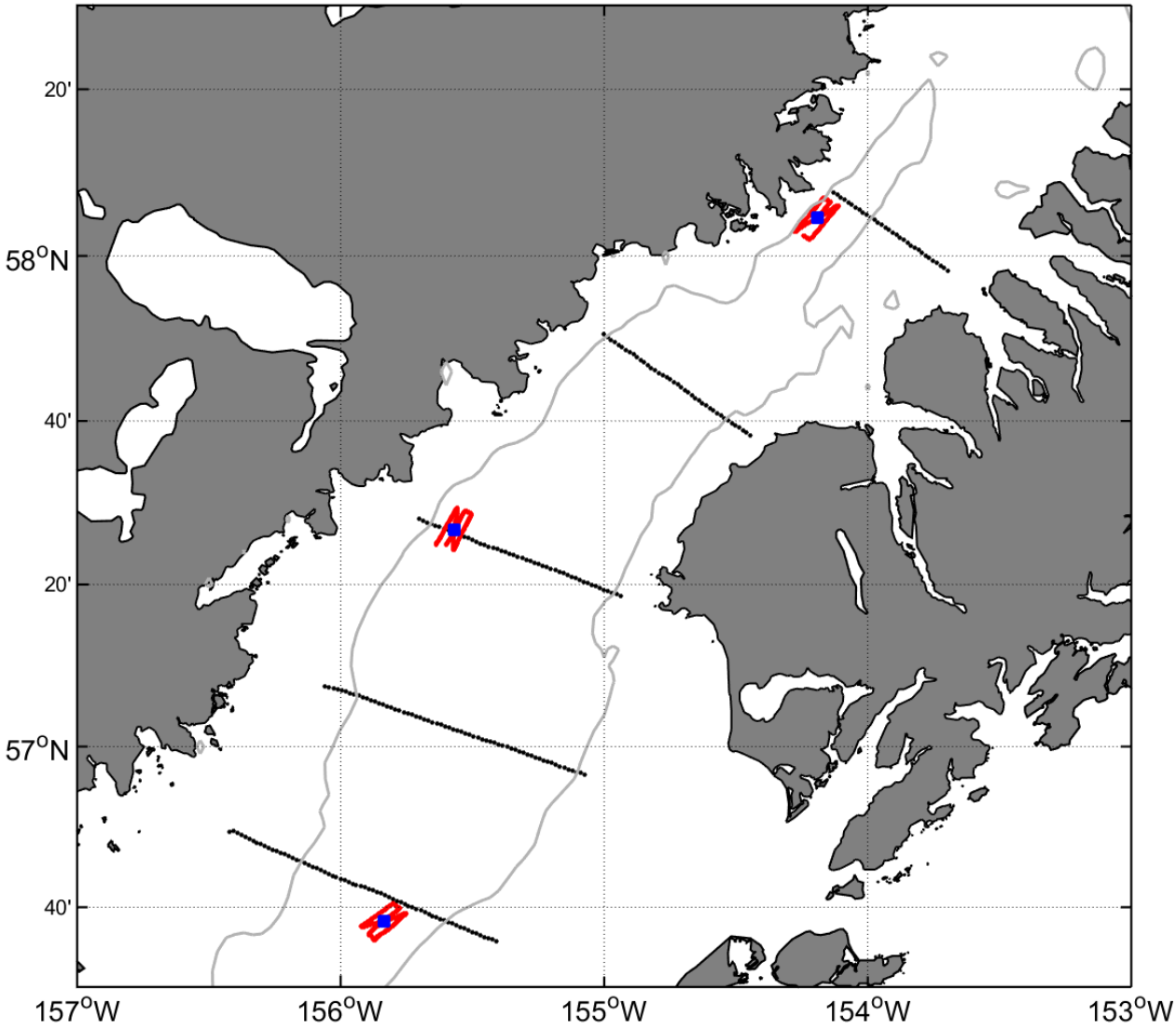

Figure 39. -- Deployment locations of three trawl-resistant bottom-mounted moorings (TRBM) instrumented with newly developed autonomous battery powered 70 kHz split-beam echosounders.

Table 1. -- Simrad ER60 38 kHz acoustic system description and settings used during the winter 2015 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 2015 system settings	10 Feb Uganik Bay Alaska	24 Mar Three Saints Bay Alaska	Final Analysis Parameters
Echosounder	Simrad ER60	--	--	Simrad ER60
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)	22.74	22.55	22.57	22.56
Sa correction (dB)	-0.63	-0.61	-0.60	-0.60
Integration gain (dB)	22.11	21.94	21.97	21.96
3 dB beamwidth along	6.74	6.66	6.61	6.64
3 dB beamwidth athwart	7.14	7.22	7.25	7.24
Angle offset along	-0.06	-0.05	-0.01	-0.03
Angle offset athwart	-0.05	-0.01	-0.08	-0.05
Post-processing S_v threshold (dB re 1 m^{-1})	-70	--	--	-70
Standard sphere TS (dB re 1 m^2)	--	-42.59	-42.55	--
Sphere range from transducer (m)	--	18.75	14.88	--
Absorption coefficient (dB/m)	0.0099	0.0097	0.0097	0.0099
Sound velocity (m/s)	1466	1470.8	1468.8	1466
Water temp at transducer (°C)	--	5.9	5.5	--

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.--Trawl station and catch data summary from the winter 2015 acoustic-trawl survey of walleye pollock in Shumagins Islands, Sanak Trough, and the Kenai Peninsula. Hauls conducted in Shelikof are part of the Trawl-Resistant Bottom-Mounted (TRBM) echosounders study.

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	Shelikof	AWT	11-Feb	23:03	61	58 00.86	-154 09.31	207	214	6.5	6.2	364.1	956	1480.7	0.3
*2	Shelikof	AWT	12-Feb	9:50	22	57 28.39	-155 33.45	285	297	5.6	5.2	894.6	4125	45.9	0
*3	Shelikof	AWT	19-Feb	15:55	9	56 38.58	-155 49.69	255	259	6	5.6	757.7	2895	14.7	0
4	Shumagins	AWT	20-Feb	11:10	4	55 47.38	-159 47.64	106	123	5.9	5.3	10.6	6	5.2	0.6
5	Shumagins	AWT	21-Feb	3:43	11	55 34.67	-160 18.52	164	189	---[3]	---[3]	3752.3	12699	0	0
6	Shumagins	AWT	21-Feb	6:48	5	55 35.60	-160 05.43	120	170	5.6	5.5	777.5	3464	1.8	0
7	Shumagins	AWT	21-Feb	12:30	4	55 27.05	-160 29.16	100	148	5.5	5.5	1110.2	5110	1.1	0
8	Shumagins	AWT	21-Feb	19:06	3	55 11.82	-160 20.40	121	179	5.6	5.6	1192.6	4765	1.1	0
9	Shumagins	AWT	22-Feb	0:09	4	55 04.33	-160 21.51	139	152	5.7	5.7	1167.7	3873	0.2	0
10	Sanak	AWT	22-Feb	12:05	8	54 33.39	-162 27.78	117	144	5.8	5.6	761.4	2931	0	0
11	Sanak	AWT	22-Feb	17:22	5	54 39.28	-162 33.44	102	135	5.5	5.5	2631	9020	0	0
12	Sanak	AWT	22-Feb	21:44	19	54 43.33	-162 46.68	74	100	5.4	5	569.3	475	0	0
13	Shumagins	PNE	23-Feb	18:40	25	55 19.47	-159 37.15	131	131	5.7	5.4	18.4	407	0.5	0
14	Shumagins	AWT	24-Feb	2:03	1	55 20.37	-159 05.82	161	183	6	5.6	3628.5	13568	0.5	0
15	Shumagins	AWT	24-Feb	10:34	3	55 13.98	-158 42.42	188	197	6.2	5.6	663.4	3340	58.1	0
*16	Shelikof	PNE	25-Feb	6:31	15	56 39.80	-155 48.82	263	265	5.8	5.9	148.7	714	17.1	0
*17	Shelikof	AWT	26-Feb	3:13	7	57 27.55	-155 34.00	274	279	6.1	5.6	1051.3	3971	8.7	0
*18	Shelikof	AWT	26-Feb	17:10	18	58 05.25	-154 12.82	222	260	6.4	3.9	1675	1782	2.2	0
19	Kenai	AWT	27-Feb	14:13	9	60 02.21	-149 22.19	96	291	6.8	5.8	1722.6	1721	1.2	0
20	Kenai	AWT	27-Feb	17:08	7	59 55.87	-149 25.46	218	246	7	5.2	1698.6	1597	15.8	0.2
21	Kenai	AWT	27-Feb	23:28	5	60 01.31	-149 07.16	138	177	6.6	5.7	1024.9	1062	28.7	0.2
22	Kenai	AWT	28-Feb	9:53	5	60 02.65	-148 21.14	83	268	6.2	5.7	1493.5	1361	0.5	0
23	Kenai	AWT	28-Feb	16:22	16	59 44.79	-149 42.04	202	295	6.8	5.8	2238.3	1820	22.1	0.1
24	Kenai	AWT	1-Mar	5:35	6	59 41.23	-149 52.47	159	204	6.6	5.9	1418.7	1006	21.7	0.2
25	Kenai	PNE	1-Mar	15:18	6	59 34.08	-150 32.85	108	143	7.1	5.8	22.8	76	0.4	33.5
26	Kenai	AWT	1-Mar	17:07	7	59 31.01	-150 34.87	74	215	6.3	5.8	3154.1	8472	0	0
27	Kenai	AWT	1-Mar	23:51	21	59 16.49	-151 08.63	134	245	6.2	5.8	527.4	634	0	0
*28	Shelikof	AWT	2-Mar	14:21	4	58 02.04	-154 12.66	124	251	5.9	5.1	975	731	1.9	0

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

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

[3]Water temperature data were not collected on this haul

*Haul is associated with mooring mini-surveys

Table 3.–Numbers of walleye pollock measured and biological samples collected during the winter 2015 acoustic-trawl surveys of Shumagin Islands (hauls 4-9 and 13-15), Sanak Trough (hauls 10-12), and the Kenai Peninsula (hauls 19-27). The other hauls are part of the trawl-resistant bottom-mounted (TRBM) echosounder study.

	Walleye pollock				
Haul no.	Lengths	Weights	Maturities	Otoliths	Ovary weights
1	537	221	220	0	3
2	297	195	168	0	0
3	502	204	134	0	0
4	6	6	6	6	3
5	514	52	51	51	11
6	410	53	51	48	4
7	405	53	53	35	1
8	310	64	64	30	0
9	337	58	58	33	1
10	330	77	76	26	3
11	266	56	56	21	0
12	288	81	81	30	5
13	54	23	13	13	0
14	349	45	28	31	0
15	434	118	84	59	9
16	343	51	51	0	24
17	472	199	199	0	80
18	444	145	144	0	0
19	273	46	45	30	0
20	268	64	59	31	0
21	330	83	52	53	16
22	353	76	76	62	42
23	272	60	49	30	0
24	335	118	113	24	33
25	19	19	18	0	0
26	417	88	88	24	0
27	431	100	100	61	14
28	348	140	140	0	0
Totals	9344	2495	2277	698	249

Table 4.–Catch by species, and numbers of length and weight measurements taken from individuals, during the eight Aleutian Wing midwater trawl hauls during the winter 2015 acoustic-trawl survey of walleye pollock in the Shumagins Islands.

		Catch				Individual Measurements	
Species name	Scientific name	Weight (kg)	%	Number	%	Length	Weight
walleye pollock	*Gadus chalcogrammus*	12,302.9	98.5	46,825	89.7	2,765	449
Pacific cod	*Gadus macrocephalus*	76.6	0.6	20	0.0	11	11
eulachon	*Thaleichthys pacificus*	68.0	0.5	1,240	2.4	149	81
Pacific herring	*Clupea pallasii*	27.7	0.2	3,753	7.2	60	8
Chinook salmon	*Oncorhynchus tshawytscha*	6.7	0.1	3	0.0	3	3
arrowtooth flounder	*Atheresthes stomias*	8.7	0.1	5	0.0	1	1
squid unidentified	Teuthoidea (order)	1.9	0.0	22	0.0	21	21
capelin	*Mallotus villosus*	0.7	0.0	265	0.5	58	32
flathead sole	*Hippoglossoides elassodon*	0.6	0.0	4	0.0	4	4
hydrozoans	Aequorea spp.	0.4	0.0	41	0.1	13	13
sturgeon poacher	*Podothecus accipenserinus*	0.3	0.0	6	0.0	2	2
shrimp unidentified	Decapoda (order)	0.2	0.0	46	0.1	45	45
Total		12,494.6		52,230		3,132	670

Table 5.--Catch by species, and numbers of length and weight measurements taken from individuals, during the one Poly North-Eastern bottom trawl haul during the winter 2015 acoustic-trawl survey of walleye pollock in the Shumagins Islands.

		Catch				Individual Measurements	
Species name	Scientific name	Weight (kg)	%	Number	%	Length	Weight
walleye pollock	*Gadus chalcogrammus*	18.4	19.5	407	39.2	54	23
Pacific cod	*Gadus macrocephalus*	30.2	32.0	14	1.3	14	14
Pacific halibut	*Hippoglossus stenolepis*	12.2	12.9	2	0.2	2	2
Chinook salmon	*Oncorhynchus tshawytscha*	11.4	12.1	6	0.6	6	6
flathead sole	*Hippoglossoides elassodon*	10.8	11.4	54	5.2	20	20
arrowtooth flounder	*Atheresthes stomias*	7.2	7.6	14	1.3	14	14
shrimp unidentified	Decapoda (order)	2.6	2.7	528	50.8	45	10
rougheye rockfish	*Sebates aleutianus*	0.7	0.8	1	0.1	1	1
eulachon	*Thaleichthys pacificus*	0.5	0.5	8	0.8	8	8
rex sole	*Glyptocephalus zachirus*	0.3	0.3	3	0.3	3	3
eelpout unidentified	Zoarcidae (family)	0.0	0.0	1	0.1	1	1
sculpin unidentified	Cottoidea (subfamily)	0.0	0.0	1	0.1	1	1
Total		94.3		1,039		169	103

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%
2015	**845,306**	**4.3%**	**61,369**	**17.1%**	**12,685**	**14.2%**	**17,863**	**10.0%**	**22,470**	**3.1%**

[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 three AWT midwater trawl hauls during the winter 2015 acoustic-trawl survey of walleye pollock in Sanak Trough.

		Catch				Individual Measurement	
Species name	Scientific name	Weight (kg)	%	Number	%	Length	Weight
walleye pollock	*Gadus chalcogrammus*	3,961.7	99.3	12,426	99.9	884	214
Pacific cod	*Gadus macrocephalus*	29.1	0.7	9	0.1	9	9
flathead sole	*Hippoglossoides elassodon*	0.3	0.0	1	0.0	1	1
moon jellyfish	*Aurelia labiata*	0.2	0.0	1	0.0	1	1
sablefish	*Anoplopoma fimbria*	0.2	0.0	1	0.0	1	1
eulachon	*Thaleichthys pacificus*	0.0	0.0	3	0.0	3	3
Total		3,991.5		12,441		4	4

Table 8.–Catch by species, and numbers of length and weight measurements taken from individuals, during the eight Aleutian Wing midwater trawl hauls during the winter 2015 acoustic-trawl survey of walleye pollock in the Kenai Peninsula.

		Catch				Individual Measurements	
Species name	Scientific name	Weight (kg)	%	Number	%	Length	Weight
walleye pollock	*Gadus chalcogrammus*	13,278.1	98.8	17,673	80.2	2,679	635
eulachon	*Thaleichthys pacificus*	90.1	0.7	2,918	13.2	162	162
Pacific cod	*Gadus macrocephalus*	43.0	0.3	14	0.1	10	9
arrowtooth flounder	*Atheresthes stomias*	6.7	0.0	3	0.0	2	2
Chinook salmon	*Oncorhynchus tshawytscha*	6.6	0.0	6	0.0	4	4
northern smoothtongue	*Leuroglossus schmidti*	5.2	0.0	673	3.1	56	56
Pacific herring	*Clupea pallasii*	3.4	0.0	121	0.5	68	68
squid unidentified	Teuthoidea (order)	1.0	0.0	45	0.2	20	20
shrimp unidentified	Decapoda (order)	0.9	0.0	464	2.1	47	0
capelin	*Mallotus villosus*	0.6	0.0	90	0.4	68	67
flathead sole	*Hippoglossoides elassodon*	0.4	0.0	3	0.0	0	0
blackmouth eelpout	*Lycodapus fierasfer*	0.1	0.0	14	0.1	8	8
eelpout unidentified	Zoarcidae (family)	0.1	0.0	5	0.0	5	5
sculpin unidentified	Cottoidea (subfamily)	0.0	0.0	2	0.0	1	1
Total		13,436.1		22,031		3130	1037

Table 9.--Catch by species, and numbers of length and weight measurements taken from individuals, during the one Poly North-Eastern bottom trawl haul during the winter 2015 acoustic-trawl survey of walleye pollock in the Kenai Peninsula

		Catch				Individual Measurements	
Species name	Scientific name	Weight (kg)	%	Number	%	Length	Weight
walleye pollock	*Gadus chalcogrammus*	22.8	33.5	76	0.7	19	19
capelin	*Mallotus villosus*	33.5	49.3	8,959	88.2	118	0
Pacfic herring	*Clupea pallasii*	9.0	13.2	349	3.4	30	30
spiny dogfish	*Squalus acanthias*	1.2	1.8	1	0.0	1	1
shrimp unidentified	Decapoda (order)	0.9	1.4	759	7.5	18	0
eulachon	*Thaleichthys pacificus*	0.4	0.6	12	0.1	3	3
Southern rock sole	*Lepidopsetta bilineata*	0.2	0.3	1	0.0	1	1
Total		68.0		10,157		190	54

Table 10.--Catch by species, and numbers of length and weight measurements taken from individuals, during the six Aleutian Wing midwater trawl hauls during the winter 2015 acoustic-trawl mini-surveys of the trawl-resistant bottom-mounted (TRBM) echosounders sites in Shelikof Strait.

		Catch				Individual Measurement	
Species name	Scientific name	Weight (kg)	%	Number	%	Length	Weight
walleye pollock	*Gadus chalcogrammus*	5,717.7	74.5	14,460	22.7	2,600	1,104
eulachon	*Thaleichthys pacificus*	1,554.1	20.3	46,027	72.2	271	138
squid unidentified	Teuthoidea (order)	235.6	3.1	2,701	4.2	98	98
magistrate armhook squid	*Berryteuthis magister*	143.4	1.9	322	0.5	0	0
Chinook salmon	*Oncorhynchus tshawytscha*	8.4	0.1	5	0.0	2	2
Bering skate	*Rhinoraja interrupta*	5.9	0.1	2	0.0	0	0
smooth lumpsucker	*Aptocyclus ventricosus*	3.5	0.0	4	0.0	2	0
Pacific herring	*Clupea pallasii*	0.9	0.0	18	0.0	9	9
Egg-yolk jellyfish	*Phacellophora camtchatica*	0.83	0.0	1	0.0	1	1
northern smoothtongue	*Leuroglossus schmidti*	0.5	0.0	32	0.1	32	32
pink salmon	*Oncorhynchus gorbuscha*	0.5	0.0	1	0.0	0	0
northern sea nettle	*Chrysaora melanaster*	0.4	0.0	1	0.0	1	1
capelin	*Mallotus villosus*	0.3	0.0	112	0.2	51	16
moon jellyfish	*Aurelia labiata*	0.3	0.0	1	0.0	1	1
Southern rock sole	*Lepidopsetta bilineata*	0.2	0.0	1	0.0	1	1
yellow Irish lord	*Hemilepidotus jordani*	0.2	0.0	2	0.0	0	0
crystal jellyfish	Aequorea sp.	0.2	0.0	1	0.0	1	1
Pacific sandfish	*Trichodon trichodon*	0.2	0.0	1	0.0	1	1
shrimp unidentified	Decapoda (order)	0.1	0.0	63	0.1	2	2
lanternfish unidentified	Myctophidae (family)	0.0	0.0	2	0.0	0	0
Total		7,673.4		63,757		3073	1407

Table 11.–Catch by species, and numbers of length and weight measurements taken from individuals, during the one Poly North-Eastern bottom trawl haul during the winter 2015 acoustic-trawl mini-surveys of the trawl-resistant bottom-mounted (TRBM) echosounders sites in Shelikof Strait.

		Catch				Individual Measurement	
Species name	Scientific name	Weight (kg)	%	Number	%	Length	Weight
walleye pollock	*Gadus chalcogrammus*	418.7	88.3	51	7.0	343	51
eulachon	*Thaleichthys pacificus*	17.1	3.6	539	74.3	23	0
longnose skate	*Raja rhina*	11.02	2.3	1	0.1	0	0
squid unidentified	Teuthoidea (order)	7.19	1.5	102	14.1	0	0
arrowtooth flounder	*Atheresthes stomias*	6.16	1.3	5	0.7	0	0
Pacific cod	*Gadus macrocephalus*	5.71	1.2	1	0.1	1	0
Pacific halibut	*Hippoglossus stenolepis*	2.72	0.6	1	0.1	1	0
lumpsucker unidentified	Cyclopteridae (family)	1.81	0.4	2	0.3	2	0
flathead sole	*Hippoglossoides elassodon*	1.77	0.4	6	0.8	0	0
rougheye rockfish	*Sebates aleutianus*	1.256	0.3	1	0.1	1	0
rex sole	*Glyptocephalus zachirus*	0.63	0.1	1	0.1	0	0
northern smoothtongue	*Leuroglossus schmidti*	0.034	0.0	1	0.1	0	0
longsnout prickleback	*Lumpenella longirostris*	0.03	0.0	1	0.1	0	0
egg-yolk jellyfish	*Phacellophora camtchatica*	0.114	0.0	1	0.1	1	0
shrimp unidentified	Decapoda (order)	0.1	0.0	9	1.2	9	0
starfish unidentified	Asteroidea (class)	0.01	0.0	3	0.4	0	0
Total		474.4		725		381	51

Table 12.–Trawl station and catch data summary from the winter 2015 acoustic-trawl survey of walleye pollock in Shelikof Strait, Chirikof Shelf break, and Marmot Bay.

Haul			Date	Time	Duration	Start position		Depth (m)		Water temp. (°C)		Catch					
												Pollock		POP	Eulachon	Capelin	Other
No.	Area	Gear type[1]	(GMT)	(GMT)	(minutes)	Latitude (N)	Longitude (W)	Footrope	Bottom	Headrope	Surface[2]	(kg)	Number	(kg)	(kg)	(kg)	(kg)
1	Marmot	AWT	15-Mar	11:15	31	58 00.38	-151 59.75	121	173	5.6	5.5	669.4	461	0	25.9	1.2	1.2
2	Marmot	AWT	16-Mar	5:32	20	57 57.85	-152 14.64	110	200	5.5	5.5	842.4	1,114	0	4.8	0	11.5
3	Marmot	PNE	16-Mar	13:40	8	58 00.31	-152 31.51	185	185	5.6	5.3	188.3	179	0	10.3	0	14.5
4	Marmot	PNE	16-Mar	18:34	5	57 56.83	-152 38.80	106	117	5.4	5.1	106.7	496	0	0	0	0.5
5	Shelikof	AWT	17-Mar	9:15	3	58 15.18	-153 15.95	77	219	5.6	5.2	1,111.2	5,006	0	0	0	6.5
6	Shelikof	AWT	17-Mar	10:37	17	58 16.54	-153 14.91	130	225			1,841.1	2,090	0	7.8	0	11.0
7	Shelikof	AWT	17-Mar	17:30	5	58 03.95	-153 36.52	198	227	6.2	5.2	884.4	1,526	0	306.7	0	55.3
*8	Shelikof	AWT	17-Mar	23:48	43	58 03.27	-154 13.61	135	277	5.2	3.2	193.5	144	0	6.3	0	3.6
9	Shelikof	AWT	18-Mar	4:12	1	58 01.41	-153 53.15	67	193	5.1	5.1	961.0	4,845	0	0.0	0	0.8
10	Shelikof	AWT	19-Mar	0:11	16	57 57.97	-154 08.33	188	206	5.9	5.3	579.1	523	0	17.2	0.1	23.7
11	Shelikof	AWT	19-Mar	3:53	1	57 58.83	-154 32.70	203	215	3.8	2.7	1,337.2	1,507	0	0.5	0	3.3
12	Shelikof	AWT	19-Mar	9:22	3	57 41.03	-154 34.41	69	214	5.3	5.4	1,097.0	5,279	0	0.1	0	1.6
13	Shelikof	AWT	19-Mar	13:49	4	57 43.46	-155 07.84	231	293	5.5	4.7	1,026.3	3,961	0	9.5	0	7.2
14	Shelikof	AWT	19-Mar	19:04	3	57 35.77	-155 09.14	226	257	6.2	4.8	1,216.9	3,689	0	59.8	0	2.0
15	Shelikof	AWT	19-Mar	22:46	2	57 30.26	-155 15.77	124	262	5.6	5.4	1,150.7	5,485	0	1.3	0	1.9
16	Shelikof	AWT	20-Mar	3:09	1	57 19.76	-155 02.98	226	238	6	5.1	237.4	969	0	277.6	0	14.8
*17	Shelikof	AWT	20-Mar	7:24	13	57 26.62	-155 35.43	244	292	5.8	4.8	668.6	1,011	0	24.6	0	8.8
18	Shelikof	AWT	20-Mar	16:45	13	57 05.66	-155 13.32	230	238	5.8	5.1	354.4	565	0	77.8	0	455.7
19	Shelikof	AWT	21-Mar	5:08	23	56 57.46	-155 51.05	285	294	6.2	5.2	320.0	944	0	26.7	0	70.8
20	Shelikof	AWT	21-Mar	12:32	5	56 46.10	-155 32.26	247	251	5.8	5.2	475.0	1,140	0	29.2	0	159.8
*21	Shelikof	AWT	21-Mar	19:02	8	56 39.38	-155 48.15	255	258	5.8	5.1	120.4	208	0	5.1	0	116.8
22	Shelikof	AWT	22-Mar	4:08	20	56 24.50	-155 45.93	84	95	5.2	5.2	968.7	2,734	0	0.1	0	28.0
23	Shelikof	AWT	22-Mar	9:18	4	56 26.35	-156 35.04	65	195	5.2	5.2	243.4	1,601	0	0	0	0
24	Shelikof	AWT	22-Mar	13:46	5	56 11.98	-156 06.62	238	241	6.1	5.1	350.9	1,853	0	138.0	0	11.7
25	Shelikof	AWT	22-Mar	17:25	4	56 09.23	-156 30.63	103	222	5.3	5.1	192.6	1,088	0	0.9	0	0.7
26	Chirikof	AWT	26-Mar	14:52	8	56 20.46	-152 25.62	262	448	5.2	5.8	0	0	46.0	0	0	0.3
27	Chirikof	AWT	26-Mar	18:39	0	56 17.68	-153 15.85	63	92	--[3]	--[3]	577.3	2,564	0	0	0	0.1
28	Chirikof	AWT	26-Mar	22:48	24	56 07.75	-153 37.78	219	330	4.9	5.8	12.2	20	0	0.5	0	3.5
29	Chirikof	AWT	27-Mar	3:01	12	55 54.17	-153 44.15	260	309	4.9	5.3	21.1	14	7.1	0	0	0.7
30	Chirikof	AWT	27-Mar	6:35	16	55 58.97	-154 21.33	291	382	5.3	5.4	10.4	8	94.4	2.1	0	47.0
*31	Shelikof	AWT	27-Mar	20:38	9	56 37.23	-155 51.31	254	259	6.1	5.3	311.1	1,115	0	7.8	0	14.2
*32	Shelikof	AWT	30-Mar	0:13	10	57 25.22	-155 35.98	282	290	6	5.6	354.4	468	0	101.6	0	102.1
*33	Shelikof	AWT	30-Mar	6:14	10	57 38.53	-154 59.53	229	238	5.9	4.9	903.7	2,938	0	112.2	0	25.2
*34	Shelikof	AWT	30-Mar	9:27	12	57 47.38	-154 56.04	273	297	5.9	4.9	1,607.9	1,876	0	143.3	0	8.7
*35	Shelikof	AWT	30-Mar	18:39	61	58 02.42	-154 14.82	277	277	6	5.4	59.9	66	0	10.2	0.1	5.8

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

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

[3]Water temperature data were not collected on this haul

*Haul is associated with Trawl-Resistant Bottom-Mounted (TRBM) echosounder sites in Shelikof Strait

Table 13.--Numbers of walleye pollock measured and biological samples collected during the winter 2015 acoustic-trawl surveys of Shelikof Strait, Marmot Bay (hauls 1-4), and the Chirikof Shelf break (hauls 26-30).

Haul no.	Walleye pollock				Ovary weights
	Lengths	Weights	Maturities	Otoliths	
1	246	91	91	30	0
2	345	68	67	30	3
3	179	96	96	29	0
4	215	59	59	36	0
5	580	110	110	29	3
6	394	120	120	40	0
7	463	123	122	40	0
8	144	144	144	30	3
9	369	58	58	35	0
10	296	101	101	30	3
11	358	120	74	31	4
12	381	73	72	39	1
13	558	88	83	15	0
14	493	87	80	17	0
15	409	44	44	16	0
16	178	64	64	20	2
17	389	121	117	34	5
18	434	153	146	30	0
19	243	62	62	29	6
20	419	108	104	30	0
21	146	82	82	29	0
22	409	84	69	23	1
23	412	41	41	15	0
24	357	101	51	41	0
25	277	29	29	29	0
26	0	0	0	0	0
27	211	31	31	30	0
28	20	20	20	20	2
29	14	14	14	14	5
30	8	8	8	8	0
31	279	130	124	30	0
32	347	133	133	30	4
33	297	80	70	35	2
34	257	58	51	36	0
35	66	66	66	23	0
Totals	10,193	2,767	2,603	953	44

Table 14.--Catch by species, and numbers of length and weight measurements taken from individuals, during the 18 midwater AWT trawl hauls during the winter 2015 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*	14,347.1	88.8	44,805	60.4	7,030	1,566
eulachon	*Thaleichthys pacificus*	953.0	5.9	22,338	30.1	158	158
squid unidentified	Teuthoidea (order)	694.5	4.3	5,533	7.5	118	118
magistrate armhook squid	*Berryteuthis magister*	60.1	0.4	98	0.1	30	30
Chinook salmon	*Oncorhynchus tshawytscha*	31.6	0.2	17	0.0	17	17
Pacific cod	*Gadus macrocephalus*	19.3	0.1	7	0.0	6	6
chum salmon	*Oncorhynchus keta*	15.8	0.1	18	0.0	13	13
lumpsucker unidentified	Cyclopteridae (family)	9.7	0.1	10	0.0	10	10
northern smoothtongue	*Leuroglossus schmidti*	8.2	0.1	771	1.0	73	73
starry flounder	*Platichthys stellatus*	4.8	0.0	1	0.0	1	1
coho salmon	*Oncorhynchus kisutch*	2.5	0.0	1	0.0	1	1
Pacific herring	*Clupea pallasi*	2.1	0.0	50	0.1	48	48
northern rockfish	*Sebastes polyspinis*	1.7	0.0	1	0.0	1	1
ragfish	*Icosteus aenigmaticus*	1.0	0.0	1	0.0	1	1
egg-yolk jellyfish	*Phacellophora camtchatica*	0.7	0.0	1	0.0	0	0
jellyfish unitentified	*Scyphozoa* (class)	0.7	0.0	1	0.0	0	0
lanternfish unidentified	Myctophidae (family)	0.6	0.0	140	0.2	12	12
shrimp unidentified	Decapoda (order)	0.6	0.0	268	0.4	31	31
northern sea nettle	*Chrysaora melanaster*	0.5	0.0	2	0.0	0	0
capelin	*Mallotus villosus*	0.2	0.0	90	0.1	69	69
lamprey unidentified	Petromzontiformes (order)	0.2	0.0	6	0.0	4	4
flathead sole	*Hippoglossoides elassodon*	0.2	0.0	1	0.0	1	1
poacher unidentified	Agonidae (family)	0.1	0.0	2	0.0	1	1
sturgeon poacher	*Podothecus accipenserinus*	0.1	0.0	1	0.0	1	1
sculpin unidentified	Cottoidea (superfamily)	0.0	0.0	2	0.0	1	1
fish larvae unidentified		0.0	0.0	7	0.0	0	0
isopod unidentified	Isopoda (order)	0.0	0.0	5	0.0	0	0
Total		16,155.2		74,177		7,627	2,163

Table 15.–Catch by species and numbers of length and weight measurements taken from individuals during the eight Aleutian Wing midwater trawl hauls during the winter 2015 acoustic-trawl mini-surveys of the trawl-resistant bottom-mounted (TRBM) sites in Shelikof Strait.

		Catch				Individual Measurements	
Species name	Scientific name	Weight (kg)	%	Number	%	Length	Weight
walleye pollock	*Gadus chalcogrammus*	4,219.5	85.8	7,826	37.7	1,925	814
eulachon	*Thaleichthys pacificus*	411.2	8.4	9,698	46.7	93	93
squid unidentified	Teuthoidea (order)	218.3	4.4	2,517	12.1	68	68
magistrate armhook squid	*Berryteuthis magister*	49.5	1.0	117	0.6	14	14
Chinook salmon	*Oncorhynchus tshawytscha*	6.1	0.1	5	0.0	5	5
northern smoothtongue	*Leuroglossus schmidti*	3.5	0.1	349	1.7	38	38
lumpsucker unidentified	Cyclopteridae (family)	2.1	0.0	1	0.0	1	1
Pacific cod	*Gadus macrocephalus*	1.3	0.0	1	0.0	1	1
Alaska plaice	*Pleuronectes quadrituberculatus*	1.2	0.0	1	0.0	1	1
English sole	*Parophrys vetulus*	1.0	0.0	1	0.0	1	1
flathead sole	*Hippoglossoides elassodon*	0.9	0.0	3	0.0	3	3
shrimp unidentified	Decapoda (order)	0.4	0.0	156	0.8	21	21
jellyfish unidentified	Cnidaria (phylum)	0.3	0.0	4	0.0	1	1
Pacific herring	*Clupea pallasii*	0.2	0.0	9	0.0	9	9
moon jellyfish	*Aurelia labiata*	0.2	0.0	1	0.0	1	1
capelin	*Mallotus villosus*	0.1	0.0	40	0.2	20	20
lamprey unidentified	Petromzontiformes (order)	0.1	0.0	2	0.0	2	2
lanternfish unidentified	Myctophidae (family)	0.0	0.0	13	0.1	7	7
comb jelly unidentified	Ctenophora (phylum)	0.0	0.0	2	0.0	2	2
Total		4,916.1		20,746		2,213	1,102

Table 16. -- 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	2015
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	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	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	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	<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	0
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	1
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	1
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	2
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	2
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	1
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	0
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	0
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	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	<1	114	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	1	492	1
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	1
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	9
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	17
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	21
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	17
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	17
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	39
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	85
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	168
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	281
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	300
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	271
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	209
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	142
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	66
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	49
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	28
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	24
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	16
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	15

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	2013	2014	2015
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	7
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	7
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	7
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	9
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	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	5	42	18
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	24
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	26
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	33
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	30
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	25
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	23
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	19
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	20
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	19
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	25
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	21
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	21
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	21
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	16
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	15
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	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	8
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	4
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	2
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	3
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	3
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	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	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	<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	<1	<1	<1	1	<1	0	
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	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	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	<1	<1	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	<1	<1	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	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	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	2,212

Table 17. – 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	2015
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	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	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	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	<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	0
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	<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	<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	<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	10	2	<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	5	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	2	<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	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	<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	<1
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	<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	<1	50	<1
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	1
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	1
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	2
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	2
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	2
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	5
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	11
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	25
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	45
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	54
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	55
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	47
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	36
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	18
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	15
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	9
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	9
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	6
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	7

Table 17-- 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	2015
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	3
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	4
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	4
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	5
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	9
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	13
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	18
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	22
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	29
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	28
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	25
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	25
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	21
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	25
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	24
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	33
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	31
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	31
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	34
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	26
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	27
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	17
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	16
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	9
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	4
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	6
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	6
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	2
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	3
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	<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	0
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	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	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	1	<1	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	1	<1	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	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	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	335.84	891.26	842	845

Table 18. – 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	2013	2014	2015	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	6,324	576	7	1,032
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	149	3,640	104	767
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	803	19	1,636	331
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	61	295	72	198
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	69	87	152	258
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	114	58	62	165
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	65	100	57	98
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	49	55	68	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	12	26	30	22
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	5	18	11	10
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	6	7	6	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	1	1	4	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	2	2	1	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	5	0	1	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	3	1	1	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	0	1	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	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	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	7,668	4,885	2,212	2,983

Table 19. -- 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	2015	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	0	14
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	10	58
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	327	79
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	39	79
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	134	131
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	66	114
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	81	84
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	101	56
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	48	27
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	17	15
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	9	8
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	6	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	2	2
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	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	2	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	0	2	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	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	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	891.3	842	845	665

Table 20.–Catch by species, and numbers of length and weight measurements taken from individuals, during the two midwater Aleutian Wing trawl hauls during the winter 2015 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*	1,511.7	97.1	1,575	32.9	591	159
eulachon	*Thaleichthys pacificus*	30.6	2.0	2,663	55.6	29	29
Pacific cod	*Gadus macrocephalus*	11.3	0.7	2	0.0	2	2
capelin	*Mallotus villosus*	1.3	0.1	450	9.4	13	13
flathead sole	*Hippoglossoides elassodon*	1.0	0.1	4	0.1	4	4
shrimp unidentified	Decapoda (order)	0.2	0.0	88	1.8	0	0
Pacific herring	*Clupea pallasi*	0.1	0.0	7	0.1	7	7
sturgeon poacher	*Podothecus accipenserinus*	0.1	0.0	1	0.0	1	1
Total		1,556.3		4,790		647	215

Table 21.–Catch by species, and numbers of length and weight measurements taken from individuals, during the two Poly North-Eastern bottom trawl hauls during the winter 2015 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*	294.9	92.1	675	69.3	394	155
Pacific cod	*Gadus macrocephalus*	10.6	3.3	6	0.6	6	6
eulachon	*Thaleichthys pacificus*	10.3	3.2	275	28.2	16	16
arrowtooth flounder	*Atheresthes stomias*	2.6	0.8	1	0.1	1	1
flathead sole	*Hippoglossoides elassodon*	1.2	0.4	3	0.3	3	3
northern sea nettle	*Chrysaora melanaster*	0.4	0.1	1	0.1	0	0
jellyfish unidentified	Cnidaria (phylum)	0.1	0.0	1	0.1	0	0
longsnout prickleback	*Lumpenella longirostris*	0.1	0.0	1	0.1	1	1
shrimp unidentified	Decapoda (order)	0.0	0.0	7	0.7	0	0
capelin	*Mallotus villosus*	0.0	0.0	3	0.3	0	0
Alaska eelpout	*Bothrocara pusillum*	0.0	0.0	1	0.1	0	0
Total		320.2		974		421	182