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Results of the Acoustic-Trawl Survey of Walleye Pollock (*Gadus chalcogrammus*) in the Gulf of Alaska, June-August 2017 (DY2017-06)

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Results of the Acoustic-Trawl Survey of Walleye Pollock (*Gadus chalcogrammus*) in the Gulf of Alaska, June-August 2017 (DY2017-06)

by

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ABSTRACT

Scientists from the Midwater Assessment and Conservation Engineering (MACE) Program of the Alaska Fisheries Science Center's (AFSC) Resource Assessment and Conservation Engineering (RACE) Division conducted an acoustic-trawl (AT) survey of the Gulf of Alaska (GOA) shelf to estimate the distribution and abundance of walleye pollock (*Gadus chalcogrammus*) in summer 2017. Previous surveys of the GOA have also been conducted by the MACE program during the summers of 2003, 2005, 2011, 2013, and 2015. The 2017 survey covered the shelf from the Islands of Four Mountains to Yakutat Trough including many bays and troughs. Surface water temperatures across the GOA shelf averaged 11.6° C, overall, approximately 0.6° C cooler than in 2015 (mean 12.2° C) and 1.0° C warmer than in 2013 (mean 10.6° C), which were the only other surveys with comparable coverage. Large aggregations of age-0 pollock were observed throughout the survey but especially in the Shumagin Islands and Shelikof Strait areas. The estimated amounts of age-1+ pollock for the entire surveyed area were 2.64 billion fish weighing 1,341,973 metric tons (t). The majority of the pollock biomass was observed on the continental shelf (84%), Shelikof Strait (5%), near Mitrofania Island (3%), and east of Kodiak Island in Chiniak (2%) and Barnabas Troughs (4%). The majority (86%) of the biomass in the survey area consisted of age-5 fish from the 2012 year class. Compared to previous summer GOA surveys, fish weight at length was similar, but length at age was slightly smaller. Backscatter was attributed to species other than pollock when trawl verification, differentiation based on backscatter frequency response, or other methods allowed. Abundance and biomass estimates were calculated for Pacific ocean perch (*Sebastes alutus*; 305.9 million fish weighing 172,388 t), and backscatter distribution and abundance relative to previous surveys was estimated for euphausiids (primarily consisting of *Thysanoessa inermis*, but also including *T. spinifera*, *T. raschii*, and *Euphausia pacifica*).

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INTRODUCTION

Scientists from the Midwater Assessment and Conservation Engineering (MACE) Program of the Alaska Fisheries Science Center's (AFSC) Resource Assessment and Conservation Engineering (RACE) Division conduct acoustic-trawl (AT) stock assessment surveys to estimate the distribution and abundance of walleye pollock (*Gadus chalcogrammus*) in Alaska waters. Surveys are conducted annually in the Gulf of Alaska (GOA) during late winter and early spring to assess pre-spawning aggregations. AT surveys have been conducted in Chiniak and Barnabas troughs east of Kodiak Island during the summers of 2000-2006 to explore species spatial distribution relative to environmental conditions (Hollowed et al. 2007, Logerwell et al. 2007) and the effect of commercial fishing on walleye pollock abundance (Walline et al. 2012, Wilson et al. 2003). A biennial schedule of expanded shelf-wide AT summer surveys to estimate walleye pollock distribution and abundance across the GOA were carried out in summers of 2003, 2005, and biennially since summer 2011. Surveys were concluded short of original plans due to budgetary restrictions in 2003, and ship mechanical issues in 2005 and 2011. The 2013 (Jones et al. 2014), 2015 (Jones et al. 2017), and 2017 surveys covered the shelf and selected bays and troughs from the Islands of Four Mountains to Yakutat Trough. Areas covered in all summer surveys include Shelikof Strait, Barnabas Trough, and Chiniak Trough. Estimates of the distribution and abundance of walleye pollock, Pacific ocean perch (POP; *Sebastes alutus*), and capelin (*Mallotus villosus*) have been made for the areas surveyed each year when possible. Since 2011, an estimate of the distribution and abundance of backscatter attributed to euphausiids (or ‘krill’, primarily consisting of *Thysanoessa inermis*, but also including *T. spinifera*, *T. raschii*, and *Euphausia pacifica*) has been provided.

This report presents the distribution and abundance estimates for walleye pollock, POP, and euphausiids based on the summer AT survey conducted during June through August 2017. Acoustic system calibration and water temperature observations results are also presented.

METHODS

The survey (cruise DY2017-06) was conducted between 8 June and 16 August on the Gulf of Alaska shelf extending from the Islands of Four Mountains in the west to Yakutat Trough in the east (Figs. 1-3). For this report the area referred to as the "shelf" includes transects that are roughly perpendicular to the continental shelf depth contours and extend in a general north-south direction covering bottom depths of approximately 50 m to 1,000 m. Smaller surveys were conducted in several bays and around islands including: Sanak Trough, Morzhovoi Bay, Pavlof Bay, the Shumagin Islands area (including Renshaw Point, Unga Strait, and West Nagai Strait), Mitrofania Island, Nakchamik Island, Shelikof Strait, Alitak Bay, Barnabas Trough, Chiniak Trough, and Marmot Bay. These areas were selected as likely pollock habitat to survey based on the presence of pollock in prior survey and catch records and recommendations from local fishermen. Survey itineraries and scientific personnel are listed in Appendices I and II. All activities were conducted aboard the NOAA ship *Oscar Dyson*, a 64 m stern trawler equipped for fisheries and oceanographic research. The survey followed established AT methods as specified in NOAA protocols for fisheries acoustics surveys and related sampling[1].

Acoustic Equipment, Calibration, and Data Collection

Acoustic measurements for abundance estimates were collected with a Simrad EK60 scientific echo sounding system (Simrad 2008, Bodholt and Solli 1992). The system electronics were housed inside the vessel in a permanent laboratory space dedicated to acoustics. Five split-beam transducers (18, 38, 70, 120, and 200 kHz) were mounted on the bottom of the vessel's retractable centerboard, which extended 9 m below the water surface. All frequencies were operated at pulse lengths of 0.5 ms at a ping interval of 1 second in water depths less than 500 m, or 2-3 seconds in waters deeper than 500 m. Acoustic backscatter data were collected to a maximum of 1,000 m.

[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 .

The EK60 echosounder was calibrated using the standard sphere method on 9 June and 15 August 2017. The vessel's dynamic positioning system was used to keep the vessel from drifting during calibrations. A tungsten carbide sphere (38.1 mm diameter) suspended below the centerboard-mounted transducers was used to calibrate the 38, 70, 120, and 200 kHz systems. The tungsten carbide sphere was replaced with a 60 mm diameter copper sphere for a second calibration of the 38 kHz system. A 64 mm diameter copper sphere was used for calibration of the 18 kHz system. A two-stage calibration approach was followed for each frequency. On-axis sensitivity (i.e., transducer gain and s_A correction) was estimated from measurements with the sphere placed in the center of the beam following the procedure described in Foote et al. (1987). 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 (i.e., beam angles and angle offsets) were estimated by moving the sphere in a horizontal plane through the beam and fitting these data to a second-order polynomial model of the beam pattern using the ER60's calibration utility (Simrad 2008, Jech et al. 2005). The equivalent beam angle (which is used to characterize the volume sampled by the beam) cannot be estimated from the calibration approach used (knowledge is required of the absolute position of the sphere; see Demer et al. 2015). Thus, the transducer-specific equivalent beam angle measured by the echosounder manufacturer, and corrected for the local sound speed (see Bodholt 2002), was used in data processing. Acoustic system gain and beam pattern parameters measured during the June and August calibrations were averaged in linear units to provide a final parameter set for data analysis (see Results for details).

The EK60 acoustic data (.raw files) were logged at five frequencies using ER60 software (v. 2.4.3). Acoustic telegram data were also logged with Echoview Echolog 500 (v. 4.70.1.14256) software as a backup. Results presented in this report are based on post-processing the 38 kHz acoustic raw data using Myriax Echoview (v. 8.0.84) using a minimum integration threshold of –70 decibels (dB) re 1 m^{-1}.

A Simrad ME70 multibeam sonar (Simrad 2007, Trenkel et al. 2008) was used in a 31-beam configuration (Weber et al. 2013) during nighttime operations only to evaluate the topography of the seafloor in various habitats. The ME70 is mounted on the hull 10 m forward of the centerboard at a depth of 6 m below the water surface. When it was operating, ME70 transmissions were synchronized with those of the EK60. The ME70 was calibrated on 9 June using a 25 mm diameter tungsten carbide sphere centered and swung through all 31 beams.

Trawl Gear and Oceanographic Equipment

Midwater and near-bottom acoustic backscatter was sampled using an Aleutian Wing 30/26 Trawl (AWT). The AWT is constructed with full-mesh nylon wings, and polyethylene mesh in the codend and aft section of the body. The headrope and footrope each measure 81.7 m (268 ft). Mesh sizes taper from 325.1 cm (128 in) in the forward section of the net to 8.9 cm (3.5 in) in the codends, which were fitted with a single 12 mm (0.5 in) codend liner. Near-bottom organisms, and some midwater backscatter, was sampled with a poly Nor'eastern (PNE) bottom trawl, which is a 4-panel high-opening trawl equipped with roller gear and constructed with stretch mesh sizes that range from 13 cm (5 in) in the forward portion of the net to 8.9 cm (3.5 in) in the codend. The PNE codend was also fitted with a single 12 mm (0.5 in) codend liner. The AWT and PNE are described in detail by Guttormsen et al. (2010).

The AWT and PNE were fished with 5 m^2 Fishbuster trawl doors each weighing 1,089 kg. Average trawling speed was approximately 1.6 m/sec (3.2 knots). Vertical net openings and headrope 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 of the AWT ranged from 13.4 to 28.6 m (44 to 94 ft) and averaged 18.6 m (61 ft) while fishing. The PNE vertical mouth opening ranged from 7 to 10 m (23 to 33 ft) and averaged 8.0 m (26 ft) while fishing.

A small-mesh recapture net was sewn into the bottom panel of the AWT trawl approximately 26 m forward of the codend. The net recaptures organisms that escape from inside the trawl by exiting through the trawl meshes. Catch in the recapture net was recorded independently from the catch in the codend. These data are being used in ongoing work to estimate the trawl selectivity of the AWT and to gauge escapement of juvenile pollock and other small fishes (Williams et al.

2011). Recapture net data were not used to adjust trawl codend catches or other estimates reported here. The AWT trawl also included a stereo camera system attached to the starboard panel forward of the codend (CamTrawl; Williams et al. 2010). The CamTrawl was used to capture stereo images for species identification and length measurement of individual fish as they pass through the net toward the codend. The CamTrawl data are useful in determining size and species composition of fish when distinct and separate backscatter layers are sampled by a trawl haul but cannot be differentiated in the trawl catch, or when an aggregation is too dense to obtain an adequate sample without overfilling the net. When extremely dense aggregations are encountered the net can be towed with the codend open and species composition and lengths can be acquired from calibrated CamTrawl images. Images are viewed and annotated using procedures described in Williams et al. (2010).

A Methot trawl (Methot 1986) was used to target midwater acoustic layers containing macro-zooplankton such as euphausiids, age-0 walleye pollock, and other larval fishes. The Methot trawl had a rigid square frame measuring 2.3 m on each side, which formed the mouth of the net. Mesh sizes were 2 by 3 mm in the body of the net and 1 mm in the codend. A 1.8 m dihedral depressor was used to generate additional downward force. A calibrated General Oceanics flowmeter was attached to the mouth of the trawl; the number of flowmeter revolutions and the total time the net was in the water was used to determine the volume of water filtered during the haul. The trawl was attached to a single cable fed through a stern-mounted A-frame. Real-time trawl depths were monitored using a Simrad ITI acoustic link temperature-depth sensor attached to the bottom of the Methot frame. The Methot net was towed at an average speed of ~1.2 m/sec (2.3 knots).

Physical oceanographic data collected during the cruise included temperature profiles obtained with a Sea-Bird Electronics temperature-depth probe (SBE 39) attached to the AWT and PNE trawl headrope and the bottom of the Methot frame. Additional temperature-depth measurements were taken from conductivity-temperature-depth (CTD) observations collected with a Sea-Bird CTD (SBE 911plus) system at calibration sites, at several predetermined stations, and at nightly opportunistic sites. Sea surface temperature data were measured using the ship's Sea-Bird Electronics sea surface temperature system (SBE 38, accuracy $\pm$ 0.002° C) located near the ship's bow, approximately 1.4 m below the surface. At times when the SBE 38 was not operating, sea surface temperatures were taken from the Furuno T-2000 temperature probe (accuracy ± 0.2° C) located amidships 1.4 m below the surface. During this survey, the SBE 38 was used 91% of the time and the Furuno was used 9% of the time. These and other environmental data were recorded using the ship's Scientific Computing Systems (SCS).

Survey Design

The survey design consisted primarily of a series of parallel line transects, except where necessary to reorient tracklines to maintain a perpendicular alignment to the isobaths and work around landmasses. Zig-zag transects were used in Deadman Bay and Alitak Bay because of the narrowness of the bay. Coverage and transect spacing were chosen to be consistent with previous surveys in each area where possible. Transect placement was randomized by moving previous survey transect starting points an amount less than the inter-transect distance, with subsequent transects evenly spaced from this point. Acoustic and trawl data used in abundance estimation were collected during daylight hours (on average between 05:30 and 23:00 local time during the survey). Nighttime activities included collection of additional physical oceanographic data, and work with other specialized sampling devices (e.g., testing effects of strobed lights attached to the Methot net frame on euphausiid catch, Simrad ME70 multibeam/EK60 sonar mini-grids for characterizing bottom type and rockfish abundance together with associated lowered camera deployments, and low-frequency, broadband response on various sizes of fish).

Trawl hauls were conducted to classify the observed backscatter by species and size composition and to collect specimens of walleye pollock. Walleye pollock were sampled to determine sex, fork length (FL), body weight, age, gonad maturity, and mature ovary weights. Walleye pollock (except age-0 fish) and fishes other than capelin (*Mallotus villosus*) were measured to the nearest 1 mm fork length (FL) using an electronic measuring board (Towler and Williams 2010). Age-0 walleye pollock and capelin were measured to the nearest millimeter standard length (SL). Standard, fork, and total lengths were collected from eulachon, capelin, Pacific ocean perch, and dusky rockfishes on several occasions. When large numbers of juveniles mixed with adults were encountered in a haul, the predominant size groups were subsampled separately (e.g., age-1 vs.

adults). For each trawl haul, sex and length measurements were collected for up to 460 randomly sampled individuals, and up to an additional 73 individuals were sampled for body weight, maturity, and age. Maturity was determined by visual inspection and was categorized as immature, developing, mature (pre-spawning), spawning, or spent (post-spawning)[2]. An electronic motion-compensating scale (Marel M60) was used to weigh individual fish to the nearest 2 g. Trawl metadata (e.g., position, speed, environmental conditions) and biological measurements of the catch were electronically recorded in the Catch Logger for Acoustic Midwater Surveys (CLAMS) database.

The catch from Methot trawl hauls was transferred to a large tote. Large organisms (such as jellyfish) and small fishes were removed, identified, weighed, and measured. The remainder of the plankton catch was placed on a 1-mm mesh screen and weighed. A subsample of the zooplankton mixture was then weighed, sorted into broad taxonomic groups for which a count and weight were determined. A second subsample was weighed and preserved in a 5% buffered formalin solution for more detailed enumeration at the Polish Sorting Center in Szczecin, Poland.

Data Analysis

Data were analyzed using Echoview post-processing software (v. 8.0.84.31252). Fish abundance and distribution results presented here are based on 38 kHz acoustic backscatter integrated using a post-processing S_v integration threshold of -70 decibels (dB re $1m^{-1}$).

Backscatter classification

The bottom depth was estimated as the mean of sounder-detected bottom depths based on the five frequencies (Jones et al. 2011). Acoustic backscatter from 16 m below the surface to 0.5 m above the bottom (except where the bottom exceeded the 1,000 m lower limit of data collection) were used in further analyses. Acoustic data were binned at 0.5 nautical mile (nmi) horizontal by 10 m vertical resolution. Acoustic backscatter was assigned to species based primarily on trawl catch composition from the nearest haul. If trawl catch verification of backscatter species

[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 .

composition was not possible, we assigned backscatter to species based on CamTrawl imagery, backscatter frequency response (De Robertis et al. 2010), school morphology (e.g., rockfish tend to form "haystacks" near the seafloor), or experience from previous summer and winter cruises in the area (e.g., POP are more adept at avoiding the trawl than walleye pollock over the shelf break).

Correction for the contribution of age-0 pollock to measured backscatter

The summer GOA AT survey is intended to estimate the distribution and abundance of age-1+ pollock. Age-0 pollock are not commonly observed in survey trawl catches or CamTrawl imagery from age-1+ pollock aggregations, and no attempt is made to estimate their abundance. However, in summer 2017 large numbers of age-0 pollock were observed on CamTrawl images and they appeared frequently in trawl catches throughout the surveyed area, particularly in the vicinity of the Shumagin Islands, the surrounding continental shelf, and in Shelikof Strait. Age-0 pollock were often co-located with larger age-1+ pollock which made it difficult to estimate the proportion of backscatter attributable to age-1+ pollock. Mixed aggregations of age-0 and age-1+ pollock occurred in approximately 22% of the entire GOA surveyed area, particularly in the west of the survey area on the shelf transects between the Islands of Four Mountains thru the Shumagin Islands area, and the northern third of Barnabas Trough.

Given their abundance and relatively high scattering strength, age-0 pollock likely contributed substantially to the observed backscatter at 38 kHz. The contribution of age-0 pollock to backscatter in mixed aggregations cannot be readily distinguished from that of larger pollock via acoustic means as these age classes have a similar relative frequency response at the frequencies used in this survey (De Robertis et al. 2010). Because of unknown selectivity and catchability we were not able to use the trawl catch directly to estimate the contribution of age-0 pollock to the observed backscatter.

When age-0 and age-1+ pollock were encountered in mixed aggregations, we used the following method to quantify and remove backscatter from age-0 pollock before estimating age-1+ pollock abundance and biomass for this survey. As a first-order correction, we developed a method to estimate the proportion of the observed backscatter that is attributable to age-0 pollock based on the trawl catch, observations in CamTrawl imagery, and assumptions about the selectivity ratio of the survey trawl for age-0 and age1+ pollock. A corrected backscatter estimate was computed by removing the estimated contribution of age-0 pollock from the observed backscatter in areas where substantial age-0 pollock were observed mixed with age-1+ pollock, and then this corrected backscatter estimate was used to compute the abundance of age-1+ pollock (see 'Computation of age-1+ pollock abundance and biomass' section). In areas where age-0 pollock were not observed in the catch or in CamTrawl, corrected backscatter was equal to the observed backscatter.

The corrected backscatter with the contribution from age-0 pollock removed was defined as

$$s_{A,corr} = s_{A,meas} \cdot (1 - PB_{age0,h}) \quad , \qquad \text{Eq. (1)}$$

where $s_{A,meas}$ is the measured backscatter, and PB_{age0} is the proportion of the total backscatter attributable to age-0 pollock in a given nearest haul, *h*.

PB_{age0} was estimated as

$$PB_{age0,h} = \frac{\sum_{l} \sigma_{bs,pk\_age0,l} \cdot N_{pk_{age0},l,h}}{\sum_{l,s} \sigma_{bs,s,l} \cdot N_{l,s,h}} \quad . \qquad \text{Eq. (2)}$$

Where σ_{bs} represents the backscattering cross section, N represents the number of individuals captured, *l* is a 1 cm length class, and *s* represents a species grouping. The backscattering cross section was estimated based on published values for species groups consisting of pollock, fishes with swim bladders, fishes without swim bladders, jellyfish, squid, and pelagic crustaceans (see Stienessen et al. 2017, table 17 for details).

Given that age-0 pollock were poorly retained by the survey trawl, the relative abundance of age-0 pollock that would have been captured if the survey trawl was 100% efficient for age-0 pollock was calculated as follows:

$$N_{pk\_age0,h} = N_{pk,codend,h} \cdot \frac{N_{pk\_age0,camtrawl,h}}{N_{pk,camtrawl,h}} \cdot SR \qquad , \qquad \text{Eq. (3)}$$

where $N_{pk,codend}$ is the number of age 1+ pollock retained in the codend, $N_{pk\_age0,camtrawl}$ and $N_{pk, camtrawl}$ are the number of age-0 and age 1+ pollock observed in the CamTrawl images respectively, and *SR* represents a selectivity ratio for age-1+ compared to age-0 pollock for the survey trawl. CamTrawl images were analyzed systematically throughout the trawl path with $N_{pk\_age0,camtrawl}$ and $N_{pk, camtrawl}$ estimated as the total observed in counts of every 20th image. As *SR* was unknown, we assumed that the age-0 pollock acted as passive particles, while all age-1+ pollock were completely herded by the survey trawl. Thus, *SR* was assumed to be 175, the ratio of the surface area of the trawl cross-section at the trawl mouth (700 m^2) and the CamTrawl location (4 m^2). In other words, the assumption is that only 1 out of 175 age-0 pollock entering the mouth of the trawl were imaged by the camera, 100% of the age-1+ pollock entering the trawl mouth were imaged by CamTrawl, and the number of age-1+ pollock in the trawl path were equal to the number of age-1+ pollock in the codend catch. This should be considered a conservative assumption since this likely under-estimates the backscatter from age-1+ pollock as they likely exhibit some escapement (e.g., Williams et al. 2011), and age-0 pollock may exhibit some herding behavior.

Computation of age-1+ pollock abundance and biomass

Walleye pollock length compositions were compiled from nearest trawl hauls based on geographic proximity and backscatter characteristics. Mean fish weight-at-length for each 1 cm length interval was estimated from the trawl information when there were six or more walleye pollock sampled in that length interval; otherwise, it was estimated using a linear regression of the natural logarithm of all length-weight data (De Robertis and Williams 2008).

Walleye pollock abundance was estimated by dividing measurements of the corrected nautical area backscattering coefficient (s_{Acorr}, m^2 nmi^{-2}) at 38 kHz attributed to age-1+ pollock (after allocating backscatter to other species present in the nearest trawl catch; Stienessen et al. 2017) by their mean backscattering cross section (MacLennan et al. 2002) as follows. 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,

$$\mathrm{TS} = 10 \log_{10} \sigma_{bs} \quad . \qquad \text{Eq. (4)}$$

The estimated TS-to-length relationship for walleye pollock (Foote and Traynor 1988, Traynor 1996) is

$$\mathrm{TS} = 20 \log_{10} \mathrm{L} - 66 \quad , \qquad \text{Eq. (5)}$$

where L = fork length (FL) in centimeters.

Biological information available from the trawl hauls includes the following:

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 nearest haul the abundance of pollock in the region (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:

$$\overline{\sigma}_{bs} = \Sigma_i \,(\mathrm{P}_i \times \sigma_{bs,i}), \text{ where } \sigma_{bs,i} = 10^{((20 \log_{10} \mathrm{L}i - 66)/10)} \qquad \text{Eq. (6)}$$

$$\text{Numbers at length } i\text{: } \mathrm{N}_i = \mathrm{P}_i \times \overline{s}_A \times A \,/\, 4\pi\overline{\sigma}_{bs} \qquad \text{Eq. (7)}$$

$$\text{Biomass at length } i : \mathrm{B}_i = \overline{W}_i \times \mathrm{N}_i \qquad \text{Eq. (8)}$$

$$\text{Numbers at age } j : \mathrm{N}_j = \Sigma_i \,\mathrm{Q}_{i,j} \times \mathrm{N}_i \qquad \text{Eq. (9)}$$

$$\text{Biomass at age } j : \mathrm{B}_j = \Sigma_i \,\mathrm{Q}_{i,j} \times \mathrm{B}_i \,. \qquad \text{Eq. (10)}$$

The abundance in each survey area was estimated by summing the geographic regional estimates for all the nearest haul strata in the area.

Determination of age at length

Walleye pollock otoliths were collected from all areas and stored in a 50% glycerin/thymol-water solution for later age determination. Otoliths were processed by AFSC Age and Growth Program researchers to determine the ages of individual fish. Length-at-age data were used to convert abundance-at-length estimates to abundance-at-age (see Appendix III). Briefly, abundance-at-length from the trawl catch is combined with an age-length matrix from otolith processing and the proportion at age for each length is determined. The proportioned length-at-age is multiplied by the abundance-at-length to obtain the abundance-at-age. For lengths where no specimens were collected, the proportion at age was derived using a Gaussian model to predict the likely age at length.

Relative estimation error

In all areas where transects were parallel, relative estimation errors for the acoustic-based estimates were derived using a one-dimensional (1-D) geostatistical method (Petitgas 1993, Williamson and Traynor 1996, Walline 2007). "Relative estimation error" is defined as the ratio of the square root of the 1-D estimation variance ($variance_{sum}$) to the biomass estimate (i.e., the sum of biomass over all transects, $biomass_{sum}$, kg):

$$Relative\ estimation\ error_{1\text{-}D} = \frac{\sqrt{variance_{sum}}}{biomass_{sum}} \quad . \qquad \text{(Eq. 11)}$$

Since sampling resolution affects the variance estimate, and the 1-D method assumes equal transect spacing, estimation variance is determined separately in each area with unique transect spacing. Relative estimation error for the entire survey (among n survey areas with different transect spacings) was computed by summing the estimation variance for each area j, taking the square root, and then dividing by the sum of the biomass over all areas, assuming independence among estimation errors for each survey area (Rivoirard et al. 2000):

$$Relative\ estimation\ error_{1\text{-}D\ survey} = \frac{\sqrt{\sum_{j=1}^{n} variance_{sum\,j}}}{\sum_{j=1}^{n} biomass_{sum_j}} \quad . \qquad \text{(Eq. 12)}$$

A two-dimensional (2-D) geostatistical method (Petigas 1993, Rivoirard et al. 2000) was used to derive relative estimation errors in a few small survey areas where zig-zag transects were used (Deadman Bay, Kenai Peninsula Bays, Izhut Bay). The 2-D method differs from the 1-D method in that it computes a variance ($variance_{mean}$) for the mean biomass density ($biomass_{mean}$, kg nmi^{-2}) rather than the biomass sum (kg) in each area. Mean biomass density is multiplied by the surveyed area (nmi^2) to obtain the biomass estimate for that area (kg); likewise, 2-D relative estimation error is obtained as:

$$Relative\ estimation\ error_{2\text{-}D} = \frac{variance_{mean_j} * area_j^2}{biomass_{mean_j} * area_j} \qquad \text{(Eq. 13)}$$

and over several zig-zag survey areas as:

$$Relative\ estimation\ error_{2\text{-}D\ survey} = \frac{\sqrt{\sum_{j=1}^{n} variance_{mean_j} * area_j^2}}{\sum_{j=1}^{n} biomass_{mean_j} * area_j} . \qquad \text{(Eq. 14)}$$

Equations 8 and 9 are analogous to Equations 6 and 7 after accounting for unit conversions.

The biomass estimate for the entire survey was obtained by summing biomass for all areas. However, the variance for that sum includes only the 1-D relative estimation errors, as it is not appropriate to combine 1-D and 2-D variance estimates since they involve different assumptions and may not be strictly comparable (Petitgas 1993). For reference, 99% of the survey biomass total was observed in areas for which 1-D relative estimation errors were obtained.

Geostatistical methods were used to compute estimation error as a means to account for estimation uncertainty arising from the observed spatial structure in the fish distribution. These errors, however, quantify only transect sampling variability of the acoustic data (Rivoirard et al. 2000). Other sources of error (e.g., target strength, trawl sampling) were not evaluated.

Mean weighted height off bottom

The mean weighted height off bottom of pollock was determined for each 0.5 nmi horizontal interval for the backscatter in 10 m bins from the bottom exclusion line as determined by the mean of the sounder-detected bottom depths (Jones et al. 2011). The product of the vertical height off bottom bin and a weighting factor determined by dividing the bin biomass by the sum of the total biomass for that interval were then summed as

$$\text{mean weighted pollock}_j \text{ height off bottom} = \sum((\text{biomass}_{ij}/\text{biomass}_j) * \text{height}_{ij}) \qquad \text{(Eq. 15)}$$

for each 10 m height off bottom bin *i* and 0.5 nmi interval *j*. All intervals within the consistently sampled areas each year (i.e. - Shelikof Strait, Barnabas Trough, and Chiniak Trough) were combined to get an overall mean weighted height off bottom by year for each area.

Computation of POP abundance and biomass

Computation of POP abundance and biomass was done as described above for age-1+ walleye pollock, except that the generic physoclist fish TS to length relationship (Foote 1987) of

$$TS = 20 \log_{10}(TL)-67.5 \quad , \qquad \text{Eq. (16)}$$

where TL = total length in centimeters was used.

Euphausiid abundance and distribution

Euphausiid backscatter was isolated by comparing the relative frequency response at 18, 38, 120, and 200 kHz, following Simonsen et al. (2016). Euphausiid backscatter at 120 kHz was identified using custom-built programs in both Echoview (Echoview Software, Hobart, Tasmania, Australia) and Matlab (Mathworks, Natick, Massachusetts, USA). Methot trawl catches were used to confirm the presence of euphausiids in the water column, determine euphausiid length and species composition, and help to ground-truth the multifrequency acoustic analyses.

RESULTS and DISCUSSION

Acoustic System Calibration

An acoustic system calibration was conducted at the beginning of the survey and another at the end of survey (Table 1). The 38 kHz transducer showed no significant differences in gain parameters or beam pattern characteristics between calibrations, confirming that the acoustic system was stable throughout the cruise. The gain values from 9 June and 16 August were averaged in the linear domain and used to scale final results. The s_A correction for the 9 June calibration of the 38 kHz transducer was entered into the sounder as -0.64 dB instead of -0.63dB (Table 1) and data were collected for the entirety of the first leg using that value. Also, following calibration it was decided to switch to a spare 200 kHz transducer because it had slightly less noise interference, but the beam widths and offsets for the spare transducer were not correctly entered into the transceiver. These incorrect settings were rectified for the final data export when the calibration results were averaged and new settings were used for the final echosounder settings file.

Walleye Pollock Weight, Length, Maturity, and Age

Weight at length was measured on 3,184 walleye pollock during the GOA survey (Table 2). Weight at length was observed to be similar throughout the surveyed areas, so fish were grouped into a single weight at length key for the entire survey. Walleye pollock weight at length during the 2017 GOA survey was similar to previous surveys (Fig. 4).

The majority ($\geq$78%) of all male and female pollock examined throughout the survey were in the developing stage of maturity (Fig. 5), with the remaining individuals primarily in the spent or post-spawning stage. There is some ambiguity as to exactly when the stage of maturity reverts from post-spawning back to developing prior to active spawning again. Very few immature, pre-spawning, or actively spawning individuals were identified.

Otoliths were collected from a total of 1,815 walleye pollock (Table 2), of which 1,810 were aged. A single length at age key was used for the entire survey. Compared to most previous surveys, length at age for fish aged 1, 3, and 9 was similar, slightly larger for age-2 fish, and slightly shorter for other ages, including age-5 fish from the 2012 year class (Table 3; Fig. 6). Additionally, mean weight at age was similar to most previous surveys for fish aged 1-3 and 8, but slightly less for all other ages (Table 4; Fig. 7).

GOA Shelf and Slope from the Islands of Four Mountains to Yakutat Trough

The GOA shelf from the Islands of Four Mountains to the Yakutat Trough (Figs. 1-3) was surveyed between 12 June and 14 August. The survey area encompassed 157,647.0 km^2 (45,962.5 nmi^2) covering the shelf and shelf break between approximately the 50 and 1,000 m depth contours. The mean depth across the shelf was 216.8 m. Acoustic backscatter was measured along 3,306.6 km (1,785.2 nmi) of trackline on 41 transects spaced 46.3 km (25 nmi) apart.

Surface water temperatures across the GOA shelf ranged from 5.0° to 16.3° C, increasing from west to east with an overall average of 11.6° C (Fig. 8), approximately 0.6° C cooler than in 2015 (mean 12.2° C) and 1.0° C warmer than in 2013 (mean 10.6° C). Inferences about spatial patterns in surface temperatures are confounded by the broad time span of the survey: the shelf was sampled over 2 months and generally progressed from west to east as water temperatures throughout the region were increasing to summer highs. Temperatures at 100 m depth from SBE 39 probes on the fishing gear ranged from 4.4° to 7.4° C and averaged 5.9° C (Fig. 9), approximately 0.7° C cooler than in 2015 (mean 6.6° C). Bottom temperatures from 25 CTD deployments on the shelf averaged 5.3° C with an average bottom depth of 214 m (Fig. 8), 0.5° C cooler than bottom temperatures from CTD deployments across the shelf 2015 (mean 5.8° C).

Biological data and specimens were collected along the GOA shelf from 47 AWT hauls, and 7 PNE hauls (Tables 5-7; Figs. 1-3). Walleye pollock (including age-0) was the most abundant species by weight (92.6%) and number (58.7%) caught in the midwater hauls (Table 6). Pacific ocean perch (POP) was the second most abundant species captured by weight (4.6%) in the midwater hauls. Euphausiids were the second most abundant species captured by number (23.2%) in the midwater hauls, followed by Pacific herring (8.4%). In the demersal hauls, Pacific ocean perch was the most abundant species by weight (86.7%) but the second most abundant species captured by number (41.5%; Table 7). Walleye pollock (including age-0) was the second most abundant species caught by weight (10.1%) but the most abundant species captured by number (54.2%) in demersal hauls on the shelf.

Age-1+ walleye pollock observed on the GOA shelf were predominately 36 to 58 cm FL with a mode of 44 cm FL, with a smaller number of fish 17 to 23 cm FL with a mode of 20 cm FL (Tables 8 and 9; Fig. 10). Pollock ranged in age from 1 to 11, with age-5 fish (the 2012 year class) comprising the vast majority by number (87%) and biomass (88%; Tables 10 and 11). Walleye pollock were distributed across the shelf, with areas of greatest density between Unimak Pass and Sanak Island in The Davidson Bank area, between the Shumagin Islands and Shelikof Strait south of Mitrofania Island, and east of Kodiak Island on the western portion of Portlock Bank (Figs. 11-14). The average depth pollock were found was approximately 114 m over waters 188 m deep (Fig. 15).

The estimated amounts of age-1+ pollock for the GOA shelf were 1.67 billion fish weighing 1,124,531 metric tons (t; Table 12), approximately 84% of the total pollock biomass observed in this survey and similar to the 2015 estimate for the shelf. The relative estimation error of the biomass resulting from the 1-D geostatistical analysis was 6.8%.

Sanak Trough

Sanak Trough (Fig. 1) was surveyed on 19 June along 86.7 km (46.8 nmi) of trackline on five transects spaced 7.4 km (4 nmi) apart encompassing a total area of 721.5 km^2 (210.4 nmi^2). Bottom depths in Sanak Trough ranged from 54 to 170 m and averaged 120.2 m. Surface temperatures in Sanak Trough averaged 8.4° C (Fig. 8), 0.6° C cooler than temperatures in 2015. The average temperature at 50 m depth from SBE 39 probes on the fishing gear was 5.5° C (Fig. 9), 0.6° C cooler than in 2015.

Two midwater AWT hauls were conducted in Sanak Trough (Tables 2, 5, and 13; Fig. 1). Walleye pollock was the most abundant species the catch by weight (98.7%) and number (98.5%) and chum salmon was the second most abundant species by weight (0.7%) and number (0.2%). Walleye pollock in Sanak ranged in length from 37 to 56 cm FL with a major mode at 42 cm FL (Tables 8 and 9; Fig. 10). Fish caught in Sanak Trough were aged 2 - 11, with age-5 fish most abundant by number (86%) and biomass (85%; Tables 10 and 11).

The walleye pollock biomass in Sanak Trough was light but evenly distributed across the surveyed area (Fig. 12) and was most abundant at approximately 74 m depth and 47 m above the seafloor (Fig. 15). The estimated amounts of age-1+ pollock for Sanak Trough were 5.58 million fish weighing 3,709 t (Table 12), approximately 20% higher than what was seen in 2015. The relative estimation error of the biomass based on the 1-D geostatistical analysis was 9.9%.

Morzhovoi and Pavlof Bays

Morzhovoi and Pavlof bays (Fig. 1) were surveyed on 19 thru 21 June. Acoustic backscatter in Morzhovoi Bay was measured along 43.0 km (23.3 nmi) of trackline encompassing an area of 326.7 km^2 (95.3 nmi^2), and in Pavlof Bay along 54.1 km (29.2 nmi) of trackline encompassing an area of 425.3 km^2 (124.0 nmi^2). Transects in both bays were spaced 7.4 km (4 nmi) apart and bottom depths ranged from 41 to 135 m and averaged 88.1 m. Morzhovoi and Pavlof bays had average surface temperatures of 8.4° and 8.9° C, respectively (Fig. 8), 0.6° C and 1.3° C cooler respectively than temperatures in 2015. Trawls in these areas did not extend to 100 m depth but temperatures in Morzhovoi Bay at 70 m were 5.8° C, approximately 0.1° C warmer than in 2015, and trawls in Pavlof at 80 m depth were 4.1° C (Fig. 9), approximately 1.6° C cooler than temperatures at a similar depth in 2015.

Biological data and specimens were collected in Morzhovoi Bay from one AWT midwater haul (Tables 2, 5, and 14; Fig. 1). Walleye pollock (including age-0) was the most abundant species caught by weight (99.8%) and number (86.8%; Table 14). Egg yolk jelly (*Phacellophora camtschatica*) was the second most abundant species by weight (3.5%) with other unidentified jellies making up the second most abundant catch by number (6.1%). Walleye pollock in

Morzhovoi Bay ranged from 37 to 56 cm with modes at 43 and 47 cm FL (Tables 8 and 9; Fig. 10). Age-5 pollock accounted for 81% of the total number and 77% of the total biomass in Morzhovoi Bay (Tables 10 and 11).

Backscatter in Morzhovoi Bay attributed to walleye pollock was light and evenly scattered throughout the bay (Fig. 12). Pollock were most abundant between 50 and 100 m depths approximately 17 m above the seafloor (Fig. 15). The estimated amounts of age-1+ pollock for for Morzhovoi Bay were 2.13 million fish weighing 1,606 t (Table 12), approximately a third of what was seen in Morzhovoi Bay in 2015. The relative estimation error of the Morzhovoi biomass based on the 1-D geostatistical analysis was 20.1%.

One midwater AWT was conducted in Pavlof Bay (Tables 2, 5, and 15; Fig. 1). The catch in the AWT was dominated by walleye pollock (96% by weight, 84.2% by number) while Pacific cod (*Gadus microcephalus*) were the second most abundant species by weight (3.6%) and *Cyanea* sp. jellyfish were the second most abundant species by number (15.2%; Table 15). Walleye pollock lengths in Pavlof Bay ranged predominately from 36 to 50 cm FL, with a mode at 44 cm FL (Tables 8 and 9; Fig. 10). Age-5 pollock accounted for 86% by number and 85% by biomass of the Pavlov totals (Tables 10 and 11).

Acoustic backscatter attributed to walleye pollock in Pavlof Bay was light but evenly scattered throughout the survey area (Fig. 12). Pollock was most abundant between 50 and 100 m depths approximately 17 m above the seafloor (Fig. 15). The estimated amounts of age-1+ pollock for Pavlof Bay were 2.06 million fish weighing 1,397 t (Table 12), approximately half of what was seen in the bay in 2015. The relative estimation error of the biomass based on the 1-D geostatistical analysis was 16.6%.

Shumagin Islands

The West Nagai Strait, Unga Strait, Renshaw Point, and Shumagin Trough areas in the Shumagin Islands (Fig. 1) were surveyed from 23 to 26 June. Acoustic backscatter was measured along 351.1 km (189.6 nmi) of trackline from 25 transects encompassing an area of 2,800.5 km^2

(816.5 nmi^2). Transects were spaced 5.6 km (3.0 nmi) apart in West Nagai Strait, Unga Strait, Renshaw Point, and inner Shumagin Trough, and 11.1 km (6.0 nmi) apart in the outer Shumagin Trough area. Bottom depths in the Shumagin Islands area ranged from 53 to 221 m and averaged 138.2 m. Surface water temperatures in the Shumagin Islands area averaged 9.8° C (Fig. 8), 0.7° C cooler than temperatures in 2015. Temperatures at 100 m depth from SBE 39 probes on the fishing gear in this area averaged 4.4° C (Fig. 9), approximately 1.3° C cooler than 2015.

Biological data and specimens were collected in the Shumagin Islands in five midwater AWT hauls (Tables 2, 5, and 16; Fig. 1). Walleye pollock (including age-0) was the most abundant species caught in AWT hauls by weight (99.2%) and number (95.1%; Table 16). Chum salmon was the second most abundant species caught by number (0.4%) and unidentified jellyfish were the second most abundant catch by number (1.9%). Walleye pollock lengths in the Shumagin Islands were divided between two major groups, one ranging from 13 to 19 cm FL and the other from 37 to 53 cm FL with respective modes at 16 and 43 cm FL (Tables 8 and 9; Fig. 10). The shorter age-1 pollock accounted for 95% of the number and 52% of the biomass for the Shumagins total while the larger age-5 fish accounted for 5% of the numbers and 42% of the biomass (Tables 10 and 11).

Walleye pollock in the Shumagin Islands area were most abundant in the Unga Strait and in Shumagin Trough areas (Fig. 12). Pollock were found at depths averaging 74 m and approximately 67 m above the seafloor (Fig. 15). The estimated amounts of age-1+ pollock for the Shumagin Islands area were 229.5 million fish weighing 15,234 t (Table 12), a slight increase (1%) from the 2015 estimate. The relative estimation error of the biomass based on the 1-D geostatistical analysis was 10.1%.

Mitrofania Island

The acoustic trawl survey near Mitrofania Island (Fig. 1) was conducted from 25 June along 58.9 km (31.8 nmi) of trackline from four transects spaced 14.8 km (8.0 nmi) apart encompassing an area of 891.8 km^2 (260.0 nmi^2). Bottom depths near Mitrofania Island ranged from 60 to 172 m and averaged 125.6 m. Surface water temperatures near Mitrofania Island averaged 9.7° C (Fig. 8), 1.0° C cooler than temperatures in 2015. Temperature was not recorded on the trawl in Mitrofania but the temperature at 100 m depth from the SBE 39 probe on the fishing gear on a trawl near the Mitrofania transects was 4.5° C, 1.6° C cooler than in 2015.

Biological data and specimens were collected from one midwater AWT haul in the Mitrofania area (Tables 2, 5, and 17; Fig. 1). Walleye pollock (including age-0) was the most abundant species caught, contributing 98.9% by weight, and 98.2% by number (Table 17). Chum salmon was the second most abundant species by weight (1.1%) in the hauls near Mitrofania and *Cyanea* sp. jellyfish were the second most abundant species caught by number (1.7%). In Mitrofania, pollock lengths were divided between two groups: one ranging from 13 to 19 cm FL and the other from 37 to 48 cm FL with respective modes at 16 and 43 cm FL (Tables 8 and 9; Fig. 10), representing age-1 and age-5 fish, respectively. The age-1 pollock accounted for 10% of the number but only 1% of the biomass for the Mitrofania total while the larger age-5 fish accounted for 81% of the numbers and 90% of the biomass (Tables 10 and 11).

Walleye pollock backscatter was relatively high on all transects in the Mitrofania Island area (Fig. 13) with most backscatter in dense balls between 50 and 100 m depths approximately 53 m above the seafloor (Fig. 15). The estimated amounts of age-1+ pollock for the Mitrofania Island area were 71.0 million fish weighing 41,994 t (Table 12), approximately three times greater than the 2015 estimate. The relative estimation error of the biomass based on the 1-D geostatistical analysis was 13.3%.

Shelikof Strait

The Shelikof Strait sea valley (Fig. 2) was surveyed from 3 to 10 July. Acoustic backscatter was measured along 16 transects spaced at 27.8 km (15 nmi) along 987.9 km (533.4 nmi) of trackline encompassing an area of 27,807.9 km^2 (8107.5 nmi^2). Bottom depths in Shelikof Strait ranged from 44 to 330 m and averaged 189.0 m. Surface water temperatures in Shelikof Strait averaged 11.0° C (Fig. 8), 0.9° C cooler than surface temperatures in 2015. Water temperatures at 100 m depth from SBE 39 probes on the fishing gear averaged 6.1° C (Fig. 9), 0.1° C cooler than in 2015.

Biological data and specimens were collected in Shelikof Strait from nine AWT and two PNE trawls (Tables 2, 5, 18, and 19; Fig. 2). Walleye pollock (including age-0) was the most abundant species captured in the AWT trawls contributing 95.9% by weight and 79.6% by number (Table 18). Eulachon (*Thaleichthys pacificus*) was the second most abundant species caught by weight (2.0%) and number (6.8%) in the AWT trawls in Shelikof Strait. Pacific herring (*Clupea pallasii*) were the most abundant species captured in the PNE trawls by weight (28.4%) but the second most abundant species by number (0.6%). Walleye pollock (including age-0) were the second most abundant species captured in the PNE trawls in Shelikof Strait by weight (28.2%) but the most abundant species captured by number (55.1%). Walleye pollock in Shelikof Strait were divided between two groups, one ranging from 13 to 19 cm FL and the other from 29 to 58 cm FL with respective modes at 16 and 44 cm FL (Tables 8 and 9; Fig. 10). Ages of walleye pollock from Shelikof Strait ranged from 1 to 11-years-old, with age-1 fish comprising 86% of the numbers and 23% of the biomass, while age-5 fish made up 12% of the numbers and 66% of the biomass (Tables 10 and 11).

Walleye pollock were predominately distributed throughout the western and central area of Shelikof Strait from Portage Bay to Katmai Bay area (Fig. 13). In the central portion of the Strait large aggregations of predominately age-1 pollock formed a dense layer in the midwater. Additionally, age-0 pollock were present throughout the entire Strait from the surface to depths as deep as 150 m in some areas. Age 1+ pollock were found on average at depths of approximately 167 m and roughly 54 m above the seafloor (Fig. 15). The estimated amounts of age-1+ pollock for Shelikof Strait were 546.4 million fish weighing 70,053 t (Table 12) which is less than a quarter of the 2015 estimate and the lowest estimate for this area in the summer survey time series (approximately 16% lower than the 2005 series low). The pollock abundance in Shelikof Strait only accounted for approximately 5% of the entire GOA summer survey pollock biomass. The relative estimation error of the biomass based on the 1-D geostatistical analysis was 11.2%.

Nakchamik Island

The waters near Nakchamik Island (Fig. 2) were surveyed on 9 July. Near Nakchamik Island, acoustic backscatter was measured along 46.3 km (25 nmi) of trackline from four transects spaced 14.8 km (8.0 nmi) apart encompassing an area of 713.4 km^2 (208.0 nmi^2). Bottom depths near Nakchamik Island ranged from 40 to 259 m and averaged 140.5 m. Surface water temperatures near Nakchamik Island averaged 10.8° C (Fig. 8), 0.8° C cooler than in 2015. Water temperatures at 100 m depth from the SBE 39 probe on the fishing gear was 6.6° C (Fig. 9), approximately 0.8° C cooler than in 2015.

Biological data and specimens were collected from one midwater AWT haul near Nakchamik Island (Tables 2, 5, and 20; Fig. 2). Walleye pollock was the most abundant species caught, contributing 96.1% by weight and 51.2% by number (Table 19). Chinook salmon (*Oncorhynchus tshawytscha*) was the second most abundant species by weight (2.1%) and Eulachon were the second most abundant species captured by number (33.2%) in the Nakchamik hauls. Pollock captured in the trawl near Nakchamik ranged from 37 and 48 cm with a mode of 43 cm FL (Tables 8 and 9; Fig. 10). Pollock ages ranged from age-2 to 7 with age-5 fish most abundant in number (89%) and biomass (89%; Tables 10 and 11).

Walleye pollock were lightly distributed throughout the Nakchamik region (Fig. 13) and were most abundant at depths of approximately 180 m and 21 m above the seafloor (Fig. 15). The estimated amounts of age-1+ pollock for the Nakchamik area were 0.61 million fish weighing 379 t (Table 12), the lowest seen in this region in the summer survey time series and approximately only 4% of the 2015 estimate. The relative estimation error of the biomass based on the 1-D geostatistical analysis was 15.6%.

Alitak and Deadman Bays

Alitak and Deadman bays (Fig. 2) were surveyed on 12 and 13 July with a zig-zag pattern into the narrow inner bay area. Acoustic backscatter was measured along 73.5 km (39.7 nmi) of trackline encompassing an area of 333.6 km^2 (97.3 nmi^2). Bottom depths ranged from 33 to

176 m and averaged 88.2 m. Surface water temperatures averaged 11.2° C (Fig. 8), 0.8° C cooler than temperatures in 2015. Hauls were shallow and at 50 m depth the temperature was 9.2° C (Fig. 9), approximately 1.4° C warmer than in 2015.

Biological data and specimens were collected from one AWT haul and one PNE haul in Alitak Bay (Tables 2, 5, 21, and 22; Fig. 2). Walleye pollock (including age-0) made up 89.3% by weight and 97.7% by number of the catch from the AWT trawl (Table 20). Lion's mane jellyfish (*Cyanea capillata*) was the second most abundant species captured by weight (6.4%) in Alitak Bay, while capelin (*Mallotus villosus*) were the second most abundant species captured by number (0.8%) in the AWT in Alitak Bay. Walleye pollock (including age-0) made up 95.1% by weight and 98.2% by number of the catch from the PNE trawl in Alitak Bay (Table 21). Lion's mane jellyfish (*Cyanea capillata*) was the second most abundant species captured by weight (3.2%) in the PNE trawl in Alitak Bay, while unidentified shrimp were the second most abundant species captured by number (0.5%). The walleye pollock captured in Alitak Bay ranged in length predominately from 39 to 58 cm FL with a major mode at 47 cm FL (Tables 8 and 9; Fig. 10). Walleye pollock were found on average on average at approximately 95 m depth and 16 m above the seafloor (Fig. 15). Ages of walleye pollock from Alitak Bay ranged from 1 to 12 years old, with age-5 fish most abundant by number (67%) and biomass (62%; Tables 10 and 11).

The estimated amounts of age-1+ pollock for the Alitak/Deadman Bay area were 0.8 million fish weighing 667 t (Table 12), the lowest seen in this region in the summer survey time series and approximately only 11% of the 2015 estimate. The relative estimation error of the biomass based on the 2-D geostatistical analysis was 36.1%.

Chiniak Trough

Chiniak Trough (Fig. 2) was surveyed from 28 to 29 July. Acoustic backscatter was measured along seven transects spaced 11.1 km (6 nmi) apart covering 102.6 km (55.4 nmi; 1,173.0 km^2; 342.0 nmi^2) of trackline. Bottom depths ranged from 72 to 183 m and averaged 131.2 in Chiniak Trough. Surface water temperatures in Chiniak Trough averaged 11.1° C (Fig. 8), 0.2° C cooler than in 2015. Water temperatures at 100 m depth from SBE 39 probes on the fishing gear averaged 6.7° C (Fig. 9), approximately 0.7° C cooler than in 2015.

Biological data and specimens were collected from four AWT hauls in Chiniak Trough (Tables 2, 5, and 23; Fig. 2). Walleye pollock (including age-0) was the dominant species caught, contributing 94.0% by weight and 83.5% by number to the catch (Table 24). Pacific ocean perch were the second most abundant species caught by weight (2.3%) and eulachon were the second most abundant species caught by number (12.8%) in Chiniak Trough. Pollock caught in Chiniak Trough ranged in length predominately from 39 to 57 cm FL, with a mode at 44 cm FL (Tables 8 and 9; Fig. 10). Fish ranged in age from 1 to 11 years old with age-5 fish most abundant by number (87%) and biomass (86%) in Chiniak Trough (Tables 10 and 11).

Patchy, dense aggregations of adult walleye pollock were detected primarily in the northern transects in Chiniak Trough (Fig. 13) and were most abundant at approximately 70 m depth and 60 m above the seafloor (Fig. 15). The estimated amounts of age-1+ pollock for Chiniak Trough were 41.2 million fish weighing 30,131 t (Table 12) was 14% lower than the 2015 estimate. The relative estimation error of the biomass based on the 1-D geostatistical analysis was 19.0%.

Barnabas Trough

Barnabas Trough (Fig. 2) was initially partially surveyed from 14 to 15 July before mechanical issues required the ship to return to port before completing the survey. Once repairs were completed Barnabas Trough was completely surveyed from 31 July thru 1 Aug. along 12 transects spaced 11.1 km (6 nmi) apart encompassing 279.3 km (150.8 nmi; 3,179.5 km^2; 927.0 nmi^2). Depths in Barnabas Trough ranged from 42 to over 1,000 m and averaged 172.8 m. Surface water temperatures in Barnabas Trough averaged 13.1° C (Fig. 8), 0.8° C warmer than in 2015. Water temperatures at 100 m depth from SBE 39 probes on the fishing gear averaged 6.2° C (Fig. 9), approximately 0.4° C cooler than in 2015.

Biological data and specimens were collected in Barnabas Trough initially from three AWT and one PNE haul, and upon returning seven AWT trawls (Tables 2, 5, 24, and 25; Fig. 2). Walleye pollock (including age-0) was the dominant species caught in the AWT hauls, contributing 97.3% by weight and 72.4% of the catch by number (Tables 22 and 23). Pacific ocean perch was the second most abundant species caught by weight (1.4%, 92% of which was caught in haul 124 on the initial visit), and euphausiids were the second most abundant species by number caught (21.5%) in AWT hauls Barnabas Trough. Walleye pollock (including age-0) were the most abundant species caught by weight and number (94.0% and 83.5%, respectively) in the PNE haul in Barnabas Trough. Pacific ocean perch were the second most abundant species caught by weight (2.3%) and eulachon were the second most abundant species caught by number (12.8%) in the PNE in Barnabas Trough. Pollock caught in Barnabas Trough were predominately 38 to 50 cm FL and were dominated by a single mode at 44 cm FL (Tables 8 and 9; Fig. 10). Fish ranged in age from 4 to 12 years old with age-5 fish most abundant by number (90%) and biomass (90%; Tables 10 and 11).

Aggregations of adult walleye pollock were detected primarily in the central transects in Barnabas Trough (Fig. 13) and were most abundant at depths of approximately 97 m and 44 m above the seafloor (Fig. 15). The estimated amounts of age-1+ pollock for Barnabas Trough were 73.2 million fish weighing 49,845 t (Table 12), approximately 4% of the entire GOA summer survey biomass estimate and almost half of the estimated biomass for this area in 2015. The relative estimation error of the biomass based on the 1-D geostatistical analysis was 12.3%.

Marmot Bay

Marmot Bay (Fig. 2) was surveyed 3-4 August. Acoustic backscatter in Marmot Bay was measured along 199.3 km (107.6 nmi) of trackline along 15 transects spaced 3.7 km (2.0 nmi) apart in the inner bay and Spruce Gully, and 7.4 km (4.0 nmi) apart in the outer bay, encompassing a total area of 1,231.3 km^2 (359.0 nmi^2). Bottom depths ranged from about 46 to 268 m and averaged 139.3 m in Marmot Bay. An average surface water temperature in Marmot Bay was 10.7° C (Fig. 8), 0.1° C warmer than in 2015. Water temperatures at 100 m depth from SBE 39 probes on the fishing gear in Marmot Bay averaged 7.0° C (Fig. 9), 1.0° C cooler than in 2015.

Biological data and specimens were collected from five AWT and one PNE haul in Marmot Bay (Tables 2, 5, 26, and 27; Fig. 2). Walleye pollock (including age-0) was the most abundant species caught by weight and number in the AWT hauls in Marmot (97.7% and 86.8%, respectively; Table 21). Lion's mane jellyfish was the second most abundant species captured by weight (0.6%) in the AWT in Marmot Bay, while capelin was the second most abundant species captured by number (8.4%). *Aequorea* sp. jellyfish were the most abundant species captured in the PNE in Marmot Bay by weight (60.8%) and walleye pollock (age-0) were the second most abundant species caught by weight (18.5%) but the most abundant species caught by number (84.0%). Walleye pollock predominately ranged in length from 37 to 56 cm FL with a primary mode at 40 cm FL (Tables 8 and 9; Fig. 10). Walleye pollock from Marmot Bay ranged in age from 1 to 11 years old with age-5 fish most abundant by number (83%) and biomass (81%; Tables 10 and 11).

Backscatter attributed to walleye pollock was light in Marmot Bay with the greatest amounts found in the outer bay (Fig. 13). Pollock were most abundant at depths of approximately 97 m and 44 m above the seafloor (Fig. 15). The estimated amounts of age-1+ pollock for Marmot Bay were 3.7 million fish weighing 2,426 t (Table 12), the lowest estimate for this area in the summer survey time series and only approximately 5% of the 2015 estimate. The relative estimation error of the Marmot biomass based on the 1-D geostatistical analysis was 20.8%.

Pollock Biomass by Management Area

The survey areas outlined above do not necessarily follow the boundaries of the National Marine Fisheries Service (NMFS) reporting areas. Some areas, such as the expansive shelf survey, Mitrofania, and Shelikof Strait extend across multiple reporting areas. Because walleye pollock are managed by reporting area, we have also summarized the survey results based on these units. Table 28 presents the biomass of pollock within each reporting area, along with the geographic survey area from which they were derived, for all pollock and for age-5 fish (between ~38 and 56 cm FL).

The total estimated amounts of age-1+ walleye pollock for the GOA summer acoustic-trawl survey were 2,641 million fish weighing 1,341,973 t (Table 12). The relative estimation error of the overall biomass based on the 1-D geostatistical analysis was 6.4%. The survey spanned four different reporting areas. Pollock biomass was distributed fairly evenly across areas 610, 620, and 630 with 31%, 25% and 37% in each area, respectively, with 5% in 640. However, unlike 2015 when the majority of pollock on the shelf were detected in NMFS reporting area 610, in 2017 approximately 36% of the walleye pollock biomass on the shelf was detected in area 630, and approximately 33% were detected in reporting area 610 (Table 28). Roughly 23% of pollock on the shelf were detected in area 620 and 6% were in area 640. The first transect extended to the west outside of area 610 where approximately 2% of the biomass detected on the shelf were located. Approximately 86% of the total walleye pollock biomass in the entire GOA survey was attributed to age-5 fish (Table 28).

Age-0 Pollock and Uncertainty in Age-1+ Pollock Abundance Estimates

The substantial occurrence of age-0 pollock in mixed aggregations with age-1+ pollock (Fig. 16) in 2017 introduced additional uncertainty into backscatter classification and computation of age-1+ abundance and biomass estimates from the survey. Age-1+ biomass estimates for places with these mixed aggregations are sensitive to the assumptions made to exclude backscatter from age-0 pollock (see 'Correction for the contribution of age-0 pollock to measured backscatter' section), although it is difficult to quantitatively assess the additional uncertainty that resulted. Of the overall age-1+ biomass of 1,341,973 t reported above, approximately 362,515 t (27%) came from these mixed aggregations. By reporting area, approximately 187,236 t (46%) in 610, 153,229 t (45%) in 620, 412 t (<1%) in 630, 383 t (<1%) in 640 came from these mixed aggregations.

Although the survey estimate computed with the correction for age-0 pollock backscatter described above constitutes the best available survey estimate, this introduces uncertainty in the estimate. It is thus informative to consider the sensitivity of the survey estimate to the use of this correction. If the correction was not applied and the acoustic contribution of age-0 pollock is ignored, the pollock biomass would be approximately 2.0 million t (~49% greater than the reported biomass using the correction). However, if all areas where age 0 and age 1+ fish were found to be mixed together are excluded from the biomass estimate, the pollock biomass would be approximately 1.2 million t (~12% lower than the reported biomass using the correction). Thus, the biomass estimate could vary between 1.2 and 2.0 million tons depending on the assumptions made regarding the acoustic contribution of age-0 pollock in this survey.

Multi-Year Relative Height off Bottom

The height of pollock from the seafloor was compared between commonly surveyed areas (Shelikof Strait, Chiniak Trough, and Barnabas Trough) for the GOA-wide surveys conducted in 2013, 2015, and 2017 (Fig. 17). Fish were farther off bottom in 2017 compared to 2013, but in 2015 fish in Barnabas Trough were slightly closer to the bottom comparted to 2013. Fish height off bottom on the shelf was higher in 2015 compared to 2013 but decreased slightly in 2017. The overall biomass in 2013 was dominated by adult fish, 48% of which were in Shelikof Strait, while in 2017 the majority of fish were found on the shelf transects (84%).

Multi-Year Survey Water Temperatures

The only areas that have been surveyed in all six summer GOA AT surveys are Shelikof Strait, Barnabas Trough, and Chiniak Trough. Given differences in equipment and haul locations among those surveys, the temperatures from SBE 39 probes attached to the net during fishing operations provide the only consistent means of comparing temperature among years in these places. Overall mean surface temperatures in 2017 (11.5° C) was comparable to, but slightly lower than, 2015 (12.0° C; Fig. 18, panel a). Summer 2003 had the coolest average surface temperatures (9.4° C) and 2005 had the warmest (12.5° C) for all of these consistently sampled areas.

Mean temperature in 2017 at 100 m depth in the consistently sampled areas (6.1° C) were similar to those in 2003 (6.3° C) and 2005 (6.4° C; Fig. 18, panel b). Summer 2013 had the coolest mean temperatures (5.2° C) at 100 m depth, while summer 2015 had the warmest (6.8° C).

Non-Pollock Backscatter

The GOA AT survey design is intended to encompass the geographic distribution of midwater age-1+ walleye pollock during summer. Other species are encountered, but the survey design may not provide adequate coverage for complete population assessment. Thus, the following distribution and abundance estimates for species other than walleye pollock are not comprehensive and are likely underestimates due to incomplete coverage of the population's geographic extent. Because biennial summer acoustic trawl surveys of the Gulf of Alaska are planned, backscatter from these species is reported to establish a time series of relative abundances and distributions from the survey.

POP/Rockfish

Backscatter characterized as POP or other rockfishes based on trawl catches and backscatter morphology ("haystacks" on the bottom) was present throughout the shelf and in several of the bays (Figs. 19 and 20). Backscatter attributed to POP was primarily located on the outer shelf transects near the shelf break. POP were detected south of Unalaska Island, south of the Shumagin Islands, to the east of the Portlock Bank area, and south west of Yakutat Bay, most often intermixed with pollock in the midwater. POP captured in trawl hauls ranged from 24 cm to 46 cm FL with a minor mode at 28 cm and a larger mode at 36-39 cm (Fig. 21). The majority of POP less than 33 cm FL were captured in two hauls (hauls 8 and 18) to the west near Unimak Pass. The estimated amounts of POP for the 2017 GOA survey area were 305.9 million fish weighing 172,388 t, approximately 40% the 2015 estimate. The relative estimation error of the biomass based on the 1-D geostatistical analysis was 12.7%.

Near bottom aggregations of rockfish (primarily dusky rockfish or northern rockfish) typically extended from the seafloor to approximately 10 - 20 m off the seafloor and were localized and patchy. The frequency response was rather flat in that the response from all frequencies did not differ markedly from 38 kHz (cf. fig. 4 in De Robertis et al. 2010). Several species of rockfishes were captured during trawl operations on the shelf with POP, including harlequin rockfish (*Sebastes variegatus*), rougheye rockfish (*S. aleutianus*), and northern rockfish (*S. polyspinis*).

Rockfish comprised a total of 88.8% of the PNE catch by weight on the shelf, of which 97.7% were POP (Table 7).

Capelin

Capelin were captured in 23 trawls across the GOA survey in 2017 (Fig. 22). No backscatter could be attributed to capelin alone as they were found in mixed aggregations (often including substantial numbers of age-0 pollock) and capelin did not dominate the trawl catch. The largest catches of capelin were in the Marmot Bay area (hauls 156 and 159; 16% and 30% capelin by number respectively) and on the shelf south of the Kenai Peninsula (haul 184; 16% capelin by number). The catch composition from these hauls was dominated by age-0 pollock (Table 29). Capelin comprised less than 5% of the catch by number in all other hauls. Capelin sizes ranged in length from 7.7 cm to 12.2 cm SL and averaged 10.2 cm SL. The abundance of capelin was not estimated from this survey as it was not possible to isolate the backscatter from capelin from that of other sound scatters with any confidence.

Eulachon

Because eulachon lack swimbladders, they do not produce a strong acoustic return (Gauthier and Horne 2004); therefore, they are generally only detected in our surveys when they are caught in trawls. Eulachon were caught in 24 hauls (Fig. 23) with the largest catches (>10% by number) occurring in the central portion of Shelikof Strait (haul 90; 43% eulachon by number), near Nakchamik Island (haul 102; 33% eulachon by number), Chiniak trough (haul 130; 45% eulachon by number), Marmot Bay (haul 158; 15% eulachon by number), and on the shelf south of the Kenai Peninsula (hauls 163 and 178; 35% and 78% eulachon by number, respectively). Species composition of hauls where eulachon were caught were dominated by age-0 and adult pollock (74% of the catch by number combined), while eulachon comprised less than 2% of the catch composition by number and 0.4% of the catch by weight (Table 30). Length of eulachon in catches ranged from 7.0 cm to 20.9 cm FL and averaged 13.7 cm FL. No biomass estimate was calculated for eulachon.

Methot Hauls and Euphausiid Abundance

A total of 32 Methot hauls were conducted over the course of the 2-month survey. Of those, 16 were on the shelf, 2 were in the Shumagin Islands, 2 were in Shelikof Strait, 3 were in Chiniak, seven were in Barnabas, and 2 were in Marmot Bay. Most of the Methot deployments were conducted in pairs with one of each pair conducted with strobed flashing lights to investigate the lights effects on euphausiid catch. Most of the Methot hauls were fished in an oblique manner down through the water column and back to the surface at fixed rates during the light experiments, while others were targeted on suspected euphausiid backscatter layers, and a few were fished very shallow to collect live specimens. The average depth fished was 122 m below the surface and 35 m above the bottom. Catch composition (Table 31) by weight consisted primarily of euphausiids (54.8%; primarily consisting of *Thysanoessa inermis*, *T. spinifera*, and *Euphausia pacifica*) and jellyfish spp. (37%; mainly consisting of *Aequorea* sp.).

Backscatter attributed to euphausiids was found throughout the survey area, but it was patchy in distribution (Fig. 24). Areas of relatively high abundance included the Shelf transects (66% of backscatter), Shelikof Strait (11%), Barnabas Trough (10%), and Shumagin Islands (7%). Unlike previous years, Chiniak Trough and Marmot Bay had relatively low levels of backscatter attributed to euphausiids in 2017. Though surveys since 2013 have covered the shelf from the Islands of Four Mountains to Yakutat, the index reported here is limited to areas that were consistently sampled in all years (Simonsen et al. 2016). Results indicate that highest abundance of euphausiids in the time series was observed in 2011 and the lowest in 2003 (Fig. 24). There was a decline in 2017 relative to the previous survey in 2015, to a value similar to 2003. Barnabas Trough appears to be a local hotspot, as observed in previous surveys (Simonsen et al. 2016).

Additional Projects

Data collections in support of ongoing work that addresses rockfish assessment in untrawlable habitat on the GOA shelf were conducted (contact: darin.jones@noaa.gov, 206-526-4166). Activities included surveying closely-spaced parallel transects within GOA bottom trawl survey grids which defined areas of untrawlable (n = 13) or trawlable (n = 16) bottom type. Data were collected from synchronized ME70 multibeam and EK60 echosounders with accompanying lowered stereo video camera deployments (n = 77) to record bottom type and assess abundance of rockfishes. Operations were conducted during nighttime hours and sampling operations for each grid cell took approximately 3 hours depending on the number of camera deployments at each site (2-3 each).

Engineering field tests of a low-frequency, broadband acoustic scattering system targeting age class discrimination were also performed. This work is supported by ASTWG and is a collaboration between AFSC/MACE, the University of New Hampshire, and NWFSC (Dezhang Chu). Tests were conducted to verify system performance and, where possible, measure backscatter from different walleye pollock age classes. Although valuable system performance measurements were obtained, the data set was insufficient for a detailed investigation of the potential of the methods due to limited observations of different pollock sizes classes. Several gas seeps were also surveyed using the broadband system to investigate characteristics of gas bubble plumes.

On Leg 3, several studies related to euphausiid catchability and TS were conducted. Paired Methot hauls with and without a strobe light were used to detect the effect on capture efficiency. Live euphausiid specimens were collected, the material properties and target strength of these individuals were measured, and the specimens were preserved for lipid analysis on shore subsequent to the cruise. Finally, deployments of lowered stereo cameras were used to observe the euphausiids and their orientation *in situ*. These experiments followed similar work in the eastern Bering Sea during DY1608.

Ovaries from walleye pollock at various maturity stages were collected throughout the survey and preserved in formalin for maturity development analysis (contact: Sandi.Neidetcher@noaa.gov, 206-526-4521). Age-0 and age-1 pollock were frozen at -20° C for age and growth analysis (contact: Annette.Dougherty@noaa.gov, 206-526-6523).

Results for these special projects are to be reported elsewhere.

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TABLES AND FIGURES

Table 1. -- Simrad EK60 38 kHz acoustic system description and settings used during the summer 2017 acoustic-trawl surveys of walleye pollock in the Gulf of Alaska, results from standard sphere acoustic system calibrations conducted in association with the surveys and final analysis parameters.

		System settings	9 June Kalsin Bay Kodiak	16 Aug. Kalsin Bay Kodiak	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)		0.512	--	--	0.512
Transmitted power (W)		2000	--	--	2000
Angle sensitivity	Along	22.67	--	--	22.67
	Athwart	21.29	--	--	21.29
2-way beam angle (dB re 1 steradian)		-20.71	--	--	-20.71
Gain (dB)		22.09	22.09	21.88	21.98
s_A correction (dB)		*-0.63	-0.63	-0.60	-0.62
Integration gain (dB)		21.45	21.45	21.28	21.37
3 dB beamwidth	Along	6.80	6.80	6.75	6.82
	Athwart	7.33	7.33	7.17	7.25
Angle offset	Along	-0.07	-0.07	-0.03	-0.05
	Athwart	-0.07	-0.07	-0.03	-0.05
Post-processing S_v threshold (dB re 1 m^-1)		-70	--	--	-70
Measured standard sphere TS (dB re 1 m^2)		--	-41.66	-42.23	--
Sphere range from transducer (m)		--	45.00	20.00	--
Absorption coefficient (dB/m)		0.0096	0.0097	0.0093	0.0096
Sound velocity (m/s)		1476.0	1476.0	1486.0	1476.0
Water temp at transducer (ºC)		--	7.1	9.7	--

Note: Gain and beam pattern terms are defined in the Operator Manual for Simrad EK60 Scientific echosounder application, which is available from Simrad Strandpromenaden 50, Box 111, N-3191 Horten, Norway.
* s_A correction setting in transceiver for leg 1 was -0.64

Table 2. -- Number of biological samples and measurements collected during the summer 2017 walleye pollock acoustic-trawl survey of the Gulf of Alaska shelf and associated areas.

Haul	Walleye pollock					Capelin	Eulachon	Pacific herring	POP	Dusky rockfish	Other*
no.	Lengths	Weights	Maturity	Otoliths	Ovaries	length/weight	length/weight	length/weight	length/weight	length/weight	length/weight
1	231	50	50	25							
2	25	25	25	25	3						5/1
6	417	50	50	25	1						
7	319	50	50	25	1						3/3
8	4	4	4	4					163/50		7/7
9	299	50	50	25	3						11/11
10	280	50	50	25	1						3/3
15	344	21	21	21							
18	122	50	50	25	4				18/18		2/2
25	330	34	34	30							19/19
26	320	25	25	25	5						7/7
27	119	49	49	24	1						6/6
33	2	2	2	2	1						6/0
34	364	50	50	25							1/1
35	292	48	48	25	1					1/1	6/5
39	214	27	27	27	3						14/0
40	174	50	50	25	4	9/9		2/2			7/2
44	275	27	27	27	3						10/5
46	338	50	50	25	1						16/9
50	242	24	23	23	3						17/3
51	303	50	50	25							40/40
56	61	34	34	8	3				27/27		17/0
57											33/33
58											29/29
63	301	49	49	18	3						12/1
64	335	50	50	15							42/19
65	316	50	50	15	1	21/10					53/26
70	343	52	52	18	4						9/0
71	289	51	50	16	1						57/22
76	349	50	50	21	1						7/0
77	252	38	38	15							1/0
78	212	51	50	25							38/20
80	9	9	9	9							55/22
85	133	54	53	25		18/10	2/2				60/11
86	2	2	2	2		1/1		1/1			45/9

Table 2. -- Cont.

Haul no.	Walleye pollock Lengths	Walleye pollock Weights	Walleye pollock Maturity	Walleye pollock Otoliths	Walleye pollock Ovaries	Capelin length/weight	Eulachon length/weight	Pacific herring length/weight	POP length/weight	Dusky rockfish length/weight	Other* length/weight
87	2	2	1	2		11/11	3/3	35/10			126/40
89	160	48	48	25	3	10/10					28/3
90	146	68	48	52	8		34/13	48/14			50/29
91	381	65	50	45	1		8/8				5/5
92											36/11
93											14/11
94											18/8
95	119	42	17	22		1/1	36/10				67/32
99	173	50	50	50	3	21/12	32/10	1/1			38/18
101	1	1	1								48/23
102	158	52	50	42		12/12	35/9	13/13			22/22
103	326	50	50	40							8/8
105	322	50	50	40						1/1	
109	313	50	50	40					23/23		21/21
110	9	9	9	9					149/36		45/45
111	382	50	50	40	1						46/20
112	333	50	50	40					7/7		63/26
113	313	50	50	35	1						73/11
114	9	9	9	9		36/10		5/5			83/20
118	358	53	52	41	8	40/13	6/3	64/10			107/29
119	75	51	21	26	1	35/10					63/12
124	309	50	50	25							5/5
125	7	7	7	7					127/41		98/36
126	335	50	50	25							31/27
127	284	50	50	25							30/17
128	2	2	2	2		3/3		1/1			57/32
129	1	1	1	1		1/1			40/25		82/49
130	319	60	49	30			52/52		27/26		22/0
131											50/3
132											96/0
133											85/0
134	327	58	58	29	3				62/29		34/12
135	11	11	11	11							73/27
136	64	64	64	25	2	11/11		63/10			39/13
137											77/0

Table 2. -- Cont.

Haul no.	Walleye pollock Lengths	Weights	Maturity	Otoliths	Ovaries	Capelin length/weight	Eulachon length/weight	Pacific herring length/weight	POP length/weight	Dusky rockfish length/weight	Other* length/weight
138											80/0
139	5	5	5	5	2	2/2		4/4			56/31
140	432	50	50	25	2	2/0					80/11
141	11	11	11	11		1/1	23/10		1/1		96/25
142	348	54	50	29		1/	4/0		17/17		12/0
144	1										112/26
145											61/57
146	333	48	48	10					48/25		40/40
147	328	50	50						1/1		24/24
150						22/22					94/4
151	327	61	50	25		25/10			19/19		2/2
152	317	54	54	24	3				4/4		49/4
156	1	1				33/10					78/18
157											104/15
158	7	7	1	6			34/10				44/2
159	3	3	3			27/0	2/2				50/0
160											54/0
161	2	2	2			1/1	10/10				38/0
162						1/0					74/5
163	1	1	1				75/0				174/3
164							4/0				136/0
165											90/0
166											46/15
167	256	50	50	25					47/10	2/2	16/12
168	331	51	50	31					1/1	1/1	2/2
169											83/0
170											126/0
171	158	99	73	38	6		44/10	2/1	4/4		31/19
177									97/37		6/5
178	307	51	51	25			61/10		43/25	1/0	21/2
179											36/0
180											35/0
181							1/0				102/0
182											45/0
184						29/0					64/12

Table 2. -- Cont.

Haul	Walleye pollock					Capelin	Eulachon	Pacific herring	POP	Dusky rockfish	Other*
no.	Lengths	Weights	Maturity	Otoliths	Ovaries	length/weight	length/weight	length/weight	length/weight	length/weight	length/weight
185						5/5		8/8			58/33
190						2/	30/0		1/0		79/0
191								6/3			88/1
196	366	63	63	50			1/1	1/0	49/27		49/11
197											41/0
198								14/			37/0
199						39/11		105/30			58/1
200	47	37	1	11			4/2	75/10		4/4	46/14
201											4/0
202											17/0
209	285	57	57	51	1		1/0		64/64		70/21
212							1/0				56/0
213								114/13		7/7	19/10
214									9/9		23/11
215	309	50	50	41					96/27		
218							1/1				25/1
219								64/25			30/11
	17,030	3,184	2,990	1,815	93	420/186	504/166	626/161	1144/553	17/16	5239/1379

*Lengths and weights were collected from a sample of all species caught in each haul. See species composition by area tables for details.

Table 3. -- Average walleye pollock length (cm) at age (and sample size) for each area of the Gulf of Alaska shelf for all summer acoustic-trawl surveys. Age's were not determined from the 2005 summer GOA survey.

									Age								
Survey	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**18**
2017																	
Alitak	50	19.0			39.0	45.2	49.3	51.3	51.0		62.0						
Barnabas	162	20.5			40.7	44.3	48.6	57.5									
Chiniak	58	21.4			43.5	44.9		51.0									
Marmot	30	20.2				45.1	48.0	51.5	55.3								
Mitrofania	21				47.0	41.9		55.0					60.0				
Morzhovoi	25				43.0	47.4	52.3	50.8									
Nakchamik	42	17.5			43.6	44.2	46.0										
Pavlof	23			37.0		45.0	48.0										
Sanak	52				40.6	42.5				60.0							
Shelikof	223	16.9		37.0	42.1	43.8	48.3	56.5									
Shumagins	82	16.0			42.3	42.9	44.4										
GOA Shelf	#####	19.7	33.7		42.3	44.0	46.8	52.7	58.0		53.5	52.0					
average		**19.1**	**33.7**	**37.0**	**42.3**	**44.0**	**47.4**	**52.7**	**55.0**	**60.0**	**56.3**	**52.0**	**60.0**				
2015																	
Alitak	77	18.9	28.0	33.5	47.8	49.7	53.1	56.4	55.9	62.0	71.5	67.2					
Barnabas	102		35.6	38.7	51.0	51.8	56.5	54.9	60.3	62.1	65.1						
Chiniak	10			33.7		50.3		54.5		59.6							
GOA shelf	573	17.7	27.6	38.0	45.8	49.5	52.1	55.8	57.5	57.3	59.9	56.3	56.8				
Marmot	104	18.7	31.9	39.4	48.9	49.9	58.5	53.8			61.8						
Morzhovoi	70	17.8	31.9	38.5	43.2	45.6	49.1			59.3							
Nakchamik	44	18.4		43.4	48.1	54.8	51.2	61.4	59.0	62.5	62.8	61.8					
PWS	56				52.6	53.5	55.6	56.7	58.8	56.4	58.8	61.0	61.6				
Sanak	30		31.5	35.7													
Shelikof	308		26.8	35.2	42.5	49.4		57.7	56.5	56.6	59.8						
Shumagins	80	14.4	29.7	37.4	46.0	47.9	61.4	60.3	59.1	59.2	59.7						
Kenai	14	18.4	26.7	31.7	48.5	50.4	53.5	55.2	60.6	58.2	59.2						
Yakutat	208					50.1	49.7	56.3	53.6		60.8		56.1				
average		**17.4**	**29.5**	**36.8**	**46.7**	**49.9**	**53.3**	**56.7**	**58.0**	**58.9**	**60.8**	**61.4**	**57.8**				
2013																	
Alitak	51		31.5	32.1	50.0	53.3	54.0	59.7	57.5	61.6	62.5	74.0					
Barnabas	97	20.3	36.0	42.0	47.3	50.9	54.8	55.5	58.0	56.7	58.0	62.0	56.0				
Chiniak	62	21.0			52.0	51.5	54.7	55.7	56.7	53.7	56.0	58.0	60.0				
GOA shelf	352	17.8	31.0	40.4	46.2	51.9	54.3	55.4	56.5	59.0	58.0	61.0			61.0		
Izhut	13		36.3	42.0													
Marmot	16		34.1	38.0		53.0			60.3								
Morzhovoi	72	14.2				55.0		59.1	61.1	62.3	62.1	66.5	66.3	65.5	67.0	70.5	64.0
Nakchamik	60			44.0	50.0	53.3	54.3	54.1	57.8	64.0							
Pavlof	62	15.0	30.0	31.9			63.0	62.0	67.7	67.3	66.8	66.4	70.0	72.5	66.0		
PWS	55	17.8	29.1	42.0	46.4	52.0	54.6	58.6	57.7	55.0							
Sanak	97	14.3	31.4	43.0	44.6	55.0		53.8								73.0	
Shelikof	401	15.1	28.3	38.1	43.0	51.7	53.4	55.1	55.1	57.0							
Shumagins	58	13.5	34.6	45.5			56.6	59.7	60.0						68.0		
Kayak	40			42.7	47.1	49.6	53.0			57.0							
Yakutat	63		36.0	43.8	49.8	50.5	56.6	58.0	54.0				60.0				
average		**16.8**	**30.7**	**39.4**	**46.5**	**52.0**	**54.5**	**56.7**	**58.6**	**59.7**	**61.8**	**65.4**	**65.3**	**67.8**	**65.3**	**71.3**	**64.0**

Table 3. -- Cont.

Survey	n	Age 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	18
2011																	
Alitak	86	19.0	30.1	37.6	48.2	54.5	58.1	59.5	60.5	59.0	70.0						
Barnabas	79			42.0	47.7	54.7	58.5	58.0		73.0							
Chiniak	112			37.0	47.9	53.0	53.8	57.7	67.0								
GOA shelf	334		32.0	38.6	44.9	49.8	53.3	55.0	50.7	63.3	61.5	63.0	62.1	60.3	61.0		
Mitrofania	52			39.1	45.4	50.3	56.0	53.0									
Morzhovoi	29		29.0		42.0	51.7	66.0	63.8	73.0	68.5	65.0	64.0	64.3	62.0		62.0	
Nakchamik	67		30.2	35.8	40.0	56.0	59.0										
Shelikof	328	16.1	27.0	37.6	45.2	50.0	53.8	55.4	54.4		56.5	58.0					
average		**16.1**	**28.1**	**37.4**	**45.6**	**51.6**	**54.9**	**57.2**	**57.1**	**65.3**	**62.0**	**63.1**	**62.6**	**61.1**	**61.0**	**62.0**	
2003																	
Alitak	79	16.3	29.4	39.2	42.6	44.8	50.5	54.5		54.5							
Barnabas	130		33.4	39.4	41.6	43.2											
Chiniak	75	17.3	34.2	38.7	44.4	47.0	55.0	60.7	60.0	64.0	63.0		64.0				
GOA shelf	566	17.3	30.2	37.1	38.7	46.1	52.5	55.2	55.3	54.7	59.0	60.0					
Marmot	84	18.6	34.2	37.8	44.0	52.7	55.0	63.0	64.6	64.2	65.5	63.0					
Nakchamik	28		28.8	34.5	38.0	43.0											
PWS	81	18.0	32.0	37.7	41.7	49.3	53.0	56.0									
Shelikof	269	16.7	26.8	33.1	35.1	40.6	47.0	49.8	51.0								
Shumagins	43	15.7	31.0	36.2	41.6	48.0	58.0	54.5	60.0								
average		**17.0**	**29.3**	**37.4**	**38.7**	**45.2**	**52.2**	**55.1**	**59.0**	**59.1**	**62.8**	**61.0**	**64.0**				
overall average		**17.2**	**29.7**	**37.6**	**42.6**	**45.8**	**53.0**	**56.2**	**58.3**	**59.6**	**61.3**	**63.1**	**63.0**	**64.0**	**64.7**	**69.0**	**64.0**

Table 4. -- Average walleye pollock weight (g) by age for each area of the Gulf of Alaska shelf for all summer acoustic-trawl surveys. Age's were not determined

									Age								
Survey	**n**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**18**
2017																	
Alitak	50	0.06			0.40	0.78	0.96	1.02	0.93		1.59						
Barnabas	162	0.07			0.60	0.71	0.96	1.21									
Chiniak	58	0.08			0.71	0.78		1.03									
Marmot	30	0.07				0.79	1.03	1.27	1.54								
Mitrofania	21				0.86	0.60		1.03					1.05				
Morzhovoi	25				0.55	0.83	0.98	0.86									
Nakchamik	42	0.04			0.63	0.66	0.73										
Pavlof	23			0.39		0.70	0.73										
Sanak	52				0.50	0.59				1.20							
Shelikof	223	0.04		0.43	0.60	0.69	0.84	1.08									
Shumagins	82	0.03			0.59	0.61	0.61										
GOA Shelf	#####	0.06	0.26		0.62	0.68	0.79	1.04	1.34		1.03	0.98					
average		**0.06**	**0.26**	**0.41**	**0.61**	**0.69**	**0.82**	**1.04**	**1.40**	**1.20**	**1.22**	**0.98**	**1.05**				
2015																	
Alitak	77	0.05	0.16	0.27	0.80	0.85	1.08	1.15	1.10	1.70	2.66	1.90					
Barnabas	102		0.36	0.46	1.19	1.04	1.43	1.23	1.46	1.67	1.75						
Chiniak	10			0.30		0.97		1.18		1.35							
GOA shelf	573	0.04	0.17	0.43	0.71	0.87	0.99	1.18	1.24	1.24	1.42	1.08	1.37				
Marmot	104	0.05	0.27	0.50	0.81	0.79	1.20	0.94			1.26						
Morzhovoi	70	0.03	0.25	0.44	0.58	0.65	0.82			1.30							
Nakchamik	44	0.05		0.65	0.81	1.17	0.99	1.57	1.35	1.77	1.67	1.37					
PWS	56				1.05	1.22	1.29	1.32	1.39	1.32	1.50	1.62	1.57				
Sanak	30		0.23	0.33													
Shelikof	308		0.15	0.33	0.58	0.87		1.24	1.20	1.16	1.33						
Shumagins	80	0.02	0.19	0.41	0.77	0.80	1.69	1.53	1.36	1.28	1.40						
Kenai	14					0.93	0.82	1.22	1.14		1.40		1.11				
Yakutat	208	0.05	0.15	0.25	0.91	0.99	1.14	1.19	1.63	1.34	1.51						
average		**0.04**	**0.20**	**0.39**	**0.78**	**0.91**	**1.10**	**1.25**	**1.30**	**1.41**	**1.51**	**1.53**	**1.35**				
2013																	
Alitak	51		0.24	0.24	1.08	1.33	1.27	1.68	1.53	1.83	1.93	2.82					
Barnabas	97	0.06	0.40	0.60	0.97	1.16	1.36	1.34	1.58	1.53	1.70	2.28	1.53				
Chiniak	62	0.07			1.04	1.06	1.28	1.37	1.44	1.27	1.26	1.56	1.90				
GOA shelf	352	0.04	0.24	0.56	0.80	1.16	1.30	1.34	1.37	1.77	1.67	1.76			1.40		
Izhut	13		0.38	0.53													
Marmot	16		0.31	0.40		1.19			1.71								
Morzhovoi	72	0.02				1.42		1.56	1.82	1.73	1.74	2.06	2.04	2.02	2.10	2.56	1.54
Nakchamik	60			0.83	1.24	1.32	1.39	1.39	1.53	1.68							
Pavlof	62	0.03	0.21	0.27			2.13	1.88	2.58	2.40	2.33	2.22	2.54	2.58	2.22		
PWS	55	0.04	0.19	0.64	0.78	1.17	1.36	1.57	1.54	1.24							
Sanak	97	0.02	0.25	0.66	0.74	1.11		1.26								2.21	
Shelikof	401	0.02	0.17	0.45	0.66	1.12	1.18	1.25	1.22	1.27							
Shumagins	58	0.02	0.35	0.79			1.55	1.73	1.73						2.13		
Kayak	40			0.64	0.88	0.94	1.10			1.48							
Yakutat	63		0.37	0.66	0.98	0.97	1.42	1.40	1.06				1.50				
average		**0.04**	**0.23**	**0.51**	**0.83**	**1.16**	**1.32**	**1.43**	**1.60**	**1.67**	**1.83**	**2.14**	**2.06**	**2.21**	**1.82**	**2.44**	**1.54**

Table 4. -- Cont.

Survey	n	Age 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	18
2011																	
Alitak	86	0.05	0.25	0.46	0.95	1.19	1.44	1.65	1.50	1.63	1.90						
Barnabas	79			0.62	0.94	1.28	1.61	1.47		2.09							
Chiniak	112			0.45	0.91	1.18	1.25	1.53	1.86								
GOA shelf	334		0.27	0.49	0.75	0.99	1.17	1.29	0.99	1.53	1.75	1.78	1.62	1.61	1.48		
Mitrofania	52			0.52	0.78	1.05	1.37	1.31									
Morzhovoi	29		0.18		0.57	1.03	1.81	1.83	2.49	2.10	1.83	1.44	1.64	1.53		1.54	
Nakchamik	67		0.20	0.37	0.54	1.07	1.16										
Shelikof	328	0.03	0.15	0.44	0.79	1.06	1.28	1.34	1.25		1.53	1.65					
average		**0.03**	**0.18**	**0.44**	**0.80**	**1.10**	**1.31**	**1.46**	**1.38**	**1.75**	**1.74**	**1.66**	**1.63**	**1.57**	**1.48**	**1.54**	
2003																	
Alitak	79	0.03	0.22	0.53	0.67	0.73	0.94	1.16		1.34							
Barnabas	130		0.30	0.50	0.60	0.67											
Chiniak	75	0.04	0.32	0.45	0.71	0.84	1.39	1.67	1.57	1.84	1.81		1.70				
GOA shelf	566	0.04	0.24	0.42	0.47	0.82	1.14	1.22	1.21	1.18	1.27	1.58					
Marmot	84	0.05	0.31	0.42	0.70	1.15	1.47	1.99	2.28	2.22	2.10	2.50					
Nakchamik	28		0.20	0.31	0.40	0.56											
PWS	81	0.04	0.28	0.45	0.60	1.01	1.08	1.23									
Shelikof	269	0.04	0.16	0.28	0.34	0.51	0.74	0.80	0.77								
Shumagins	43	0.03	0.23	0.37	0.54	0.82	1.24	1.17	1.20								
average		**0.04**	**0.21**	**0.43**	**0.48**	**0.77**	**1.10**	**1.21**	**1.58**	**1.64**	**1.76**	**1.89**	**1.70**				
overall average		**0.04**	**0.21**	**0.43**	**0.65**	**0.78**	**1.17**	**1.34**	**1.47**	**1.54**	**1.63**	**1.80**	**1.74**	**1.84**	**1.77**	**2.22**	**1.54**

Table 5. -- Trawl stations and catch data summary from the summer 2017 Gulf of Alaska shelf walleye pollock acoustic trawl survey aboard the NOAA ship *Oscar Dyson*.

Haul	area	Gear[a]	Date	Time	Duration	Start position		Depth (m)		Temp. (°C)		Walleye pollock		Other
no.		type	(GMT)	(GMT)	(minutes)	Lat. (N)	Long. (W)	gear	bottom	gear[b]	surface[c]	(kg)	number	(kg)
1*	Shelf	AWT	13-Jun	0:49	23.47	52 ° 34.00	170 ° 8.39	215	259		5.5	159.8	231	0.2
2	Shelf	PNE	13-Jun	8:24	1.98	52 ° 37.49	169 ° 24.64	154	162	5.3	8.1	16.0	25	1.2
3*	Shelf	StereoDropCam	13-Jun	11:01	15	52 ° 37.93	169 ° 27.29	248	248		7.0	-	-	-
4	Shelf	StereoDropCam	13-Jun	11:50	15.27	52 ° 37.85	169 ° 25.92	199	204	5.3	7.6	-	-	-
5	Shelf	StereoDropCam	13-Jun	12:49	15.23	52 ° 38.95	169 ° 24.37	192	192	5.3	7.9	-	-	-
6	Shelf	AWT	13-Jun	23:14	12.55	53 ° 3.94	168 ° 13.71	54	96	5.0	7.8	245.9	418	-
7	Shelf	AWT	14-Jun	5:40	36.62	53 ° 9.55	167 ° 33.56	42	100	5.5	7.2	772.5	1339	4.0
8	Shelf	PNE	14-Jun	23:12	9.45	53 ° 29.31	166 ° 16.63	106	113	5.2	7.8	4.3	4	1336.7
9	Shelf	AWT	15-Jun	7:28	11.37	53 ° 49.09	165 ° 46.28	50	81	5.6	7.7	905.6	1401	15.3
10	Shelf	AWT	16-Jun	6:35	22.75	54 ° 15.83	164 ° 34.44	39		5.3		684.2	1154	0.3
11	Shelf	StereoDropCam	16-Jun	10:07	15.23	54 ° 17.92	164 ° 38.29	88	88	5.0	7.0	-	-	-
12	Shelf	StereoDropCam	16-Jun	10:46	15.23	54 ° 16.38	164 ° 39.85	99	100	5.4	7.4	-	-	-
13	Shelf	StereoDropCam	16-Jun	12:39	15.28	54 ° 14.71	164 ° 38.07	98	101	5.7	7.6	-	-	-
14	Shelf	StereoDropCam	16-Jun	13:18	15.22	54 ° 13.96	164 ° 36.65	97	101	5.4	7.4	-	-	-
15	Shelf	AWT	16-Jun	17:55	25.73	53 ° 49.88	164 ° 13.14	53	81	5.1	8.2	487.7	730	-
16	Shelf	Methot	17-Jun	1:05	14.4	53 ° 51.41	163 ° 26.33	154	673	5.4	8.5	-	-	0.6
17	Shelf	Methot	17-Jun	2:35	13.22	53 ° 51.44	163 ° 26.60	157	633	5.4	8.5	-	-	2.8
18	Shelf	PNE	17-Jun	5:17	3.4	53 ° 55.52	163 ° 29.94	73	88	4.5	8.1	88.9	122	8.8
19	Shelf	StereoDropCam	17-Jun	9:17	15.22	54 ° 6.94	163 ° 37.27	88	90	4.8	8.7	-	-	-
20	Shelf	StereoDropCam	17-Jun	9:53	15.22	54 ° 6.94	163 ° 38.77	86	89	4.3	8.7	-	-	-
21	Shelf	StereoDropCam	17-Jun	10:28	15.22	54 ° 6.68	163 ° 40.36	83	85	4.3	8.7	-	-	-
22	Shelf	StereoDropCam	17-Jun	12:21	15.28	54 ° 10.73	163 ° 43.96	77	80	4.3	8.5	-	-	-
23	Shelf	StereoDropCam	17-Jun	13:12	15.23	54 ° 8.63	163 ° 42.29	79	82	4.3	8.6	-	-	-
24	Shelf	StereoDropCam	17-Jun	14:18	15.27	54 ° 10.54	163 ° 42.21	77	79	4.3	8.6	-	-	-
25	Shelf	AWT	17-Jun	16:45	17.67	54 ° 19.24	163 ° 47.99	63	108	4.7	8.6	370.8	619	0.1
26	Shelf	AWT	17-Jun	21:47	5.33	54 ° 28.75	163 ° 56.78	53	82	5.7	9.3	1723.9	2899	0.1
27	Shelf	AWT	18-Jun	6:28	6.58	54 ° 11.14	162 ° 56.50	38	72	5.4	8.7	74.4	120	3.3
28	Shelf	StereoDropCam	18-Jun	9:54	15.22	54 ° 5.41	162 ° 47.51	79	81	4.2	8.4	-	-	-
29	Shelf	StereoDropCam	18-Jun	10:33	15.23	54 ° 4.44	162 ° 49.06	78	82	4.2	8.6	-	-	-
30	Shelf	StereoDropCam	18-Jun	11:07	15.27	54 ° 3.92	162 ° 50.58	79	81	4.2	8.5	-	-	-
31*	Shelf	StereoDropCam	18-Jun	13:03	17.28	54 ° 3.71	162 ° 53.98	79	79		8.5	-	-	-
32	Shelf	StereoDropCam	18-Jun	13:50	15.37	54 ° 4.76	162 ° 51.88	73	76	4.4	8.5	-	-	-
33	Shelf	AWT	18-Jun	20:30	18.2	54 ° 4.82	162 ° 4.60	75	119	4.2	8.3	1.6	2	0.0
34	Shelf	PNE	19-Jun	1:24	22.8	54 ° 11.07	162 ° 8.99	69	85	4.2	8.3	255.5	364	1.2
35	Sanak	AWT	19-Jun	7:17	30.2	54 ° 28.48	162 ° 24.04	43	145	5.6	8.9	587.4	1031	9.2
36	Sanak	StereoDropCam	19-Jun	11:17	15.23	54 ° 30.02	162 ° 30.85	143	145	3.9	8.8	-	-	-
37	Sanak	StereoDropCam	19-Jun	11:59	15.22	54 ° 29.51	162 ° 29.32	142	144	3.9	8.7	-	-	-

Table 5. -- Cont.

Haul no.	area	Gear[a] type	Date (GMT)	Time (GMT)	Duration (minutes)	Start position Lat. (N)	Long. (W)	Depth (m) gear	bottom	Temp. (°C) gear[b]	surface[c]	Walleye pollock (kg)	number	Other (kg)
38	Sanak	StereoDropCam	19-Jun	12:51	15.25	54 ° 30.38	162 ° 27.85	143	147	4.0	8.8	-	-	-
39	Sanak	AWT	19-Jun	17:16	16.37	54 ° 38.47	162 ° 37.98	56	108	5.6	8.5	130.4	214	0.1
40	Morzhovoi	AWT	20-Jun	3:40	20.88	54 ° 55.45	162 ° 57.13	59	137	6.0	8.5	132.2	174	0.4
41	Shelf	StereoDropCam	20-Jun	10:42	15.22	54 ° 33.76	161 ° 49.52	124	127	3.9	8.8	-	-	-
42	Shelf	StereoDropCam	20-Jun	11:20	15.22	54 ° 34.50	161 ° 50.79	126	130	3.9	9.0	-	-	-
43	Shelf	StereoDropCam	20-Jun	12:12	15.27	54 ° 35.21	161 ° 47.93	123	125	4.0	8.8	-	-	-
44	Shelf	AWT	20-Jun	17:09	3	54 ° 23.02	161 ° 31.32	59	83	4.2	8.8	812.7	1376	5.3
45	Shelf	StereoDropCam	21-Jun	0:15	12.95	54 ° 26.68	160 ° 46.07	103	104	5.0	9.1	-	-	-
46	Shelf	AWT	21-Jun	3:01	32.55	54 ° 33.92	160 ° 51.80	98	130	4.8	9.1	######	1587	5.2
47	Pavlof	StereoDropCam	21-Jun	10:46	15.23	55 ° 16.32	161 ° 45.94	108	110	4.0	9.3	-	-	-
48*	Pavlof	StereoDropCam	21-Jun	11:22	15.22	55 ° 16.60	161 ° 44.55	108	108		9.0	-	-	-
49	Pavlof	StereoDropCam	21-Jun	12:12	15.32	55 ° 16.80	161 ° 42.98	108	109	4.0	8.8	-	-	-
50	Pavlof	AWT	21-Jun	18:04	31.32	55 ° 20.16	161 ° 39.02	66	107	4.6	9.7	262.7	408	11.3
51	Shelf	AWT	22-Jun	4:14	25.6	54 ° 47.99	160 ° 15.90	52	85	5.4	9.1	180.1	303	0.5
52	Shelf	StereoDropCam	22-Jun	9:18	15.25	54 ° 37.67	159 ° 54.08	84	86	4.0	9.6	-	-	-
53	Shelf	StereoDropCam	22-Jun	9:56	15.22	54 ° 36.47	159 ° 55.63	86	88	3.9	9.5	-	-	-
54	Shelf	StereoDropCam	22-Jun	10:36	15.22	54 ° 37.53	159 ° 57.24	82	84	4.0	9.5	-	-	-
55	Shelf	StereoDropCam	22-Jun	11:15	15.23	54 ° 37.72	159 ° 55.59	83	85	4.0	9.5	-	-	-
56	Shelf	AWT	22-Jun	19:13	54.35	54 ° 27.58	159 ° 13.51	205	242	5.6	9.7	43.2	61	20.2
57	Shumagins	Methot	23-Jun	5:00	12.18	55 ° 6.27	160 ° 19.61	156	178	3.9	8.6	-	-	6.8
58	Shumagins	Methot	23-Jun	6:12	12.2	55 ° 6.29	160 ° 19.60	157	185	3.9	8.6	-	-	13.2
59	Shumagins	StereoDropCam	23-Jun	9:09	15.23	55 ° 14.09	160 ° 23.89	179	186	4.2	9.0	-	-	-
60	Shumagins	StereoDropCam	23-Jun	9:51	16.23	55 ° 14.32	160 ° 25.33	140	144	4.2	9.4	-	-	-
61	Shumagins	StereoDropCam	23-Jun	10:40	15.23	55 ° 13.40	160 ° 26.81	86	86	4.7	9.6	-	-	-
62	Shumagins	StereoDropCam	23-Jun	11:22	15.22	55 ° 12.10	160 ° 25.48	72	74	4.7	9.1	-	-	-
63	Shumagins	AWT	23-Jun	17:03	13.42	55 ° 5.06	160 ° 17.41	42	84	5.6	8.9	######	1788	1.4
64	Shumagins	AWT	23-Jun	23:53	6.45	55 ° 19.11	160 ° 14.20	114	161	4.8	9.7	794.9	1338	0.4
65	Shumagins	AWT	24-Jun	7:00	28.72	55 ° 24.25	160 ° 30.41	47	98	6.6	10.1	239.9	392	19.9
66	Shumagins	StereoDropCam	24-Jun	10:03	15.22	55 ° 26.24	160 ° 28.63	137	139	3.6	10.2	-	-	-
67	Shumagins	StereoDropCam	24-Jun	10:39	15.22	55 ° 26.21	160 ° 30.16	138	140	3.6	10.1	-	-	-
68	Shumagins	StereoDropCam	24-Jun	11:29	15.22	55 ° 26.91	160 ° 31.65	146	148	3.6	10.2	-	-	-
69	Shumagins	StereoDropCam	24-Jun	12:18	15.28	55 ° 27.16	160 ° 29.95	152	154	3.6	10.2	-	-	-
70	Shumagins	AWT	24-Jun	19:32	25.37	55 ° 33.25	160 ° 3.64	90	170	4.4	10.2	354.0	589	3.2
71	Shumagins	AWT	25-Jun	2:50	29.57	55 ° 25.51	159 ° 30.92	109	158	4.3	10.6	431.6	667	2.0
72	Shumagins	StereoDropCam	25-Jun	8:48	15.25	55 ° 15.43	159 ° 19.31	126	130	3.7	10.5	-	-	-
73	Shumagins	StereoDropCam	25-Jun	9:30	15.22	55 ° 14.94	159 ° 20.99	99	101	4.0	10.1	-	-	-
74	Shumagins	StereoDropCam	25-Jun	10:08	15.22	55 ° 15.60	159 ° 22.57	98	101	3.7	10.3	-	-	-
75*	Shumagins	StereoDropCam	25-Jun	10:43	15.3	55 ° 15.92	159 ° 20.90	130	130		10.3	-	-	-

Table 5. -- Cont.

Haul no.	area	Gear[a] type	Date (GMT)	Time (GMT)	Duration (minutes)	Start position Lat. (N)	Start position Long. (W)	Depth (m) gear	Depth (m) bottom	Temp. (°C) gear[b]	Temp. (°C) surface[c]	Walleye pollock (kg)	Walleye pollock number	Other (kg)
76*	Mitrofania	AWT	25-Jun	19:44	21.27	55 ° 41.13	158 ° 53.26	85	154		9.9	421.9	703	5.2
77	Shelf	AWT	26-Jun	17:47	3.17	55 ° 10.15	158 ° 11.58	96	130	4.4	9.7	1996.0	2867	0.0
78	Shelf	AWT	26-Jun	23:18	30.32	55 ° 35.62	158 ° 32.43	82	134	4.7	9.9	132.6	213	1.4
79*	Shelf	StereoDropCam	27-Jun	2:35	3.83	55 ° 45.33	158 ° 40.89	80	80		9.1	-	-	-
80	Shelf	PNE	27-Jun	3:47	4.13	55 ° 45.52	158 ° 40.88	63	79	5.7	9.1	5.0	9	0.8
81	Shelf	StereoDropCam	27-Jun	8:13	15.28	55 ° 59.58	158 ° 4.91	85	87	5.7	8.2	-	-	-
82	Shelf	StereoDropCam	27-Jun	8:51	15.22	55 ° 59.27	158 ° 6.65	106	109	5.8	8.3	-	-	-
83	Shelf	StereoDropCam	27-Jun	11:03	15.22	55 ° 57.58	158 ° 12.95	160	162	5.1	8.5	-	-	-
84	Shelf	StereoDropCam	27-Jun	11:44	15.23	55 ° 58.27	158 ° 9.91	158	160	5.0	8.5	-	-	-
85	Shelikof	AWT	4-Jul	2:35	41.02	58 ° 46.73	152 ° 47.20	101	174	6.5	9.8	92.0	133	7.3
86	Shelikof	AWT	4-Jul	6:54	12.83	58 ° 57.26	153 ° 11.72	44	147	7.5	9.8	1.5	2	3.8
87	Shelikof	PNE	4-Jul	19:03	9.77	58 ° 31.03	153 ° 39.86	84	93	7.5	10.4	1.3	2	166.3
88&	Shelikof	AWT	4-Jul	22:50	29.87	58 ° 13.79	153 ° 45.86	108	195	6.1	10.5	-	-	-
89	Shelikof	AWT	5-Jul	6:48	10.6	58 ° 1.01	153 ° 59.54	71	201	6.6	11.5	116.3	160	3.8
90	Shelikof	AWT	5-Jul	18:51	25.47	57 ° 43.34	154 ° 49.04	159	238	5.4	11.3	89.2	671	51.6
91	Shelikof	AWT	6-Jul	6:09	36.53	57 ° 22.34	155 ° 42.51	78	279	6.9	11.2	1302.4	2109	1.6
92	Shelikof	AWT	6-Jul	16:52	15.32	57 ° 2.72	155 ° 23.79	31	262	7.3	11.6	-	-	2.5
93	Shelikof	Methot	6-Jul	23:46	15.23	56 ° 44.56	155 ° 11.71	85	95	5.1	12.1	-	-	2.5
94	Shelikof	Methot	7-Jul	1:45	15.23	56 ° 44.54	155 ° 11.56	85	92	5.1	12.0	-	-	14.2
95	Shelikof	AWT	7-Jul	5:08	17.45	56 ° 48.17	155 ° 29.99	159	251	5.1	13.0	270.3	7925	3.4
96	Shelikof	StereoDropCam	7-Jul	9:32	15.23	56 ° 49.01	155 ° 11.28	147	149	4.9	12.5	-	-	-
97	Shelikof	StereoDropCam	7-Jul	10:37	15.23	56 ° 46.71	155 ° 12.85	129	131	5.0	12.6	-	-	-
98	Shelikof	StereoDropCam	7-Jul	11:24	15.23	56 ° 47.22	155 ° 14.51	159	162	5.0	12.5	-	-	-
99	Shelikof	AWT	7-Jul	16:33	16.58	56 ° 55.07	156 ° 6.02	94	203	6.5	12.5	120.1	173	14.4
100	Shelikof	StereoDropCam	8-Jul	7:25	16	56 ° 14.29	156 ° 37.46	17	162	9.7	13.3	-	-	-
101	Shelikof	PNE	8-Jul	17:33	15.43	56 ° 3.77	155 ° 49.11	57	63	7.4	12.8	0.5	1	99.4
102	Nakchamik	AWT	9-Jul	6:54	36.37	56 ° 25.39	158 ° 6.44	88	193	6.9	10.9	101.6	158	4.1
103	Shelf	AWT	9-Jul	18:57	12.3	55 ° 27.72	157 ° 37.63	50	95	5.7	12.1	1852.0	2982	6.9
104	Shelf	StereoDropCam	10-Jul	1:05	20.43	55 ° 1.78	157 ° 16.61	131	134	5.7	11.1	-	-	-
105	Shelf	AWT	10-Jul	6:50	8.28	55 ° 20.66	156 ° 43.70	44	101	7.9	10.6	757.8	1159	1.3
106	Shelf	StereoDropCam	10-Jul	9:55	15.77	55 ° 24.59	156 ° 58.57	92	94	5.9	11.3	-	-	-
107	Shelf	StereoDropCam	10-Jul	10:44	15	55 ° 23.14	156 ° 57.02	92	94	5.8	11.3	-	-	-
108	Shelf	StereoDropCam	10-Jul	11:26	15.27	55 ° 24.01	156 ° 55.40	93	95	5.8	11.3	-	-	-
109	Shelf	AWT	11-Jul	0:59	20.2	55 ° 24.75	155 ° 58.70	129	220	5.8	11.0	517.8	707	18.6
110	Shelf	PNE	11-Jul	4:49	15.23	55 ° 21.72	155 ° 56.27	220	223	5.2	11.3	30.4	42	2319.6
111	Shelf	AWT	11-Jul	19:15	25.75	56 ° 1.72	154 ° 52.04	53	141	6.6	11.1	271.7	396	0.5
112	Shelf	AWT	12-Jul	4:34	14.82	55 ° 58.09	154 ° 0.06	156	289	6.0	11.2	563.5	866	7.4
113	Shelf	AWT	12-Jul	15:57	21.4	56 ° 18.85	154 ° 17.30	51	95	7.4	10.3	702.3	1021	8.0
114	Alitak	AWT	13-Jul	4:34	17.25	56 ° 52.85	154 ° 7.72	32	60	8.5	11.9	6.0	9	3.9

Table 5. -- Cont.

Haul no.	area	Gear[a] type	Date (GMT)	Time (GMT)	Duration (minutes)	Start position Lat. (N)	Start position Long. (W)	Depth (m) gear	Depth (m) bottom	Temp. (°C) gear[b]	Temp. (°C) surface[c]	Walleye pollock (kg)	Walleye pollock number	Other (kg)
115	Alitak	StereoDropCam	13-Jul	10:04	15.33	56 ° 48.14	154 ° 29.73	62	65	8.1	12.0	-	-	-
116	Alitak	StereoDropCam	13-Jul	10:46	15.22	56 ° 47.62	154 ° 28.11	64	65	7.8	11.5	-	-	-
117	Alitak	StereoDropCam	13-Jul	11:26	15.22	56 ° 48.74	154 ° 26.56	70	71	7.6	11.6	-	-	-
118	Alitak	PNE	13-Jul	14:30	15.67	56 ° 49.72	154 ° 26.46	61	72	8.6	11.5	302.9	358	29.1
119	Shelf	AWT	13-Jul	22:01	15.28	56 ° 30.08	153 ° 37.15	120	149	5.5	11.5	151.5	2389	14.7
120&	Barnabas	AWT	14-Jul	6:02	30.58	56 ° 21.43	152 ° 21.08	136	421	6.1	13.0	-	-	-
121	Barnabas	StereoDropCam	14-Jul	9:55	15.25	56 ° 38.20	152 ° 7.74	46	47	8.2	10.7	-	-	-
122	Barnabas	StereoDropCam	14-Jul	10:34	15.22	56 ° 37.82	152 ° 9.32	49	50	8.4	10.8	-	-	-
123	Barnabas	StereoDropCam	14-Jul	11:09	15.27	56 ° 37.40	152 ° 10.93	49	50	8.4	10.7	-	-	-
124	Barnabas	AWT	14-Jul	18:33	30.68	56 ° 28.70	152 ° 16.22	75	258	6.6	11.4	219.2	309	0.5
125	Barnabas	PNE	15-Jul	0:00	5.38	56 ° 36.29	152 ° 27.22	135	144	5.9	12.5	4.7	7	181.5
126	Barnabas	AWT	15-Jul	4:41	25.37	56 ° 43.75	152 ° 20.99	62	164	6.6	12.9	215.3	335	0.9
127	Chiniak	AWT	28-Jul	21:50	34.15	57 ° 42.47	151 ° 57.68	43	99	8.8	11.1	1799.2	2304	19.3
128	Chiniak	AWT	29-Jul	17:08	21.93	57 ° 29.48	151 ° 50.17	67	91	7.9	10.4	1.4	2	31.3
129	Chiniak	AWT	29-Jul	22:23	30.25	57 ° 11.20	151 ° 21.26	109	144	6.3	12.3	0.6	1	67.3
130	Chiniak	AWT	30-Jul	2:18	20.88	57 ° 27.09	151 ° 23.30	114	170	6.7	13.0	2012.7	2546	137.3
131	Chiniak	Methot	30-Jul	6:05	19.52	57 ° 29.16	151 ° 22.90	59	89	7.6	13.0	-	-	7.8
132	Chiniak	Methot	30-Jul	8:31	0.13	57 ° 29.20	151 ° 22.72	78	88	7.5	12.4	-	-	15.5
133	Chiniak	Methot	30-Jul	10:32	0.17	57 ° 29.24	151 ° 22.85	77	89	8.4	11.1	-	-	3.4
134	Shelf	AWT	30-Jul	16:11	20.42	56 ° 54.78	151 ° 33.55	207	242	5.8	13.9	524.5	679	167.0
135	Shelf	PNE	30-Jul	21:06	12.2	57 ° 15.59	151 ° 58.27	66	77	7.8	13.6	8.2	11	18.4
136	Barnabas	AWT	31-Jul	3:46	14.4	57 ° 17.05	152 ° 30.96	81	105	7.7	13.3	50.6	64	4.3
137	Barnabas	Methot	31-Jul	7:05	0.2	57 ° 10.31	152 ° 32.20	81	95	6.9	13.6	-	-	2.8
138	Barnabas	Methot	31-Jul	8:36	0.3	57 ° 10.22	152 ° 32.32	78	92	6.9	13.6	-	-	5.6
139	Barnabas	AWT	31-Jul	17:45	7.03	56 ° 58.65	152 ° 59.09	81	122	8.2	13.4	4.9	5	4.4
140	Barnabas	AWT	31-Jul	22:17	21.58	56 ° 58.00	152 ° 29.47	100	141	6.2	13.6	1393.9	2030	10.3
141	Barnabas	AWT	1-Aug	4:24	6.15	56 ° 46.00	152 ° 25.68	117	179	6.0	13.3	7.4	11	20.7
142	Barnabas	AWT	1-Aug	6:10	16.15	56 ° 52.46	152 ° 25.50	120	153	5.8	13.2	924.4	1322	23.5
143^	Barnabas	Methot	1-Aug	9:24	0.07	56 ° 50.86	152 ° 32.70	140	154	5.8	13.6	-	-	-
144	Barnabas	Methot	1-Aug	10:40	0.18	56 ° 50.83	152 ° 32.78	144	153	5.8	13.4	0.6	1	8.1
145	Barnabas	Methot	1-Aug	12:54	0.38	56 ° 50.81	152 ° 32.82	142	153	5.8	13.4	-	-	5.4
146	Barnabas	AWT	1-Aug	17:54	20.62	56 ° 32.47	152 ° 28.17	160	247	5.9	13.8	326.2	476	44.3
147	Barnabas	AWT	2-Aug	2:23	1.05	56 ° 30.88	152 ° 34.64	107	207	6.6	13.6	895.9	1280	8.2
148%	Barnabas	Methot	2-Aug	4:56	0.12	56 ° 51.17	152 ° 32.77	21	156	10.2	13.6	-	-	-
149%	Barnabas	Methot	2-Aug	5:44	0.3	56 ° 51.56	152 ° 31.88	137	160	5.9	13.5	-	-	-
150	Shelf	AWT	2-Aug	18:27	11.18	57 ° 42.35	150 ° 40.60	66	94	7.7	11.5	-	-	20.6
151	Shelf	AWT	2-Aug	23:34	27.47	58 ° 12.65	151 ° 21.88	121	171	7.1	11.7	2069.8	2728	90.2
152	Marmot	AWT	3-Aug	5:31	5.5	57 ° 57.73	151 ° 49.71	66	92	7.4	12.3	1304.2	1681	10.1
153	Marmot	StereoDropCam	3-Aug	9:41	15.33	58 ° 2.21	152 ° 14.52	136	138	7.1	11.3	-	-	-

Table 5. -- Cont.

Haul no.	area	Gear[a] type	Date (GMT)	Time (GMT)	Duration (minutes)	Start position Lat. (N)	Start position Long. (W)	Depth (m) gear	Depth (m) bottom	Temp. (°C) gear[b]	Temp. (°C) surface[c]	Walleye pollock (kg)	Walleye pollock number	Other (kg)
154	Marmot	StereoDropCam	3-Aug	10:32	15.27	58 ° 2.40	152 ° 12.92	142	143	7.0	11.0	-	-	-
155	Marmot	StereoDropCam	3-Aug	11:22	15.42	58 ° 1.61	152 ° 14.44	127	128	7.0	11.2	-	-	-
156	Marmot	AWT	3-Aug	16:28	6.4	57 ° 56.33	152 ° 39.79	75	109	7.8	10.3	0.04	1	13.5
157	Marmot	AWT	3-Aug	20:50	6.4	57 ° 59.44	152 ° 32.54	78	178	8.2	11.7	-	-	4.5
158	Marmot	AWT	4-Aug	0:37	7	57 ° 59.13	152 ° 18.97	129	237	7.0	10.1	1.3	7	10.3
159	Marmot	AWT	4-Aug	5:30	3.05	57 ° 59.93	152 ° 4.146	80	176	6.9	11.5	1.5	3	7.9
160	Marmot	Methot	4-Aug	7:44	0.13	57 ° 57.79	151 ° 55.49	171	183	6.3	11.5	-	-	7.6
161	Marmot	Methot	4-Aug	9:30	0.28	57 ° 57.83	151 ° 55.53	173	183	6.3	11.6	1.6	2	8.7
162	Marmot	PNE	4-Aug	17:46	14.45	58 ° 4.82	151 ° 57.86	81	91	7.9	11.2	-	-	20.3
163	Shelf	AWT	5-Aug	6:05	11.3	58 ° 37.51	150 ° 55.32	112	202	5.9	12.8	0.9	1	18.1
164	Shelf	Methot	5-Aug	8:06	0.35	58 ° 36.74	150 ° 54.64	182	194	5.8	12.6	-	-	13.5
165	Shelf	Methot	5-Aug	9:47	-0.13	58 ° 36.75	150 ° 54.5	182	194	5.8	12.4	-	-	14.6
166	Shelf	AWT	5-Aug	17:48	2.18	58 ° 9.22	150 ° 18.33	76	140	7.5	13.8	-	-	4.8
167	Shelf	AWT	6-Aug	2:05	16.35	57 ° 58.64	149 ° 3.456	213	426	5.6	14.6	273.4	369	57.8
168	Shelf	AWT	6-Aug	6:26	1.28	58 ° 18.29	149 ° 29.82	119	145	6.0	13.3	604.6	768	2.7
169	Shelf	Methot	6-Aug	8:37	0.22	58 ° 18.08	149 ° 29.65	136	143	6.1	13.1	-	-	7.4
170	Shelf	Methot	6-Aug	9:59	0.3	58 ° 17.98	149 ° 29.71	132	141	6.2	12.7	-	-	10.2
171	Shelf	AWT	6-Aug	21:19	12.87	59 ° 13.32	150 ° 46.78	219	254	6.5	14.4	107.6	1001	13.1
172	Shelf	StereoDropCam	7-Aug	8:22	14.48	58 ° 33.23	148 ° 44.69	119	121	6.1	14.7	-	-	-
173	Shelf	StereoDropCam	7-Aug	9:16	15.7	58 ° 32.57	148 ° 46.25	116	118	6.1	14.6	-	-	-
174	Shelf	StereoDropCam	7-Aug	10:13	15.38	58 ° 31.17	148 ° 44.48	116	118	6.1	14.6	-	-	-
175	Shelf	StereoDropCam	7-Aug	12:45	15.32	58 ° 33.11	148 ° 49.46	112	114	6.1	14.2	-	-	-
176	Shelf	StereoDropCam	7-Aug	13:33	17.57	58 ° 32.17	148 ° 51.13	112	113	6.2	14.3	-	-	-
177	Shelf	AWT	7-Aug	20:42	12.12	58 ° 48.35	148 ° 13.32	185	310	5.7	15.3	-	-	197.2
178	Shelf	AWT	8-Aug	0:48	16.55	59 ° 0.94	148 ° 30.23	207	233	5.4	14.8	424.9	635	84.7
179	Shelf	Methot	8-Aug	3:31	25.4	59 ° 6.00	148 ° 36.76	108	205	6.5	15.2	-	-	3.9
180	Shelf	Methot	8-Aug	4:45	25.45	59 ° 6.01	148 ° 36.71	97	204	6.5	15.2	-	-	13.1
181	Shelf	Methot	8-Aug	6:46	0.22	59 ° 5.87	148 ° 36.16	187	198	5.6	15.1	-	-	5.5
182	Shelf	Methot	8-Aug	8:15	0.23	59 ° 6.17	148 ° 37.26	170	181	5.7	15.1	-	-	3.5
183	Shelf	StereoDropCam	8-Aug	10:03	1.32	59 ° 5.86	148 ° 37.09	170	186	5.6	15.3	-	-	-
184	Shelf	AWT	8-Aug	16:50	8.3	59 ° 21.76	148 ° 59.79	119	192	6.0	15.0	-	-	4.5
185	Shelf	AWT	8-Aug	20:24	12.07	59 ° 36.28	149 ° 21.59	150	237	6.1	15.2	-	-	9.2
186	Shelf	StereoDropCam	9-Aug	0:22	15.22	59 ° 39.81	149 ° 27.52	257	257	6.0	15.1	-	-	-
187	Shelf	StereoDropCam	9-Aug	1:39	15.37	59 ° 41.24	149 ° 25.97	163	164	6.0	15.1	-	-	-
188	Shelf	StereoDropCam	9-Aug	2:27	15.28	59 ° 41.60	149 ° 24.44	166	166	6.0	15.4	-	-	-
189	Shelf	StereoDropCam	9-Aug	3:47	9.05	59 ° 41.60	149 ° 24.19	142	170	6.2	15.3	-	-	-
190	Shelf	AWT	9-Aug	23:48	4.28	59 ° 29.77	146 ° 56.79	153	213	6.0	15.3	-	-	6.2
191	Shelf	AWT	10-Aug	3:10	15.07	59 ° 49.89	146 ° 55.67	76	97	7.9	15.5	-	-	6.9
192	Shelf	StereoDropCam	10-Aug	8:44	15.23	60 ° 7.21	146 ° 42.35	111	113	6.6	14.6	-	-	-

Table 5. -- Cont.

Haul no.	area	Gear[a] type	Date (GMT)	Time (GMT)	Duration (minutes)	Start position Lat. (N)	Long. (W)	Depth (m) gear	bottom	Temp. (°C) gear[b]	surface[c]	Walleye pollock (kg)	number	Other (kg)
193	Shelf	StereoDropCam	10-Aug	9:48	15.38	60 ° 7.62	146 ° 43.75	113	115	6.7	14.6	-	-	-
194^	Shelf	AWT	10-Aug	20:48	0.48	59 ° 29.00	146 ° 6.22		109		16.2	-	-	-
195^	Shelf	AWT	11-Aug	4:16	0.08	59 ° 31.72	145 ° 11.59		122		16.8	-	-	-
196	Shelf	AWT	11-Aug	5:55	5.28	59 ° 28.45	145 ° 15.61	187	356	5.9	16.3	1579.6	2111	46.2
197	Shelf	Methot	11-Aug	9:24	0.25	59 ° 28.67	145 ° 13.90	144	184	6.1	16.3	-	-	5.6
198	Shelf	Methot	11-Aug	10:49	0.18	59 ° 28.66	145 ° 14.03	143	185	6.1	16.3	-	-	6.0
199	Shelf	AWT	11-Aug	15:41	11.32	59 ° 32.82	145 ° 16.83	90	114	6.3	16.2	-	-	124.9
200	Shelf	AWT	11-Aug	19:13	3.23	59 ° 48.76	145 ° 17.71	91	118	6.1	16.1	2.9	37	36.2
201	Shelf	Methot	12-Aug	2:56	25.38	59 ° 40.40	144 ° 28.15	128	142	6.2	16.1	-	-	5.1
202	Shelf	Methot	12-Aug	4:17	25.4	59 ° 40.48	144 ° 28.42	122	145	6.2	15.8	-	-	16.7
203	Shelf	StereoDropCam	12-Aug	5:47	13.18	59 ° 40.31	144 ° 27.47	82	144	7.1	15.6	-	-	-
204	Shelf	StereoDropCam	12-Aug	6:12	9.4	59 ° 40.26	144 ° 27.76	68	144	7.1	15.7	-	-	-
205	Shelf	StereoDropCam	12-Aug	8:31	15.38	59 ° 41.23	144 ° 23.13	143	144	6.1	15.0	-	-	-
206	Shelf	StereoDropCam	12-Aug	9:23	15.13	59 ° 40.18	144 ° 24.91	147	149	6.0	15.2	-	-	-
207	Shelf	StereoDropCam	12-Aug	11:53	15.35	59 ° 41.60	144 ° 31.78	142	143	6.2	15.3	-	-	-
208	Shelf	StereoDropCam	12-Aug	12:49	15.25	59 ° 39.63	144 ° 34.94	146	148	6.1	15.9	-	-	-
209	Shelf	AWT	13-Aug	2:10	12.63	59 ° 40.11	142 ° 48.56	283	319	4.9	14.9	686.7	858	195.8
210	Shelf	StereoDropCam	13-Aug	6:03	10.95	59 ° 45.11	142 ° 47.90	91	199	6.5	15.3	-	-	-
211	Shelf	StereoDropCam	13-Aug	6:44	20.85	59 ° 45.44	142 ° 47.64	56	199	7.4	15.3	-	-	-
212	Shelf	Methot	13-Aug	8:05	9.6	59 ° 44.85	142 ° 48.20	50	197	7.7	15.3	-	-	4.8
213	Shelf	AWT	13-Aug	16:25	15.95	59 ° 48.10	142 ° 0.83	56	86	7.9	14.5	-	-	183.7
214	Shelf	AWT	13-Aug	21:03	12.62	59 ° 18.87	141 ° 59.14	213	245	5.2	14.7	-	-	9.7
215	Shelf	AWT	14-Aug	2:15	0.95	58 ° 58.65	141 ° 9.62	245	693	4.9	15.0	425.6	527	274.7
216	Shelf	StereoDropCam	14-Aug	6:40	10.23	59 ° 19.66	141 ° 10.62	53	284	7.8	15.5	-	-	-
217	Shelf	StereoDropCam	14-Aug	7:06	20.15	59 ° 19.52	141 ° 10.95	51	286	8.0	15.5	-	-	-
218	Shelf	Methot	14-Aug	8:18	10.13	59 ° 19.79	141 ° 9.17	48	278	7.9	15.3	-	-	2.7
219	Shelf	AWT	14-Aug	15:56	7.3	59 ° 37.48	141 ° 9.75	52	88	8.5	15.5	-	-	82.4

[a]AWT = Aleutian wing trawl, PNE = Poly nor'eastern bottom trawl, Methot = Methot trawl, StereoDropCam = camera drop on un/trawlable areas to verify bottom type determined using ME70.

[b]Temperature from SBE39 placed on headrope of trawls and on camera frame for stereo drop cam.

[c]shipboard sensor at 1.4 m depth.

^Haul aborted due to gear malfunction or to replace gear

*Haul has no SBE39 data

%Haul performed to retain live specimens

&Haul deployed with open codend to sample multiple layers with stereo camera

Table 6. -- Summary of catch by species in 47 Aleutian wing trawls conducted in midwater during the summer 2017 walleye pollock acoustic-trawl survey of the Gulf of Alaska shelf.

		Weight		Number	
Common name	Scientific name	kg.	Percent	Nos.	Percent
walleye pollock	*Gadus chalcogrammus*	21,157.7	92.4	34,553	30.8
Pacific ocean perch	*Sebastes alutus*	1,054.4	4.6	1,684	1.5
Pacific herring	*Clupea pallasii*	370.7	1.6	9,419	8.4
eulachon	*Thaleichthys pacificus*	57.8	0.3	3,689	3.3
walleye pollock age-0	*Gadus chalcogrammus*	43.7	0.2	31,238	27.9
lions mane jelly	*Cyanea capillata*	38.5	0.2	216	0.2
dusky rockfish	*Sebastes variabilis*	35.0	0.2	16	<0.1
chum salmon	*Oncorhynchus keta*	28.0	0.1	13	<0.1
unid. pelagic hydrozoan sp.	*Aequorea* sp.	20.4	<0.1	720	0.6
chinook salmon	*Oncorhynchus tshawytscha*	12.9	<0.1	9	<0.1
lanternfish unid.	*Stenobrachius* sp.	8.8	<0.1	1,057	0.9
Pacific cod	*Gadus macrocephalus*	8.7	<0.1	163	0.1
capelin	*Mallotus villosus*	7.3	<0.1	1,033	0.9
pink salmon	*Oncorhynchus gorbuscha*	7.2	<0.1	5	<0.1
magistrate armhook squid	*Berryteuthis magister*	6.0	<0.1	80	0.1
comb jelly unid.	Ctenophora (phylum)	6.0	<0.1	348	0.3
arrowtooth flounder	*Atheresthes stomias*	5.8	<0.1	7	<0.1
euphausiid unid.	Euphausiacea (order)	5.2	<0.1	26,024	23.2
northern rockfish	*Sebastes polyspinis*	5.1	<0.1	6	<0.1
shortraker rockfish	*Sebastes borealis*	4.5	<0.1	1	<0.1
spiny dogfish	*Squalus suckleyi*	4.3	<0.1	2	<0.1
coho salmon	*Oncorhynchus kisutch*	3.4	<0.1	3	<0.1
Atka mackerel	*Pleurogrammus monopterygius*	2.8	<0.1	3	<0.1
northern smoothtongue	*Leuroglossus schmidti*	2.1	<0.1	96	0.1
jellyfish unid.	Scyphozoa (class)	1.9	<0.1	197	0.2
smooth lumpsucker	*Aptocyclus ventricosus*	1.6	<0.1	2	<0.1
egg yolk jelly unid.	*Phacellophora* sp.	1.2	<0.1	5	<0.1
squid unid.	Cephalopoda (class)	1.2	<0.1	167	0.1
blackspotted rockfish	*Sebastes melanostictus*	0.9	<0.1	1	<0.1
shrimp unid.	Malacostraca (class)	0.7	<0.1	500	0.4
redstripe rockfish	*Sebastes proriger*	0.7	<0.1	1	<0.1
northern sea nettle	*Chrysaora melanaster*	0.6	<0.1	10	<0.1
moon jelly	*Aurelia labiata*	0.4	<0.1	17	<0.1
moon jelly unid.	*Aurelia* sp.	0.4	<0.1	4	<0.1
sea nettle unid.	*Chrysaora* sp.	0.4	<0.1	2	<0.1
Pacific glass shrimp	*Pasiphaea pacifica*	0.3	<0.1	403	0.4
lions mane jelly unid.	*Cyanea* sp.	0.2	<0.1	20	<0.1
salmon unid.	Oncorhynchus (genus)	0.2	<0.1	2	<0.1
isopod unid.	Isopoda (order)	0.1	<0.1	142	0.1
rockfish unid.	Sebastes (genus)	0.1	<0.1	61	0.1
Berry armhook squid	*Gonatus berryi*	0.1	<0.1	36	<0.1
California market squid	*Doryteuthis opalescens*	0.1	<0.1	3	<0.1
Pyrosoma atlanticum	*Pyrosoma atlanticum*	0.1	<0.1	16	<0.1
Pacific lamprey	*Lampetra tridentata*	0.1	<0.1	1	<0.1
flatfish larvae	*Pleuronectiform larvae*	<0.1	<0.1	26	<0.1
eelpout unid.	Zoarcidae (family)	<0.1	<0.1	8	<0.1
prowfish	*Zaprora silenus*	<0.1	<0.1	7	<0.1
lanternfish unid.	*Tarletonbeania* sp.	<0.1	<0.1	1	<0.1

Table 6. -- cont.

Common name	Scientific name	Weight kg.	Weight Percent	Number Nos.	Number Percent
prickleback unid.	Stichaeidae (family)	<0.1	<0.1	2	<0.1
rex sole larvae	*Glyptocephalus zachirus* larvae	<0.1	<0.1	2	<0.1
darkfin sculpin	*Malacocottus zonurus*	<0.1	<0.1	1	<0.1
sand lance unid.	Ammodytes (genus)	<0.1	<0.1	1	<0.1
Dover sole	*Microstomus pacificus*	<0.1	<0.1	1	<0.1
		22,907.6		112,023	

Table 7. -- Summary of catch by species in seven Poly Nor'eastern bottom trawls conducted during the summer 2017 walleye pollock acoustic-trawl survey of the Gulf of Alaska shelf.

Common name	Scientific name	Weight kg.	Weight Percent	Number Nos.	Number Percent
Pacific ocean perch	*Sebastes alutus*	3,549.3	86.7	6,568	41.5
walleye pollock	*Gadus chalcogrammus*	408.3	10.0	577	3.6
harlequin rockfish	*Sebastes variegatus*	72.6	1.8	149	0.9
rougheye rockfish	*Sebastes aleutianus*	8.0	0.2	9	0.1
Unident. pelagic hydrozoan sp.	*Aequorea* sp.	8.0	0.2	317	2.0
Pacific halibut	*Hippoglossus stenolepis*	7.1	0.2	5	<0.1
walleye pollock age-0	*Gadus chalcogrammus*	5.6	0.1	8,000	50.5
prowfish	*Zaprora silenus*	5.4	0.1	5	<0.1
rex sole	*Glyptocephalus zachirus*	4.8	0.1	9	0.1
sablefish	*Anoplopoma fimbria*	4.7	0.1	5	<0.1
northern rockfish	*Sebastes polyspinis*	4.6	0.1	5	<0.1
lions mane jelly	*Cyanea capillata*	4.5	0.1	36	0.2
Atka mackerel	*Pleurogrammus monopterygius*	3.3	0.1	3	<0.1
rosethorn rockfish	*Sebastes helvomaculatus*	2.1	0.1	5	<0.1
egg yolk jelly	*Phacellophora camtschatica*	1.8	<0.1	1	<0.1
darkfin sculpin	*Malacocottus zonurus*	1.2	<0.1	19	0.1
jellyfish unid.	Scyphozoa (class)	1.1	<0.1	70	0.4
pink salmon	*Oncorhynchus gorbuscha*	0.9	<0.1	1	<0.1
blackspotted rockfish	*Sebastes melanostictus*	0.7	<0.1	1	<0.1
smooth lumpsucker	*Aptocyclus ventricosus*	0.6	<0.1	5	<0.1
egg yolk jelly unid.	*Phacellophora* sp.	0.3	<0.1	1	<0.1
graceful decorator crab	*Oregonia gracilis*	0.1	<0.1	5	<0.1
comb jelly unid.	Ctenophora (phylum)	<0.1	<0.1	2	<0.1
moon jelly unid.	*Aurelia* sp.	<0.1	<0.1	1	<0.1
isopod unid.	Isopoda (order)	<0.1	<0.1	25	0.2
euphausiid unid.	Euphausiacea (order)	<0.1	<0.1	7	<0.1
fish larvae unid.	Actinopterygii (class)	<0.1	<0.1	3	<0.1
flatfish larvae	Pleuronectiform larvae	<0.1	<0.1	2	<0.1
squid unid.	Cephalopoda (class)	<0.1	<0.1	1	<0.1
		4,094.9		15,835	

Table 8. -- Number-at-length estimates (millions) by area from acoustic-trawl surveys of walleye pollock during the 2017 summer GOA survey.

Length	Shelf	Sanak	Morzhovoi	Pavlof	Shumagins	Mitrofania	Nakchamik	Shelikof	Alitak/ Deadman	Chiniak	Barnabas	Marmot	Total
10	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	4.26	0.13	-	9.19	-	-	-	-	13.58
14	-	-	-	-	10.66	0.33	-	22.95	-	-	-	-	33.95
15	-	-	-	-	36.25	1.14	-	77.94	-	-	-	-	115.32
16	0.27	-	-	0.01	70.38	2.21	-	152.13	-	-	-	-	225.00
17	1.58	-	-	-	70.37	2.21	-	151.42	-	-	-	-	225.58
18	2.89	-	-	-	14.93	0.47	-	32.29	-	-	-	-	50.58
19	6.53	-	-	-	10.66	0.33	-	22.98	<0.01	0.02	-	<0.01	40.52
20	6.95	-	-	-	-	-	-	-	-	0.03	-	<0.01	6.99
21	3.89	-	-	-	-	-	-	-	-	0.07	-	<0.01	3.96
22	0.51	-	-	-	-	-	-	-	-	0.07	-	-	0.58
23	0.88	-	-	-	-	-	-	-	-	-	-	-	0.88
24	0.15	-	-	-	-	-	-	-	-	-	-	-	0.15
25	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	<0.01	-	-	-	-	<0.01
30	-	-	-	-	-	-	-	-	-	-	-	-	-
31	0.01	-	-	-	-	-	-	-	-	-	-	-	0.01
32	-	-	-	-	-	-	-	-	-	-	-	-	-
33	0.01	-	-	-	-	-	-	-	-	-	-	-	0.01
34	-	-	-	0.01	-	-	-	<0.01	-	-	-	-	0.01
35	-	-	-	-	-	-	-	0.58	-	-	-	-	0.58
36	0.39	-	-	0.03	-	-	-	-	-	-	-	-	0.42
37	1.86	0.01	0.01	0.01	0.01	0.03	<0.01	<0.01	<0.01	-	-	0.01	1.94
38	5.30	0.03	0.01	0.03	0.11	0.10	0.01	0.06	-	-	0.13	0.21	5.98
39	17.20	0.09	0.02	0.04	0.36	0.33	0.02	1.16	0.01	0.05	0.48	0.28	20.05
40	43.59	0.35	0.09	0.07	1.16	0.99	0.05	2.32	0.01	0.40	1.57	0.57	51.16
41	136.65	0.52	0.08	0.20	1.58	7.40	0.08	4.25	0.01	1.07	5.13	0.49	157.46
42	223.28	1.05	0.22	0.29	2.21	14.21	0.13	12.28	0.03	2.59	10.68	0.24	267.21
43	301.28	0.86	0.27	0.31	2.49	14.54	0.15	10.73	0.03	4.86	13.59	0.24	349.36

Table 8. -- Continued.

Length	Shelf	Sanak	Morzhovoi	Pavlof	Shumagins	Mitrofania	Nakchamik	Shelikof	Alitak/ Deadman	Chiniak	Barnabas	Marmot	Total
44	288.33	0.78	0.19	0.32	1.79	7.54	0.09	16.96	0.07	8.00	15.54	0.31	339.92
45	226.65	0.52	0.25	0.26	1.14	0.95	0.05	7.60	0.06	7.35	12.07	0.45	257.35
46	189.88	0.46	0.25	0.16	0.58	11.99	0.01	7.65	0.08	7.63	8.51	0.26	227.47
47	117.68	0.48	0.27	0.16	0.32	6.03	0.01	5.79	0.09	3.80	4.02	0.24	138.89
48	55.11	0.15	0.10	0.09	0.09	0.03	<0.01	4.63	0.08	2.19	0.91	0.14	63.52
49	21.49	0.07	0.11	0.04	0.05	<0.01	-	1.16	0.05	1.23	0.23	0.06	24.49
50	12.26	0.09	0.07	0.01	0.01	-	-	0.00	0.07	0.79	0.16	0.07	13.52
51	7.59	0.03	0.04	-	0.01	-	-	1.16	0.07	0.25	<0.01	0.01	9.15
52	3.77	0.02	0.03	0.02	-	-	-	<0.01	0.06	0.14	-	0.02	4.05
53	3.83	0.02	0.03	-	0.03	<0.01	-	-	0.02	0.35	0.03	0.05	4.35
54	0.99	0.03	0.04	-	-	-	-	0.58	0.02	0.14	-	0.01	1.82
55	0.62	0.02	0.04	0.01	-	-	-	-	0.01	-	0.13	0.02	0.85
56	0.06	0.01	0.01	-	-	-	-	-	<0.01	0.09	0.02	0.01	0.20
57	0.03	-	-	-	-	-	-	-	<0.01	0.14	-	-	0.17
58	0.27	-	-	-	-	-	-	0.58	<0.01	-	-	-	0.86
59	0.22	-	-	-	-	-	-	-	-	-	-	-	0.22
60	-	-	-	-	-	-	-	-	-	-	<0.01	-	<0.01
61	-	-	-	-	-	-	-	-	-	-	-	-	-
62	-	-	-	0.01	-	-	-	-	<0.01	-	-	-	0.01
63	-	-	-	-	-	-	-	-	-	-	-	-	-
64	-	-	-	-	-	-	-	-	-	-	-	-	-
65	-	-	-	-	-	-	-	-	-	-	-	-	-
66	-	-	-	-	-	-	-	-	-	-	-	-	-
67	-	-	-	-	-	-	-	-	-	-	-	-	-
68	-	-	-	-	-	-	-	-	-	-	-	-	-
69	-	-	-	-	-	-	-	-	-	-	-	-	-
70	-	-	-	-	-	-	-	-	-	-	-	-	-
71	-	-	-	-	-	-	-	-	-	-	-	-	-
72	-	-	-	-	-	-	-	-	-	-	-	-	-
73	-	-	-	-	-	-	-	-	-	-	-	-	-
74	-	-	-	-	-	-	-	-	-	-	-	-	-
75	-	-	-	-	-	-	-	-	-	-	-	-	-
76	-	-	-	-	-	-	-	-	-	-	-	-	-
77	-	-	-	-	-	-	-	-	-	-	-	-	-
78	-	-	-	-	-	-	-	-	-	-	-	-	-
79	-	-	-	-	-	-	-	-	-	-	-	-	-
80	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1,682.00	5.58	2.13	2.06	229.46	70.96	0.61	546.38	0.79	41.24	73.22	3.69	2,658.11

Table 9. -- Biomass-at-length estimates (metric tons) by area from acoustic-trawl surveys of walleye pollock during the 2017 GOA survey.

Length	Shelf	Sanak	Morzhovoi	Pavlof	Shumagins	Mitrofania	Nakchamik	Shelikof	Alitak/ Deadman	Chiniak	Barnabas	Marmot	Total
10	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	78	2	-	149	-	-	-	-	230
14	-	-	-	-	244	8	-	467	-	-	-	-	718
15	-	-	-	-	1,017	32	-	1,957	-	-	-	-	3,006
16	9	-	-	<1	2,390	75	-	4,834	-	-	-	-	7,308
17	62	-	-	-	2,860	90	-	5,714	-	-	-	-	8,725
18	135	-	-	-	719	23	-	1,416	-	-	-	-	2,292
19	348	-	-	-	603	19	-	1,155	<1	1	-	<1	2,126
20	421	-	-	-	-	-	-	-	-	2	-	<1	423
21	280	-	-	-	-	-	-	-	-	5	-	<1	286
22	42	-	-	-	-	-	-	-	-	6	-	-	48
23	88	-	-	-	-	-	-	-	-	-	-	-	88
24	15	-	-	-	-	-	-	-	-	-	-	-	15
25	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	<1	-	-	-	-	<1
30	-	-	-	-	-	-	-	-	-	-	-	-	-
31	2	-	-	-	-	-	-	-	-	-	-	-	2
32	-	-	-	-	-	-	-	-	-	-	-	-	-
33	3	-	-	-	-	-	-	-	-	-	-	-	3
34	-	-	-	3	-	-	-	1	-	-	-	-	3
35	-	-	-	-	-	-	-	200	-	-	-	-	200
36	147	-	-	10	-	-	-	-	-	-	-	-	156
37	749	3	4	3	4	13	1	2	1	-	-	5	783
38	2,330	12	5	11	49	44	2	25	-	-	56	94	2,629
39	8,042	42	9	21	169	160	9	567	3	25	236	138	9,422
40	22,699	179	44	36	600	515	28	1,214	6	210	827	296	26,654
41	74,499	273	44	110	839	3,959	46	2,377	7	593	2,883	277	85,907
42	131,696	613	127	173	1,287	8,319	80	7,324	18	1,531	6,412	140	157,719
43	187,184	523	170	200	1,509	8,866	96	6,801	17	3,039	8,635	149	217,189

Table 9.-- Continued.

Length	Shelf	Sanak	Morzhovoi	Pavlof	Shumagins	Mitrofania	Nakchamik	Shelikof	Alitak/ Deadman	Chiniak	Barnabas	Marmot	Total
44	194,515	523	129	223	1,192	5,059	62	11,692	47	5,466	10,709	211	229,827
45	162,183	367	182	184	798	686	37	5,473	43	5,247	8,749	322	184,270
46	146,540	359	198	126	451	9,250	11	5,946	59	5,879	6,629	202	175,651
47	95,241	385	222	132	260	4,843	7	4,721	71	3,080	3,305	192	112,460
48	48,204	128	88	75	76	29	2	4,059	69	1,900	803	124	55,555
49	19,653	67	96	38	46	<1	-	1,037	49	1,088	208	53	22,334
50	11,084	76	62	8	6	-	-	2	63	719	156	65	12,242
51	7,585	35	50	-	9	-	-	1,305	67	273	2	13	9,341
52	4,196	21	30	19	-	-	-	2	62	155	-	26	4,511
53	4,247	22	32	-	30	<1	-	-	25	413	34	56	4,858
54	969	39	56	-	-	-	-	722	29	173	-	15	2,003
55	828	33	47	11	-	-	-	-	14	-	167	31	1,132
56	85	9	12	-	-	-	-	-	3	122	33	16	280
57	36	-	-	-	-	-	-	-	3	204	-	-	243
58	413	-	-	-	-	-	-	892	7	-	-	-	1,311
59	-	-	-	-	-	-	-	-	-	-	-	-	-
60	-	-	-	-	-	-	-	-	-	-	1	-	1
61	-	-	-	-	-	-	-	-	-	-	-	-	-
62	-	-	-	16	-	-	-	-	4	-	-	-	20
63	-	-	-	-	-	-	-	-	-	-	-	-	-
64	-	-	-	-	-	-	-	-	-	-	-	-	-
65	-	-	-	-	-	-	-	-	-	-	-	-	-
66	-	-	-	-	-	-	-	-	-	-	-	-	-
67	-	-	-	-	-	-	-	-	-	-	-	-	-
68	-	-	-	-	-	-	-	-	-	-	-	-	-
69	-	-	-	-	-	-	-	-	-	-	-	-	-
70	-	-	-	-	-	-	-	-	-	-	-	-	-
71	-	-	-	-	-	-	-	-	-	-	-	-	-
72	-	-	-	-	-	-	-	-	-	-	-	-	-
73	-	-	-	-	-	-	-	-	-	-	-	-	-
74	-	-	-	-	-	-	-	-	-	-	-	-	-
75	-	-	-	-	-	-	-	-	-	-	-	-	-
76	-	-	-	-	-	-	-	-	-	-	-	-	-
77	-	-	-	-	-	-	-	-	-	-	-	-	-
78	-	-	-	-	-	-	-	-	-	-	-	-	-
79	-	-	-	-	-	-	-	-	-	-	-	-	-
80	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1,124,531	3,709	1,606	1,397	15,234	41,994	379	70,053	667	30,131	49,845	2,426	1,341,973

Table 10. -- Number-at-age estimates (millions) by area from acoustic-trawl surveys of walleye pollock during the 2017 summer GOA survey.

Age	Shelf	Sanak	Morzhovoi	Pavlof	Shumagins	Mitrofania	Nakchamik	Shelikof	Alitak/ Deadman	Chiniak	Barnabas	Marmot	Total
1	23.64	-	-	0.01	217.52	6.83	-	468.90	<0.01	0.18	-	<0.01	717.08
2	0.47	<0.01	<0.01	0.01	<0.01	0.01	<0.01	0.29	<0.01	-	-	<0.01	0.80
3	0.80	<0.01	<0.01	0.01	<0.01	0.01	<0.01	0.14	<0.01	-	-	<0.01	0.98
4	101.25	0.39	0.10	0.14	1.04	4.45	0.06	4.60	0.02	1.65	4.44	0.34	118.48
5	1,451.39	4.82	1.73	1.77	10.57	57.59	0.54	67.21	0.53	35.47	65.92	3.07	1,700.59
6	75.45	0.27	0.19	0.10	0.31	2.07	0.01	3.94	0.13	2.73	2.65	0.19	88.03
7	10.66	0.08	0.09	0.02	0.02	<0.01	<0.01	0.81	0.08	0.63	0.20	0.07	12.67
8	0.79	<0.01	0.01	<0.01	<0.01	-	-	0.39	0.01	0.14	0.01	<0.01	1.35
9	-	-	-	<0.01	-	-	-	-	<0.01	-	<0.01	-	0.00
10	0.48	0.01	0.01	<0.01	<0.01	<0.01	-	0.10	0.01	0.05	<0.01	0.01	0.66
11	0.34	<0.01	<0.01	<0.01	-	-	-	<0.01	0.01	0.01	-	<0.01	0.37
12	-	-	-	<0.01	-	-	-	-	<0.01	-	<0.01	-	<0.01
Total	1,665.28	5.58	2.13	2.06	229.46	70.96	0.61	546.38	0.79	40.87	73.22	3.69	2,641.01

Table 11. -- Biomass-at-age estimates (metric tons) by area from acoustic-trawl surveys of walleye pollock during the 2017 summer GOA survey.

Age	Shelf	Sanak	Morzhovoi	Pavlof	Shumagins	Mitrofania	Nakchamik	Shelikof	Alitak/ Deadman	Chiniak	Barnabas	Marmot	Total
1	1,401	-	-	<1	7,910	248	-	15,691	<1	14	-	<1	25,265
2	185	1	1	5	1	3	<1	101	<1	-	-	1	297
3	321	1	1	3	1	5	<1	48	<1	-	-	2	384
4	62,164	230	61	84	588	2,627	32	2,895	14	1,097	2,787	188	72,768
5	988,070	3,152	1,242	1,191	6,496	37,621	337	46,310	417	25,774	44,840	1,975	1,157,425
6	59,838	223	174	77	218	1,489	9	3,318	125	2,312	1,973	163	69,918
7	10,732	86	104	21	16	1	<1	1,016	83	654	230	80	13,024
8	891	6	8	2	1	-	-	555	12	199	11	7	1,692
9	-	-	-	2	-	-	-	-	1	-	<1	-	3
10	548	9	12	4	3	<1	-	120	8	66	3	8	780
11	381	2	3	4	-	-	-	<1	6	14	-	2	413
12	-	-	-	3	-	-	-	-	1	-	<1	-	4
Total	1,124,531	3,709	1,606	1,397	15,234	41,994	379	70,053	667	30,131	49,845	2,426	1,341,973

Table 12. -- Pollock number (millions), biomass (thousands of metric tons), and relative estimation error by area for the summer 2003, 2005, 2011, 2013, 2015, and 2017 Gulf of Alaska acoustic trawl surveys. Shelf area estimated error value is for all shelf area transects combined.

	2003			2005			2011			2013			2015			2017		
Area	Number	Biomass	est. error	Number	Biomass	est. error	Number	Biomass	est. error	Number	Biomass	est. error	Number	Biomass	est. error	Number	Biomass	est. error
Aleutian shelf																31.5	21.9	
Shumagin[a] Shelf	not surveyed			68.7	61.2		72.1	68.1		38.2	41.1		876.1	394.1		580.7	374.3	
Chirikof[b] Shelf	7.6	3.9	0.21	35.5	31.3	0.11	104.6	98.8	0.09	39.8	42.8	0.15	485.3	210.5	0.09	383.1	254.3	0.07
Kodiak[c] Shelf	484.7	53.1		24.5	21.9		37.7	35.6		820.2	150.7		869.0	404.0		573.4	402.5	
Eastern[d] Shelf	not surveyed			not surveyed			not surveyed			471.2	34.6		140.7	57.3		96.6	71.6	
Sanak Trough	not surveyed			not surveyed			1.1	1.0	0.11	1.3	0.9	0.23	10.1	3.1	0.11	5.6	3.7	0.10
Morzhovoi Bay	not surveyed			not surveyed			2.5	4.4	0.07	6.5	5.8	0.20	10.3	4.9	0.28	2.1	1.6	0.20
Pavlof Bay	not surveyed			not surveyed			5.1	2.9	0.08	45.1	2.2	0.18	8.6	2.6	0.17	2.1	1.4	0.17
Shumagin Islands	15.8	7.4	0.16	not surveyed			4.6	4.2	0.09	1,644.2	33.6	0.14	32.6	15.1	0.08	229.5	15.2	0.10
Mitrofania Island	<0.1	<0.1	[e]	not surveyed			4.3	4.0	0.13	132.4	2.5	0.24	31.5	14.7	0.13	71.0	42.0	0.13
Nakchamik Island	13.0	4.1	0.13	not surveyed			4.3	1.7	0.06	6.9	8.9	0.13	19.8	9.1	0.19	0.6	0.4	0.16
Shelikof Strait	693.8	151.3	0.09	1,291.2	81.6	[e]	1,624.8	156.9	0.06	4,671.3	423.0	0.06	881.8	287.8	0.06	546.4	70.1	0.11
Alitak/Deadman Bay	14.6	9.2	0.15	not surveyed			5.3	2.6	[e]	17.4	15.1	0.26	13.7	7.2	0.16/.06[f]	0.8	0.7	0.36[f]
Chiniak Trough	29.0	14.0	0.11	12.9	15.1	0.14	35.6	38.4	0.07	25.7	24.5	0.07	82.8	35.0	0.06	41.2	30.1	0.19
Barnabas Trough	65.4	30.4	0.11	9.1	12.6	0.12	29.5	33.8	0.10	294.9	62.8	0.06	187.3	88.9	0.17	73.2	49.8	0.12
Marmot/Izhut Bay	17.2	8.3	0.18	not surveyed			not surveyed			104.7	9.0	0.07	103.4	45.8	0.14/0.16[f]	3.7	2.4	0.21
Amatuli Trench	78.7	23.1	[e]	not surveyed			not surveyed			included with shelf area			not surveyed			not surveyed		
Kenai Peninsula Bays	17.7	1.5	[e]	not surveyed			not surveyed			not surveyed			20.5	7.2	0.14[f]	not surveyed		
Prince William Sound	29.9	14.7	0.14	not surveyed			not surveyed			199.5	16.1	0.09	23.3	13.3	0.08	not surveyed		
Kayak Island Trough	not surveyed			not surveyed			not surveyed			8.8	5.2	0.15	included with shelf area			included with shelf area		
Yakutat trough	not surveyed			not surveyed			not surveyed			101.4	5.4	0.13	4.9	5.5	0.18	included with shelf area		
Total	1,467.4	320.9	[e]	1,442.0	223.9	[e]	1,982.6	453.0	0.06	8,629.5	884.0	0.08	3,801.8	1,606.2	0.08	2,641.0	1,342.0	0.06

[a] Shumagin NPFMC area 610 - 159°-170°W

[b] Chirikof NPFMC area 620 - 154°-159°W

[c] Kodiak NPFMC area 630 - 147°-154°W

[d] Eastern NPFMC area 640 - 140°-147°W

[e] variance estimation not calculated

[f] 2D variance estimation for zig-zag transects

Table 13. -- Summary of catch by species in two Aleutian wing trawls conducted in midwater in Sanak Trough during the summer 2017 walleye pollock acoustic-trawl survey of the Gulf of Alaska shelf.

		Weight		Number	
Common name	Scientific name	kg	Percent	Nos.	Percent
walleye pollock	*Gadus chalcogrammus*	717.8	98.7	1,245	98.5
chum salmon	*Oncorhynchus keta*	5.4	0.7	3	0.2
dusky rockfish	*Sebastes variabilis*	2.3	0.3	1	0.1
chinook salmon	*Oncorhynchus tshawytscha*	1.5	0.2	1	0.1
lions mane jelly unid.	*Cyanea* sp.	0.1	<0.1	14	1.1
fish larvae unid.	Actinopterygii (class)	<0.1	<0.1	1	0.1
isopod unid.	Isopoda (order)	<0.1	<0.1	1	0.1
jellyfish unid.	Scyphozoa (class)	<0.1	<0.1	1	0.1
		727.1		1,267	

Table 14. -- Summary of catch by species in the Aleutian wing trawl conducted in midwater in Morzhovoi Bay during the summer 2017 walleye pollock acoustic-trawl survey of the Gulf of Alaska shelf.

		Weight		Number	
Common name	Scientific name	kg	Percent	Nos.	Percent
walleye pollock	*Gadus chalcogrammus*	132.2	99.7	174	82.1
egg yolk jelly	*Phacellophora camtschatica*	0.1	0.1	1	0.5
jellyfish unid.	Scyphozoa (class)	0.1	0.1	13	6.1
lions mane jelly	*Cyanea capillata*	0.1	0.1	3	1.4
capelin	*Mallotus villosus*	0.1	0.1	9	4.2
Pacific herring	*Clupea pallasii*	<0.1	<0.1	2	0.9
walleye pollock age-0	*Gadus chalcogrammus*	<0.1	<0.1	10	4.7
		132.6		212	

Table 15. -- Summary of catch by species in the Aleutian wing trawl conducted in midwater in Pavlof Bay during the summer 2017 walleye pollock acoustic-trawl survey of the Gulf of Alaska shelf.

		Weight		Number	
Common name	Scientific name	kg	Percent	Nos.	Percent
walleye pollock	*Gadus chalcogrammus*	262.7	95.9	408	84.0
Pacific cod	*Gadus macrocephalus*	9.7	3.6	3	0.6
lions mane jelly unid.	*Cyanea* sp.	1.6	0.6	74	15.2
walleye pollock age-0	*Gadus chalcogrammus*	<0.1	<0.1	1	0.2
		274.0		485	

Table 16. -- Summary of catch by species in five Aleutian wing trawls conducted in midwater near Shumagin Islands during the summer 2017 walleye pollock acoustic-trawl survey of the Gulf of Alaska shelf.

		Weight		Number	
Common name	Scientific name	kg	Percent	Nos.	Percent
walleye pollock	*Gadus chalcogrammus*	2,840.0	99.1	4,774	92.9
chum salmon	*Oncorhynchus keta*	11.1	0.4	3	0.1
Pacific cod	*Gadus macrocephalus*	5.4	0.2	2	<0.1
chinook salmon	*Oncorhynchus tshawytscha*	4.9	0.2	1	<0.1
sablefish	*Anoplopoma fimbria*	1.4	<0.1	3	0.1
arrowtooth flounder	*Atheresthes stomias*	1.0	<0.1	1	<0.1
lions mane jelly	*Cyanea capillata*	0.9	<0.1	46	0.9
lions mane jelly unid.	*Cyanea* sp.	0.9	<0.1	56	1.1
jellyfish unid.	Scyphozoa (class)	0.6	<0.1	99	1.9
smooth lumpsucker	*Aptocyclus ventricosus*	0.5	<0.1	1	<0.1
capelin	*Mallotus villosus*	0.2	<0.1	21	0.4
walleye pollock age-0	*Gadus chalcogrammus*	<0.1	<0.1	112	2.2
magistrate armhook squid	*Berryteuthis magister*	<0.1	<0.1	1	<0.1
isopod unid.	Isopoda (order)	<0.1	<0.1	16	0.3
fish larvae unid.	Actinopterygii (class)	<0.1	<0.1	2	<0.1
		2,866.7		5,138	

Table 17. -- Summary of catch by species in the Aleutian wing trawl conducted in midwater near Mitrofania Island during the summer 2017 walleye pollock acoustic-trawl survey of the Gulf of Alaska shelf.

		Weight		Number	
Common name	Scientific name	kg	Percent	Nos.	Percent
walleye pollock	*Gadus chalcogrammus*	421.9	98.8	703	97.0
chum salmon	*Oncorhynchus keta*	4.8	1.1	1	0.1
lions mane jelly unid.	*Cyanea* sp.	0.4	0.1	12	1.7
walleye pollock age-0	*Gadus chalcogrammus*	<0.1	<0.1	9	1.2
		427.1		725	

Table 18. -- Summary of catch by species in nine Aleutian wing trawls conducted in midwater in Shelikof Strait during the summer 2017 walleye pollock acoustic-trawl survey of the Gulf of Alaska shelf.

		Weight		Number	
Common name	Scientific name	kg	Percent	Nos.	Percent
walleye pollock	*Gadus chalcogrammus*	1,991.7	95.8	11,172	50.8
eulachon	*Thaleichthys pacificus*	41.1	2.0	1,489	6.8
Pacific herring	*Clupea pallasii*	14.3	0.7	262	1.2
chum salmon	*Oncorhynchus keta*	11.2	0.5	5	0.0
chinook salmon	*Oncorhynchus tshawytscha*	10.0	0.5	13	0.1
walleye pollock age-0	*Gadus chalcogrammus*	3.1	0.2	6,324	28.8
lions mane jelly	*Cyanea capillata*	2.6	0.1	33	0.2
northern sea nettle	*Chrysaora melanaster*	1.1	0.1	12	0.1
moon jelly unid.	*Aurelia* sp.	0.8	<0.1	40	0.2
shrimp unid.	Malacostraca (class)	0.7	<0.1	189	0.9
squid unid.	Cephalopoda (class)	0.6	<0.1	89	0.4
magistrate armhook squid	*Berryteuthis magister*	0.6	<0.1	11	0.1
comb jelly unid.	Ctenophora (phylum)	0.5	<0.1	45	0.2
northern smoothtongue	*Leuroglossus schmidti*	0.5	<0.1	36	0.2
jellyfish unid.	Scyphozoa (class)	0.4	<0.1	59	0.3
capelin	*Mallotus villosus*	0.3	<0.1	52	0.2
euphausiid unid.	Euphausiacea (order)	0.2	<0.1	1,989	9.0
lanternfish unid.	Myctophidae (family)	0.1	<0.1	55	0.3
isopod unid.	Isopoda (order)	0.1	<0.1	65	0.3
unid. pelagic hydrozoan sp	*Aequorea* sp.	0.1	<0.1	13	0.1
Pacific cod	*Gadus macrocephalus*	0.1	<0.1	31	0.1
great sculpin	*Myoxocephalus polyacanthocephalus*	<0.1	<0.1	1	<0.1
		2,080.0		21,986	

Table 19. -- Summary of catch by species in two Poly Nor'eastern bottom trawls conducted in Shelikof Strait during the summer 2017 walleye pollock acoustic-trawl survey of the Gulf of Alaska

		Weight		Number	
Common name	Scientific name	kg	Percent	Nos.	Percent
Pacific herring	*Clupea pallasii*	76.1	28.4	1,752	0.6
walleye pollock age-0	*Gadus chalcogrammus*	73.5	27.5	166,576	55.0
arrowtooth flounder	*Atheresthes stomias*	34.3	12.8	70	<0.1
euphausiid unid.	Euphausiacea (order)	23.6	8.8	134,150	44.3
big skate	*Beringraja binoculata*	21.6	8.1	1	<0.1
rock sole unid.	Lepidopsetta (genus)	8.1	3.0	12	<0.1
Alaska plaice	*Pleuronectes quadrituberculatus*	7.4	2.8	4	<0.1
flathead sole	*Hippoglossoides elassodon*	5.5	2.0	37	<0.1
Pacific halibut	*Hippoglossus stenolepis*	4.2	1.6	8	<0.1
spiny dogfish	*Squalus suckleyi*	3.7	1.4	1	<0.1
chinook salmon	*Oncorhynchus tshawytscha*	1.9	0.7	1	<0.1
walleye pollock	*Gadus chalcogrammus*	1.8	0.7	3	<0.1
sablefish	*Anoplopoma fimbria*	1.3	0.5	3	<0.1
lions mane	*Cyanea capillata*	1.1	0.4	5	<0.1
egg yolk jelly	*Phacellophora camtschatica*	0.5	0.2	1	<0.1
jellyfish unid.	Scyphozoa (class)	0.5	0.2	1	<0.1
empty bivalve shells	Bivalvia (class)	0.4	0.2	25	<0.1
sea urchin unid.	Echinoidea (class)	0.3	0.1	25	<0.1
snail unid.	Gastropoda (class)	0.3	0.1	9	<0.1
whelk unid.	Gastropoda (class)	0.3	0.1	7	<0.1
sea anemone unid.	Actiniaria (order)	0.3	0.1	7	<0.1
rex sole	*Glyptocephalus zachirus*	0.1	0.1	4	<0.1
crab unid.	Decapoda (order)	0.1	0.1	5	<0.1
shrimp unid.	Malacostraca (class)	0.1	<0.1	60	<0.1
capelin	*Mallotus villosus*	0.1	<0.1	11	<0.1
kelp greenling	*Hexagrammos decagrammus*	0.1	<0.1	1	<0.1
comb jelly unid.	Ctenophora (phylum)	0.1	<0.1	10	<0.1
eulachon	*Thaleichthys pacificus*	0.1	<0.1	3	<0.1
isopod unid.	Isopoda (order)	0.1	<0.1	60	<0.1
sea star unid.	Asteroidea (class)	<0.1	<0.1	1	<0.1
hermit crab unid.	Paguridae (family)	<0.1	<0.1	1	<0.1
skate egg case unid.	Rajidae (family)	<0.1	<0.1	1	<0.1
		267.5		302,855	

Table 20. -- Summary of catch by species in the Aleutian wing trawl conducted in midwater near Nakchamik Island during the summer 2017 walleye pollock acoustic-trawl survey of the Gulf of Alaska

		Weight		Number	
Common name	Scientific name	kg	Percent	Nos.	Percent
walleye pollock	*Gadus chalcogrammus*	101.6	96.1	158	51.2
chinook salmon	*Oncorhynchus tshawytscha*	2.3	2.1	1	0.3
eulachon	*Thaleichthys pacificus*	0.8	0.7	103	33.2
lions mane jelly	*Cyanea capillata*	0.7	0.7	14	4.5
Pacific herring	*Clupea pallasii*	0.2	0.2	13	4.2
northern sea nettle	*Chrysaora melanaster*	0.1	0.1	5	1.6
capelin	*Mallotus villosus*	0.1	0.1	12	3.9
jellyfish unid.	Scyphozoa (class)	<0.1	<0.1	2	0.6
fish larvae unid.	Actinopterygii (class)	<0.1	<0.1	1	0.3
isopod unid.	Isopoda (order)	<0.1	<0.1	1	0.3
		105.7		310	

Table 21. -- Summary of catch by species in the Aleutian wing trawl conducted in midwater in Alitak Bay during the summer 2017 walleye pollock acoustic-trawl survey of the Gulf of Alaska shelf.

		Weight		Number	
Common name	Scientific name	kg	Percent	Nos.	Percent
walleye pollock	*Gadus chalcogrammus*	6.0	60.5	9	0.2
walleye pollock age-0	*Gadus chalcogrammus*	2.9	28.8	4,311	97.5
lions mane jelly	*Cyanea capillata*	0.6	6.4	5	0.1
capelin	*Mallotus villosus*	0.3	2.6	37	0.8
Pacific herring	*Clupea pallasii*	0.1	1.0	5	0.1
Pacific cod	*Gadus macrocephalus*	0.1	0.6	43	1.0
jellyfish unid.	Scyphozoa (class)	<0.1	0.2	7	0.2
isopod unid.	Isopoda (order)	<0.1	<0.1	3	0.1
		10.0		4,420	

Table 22. -- Summary of catch by species in the Poly Nor'eastern bottom trawl conducted in Alitak Bay during

		Weight		Number	
Common name	Scientific name	kg	Percent	Nos.	Percent
walleye pollock	*Gadus chalcogrammus*	302.9	91.2	358	2.4
walleye pollock age-0	*Gadus chalcogrammus*	12.8	3.9	14,216	95.8
lions mane jelly	*Cyanea capillata*	10.6	3.2	50	0.3
arrowtooth flounder	*Atheresthes stomias*	1.6	0.5	3	<0.1
Pacific herring	*Clupea pallasii*	1.3	0.4	34	0.2
flathead sole	*Hippoglossoides elassodon*	1.3	0.4	3	0.0
Pacific sandfish	*Trichodon trichodon*	0.9	0.3	11	0.1
shrimp unid.	Malacostraca (class)	0.3	0.1	68	0.5
capelin	*Mallotus villosus*	0.2	<0.1	23	0.2
eulachon	*Thaleichthys pacificus*	0.1	<0.1	3	<0.1
euphausiid unid.	Euphausiacea (order)	<0.1	<0.1	34	0.2
Pacific cod	*Gadus macrocephalus*	<0.1	<0.1	34	0.2
		332.1		14,837	

Table 23. -- Summary of catch by species in four Aleutian wing trawls conducted in midwater in Chiniak Trough

		Weight		Number	
Common name	Scientific name	kg	Percent	Nos.	Percent
walleye pollock	*Gadus chalcogrammus*	3,813.8	93.7	4,853	27.7
Pacific ocean perch	*Sebastes alutus*	93.3	2.3	112	0.6
lions mane	*Cyanea capillata*	50.1	1.2	203	1.2
eulachon	*Thaleichthys pacificus*	49.8	1.2	2,254	12.8
chinook salmon	*Oncorhynchus tshawytscha*	35.2	0.9	39	0.2
Pacific cod	*Gadus macrocephalus*	9.5	0.2	3	<0.1
walleye pollock age-0	*Gadus chalcogrammus*	9.4	0.2	9,791	55.8
squid unid.	Cephalopoda (class)	3.2	0.1	64	0.4
arrowtooth flounder	*Atheresthes stomias*	2.1	0.1	1	<0.1
unid. pelagic hydrozoan sp.	*Aequorea* sp.	0.9	<0.1	69	0.4
jellyfish unid.	Scyphozoa (class)	0.9	<0.1	41	0.2
capelin	*Mallotus villosus*	0.3	<0.1	73	0.4
comb jelly unid.	Ctenophora (phylum)	0.3	<0.1	17	0.1
isopod unid.	Isopoda (order)	<0.1	<0.1	23	0.1
Pacific herring	*Clupea pallasii*	<0.1	<0.1	1	<0.1
prowfish	*Zaprora silenus*	<0.1	<0.1	1	<0.1
		4,069.0		17,545	

Table 24. -- Summary of catch by species in the Poly Nor'eartern bottom trawl conducted in Barnabas Trough during the summer 2017 walleye pollock acoustic-trawl survey of the Gulf of Alaska shelf.

		Weight		Number	
Common name	Scientific name	kg	Percent	Nos.	Percent
Pacific ocean perch	*Sebastes alutus*	173.5	93.2	275	49.9
walleye pollock	*Gadus chalcogrammus*	4.7	2.5	7	1.3
comb jelly unid.	Ctenophora (phylum)	1.8	1.0	111	20.1
jellyfish unid.	Scyphozoa (class)	1.6	0.9	64	11.6
lions mane jelly	*Cyanea capillata*	1.5	0.8	19	3.4
northern rock sole	*Lepidopsetta polyxystra*	1.3	0.7	1	0.2
arrowtooth flounder	*Atheresthes stomias*	0.7	0.4	2	0.4
moon jelly	*Aurelia labiata*	0.4	0.2	1	0.2
sea urchin unid.	Echinoidea (class)	0.3	0.2	2	0.4
Pacific sandfish	*Trichodon trichodon*	0.3	0.1	3	0.5
northern sea nettle	*Chrysaora melanaster*	0.1	<0.1	1	0.2
walleye pollock age-0	*Gadus chalcogrammus*	<0.1	<0.1	56	10.1
prowfish	*Zaprora silenus*	<0.1	<0.1	9	1.6
isopod unid.	Isopoda (order)	<0.1	<0.1	1	0.2
		186.2		552	

Table 25. -- Summary of catch by species in ten Aleutian wing trawls conducted in midwater in Barnabas Trough during the summer 2017 walleye pollock acoustic-trawl survey of the Gulf of Alaska shelf.

		Weight		Number	
Common name	Scientific name	kg	Percent	Nos.	Percent
walleye pollock	*Gadus chalcogrammus*	4,037.7	97.2	5,832	40.0
Pacific ocean perch	*Sebastes alutus*	57.9	1.4	67	0.5
lions mane jelly	*Cyanea capillata*	29.2	0.7	162	1.1
eulachon	*Thaleichthys pacificus*	6.7	0.2	256	1.8
walleye pollock age-0	*Gadus chalcogrammus*	5.4	0.1	4,714	32.4
northern sea nettle	*Chrysaora melanaster*	4.8	0.1	118	0.8
chum salmon	*Oncorhynchus keta*	3.9	0.1	3	<0.1
northern rockfish	*Sebastes polyspinis*	2.9	0.1	3	<0.1
Pacific herring	*Clupea pallasii*	2.3	0.1	67	0.5
unid. pelagic hydrozoan sp.	*Aequorea* sp.	1.7	<0.1	34	0.2
euphausiid unid.	Euphausiacea (order)	0.6	<0.1	3,130	21.5
lions mane jelly unid.	*Cyanea* sp.	0.5	<0.1	1	<0.1
capelin	*Mallotus villosus*	0.4	<0.1	45	0.3
jellyfish unid.	Scyphozoa (class)	0.4	<0.1	23	0.2
isopod unid.	Isopoda (order)	0.1	<0.1	66	0.5
prowfish	*Zaprora silenus*	0.1	<0.1	11	0.1
comb jelly unid.	Ctenophora (phylum)	0.1	<0.1	6	<0.1
squid unid.	Cephalopoda (class)	0.1	<0.1	13	0.1
Pacific cod	*Gadus macrocephalus*	<0.1	<0.1	3	<0.1
lanternfish unid.	Myctophidae (family)	<0.1	<0.1	1	<0.1
bigmouth sculpin	*Hemitripterus bolini*	<0.1	<0.1	1	<0.1
flatfish larvae	*Pleuronectiform larvae*	<0.1	<0.1	7	<0.1
fish larvae unid.	Actinopterygii (class)	<0.1	<0.1	4	<0.1
		4,154.7		14,567	

Table 26. -- Summary of catch by species in five Aleutian wing trawls conducted in midwater in Marmot Bay during the summer 2017 walleye pollock acoustic-trawl survey of the Gulf of Alaska shelf.

		Weight		Number	
Common name	Scientific name	kg	Percent	Nos.	Percent
walleye pollock	*Gadus chalcogrammus*	1,307.0	96.6	1,692	11.8
walleye pollock age-0	*Gadus chalcogrammus*	14.8	1.1	10,794	75.1
lions mane jelly	*Cyanea capillata*	8.2	0.6	28	0.2
capelin	*Mallotus villosus*	6.6	0.5	1,204	8.4
eulachon	*Thaleichthys pacificus*	5.6	0.4	414	2.9
chinook salmon	*Oncorhynchus tshawytscha*	3.8	0.3	8	0.1
Pacific ocean perch	*Sebastes alutus*	3.6	0.3	4	0.0
unid. pelagic hydrozoan sp	*Aequorea* sp.	2.2	0.2	109	0.8
arrowtooth flounder	*Atheresthes stomias*	1.6	0.1	1	0.0
euphausiid unid.	Euphausiacea (order)	<0.1	<0.1	120	0.8
California market squid	*Doryteuthis opalescens*	<0.1	<0.1	1	<0.1
bigmouth sculpin	*Hemitripterus bolini*	<0.1	<0.1	1	<0.1
magistrate armhook squid	*Berryteuthis magister*	<0.1	<0.1	1	<0.1
isopod unid.	Isopoda (order)	<0.1	<0.1	2	<0.1
		1,353.3		14,378	

Table 27. -- Summary of catch by species in the Poly Nor'eastern bottom trawl conducted in midwater in Marmot Bay during the summer 2017 walleye pollock acoustic-trawl survey of the Gulf of Alaska shelf.

		Weight		Number	
Common name	Scientific name	kg	Percent	Nos.	Percent
unid. pelagic hydrozoan sp	*Aequorea* sp.	12.3	60.8	220	15.0
walleye pollock age-0	*Gadus chalcogrammus*	3.8	18.5	1,230	84.0
chinook salmon	*Oncorhynchus tshawytscha*	2.9	14.5	2	0.1
lions mane jelly	*Cyanea capillata*	1.2	5.9	3	0.2
capelin	*Mallotus villosus*	0.1	0.3	10	0.7
		20.3		1,464	

Table 28. -- Pollock biomass (metric tons) by NMFS reporting area for all walleye pollock and age-5 walleye pollock for the 2017 summer Gulf of Alaska acoustic-trawl survey.

Reporting area	Geographic area	Total biomass	Age-5 biomass
Aleutian	Shelf	21,900.17	19,036.47
Total	Total	21,900.17	19,036.47
610	Shelf	374,288.35	331,860.97
	Sanak Trough	3,708.78	3,152.11
	Morzhovoi Bay	1,606.19	1,241.59
	Pavlof Bay	1,396.93	1,191.03
	Shumagin Islands	13,322.69	5,835.34
	Mitrofania	15,083.62	13,613.94
Total		409,406.57	356,894.98
620	Shelf	254,279.13	226,938.22
	Shumagin Islands	1,911.36	660.63
	Mitrofania	26,910.45	24,006.78
	Nakchamik	378.82	337.47
	Shelikof Strait	56,489.06	34,766.10
	Alitak	667.41	416.93
Total		340,636.24	287,126.12
630	Shelf	402,497.56	351,273.38
	Shelikof Strait	13,564.42	11,543.87
	Barnabas Trough	49,845.44	44,840.10
	Chiniak Trough	30,130.54	25,773.68
	Marmot Bay	2,425.98	1,975.49
Total		498,463.94	435,406.52
640	Shelf	71,566.26	58,960.84
Total	Total	71,566.26	58,960.84
Survey Total		1,341,973.18	1,157,424.93

Table 29. -- Summary of catch number and weight by species in trawls (23) containing capelin that were conducted during the summer 2017 walleye pollock acoustic-trawl survey of the Gulf of

		Weight		Number	
Common name	Scientific name	kg	Percent	Nos.	Percent
euphausiid unid.	Euphausiacea (order)	24.5	0.6	139,438	63.0
walleye pollock Age 0	*Gadus chalcogrammus*	71.9	1.8	66,117	29.9
walleye pollock	*Gadus chalcogrammus*	3,401.0	84.6	6,764	3.1
Pacific herring	*Clupea pallasii*	201.7	5.0	3,951	1.8
capelin	*Mallotus villosus*	15.6	0.4	2,520	1.1
unid. pelagic hydrozoan sp	*Aequorea sp.*	22.1	0.5	588	0.3
eulachon	*Thaleichthys pacificus*	11.9	0.3	513	0.2
lions mane jelly	*Cyanea capillata*	50.7	1.3	288	0.1
Pacific cod	*Gadus macrocephalus*	3.1	0.1	235	0.1
isopod unid.	Isopoda (order)	0.2	<0.1	162	0.1
shrimp unid.	Malacostraca (class)	0.4	<0.1	128	0.1
comb jelly unid.	Ctenophora (phylum)	2.0	0.1	122	0.1
Pacific ocean perch	Sebastes alutus	83.3	2.1	98	<0.1
jellyfish unid.	Scyphozoa (class)	0.9	<0.1	94	<0.1
arrowtooth flounder	*Atheresthes stomias*	38.0	0.9	73	<0.1
northern sea nettle	*Chrysaora melanaster*	3.1	0.1	64	<0.1
magistrate armhook squid	*Berryteuthis magister*	0.2	<0.1	58	<0.1
chinook salmon	*Oncorhynchus tshawytscha*	41.7	1.0	40	<0.1
flathead sole	*Hippoglossoides elassodon*	6.0	0.1	38	<0.1
flatfish larvae	Pleuronectiform larvae	<0.1	<0.1	32	<0.1
squid unid.	Cephalopoda (class)	0.1	<0.1	25	<0.1
Pacific sandfish	*Trichodon trichodon*	0.9	<0.1	11	<0.1
snail unid.	*Gastropoda (class)*	0.3	<0.1	9	<0.1
chum salmon	*Oncorhynchus keta*	23.1	0.6	9	<0.1
moon jelly unid.	*Aurelia* sp.	0.1	<0.1	9	<0.1
Berry armhook squid	Gonatus berryi	0.1	<0.1	6	<0.1
prowfish	*Zaprora silenus*	0.1	<0.1	5	<0.1
fish larvae unid.	Actinopterygii (class)	<0.1	<0.1	5	<0.1
Alaska plaice	*Pleuronectes quadrituberculatus*	7.4	0.2	4	<0.1
rex sole	*Glyptocephalus zachirus*	0.1	<0.1	4	<0.1
sablefish	*Anoplopoma fimbria*	1.7	<0.1	4	<0.1
egg yolk jelly	*Phacellophora camtschatica*	0.7	<0.1	2	<0.1
Pacific halibut	*Hippoglossus stenolepis*	1.8	<0.1	2	<0.1
coho salmon	*Oncorhynchus kisutch*	0.4	<0.1	2	<0.1
smooth lumpsucker	*Aptocyclus ventricosus*	1.6	<0.1	2	<0.1
spiny dogfish	*Squalus suckleyi*	3.7	0.1	1	<0.1
Other <1% by number		0.2	<0.1	6	<0.1
		221,428.7		4,020	

Table 30. -- Summary of catch number and weight by species in hauls (24) containing eulachon that were conducted during the summer 2017 walleye pollock acoustic-trawl survey of the Gulf of

		Weight		Number	
Common name	Scientific name	kg	Percent	Nos.	Percent
walleye pollock age-0	*Gadus chalcogrammus*	178.2	0.4	261,981	59.1
walleye pollock	*Gadus chalcogrammus*	37,084.6	86.0	65,994	14.9
shrimp unid.	Malacostraca (class)	5.2	<0.1	33,265	7.5
copepod unid.	Maxillopoda (class)	1.1	<0.1	28,751	6.5
crab unid.	Decapoda (order)	1.7	<0.1	12,007	2.7
Pacific ocean perch	*Sebastes alutus*	4,651.7	10.8	8,300	1.9
eulachon	*Thaleichthys pacificus*	162.1	0.4	8,227	1.9
Pacific herring	*Clupea pallasii*	219.5	0.5	4,294	1.0
mollusk unid.	Mollusca (phylum)	1.0	<0.1	3,317	0.7
unid. pelagic hydrozoan sp	*Aequorea* sp.	104.7	0.2	2,712	0.6
capelin	*Mallotus villosus*	15.7	<0.1	2,532	0.6
fish larvae unid.	Actinopterygii (class)	1.0	<0.1	2,352	0.5
jellyfish unid.	Scyphozoa (class)	9.3	<0.1	2,033	0.5
lanternfish unid.	*Stenobrachius* sp.	8.8	<0.1	1,057	0.2
lions mane jelly	*Cyanea capillata*	156.2	0.4	957	0.2
squid unid.	Cephalopoda (class)	7.1	<0.1	951	0.2
empty gastropod shells	Gastropoda (class)	<0.1	<0.1	642	0.1
comb jelly unid.	Ctenophora (phylum)	9.8	<0.1	535	0.1
isopod unid.	Isopoda (order)	0.5	<0.1	405	0.1
Pacific glass shrimp	*Pasiphaea pacifica*	0.3	<0.1	403	0.1
stripeleg pandalid	*Pandalopsis ampla*	0.7	<0.1	295	0.1
northern sea nettle	*Chrysaora melanaster*	12.0	<0.1	285	0.1
Pacific cod	*Gadus macrocephalus*	33.5	0.1	284	0.1
worm unid.	Annelida (phylum)	0.1	<0.1	257	0.1
Other <1% by number		436.7	1.0	1,660	0.4
		43,101.6		443,493	

Table 31. -- Summary of catch by species in 32 Methot trawls conducted during the summer 2017 walleye pollock acoustic-trawl survey of the Gulf of Alaska shelf.

		Weight		Number	
Common name	Scientific name	kg	Percent	Nos.	Percent
euphausiid unid.	Euphausiacea (order)	120.4	54.8	2,212,935	96.1
unid. pelagic hydrozoan sp.	*Aequorea* sp.	59.5	27.0	1,236	0.1
lions mane jelly	*Cyanea capillata*	11.1	5.0	137	<0.1
northern sea nettle	*Chrysaora melanaster*	5.4	2.4	139	<0.1
comb jelly unid.	Ctenophora (phylum)	3.6	1.7	789	<0.1
shrimp unid.	Malacostraca (class)	3.5	1.6	32,500	1.4
walleye pollock age-0	*Gadus chalcogrammus*	3.1	1.4	4,600	0.2
walleye pollock	*Gadus chalcogrammus*	2.2	1.0	3	<0.1
squid unid.	Cephalopoda (class)	2.1	0.9	627	<0.1
jellyfish unid.	Scyphozoa (class)	1.8	0.8	1,456	0.1
crab unid.	Decapoda (order)	1.7	0.8	12,055	0.5
copepod unid.	Maxillopoda (class)	1.1	0.5	28,751	1.2
fish larvae unid.	Actinopterygii (class)	1.0	0.5	2,343	0.1
mollusk unid.	Mollusca (phylum)	1.0	0.5	3,317	0.1
stripeleg pandalid	*Pandalopsis ampla*	0.7	0.3	296	<0.1
arrowtooth flounder	*Atheresthes stomias*	0.6	0.3	1	<0.1
eulachon	*Thaleichthys pacificus*	0.2	0.1	17	<0.1
moon jelly	*Aurelia labiata*	0.2	0.1	12	<0.1
moon jelly unid.	*Aurelia* sp.	0.2	0.1	24	<0.1
fish eggs unid.	Actinopterygii (class)	0.1	0.1	219	<0.1
flatfish larvae	Pleuronectiform larvae	0.1	0.1	151	<0.1
worm unid.	Annelida (phylum)	0.1	<0.1	257	<0.1
prowfish	*Zaprora silenus*	0.1	<0.1	12	<0.1
prickleback unid.	Stichaeidae (family)	<0.1	<0.1	45	<0.1
magistrate armhook squid	*Berryteuthis magister*	<0.1	<0.1	3	<0.1
eelpout unid.	Zoarcidae (family)	<0.1	<0.1	7	<0.1
sablefish	*Anoplopoma fimbria*	<0.1	<0.1	3	<0.1
poacher unid.	Agonidae (family)	<0.1	<0.1	4	<0.1
capelin	*Mallotus villosus*	<0.1	<0.1	1	<0.1
empty gastropod shells	Gastropoda (class)	<0.1	<0.1	642	<0.1
octopus unid.	Octopoda (order)	<0.1	<0.1	2	<0.1
eastern Pacific bobtail	*Rossia pacifica*	<0.1	<0.1	1	<0.1
sculpin unid.	Cottidae (family)	<0.1	<0.1	5	<0.1
rockfish unid.	Sebastes (genus)	<0.1	<0.1	1	<0.1
Pacific cod	*Gadus macrocephalus*	<0.1	<0.1	1	<0.1
lanternfish unid.	Myctophidae (family)	<0.1	<0.1	2	<0.1
Pacific herring	*Clupea pallasii*	<0.1	<0.1	14	<0.1
amphipod unid.	Amphipoda (order)	<0.1	<0.1	1	<0.1
		219.7		2,302,607	

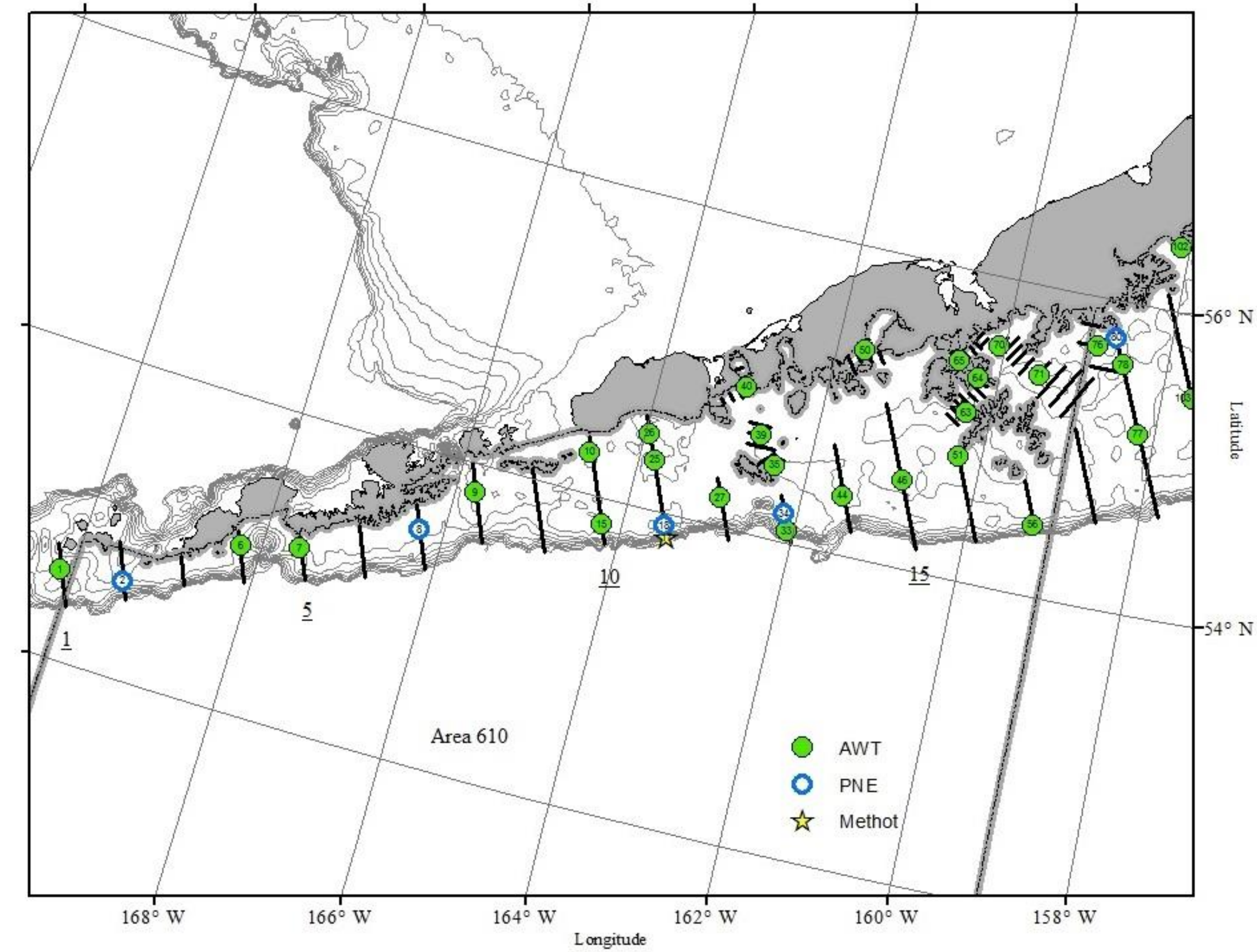

Figure 1. -- Transect lines and locations of Aleutian-wing trawl (AWT), poly-Nor'eastern trawl (PNE), and Methot hauls from the summer 2017 acoustic-trawl survey of walleye pollock in the western Gulf of Alaska from the Islands of Four Mountains to the Shumagin Islands. Transect numbers are underlined and haul numbers are on top of haul symbols. Boundary between NMFS reporting areas 610 and 620 is displayed.

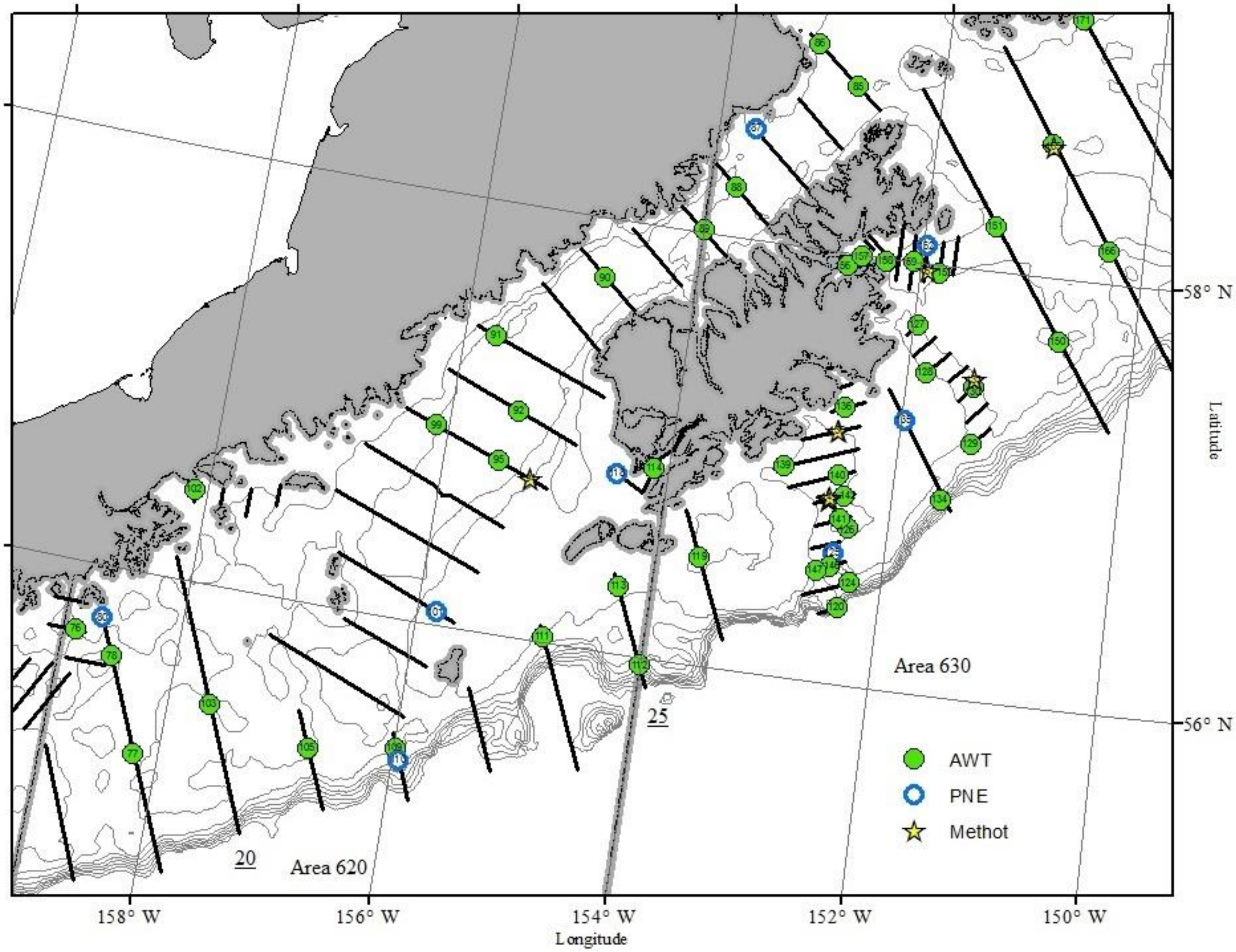

Figure 2. -- Transect lines and locations of Aleutian-wing trawl (AWT), poly-Nor'eastern trawl (PNE), and Methot hauls from the summer 2017 acoustic-trawl survey of walleye pollock in the central Gulf of Alaska from the Shumagin Islands to eastern Kodiak Island. Transect numbers are underlined and haul numbers are on top of haul symbols. Boundary between NMFS reporting areas 620 and 630 is displayed.

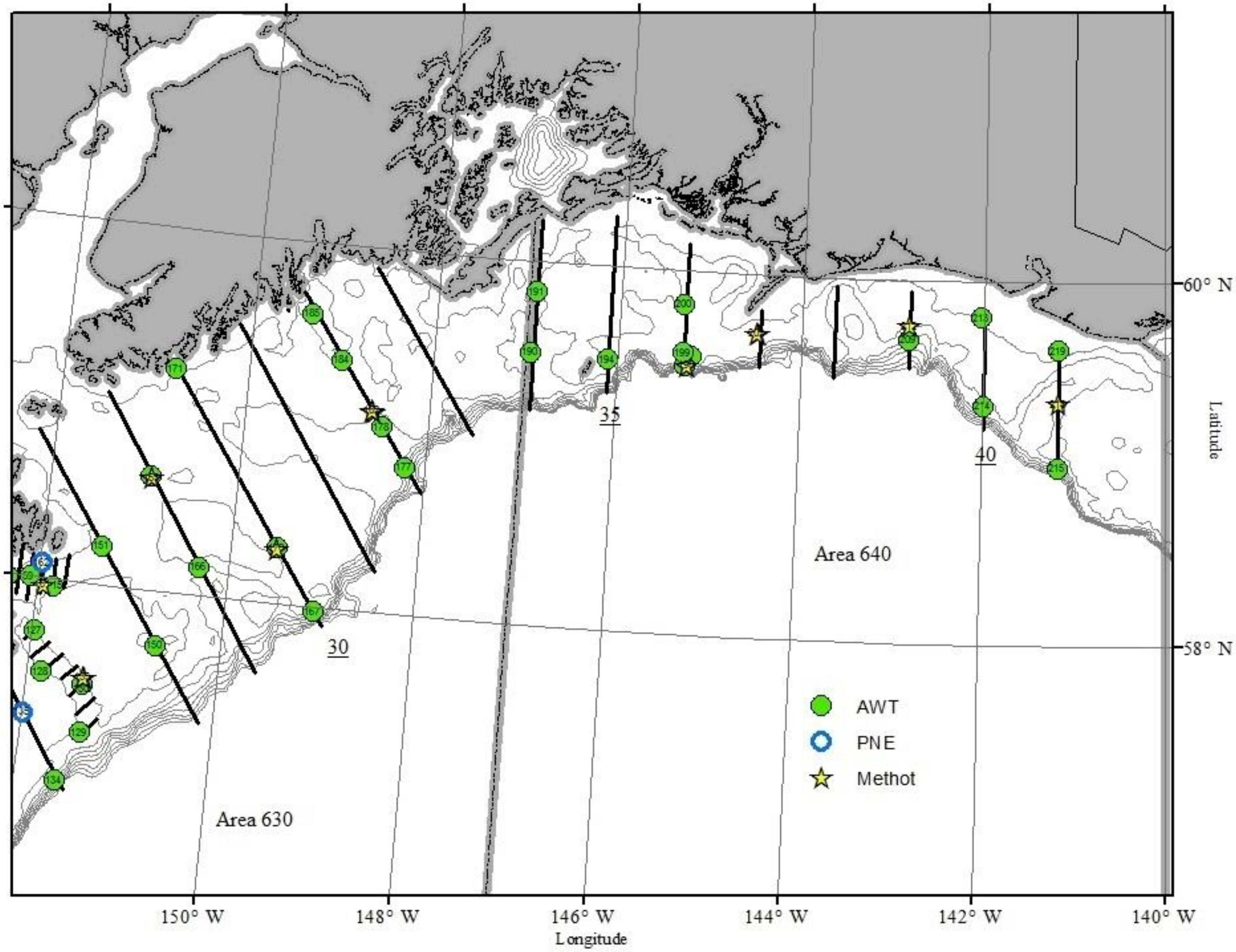

Figure 3. -- Transect lines and locations of Aleutian-wing trawl (AWT), poly-Nor'eastern trawl (PNE), and Methot hauls from the summer 2017 acoustic-trawl survey of walleye pollock in the eastern Gulf of Alaska from eastern Kodiak Island to Yakutat Trough. Transect numbers are underlined and haul numbers are on top of haul symbols. Boundaries between NMFS reporting areas 630 and 640 are displayed.

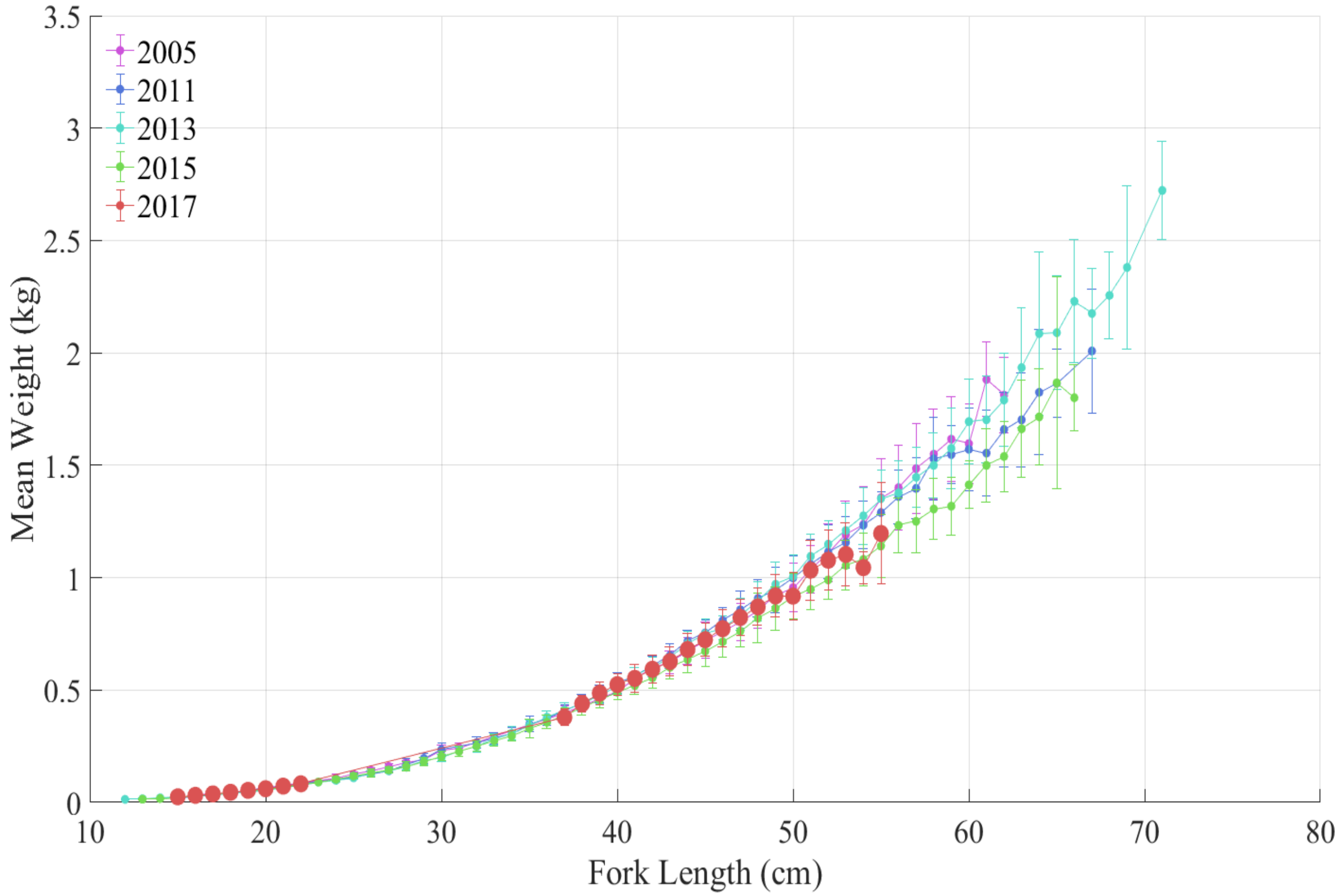

Figure 4. -- Mean weight (kg), and standard deviation, at length (cm) for all areas combined during GOA surveys conducted in summer 2005, 2011, 2013, 2015, and 2017. Only length classes containing at least six fish were plotted for each year.

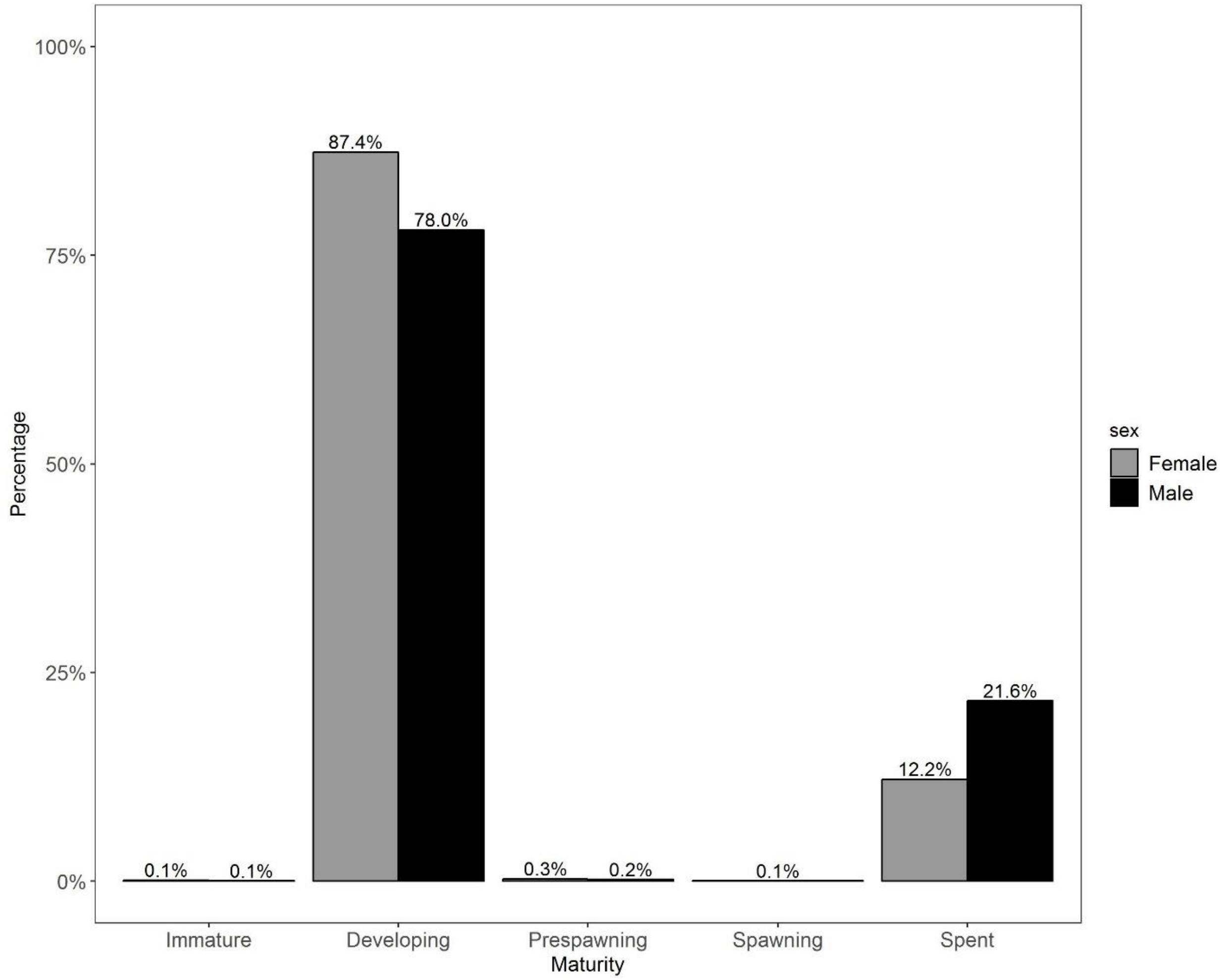

Figure 5. – Maturity designation and percentage in each category of male and female walleye pollock examined from all trawls combined during the 2017 acoustic-trawl survey of the Gulf of Alaska.

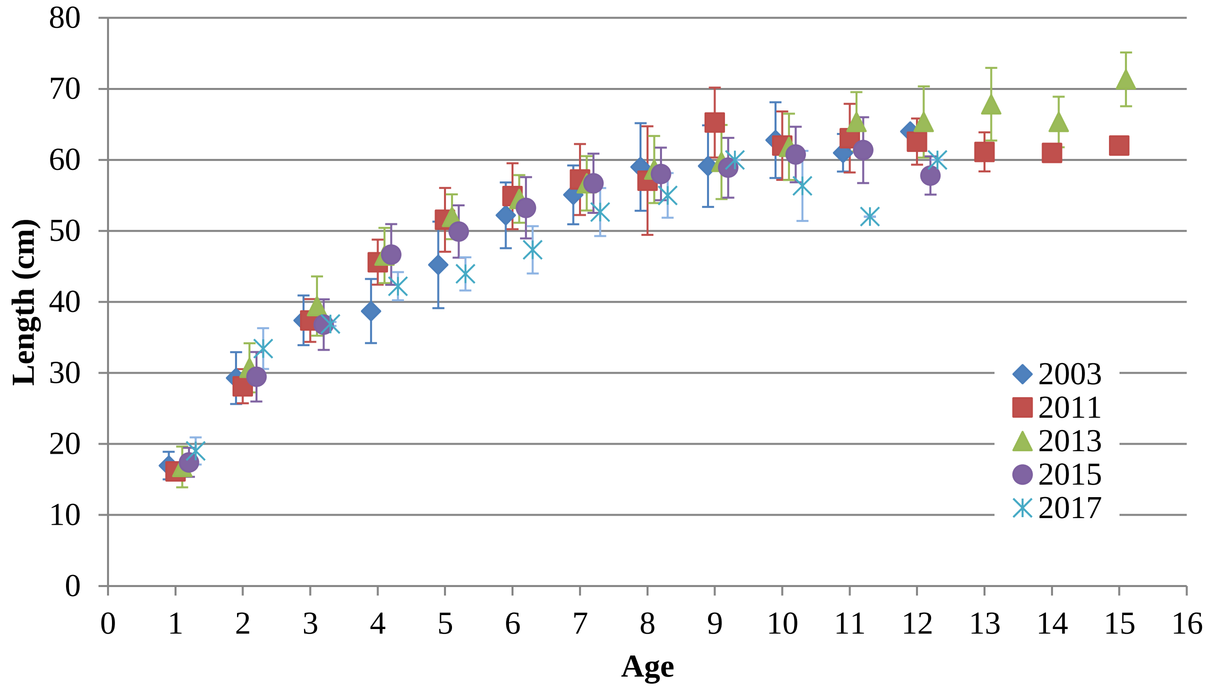

Figure 6. -- Average length (cm) at age (bars indicate 1 standard deviation) for walleye pollock from summer acoustic-trawl surveys in the Gulf of Alaska in 2003, 2011, 2013, 2015 and 2017.

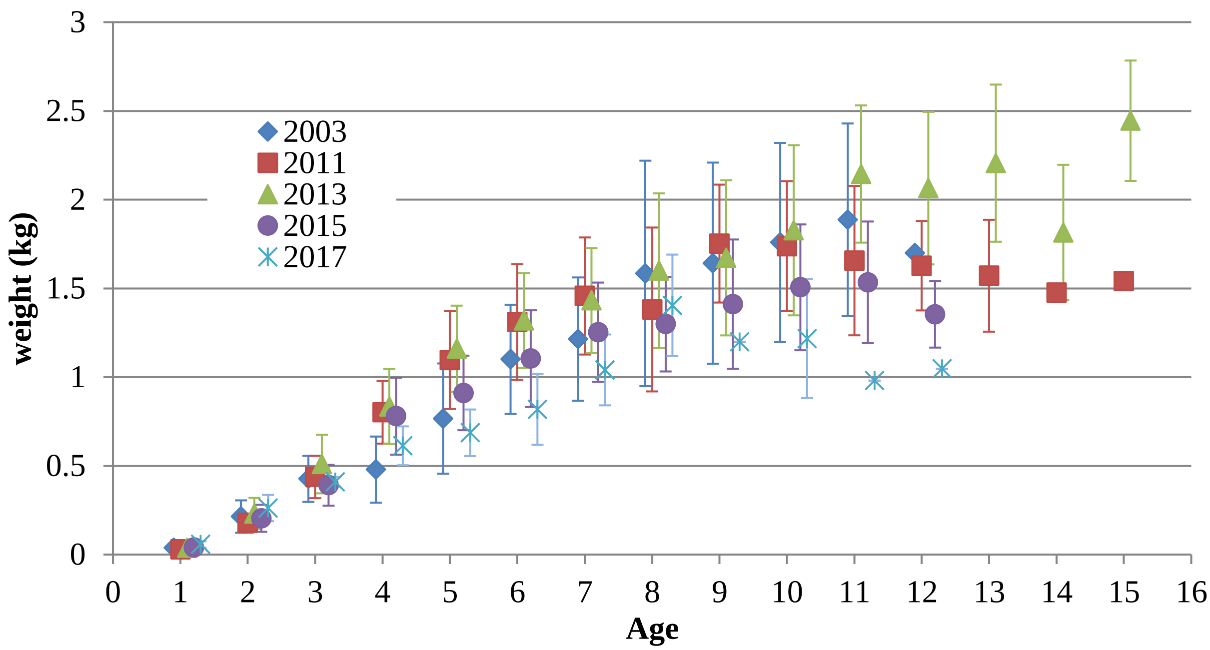

Figure 7. -- Average weight (kg) at age (bars indicate 1 standard deviation) for walleye pollock from summer acoustic-trawl surveys in the Gulf of Alaska in 2003, 2011, 2013, 2015 and 2017.

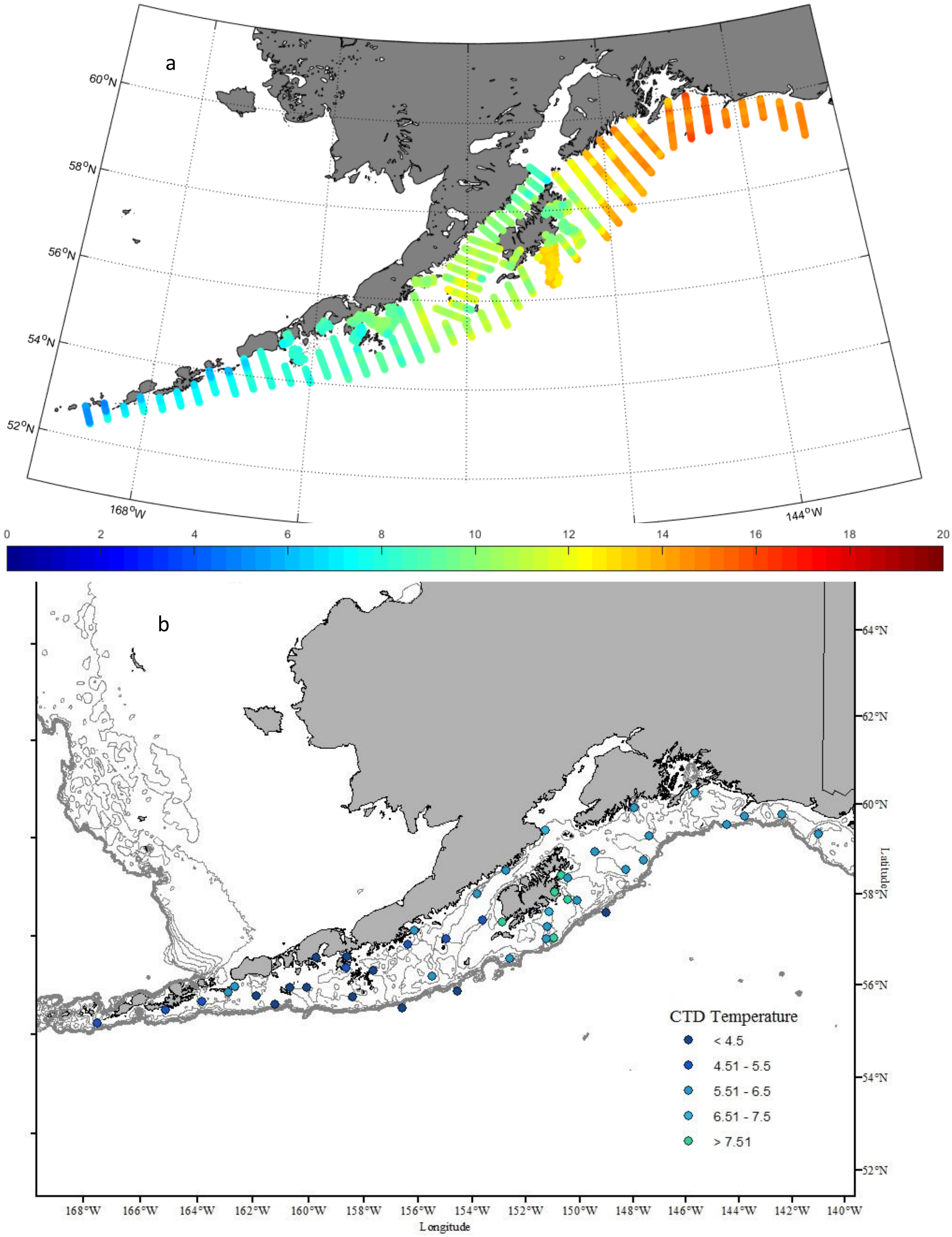

Figure 8. -- Temperature (°C) a) measured at the sea surface using shipboard surface temperature sensors along survey transects averaged at 1 nautical mile resolution, and b) near the seafloor using conductivity-temperature-depth (CTD) profilers during the summer 2017 acoustic-trawl survey of the GOA shelf.

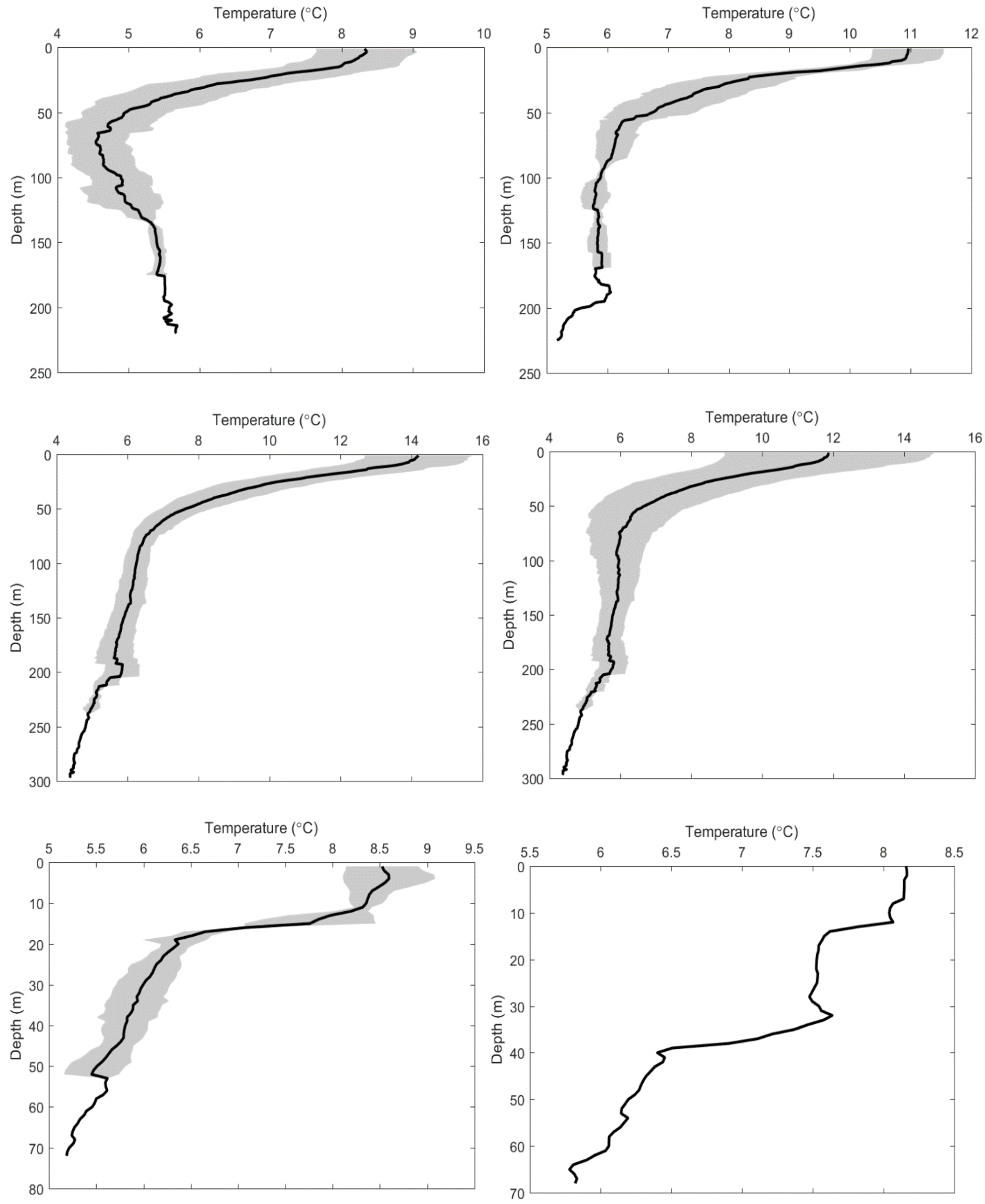

Figure 9. -- Average temperature (°C) at depth (m) by area from SBE-39 probes on the gear at sampling locations (and number of hauls with temperature data in each area) during the summer 2017 acoustic trawl survey of the Gulf of Alaska. The shaded area represents one standard deviation from mean.

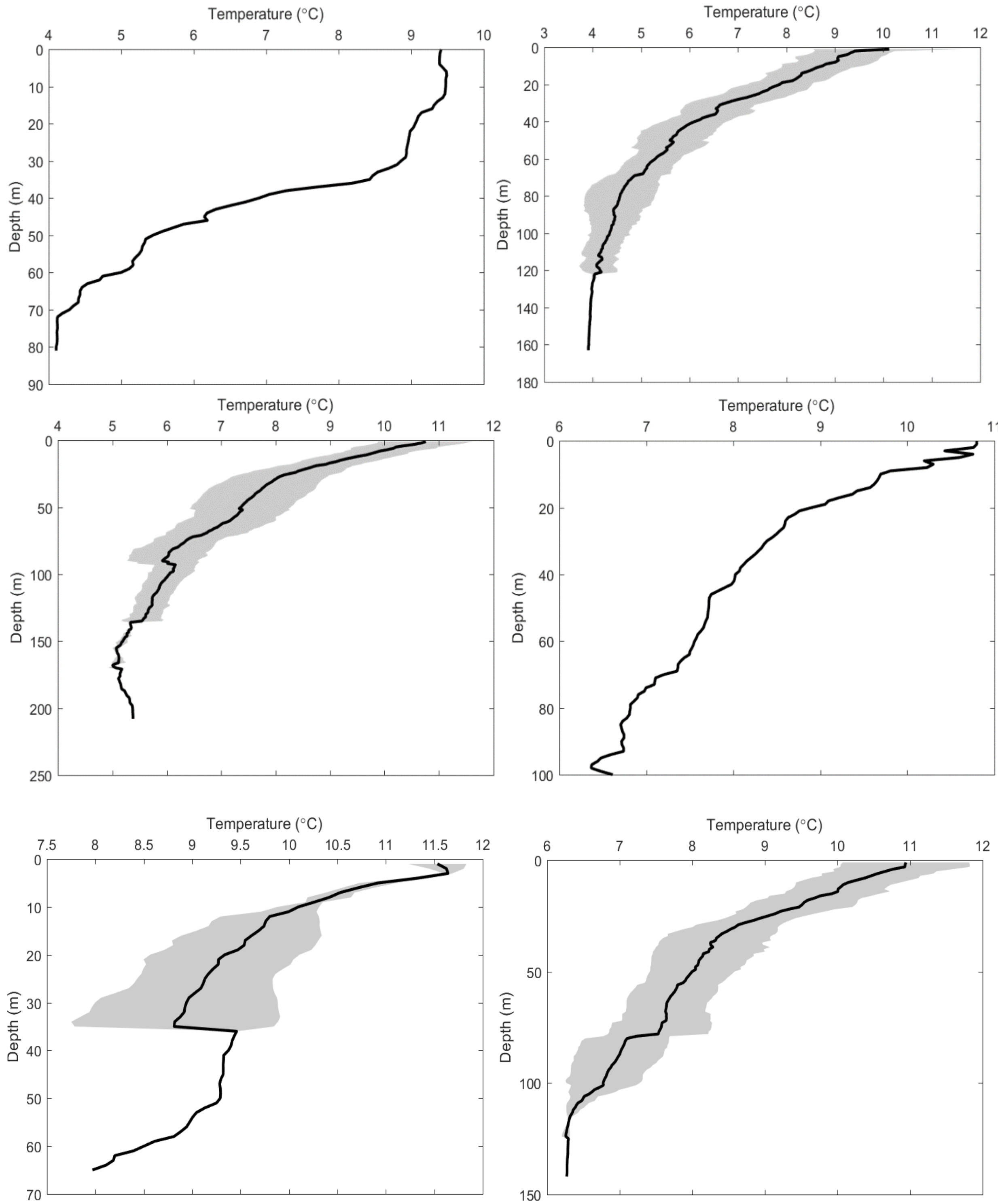

Figure 9. -- Cont.

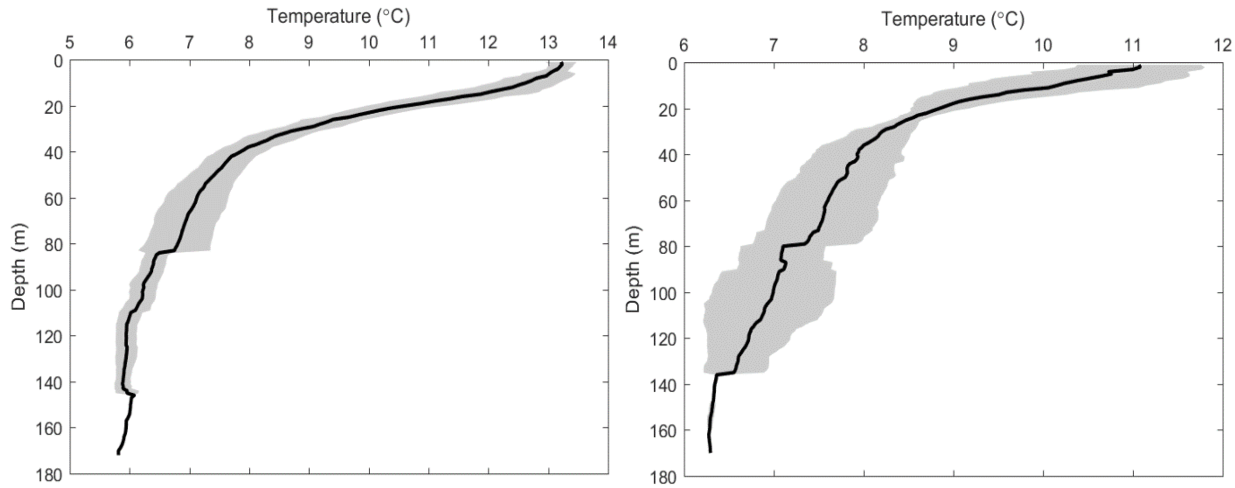

Figure 9. -- Cont.

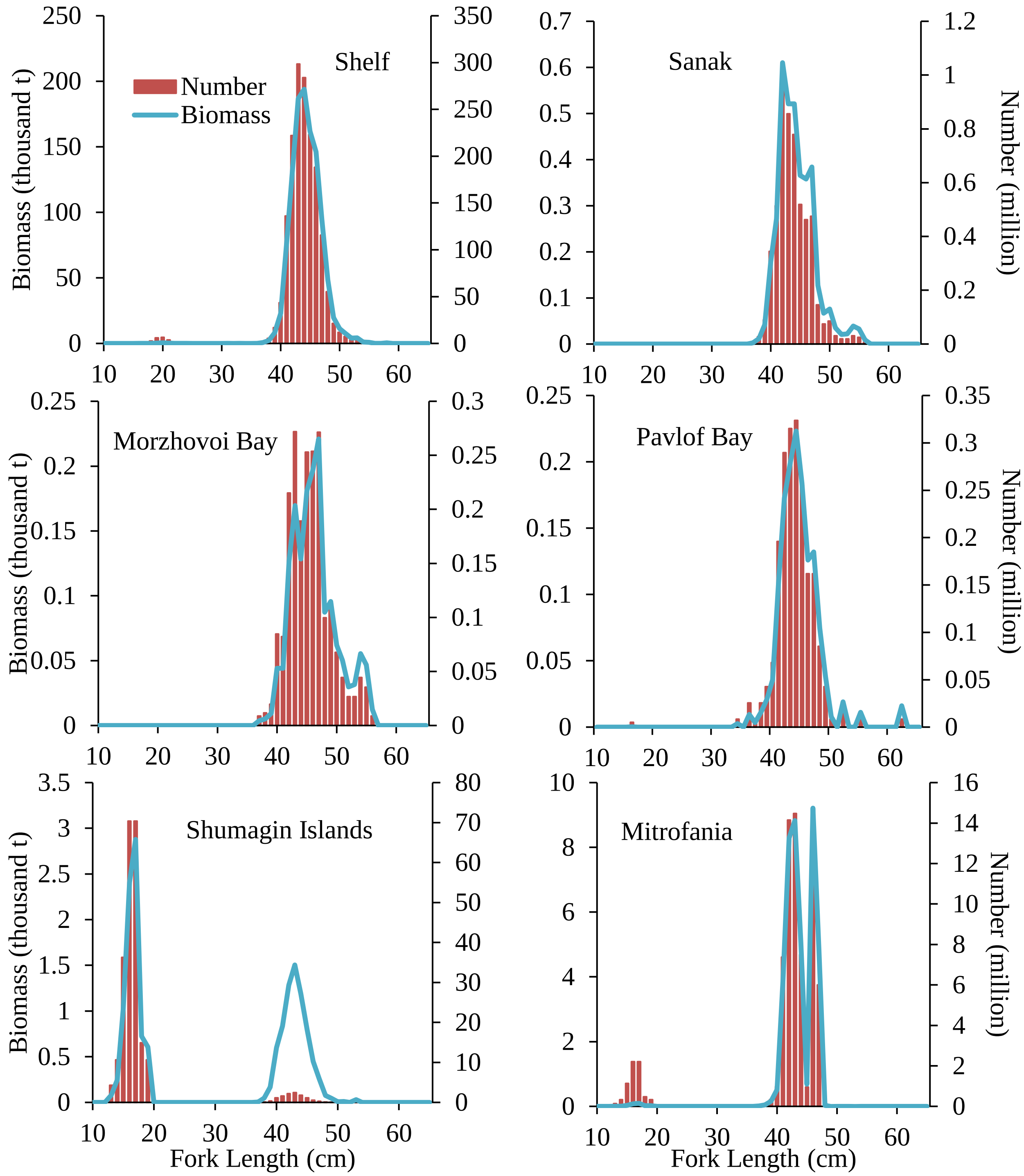

Figure 10. -- Walleye pollock biomass in thousand metric tons (blue line and primary y-axis) and numbers in millions (red bars and secondary y-axis) at length (cm) for each of the major survey areas in the 2017 summer GOA acoustic-trawl survey.

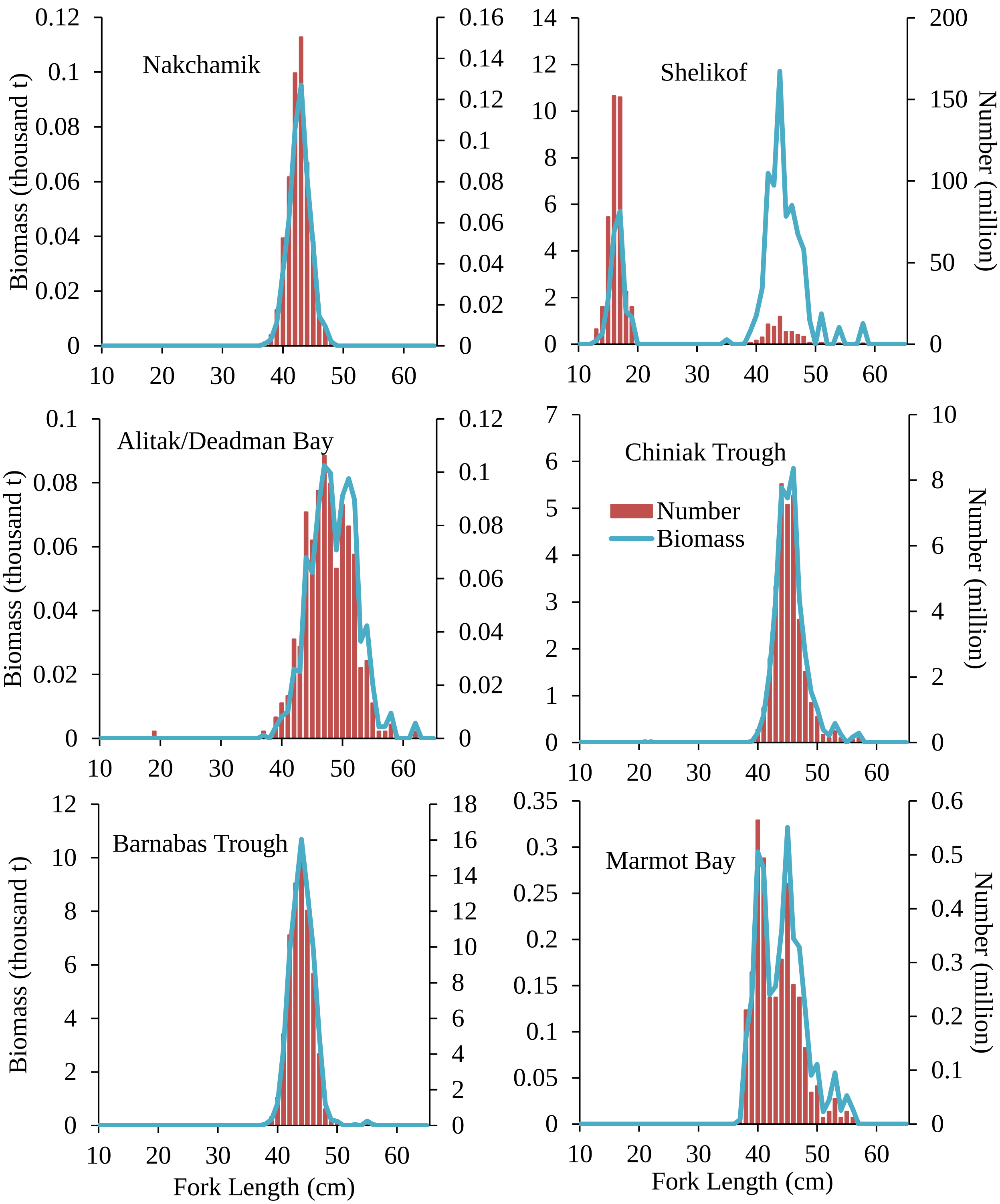

Figure 10. -- Continued.

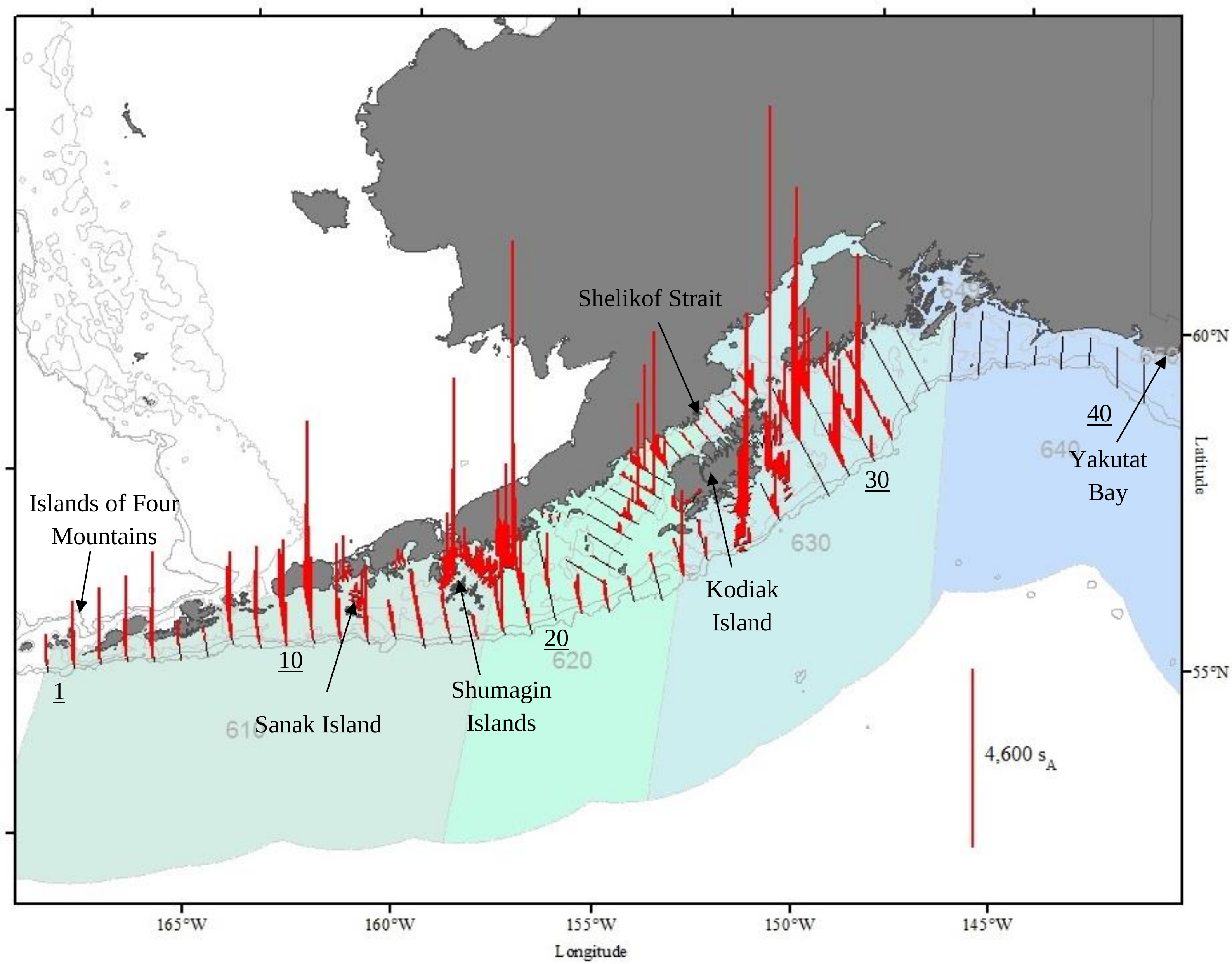

Figure 11. – Backscatter (s_A) attributed to age 1+ walleye pollock (red vertical lines) along tracklines surveyed during the summer 2017 acoustic-trawl survey in the western GOA. Transect numbers are underlined. NPFMC areas are displayed.

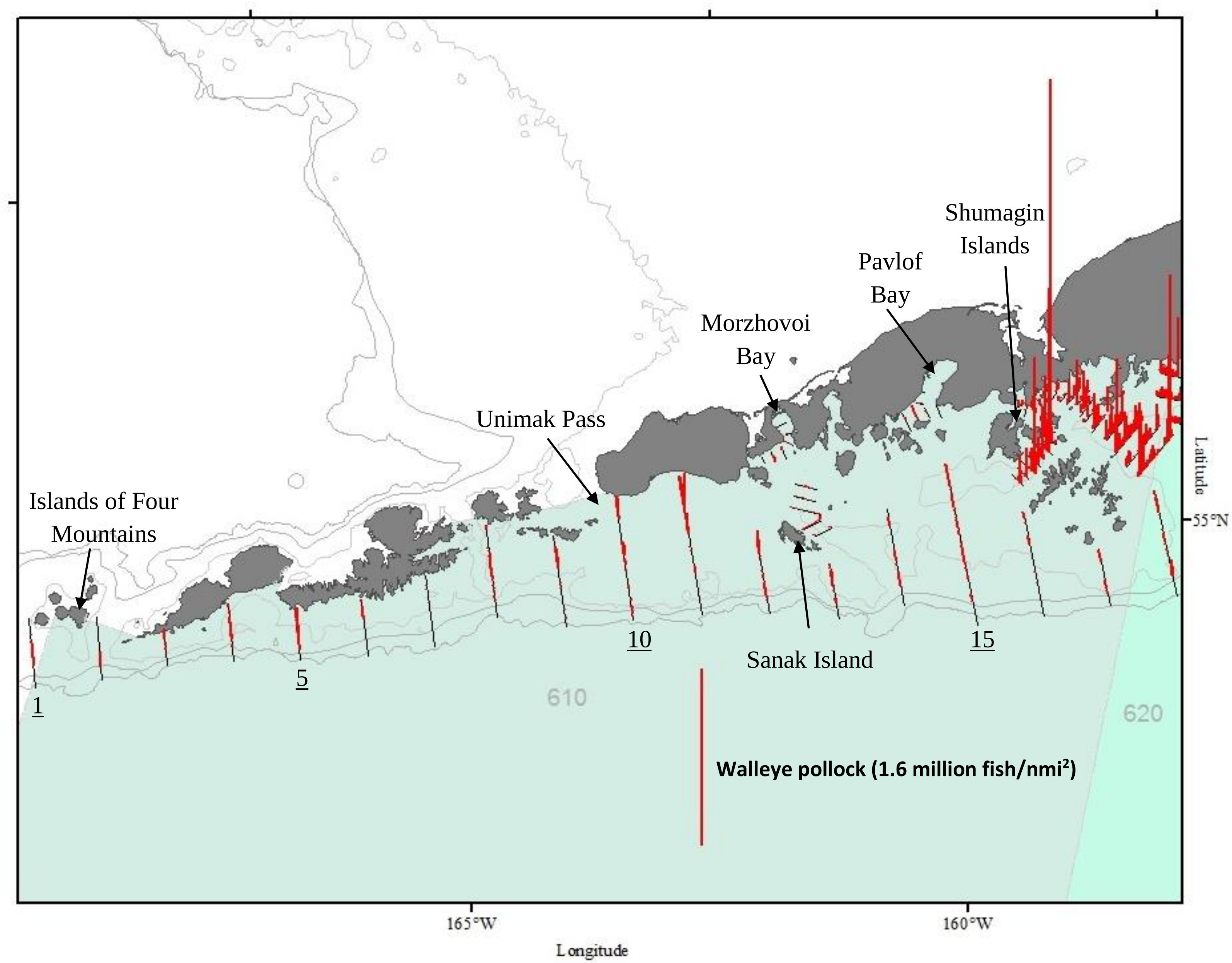

Figure 12. – Density (fish/nmi^2) of age 1+ walleye pollock (red vertical lines) along tracklines surveyed during the summer 2017 acoustic-trawl survey in the western GOA. Transect numbers are underlined. NPFMC areas 610 and 620 are displayed.

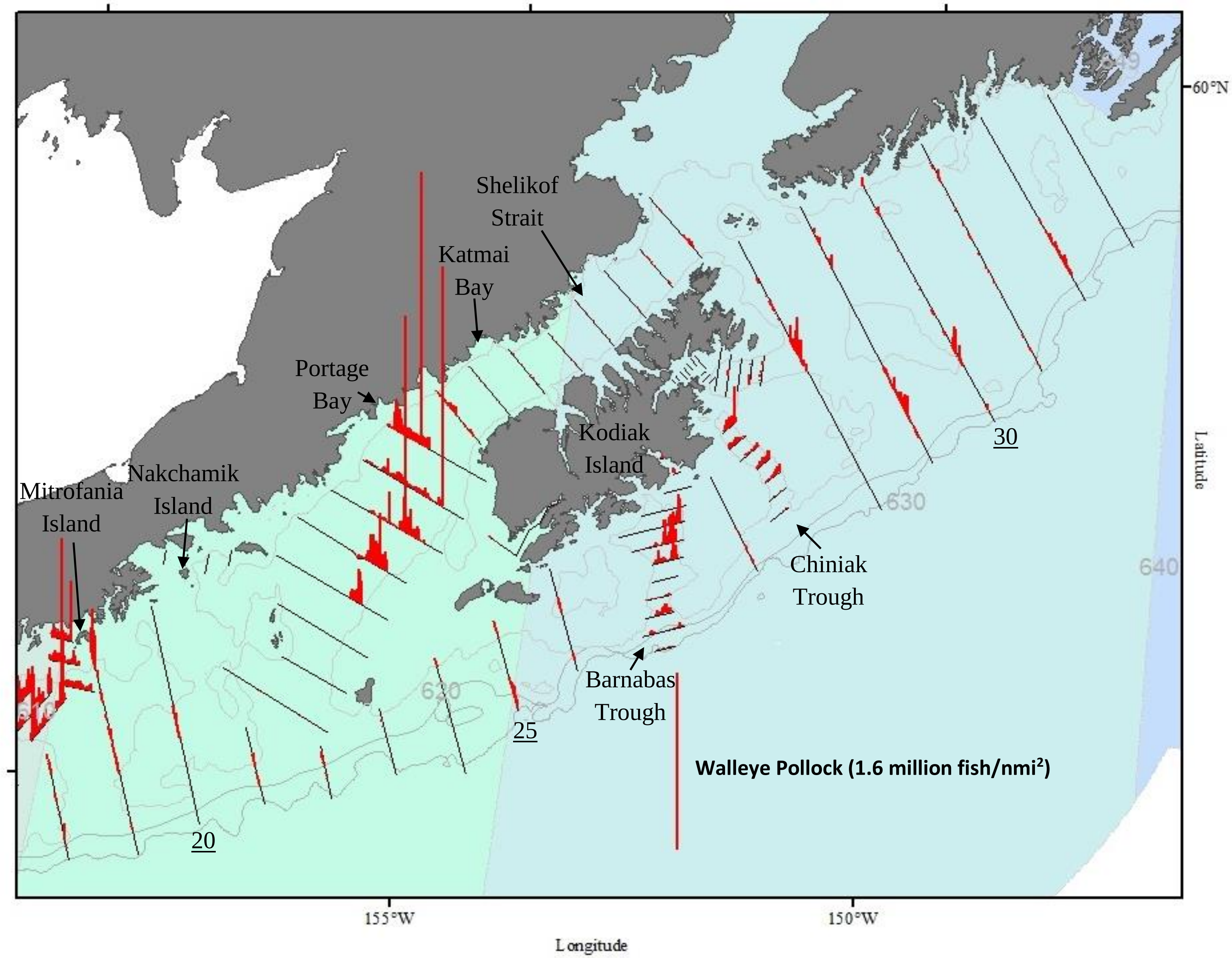

Figure 13. -- Density (fish/nmi^2) of age 1+ walleye pollock (red vertical lines) along tracklines surveyed during the summer 2017 acoustic-trawl survey in the central GOA. Transect numbers are underlined. NPFMC areas 620 and 630 are displayed.

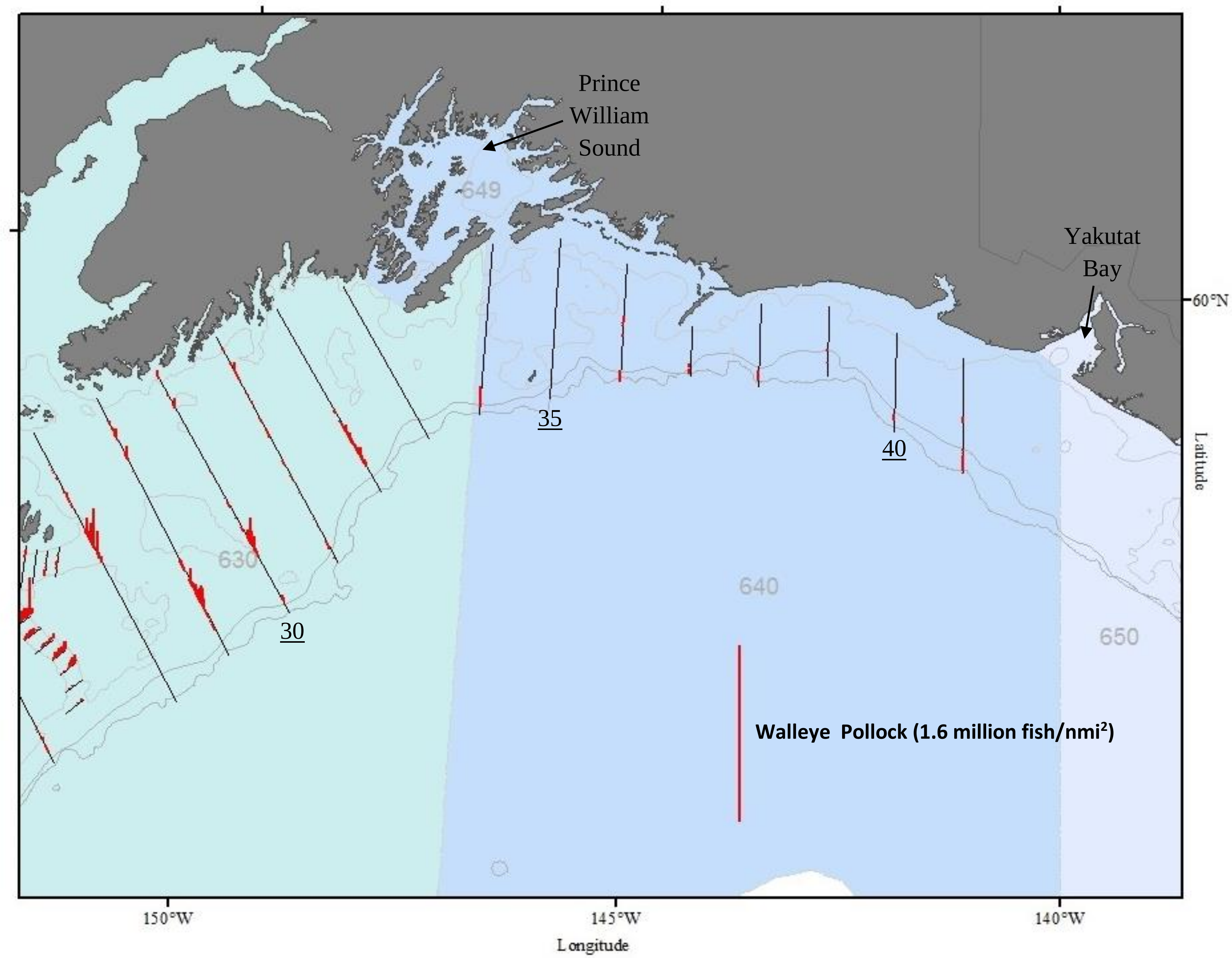

Figure 14. -- Density (fish/nmi^2) of age 1+ walleye pollock (red vertical lines) along tracklines surveyed during the summer 2017 acoustic-trawl survey in the eastern GOA. Transect numbers are underlined. NPFMC areas 630, 640, 649 and 650 are displayed.

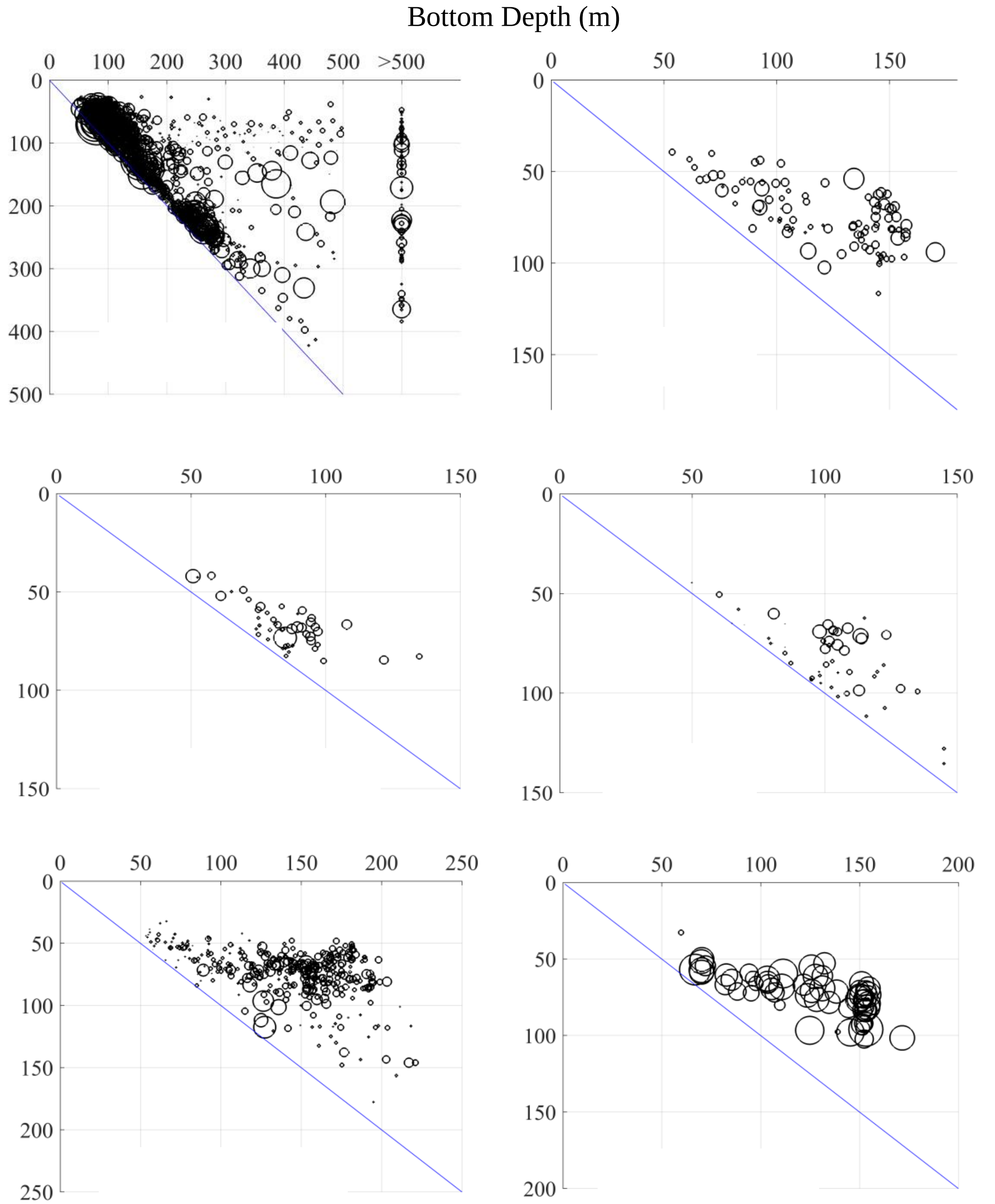

Figure 15. -- Mean pollock depth (weighted by biomass) versus bottom depth (m) for each 0.5 nmi of trackline from the summer 2017 GOA acoustic-trawl survey. Bubble size is scaled to the maximum biomass for each plot.

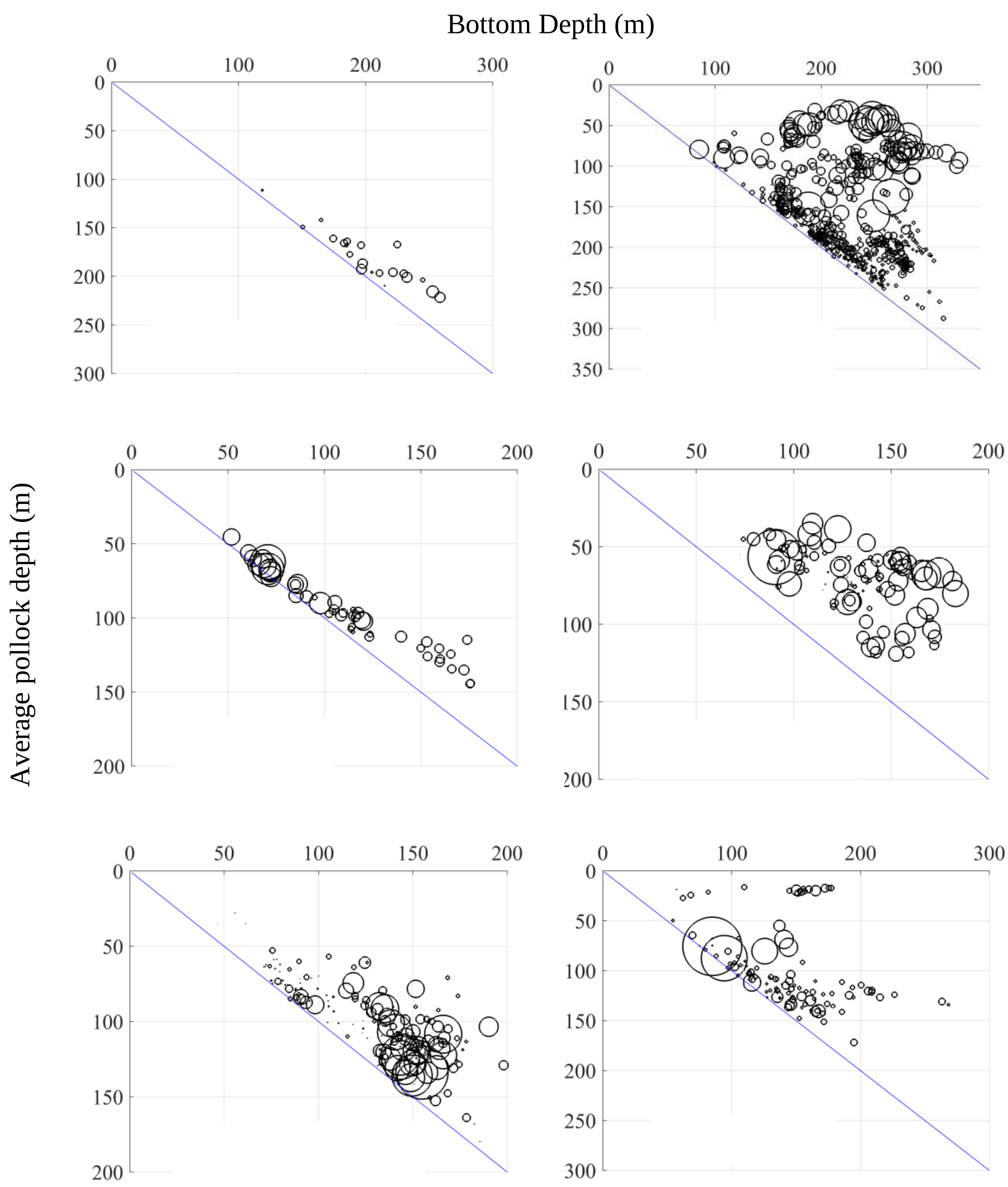

Figure 15. -- Continued.

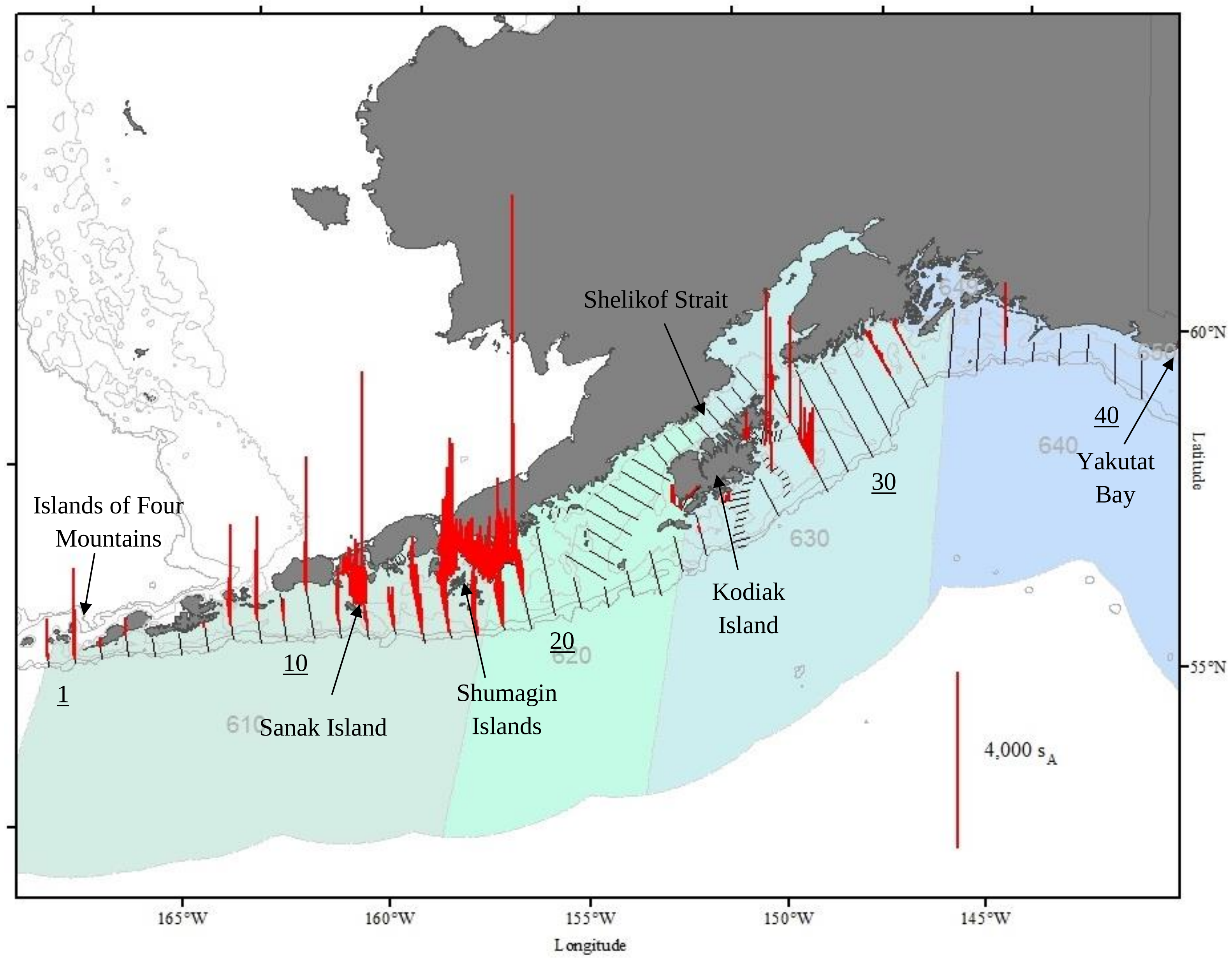

Figure 16. – Backscatter (s_A) attributed to age 0 walleye pollock mixed with adult walleye pollock (red vertical lines) along tracklines surveyed during the summer 2017 acoustic-trawl survey in the western GOA. Transect numbers are underlined. NPFMC areas are displayed.

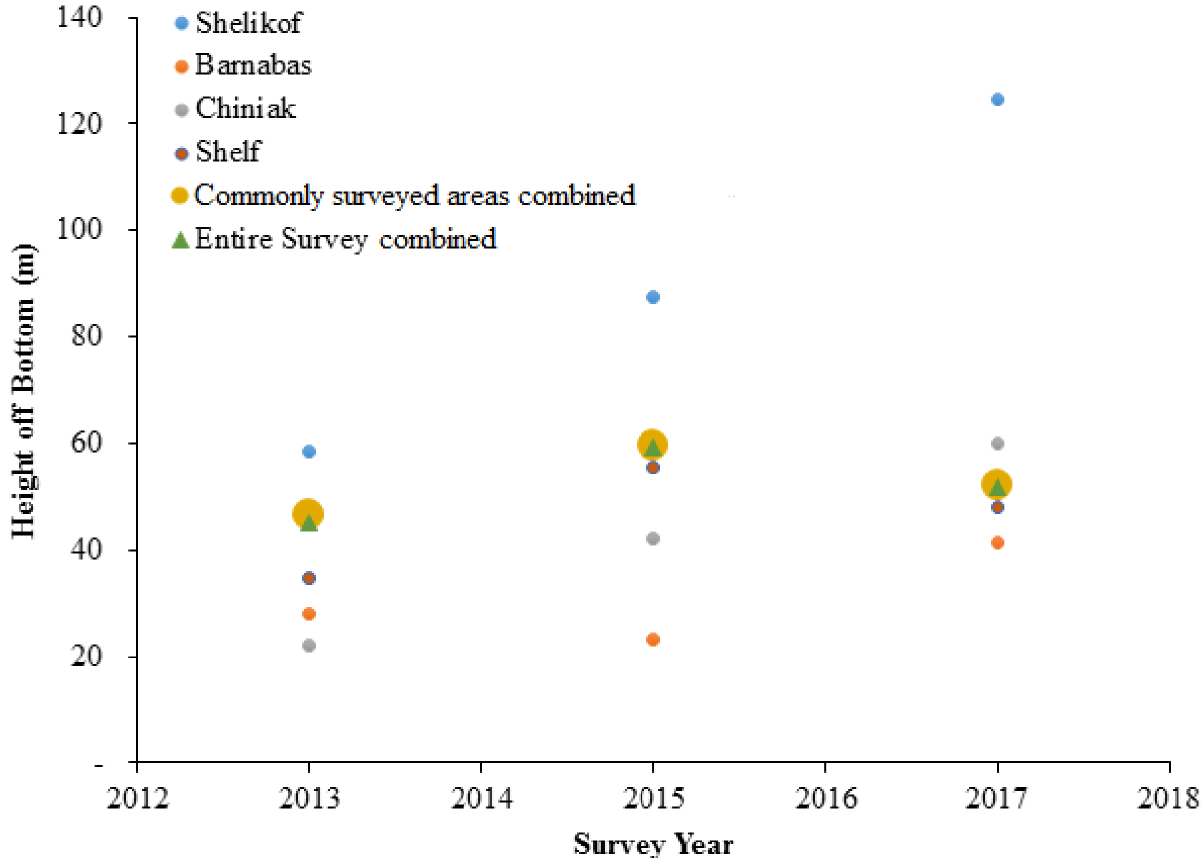

Figure 17. -- Weighted mean height off bottom of pollock in commonly surveyed areas of Shelikof Strait (blue dot), Barnabas Trough (orange dot), Chiniak Trough (grey dot), and shelf transects (burgundy dot) during summer Gulf of Alaska AT surveys conducted in 2013, 2015, and 2017. Large yellow dot represents the biomass weighted mean height off bottom of the 4 commonly surveyed areas combined, and the green triangle represents the entire survey extent combined for each survey year.

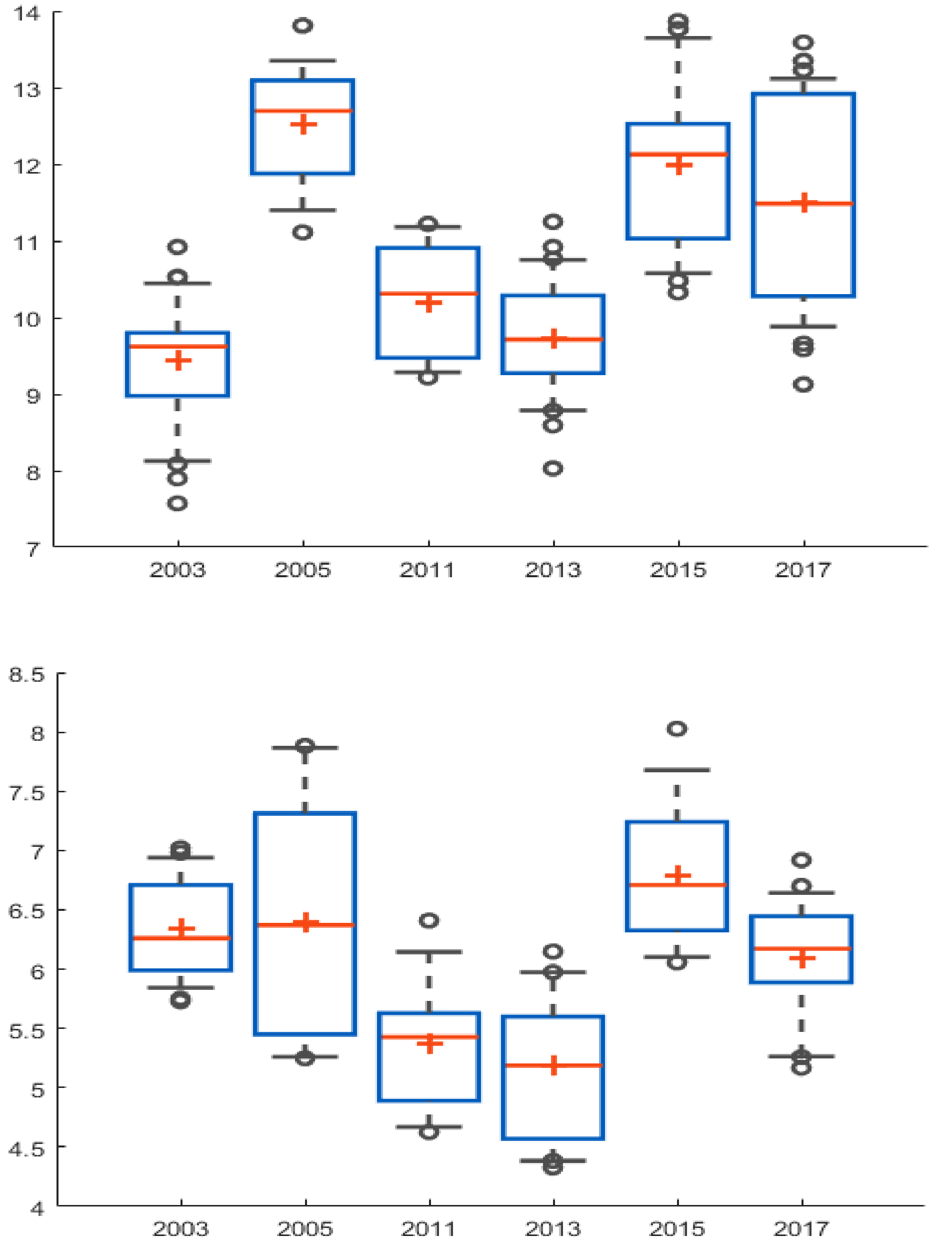

Figure 18. -- Temperatures (a) at the surface and (b) at 100 m depth from SBE-39 probes placed on the headrope of fishing gear during the commonly surveyed areas of Barnabas Trough, Chiniak Trough, and Shelikof Strait of the 2003, 3005, 2011, 2013, 2015, and 2017 GOA AT surveys. Blue boxes represent data within the 25th to 75th percentiles, whiskers bound the 9th to 91st percentile, red line represents the median, red cross represents the mean, and circles represent outliers.

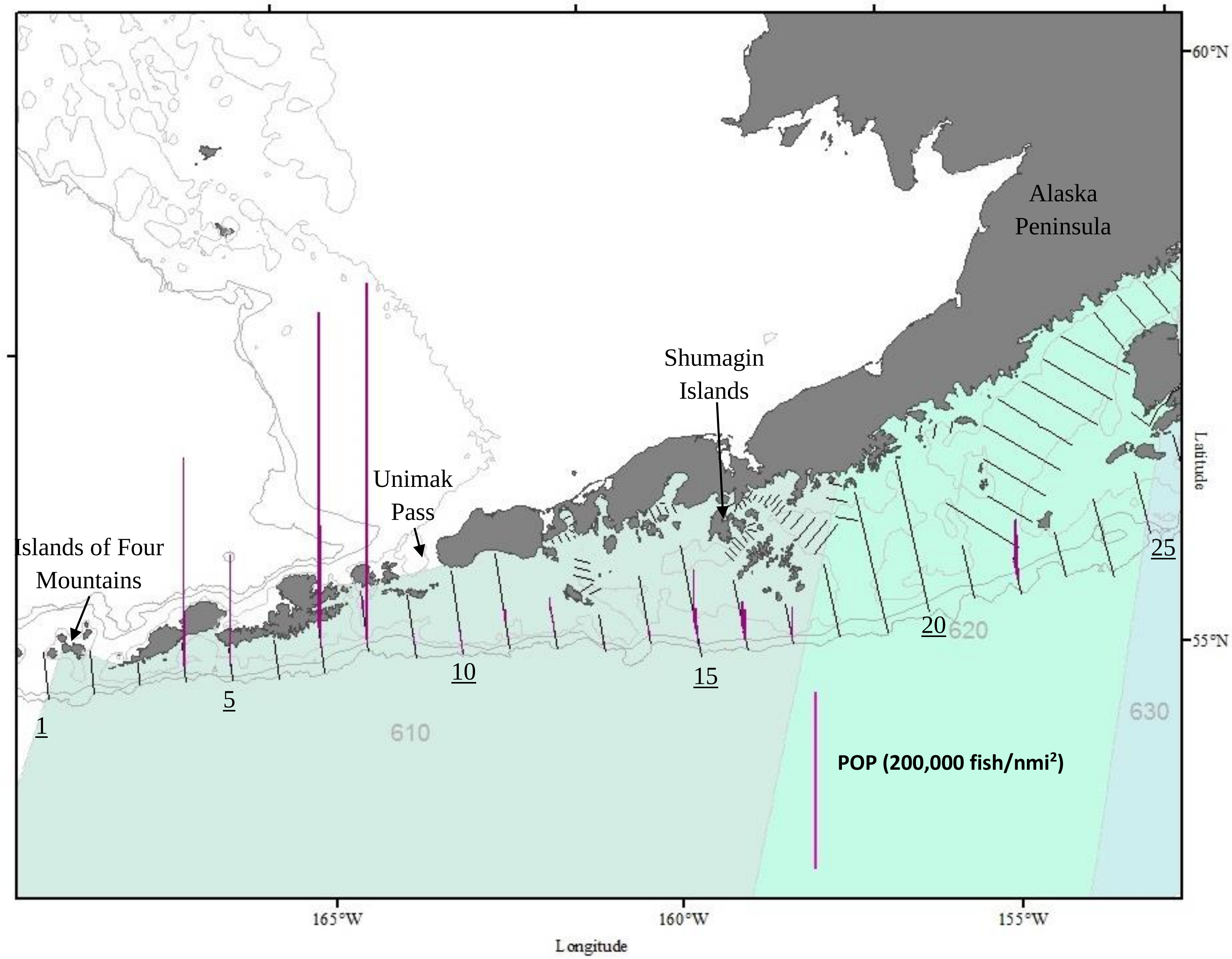

Figure 19. -- Density (fish/nmi^2) of Pacific ocean perch (purple vertical lines) along the western tracklines surveyed during the summer 2017 acoustic-trawl survey of the GOA. Shelf transect line numbers are underlined.

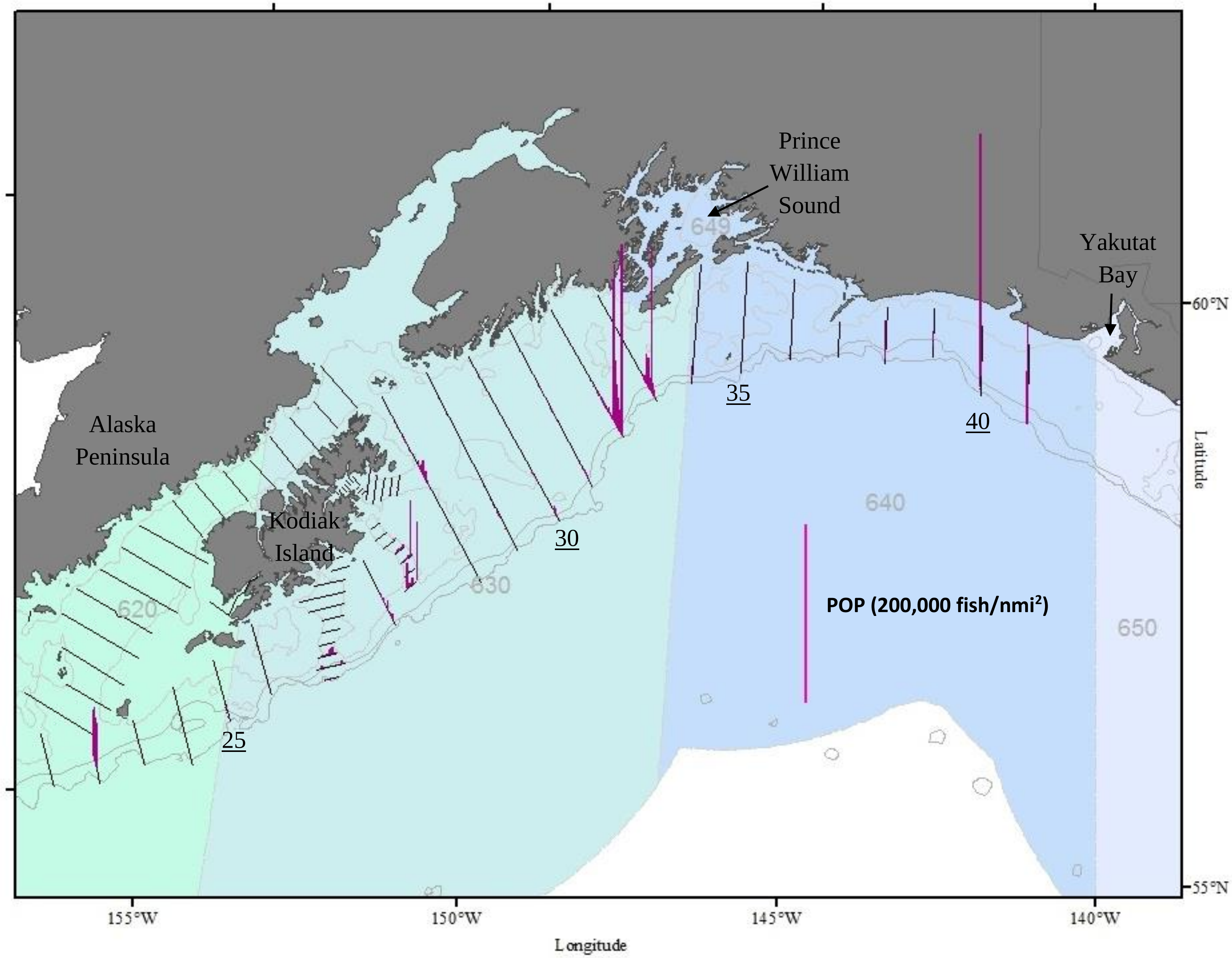

Figure 20. -- Density (fish/nmi^2) of Pacific ocean perch (purple vertical lines) along the eastern tracklines surveyed during the summer 2017 acoustic-trawl survey of the GOA. Shelf transect line numbers are underlined.

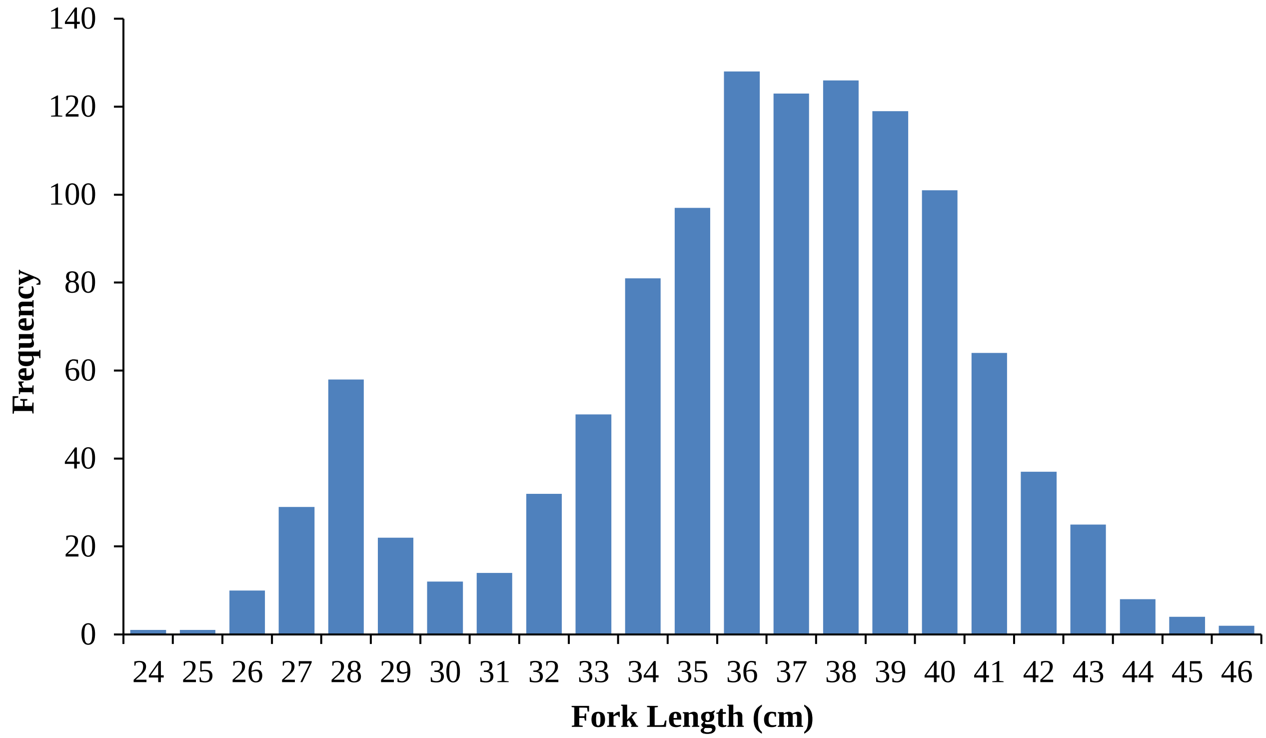

Figure 21. -- Length frequency of Pacific ocean perch captured in trawl nets during the 2017 summer GOA AT survey.

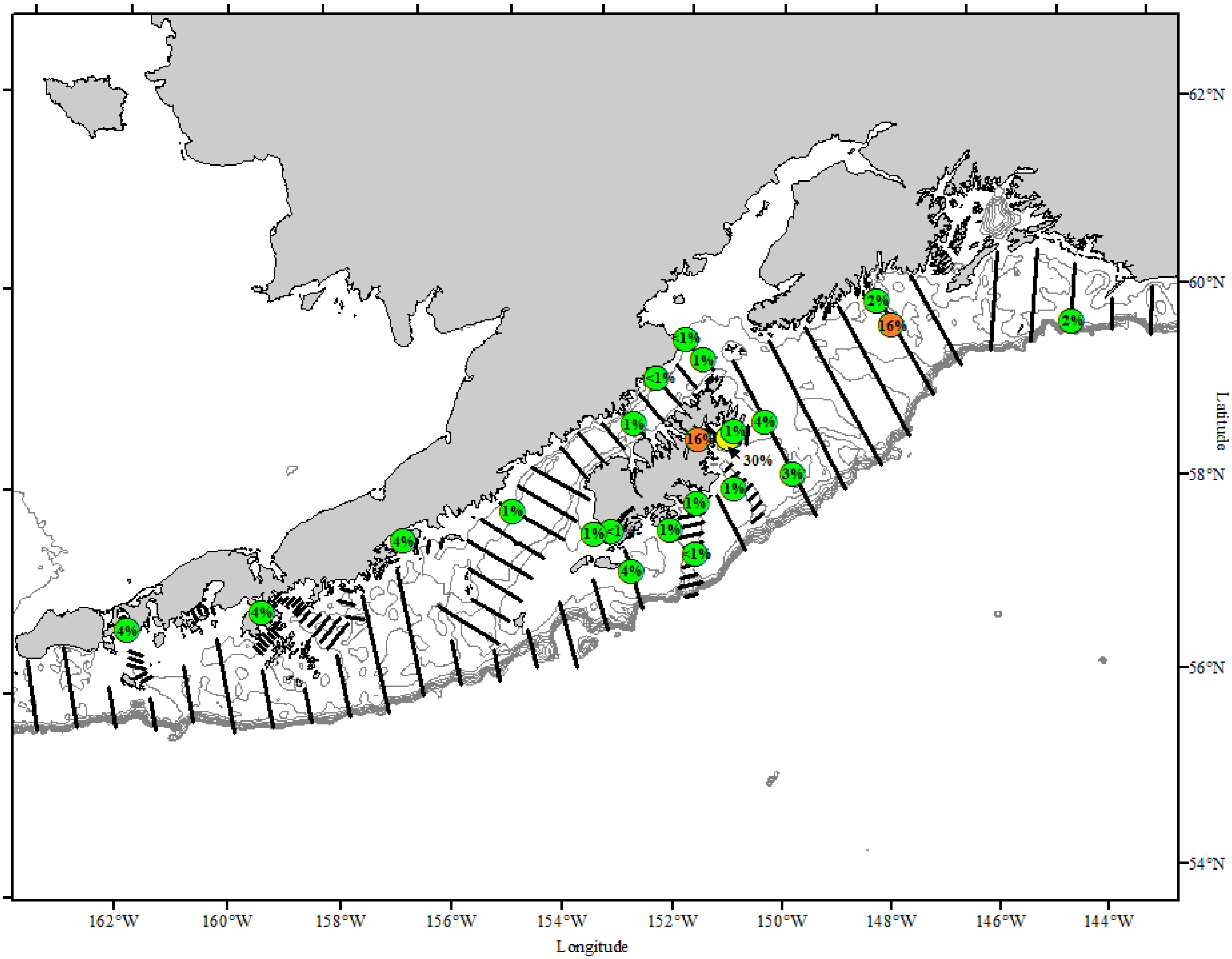

Figure 22. -- Hauls containing capelin where the catch was < 5% capelin by number (green circles), 6-16% (orange circles), or 17-30% (yellow circle) during the summer 2017 acoustic-trawl survey of the GOA.

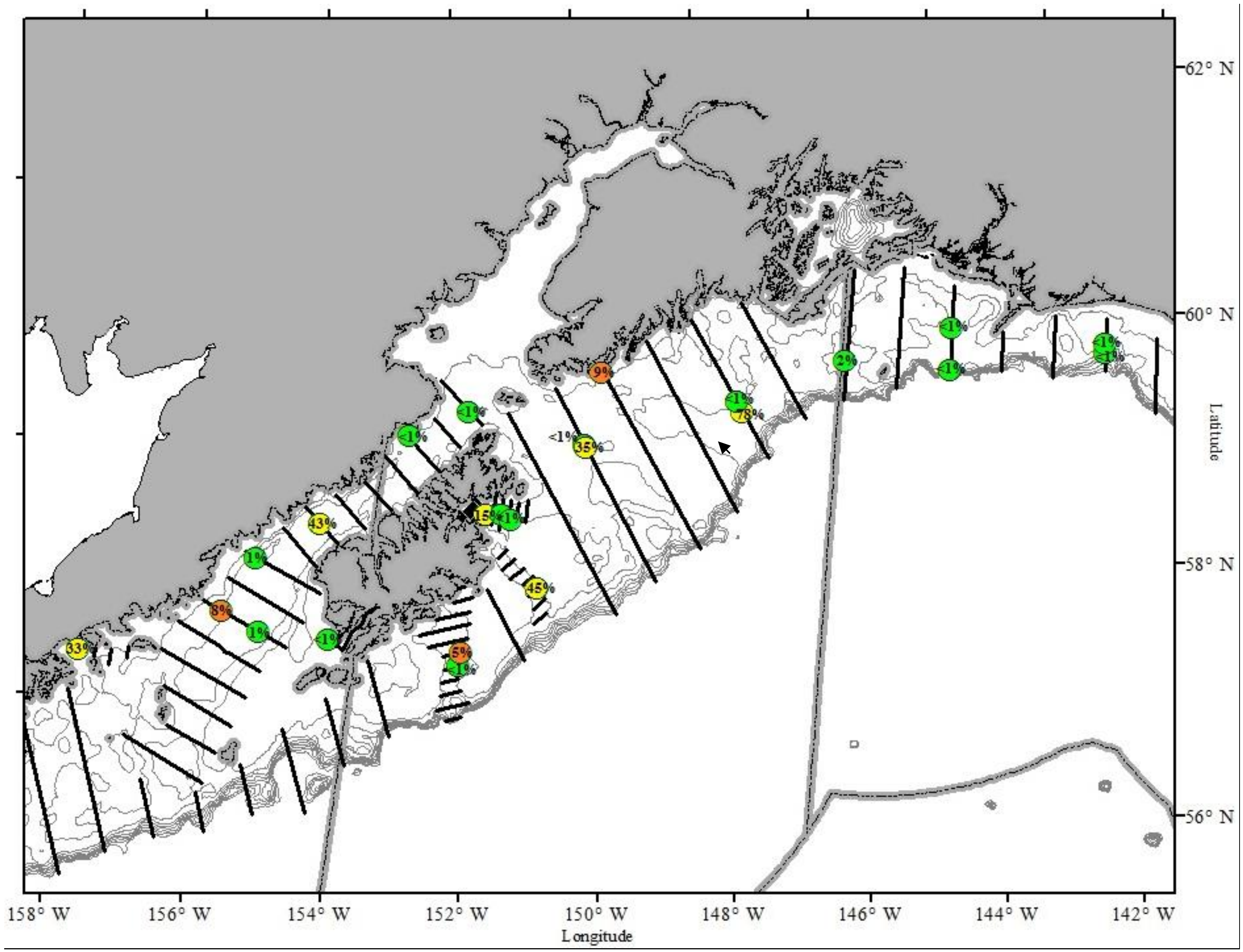

Figure 23. -- Hauls containing eulachon where the catch was < 5% eulachon by number (green circles), 5-16% (orange circles), or 17-30% (yellow circle) during the summer 2017 acoustic-trawl survey of the GOA.

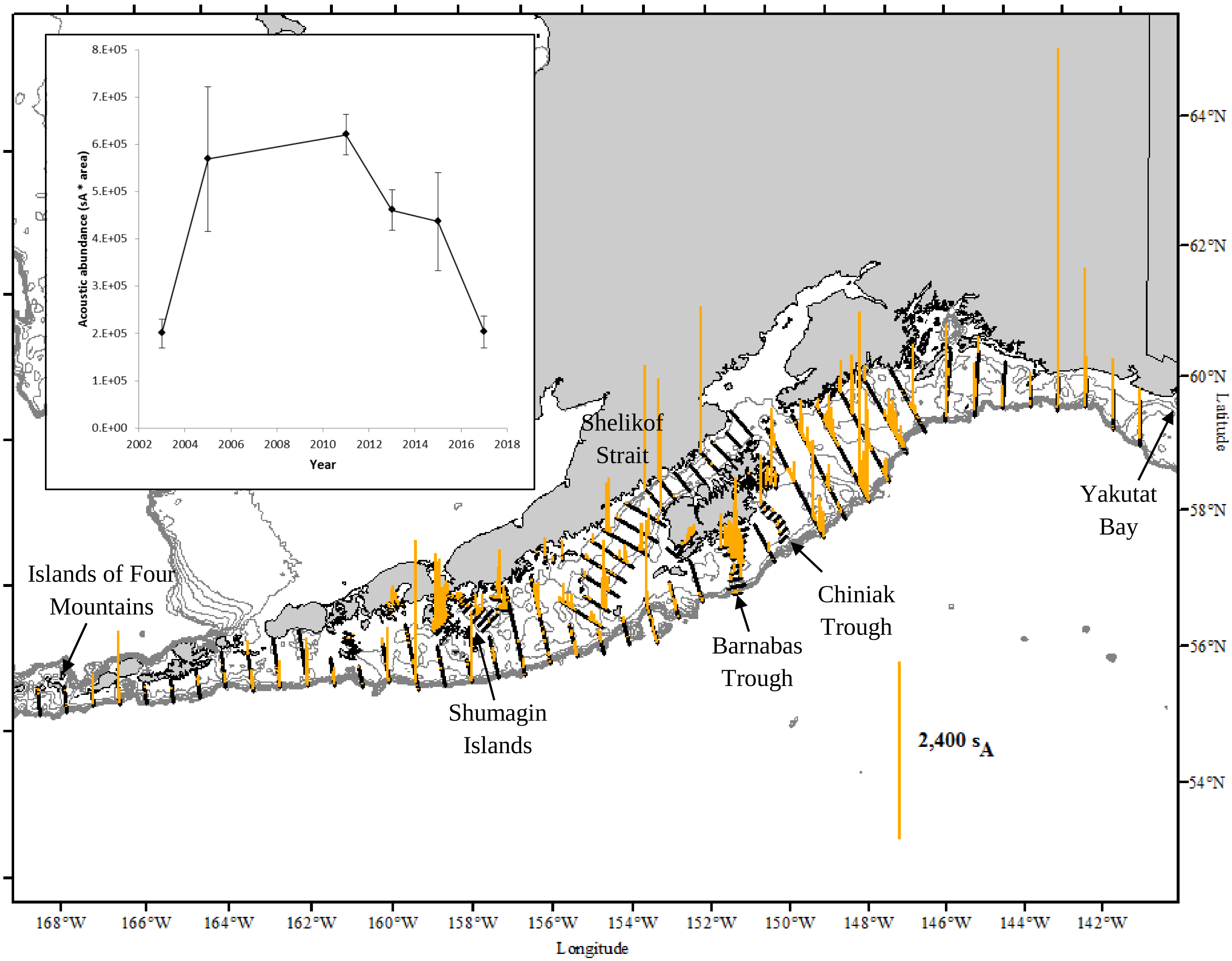

Figure 24. -- Distribution and strength of backscatter (s_A, m^2 nmi^{-2}) at 120-kHz attributed to euphausiids along tracklines surveyed in the entire GOA survey area during the summer 2017 acoustic-trawl survey of the GOA. Inset shows acoustic backscatter estimate of euphausiid abundance from common areas of Gulf of Alaska summer acoustic-trawl surveys (Shelikof Strait, Barnabas Trough, and Chiniak Trough). Error bars are approximate 95% confidence intervals computed from geostatistical estimates of relative estimation error (Petitgas 1993).

APPENDIX I. ITINERARY

Leg 1

9 June	Acoustic sphere calibration in Kalsin Bay, Kodiak Island
10 June	Depart Kodiak, AK
11 June	Transit to survey start area
12 - 18 June	Acoustic-trawl survey of the GOA shelf (Transects 1-13)
19 June	Acoustic-trawl survey of Sanak Trough (Transects 101-105)
19 - 20 June	Acoustic-trawl survey of Morzhovoi Bay (Transects 151-156)
20 - 21 June	Acoustic-trawl survey of the GOA shelf (Transects 14-15)
21 June	Acoustic-trawl survey of Pavlof Bay (Transects 201-206)
22 June	Acoustic-trawl survey of the GOA shelf (Transects 16-17)
23 - 25 June	Acoustic-trawl survey of Shumagins Islands area (Transects 251-274)
25 June	Acoustic-trawl survey of Mitrofania area (Transects 301-303)
26 June	Acoustic-trawl survey of Shumagin Islands area (Transect 275)
26 - 27 June	Acoustic-trawl survey of the GOA shelf (Transects 18-19)
27 - 28 June	Transit to Kodiak
28 June - 3 July	In port Kodiak

Leg 2

3 July	Transit to survey resume point
3 - 8 July	Acoustic-trawl survey of Shelikof Strait (Transects 401-415)
9 July	Acoustic-trawl survey of Nakchamik area (Transects 351-354)
9 - 10 July	Acoustic-trawl survey of the GOA shelf (Transects 20-21)
10 July	Acoustic-trawl survey of Shelikof Strait (Transect 416)
10 - 12 July	Acoustic-trawl survey of the GOA shelf (Transects 22-25)
12 - 13 July	Acoustic-trawl survey of Alitak Bay (Transect 451)
13 - 14 July	Acoustic-trawl survey of the GOA shelf (Transect 26)
14 - 15 July	Initial Acoustic-trawl survey of Barnabas Trough (Transects 501-509)
15 July	Transit to Kodiak, AK
15 - 28 July	In port Kodiak, AK

Leg 3

28 July	Transit to survey resume point
28 - 29 July	Acoustic-trawl survey of Chiniak Trough (Transects 551-557)
30 July	Acoustic-trawl survey of the GOA shelf (Transect 27)
31 July - 1 Aug.	Acoustic-trawl survey of Barnabas Trough (Transects 501-512)
2 Aug.	Acoustic-trawl survey of the GOA shelf (Transect 28)
3 - 4 Aug.	Acoustic-trawl survey of Marmot Bay (Transects 601-616)
4 - 14 Aug.	Acoustic-trawl survey of the GOA shelf (Transects 29-41)
14 - 15 Aug.	Transit to Kodiak, AK
16 Aug.	Acoustic sphere calibration in Kalsin Bay, Kodiak, AK
16 Aug.	In Kodiak, AK. End of survey

APPENDIX II. SCIENTIFIC PERSONNEL

Leg I (8 - 28 June)

Name	Position	Organization
Darin Jones	Chief Scientist	AFSC
Nathan Lauffenburger	Fishery Biologist	AFSC
Rick Towler	Computer Spec.	AFSC
Abigail McCarthy	Fishery Biologist	AFSC
Mike Levine	Fishery Biologist	AFSC
Matthew Phillips	Fishery Biologist	OAI
Ethan Beyer	Fishery Biologist	OAI
Marsha Lenz	Teacher at Sea	NOAA

Leg II (3 - 15 July)

Name	Position	Organization
Taina Honkalehto	Chief Scientist	AFSC
Sarah Steinessen	Fishery Biologist	AFSC
Kresimir Williams	Fishery Biologist	AFSC
Christopher Bassett	Fishery Biologist	AFSC
Mike Levine	Fishery Biologist	AFSC
Michael Martin	RACE Deputy Director	AFSC
Matthew Phillips	Fishery Biologist	OAI
Alexandra Padilla	Acoustician	UNH
Sian Proctor	Teacher at Sea	NOAA

Leg III (28 July - 16 Aug.)

Name	Position	Organization
Denise McKelvey	Chief Scientist	AFSC
Patrick Ressler	Fishery Biologist	AFSC
Abigail McCarthy	Fishery Biologist	AFSC
Darin Jones	Fishery Biologist	AFSC
Scott Furnish	Computer Spec.	AFSC
Pete Hulson	Fishery Biologist	AFSC
Joe Warren	Guest Scientist	SBU
Brandyn Lucca	Graduate Student	SBU
Matthew Phillips	Fishery Biologist	OAI

AFSC – Alaska Fisheries Science Center, Seattle, WA
NOAA – National Oceanic and Atmospheric Administration, Teacher at Sea Program
OAI – Ocean Associates, Inc., Arlington, VA
SBU – Stony Brook University, Southampton, NY
UNH – University of New Hampshire - Center for Coastal & Ocean Mapping, Durham, NH

APPENDIX III. DERIVING ABUNDANCE-AT-AGE USING AGE-LENGTH KEYS

Acoustic data processing results in abundance-at-length estimates, usually for each 1 cm length bin. To estimate the age composition of the fish population being assessed for abundance, abundance-at-length must be converted to abundance-at-age. A subset of fish from the trawl catches are sampled for age structures, producing a data set of combined length measurements and age estimates. These are used as a basis for computing an age-length key.

The first step in this process is to arrange the data in a length-age matrix (X), where rows represent length (i) in cm and columns represent age (j) in years. Each element then represents the frequency of individual fish samples with a length i and age j. The proportion of fish of each age that were observed for a given length is then computed across rows from the length-age matrix, yielding a new proportion matrix $P_{i,j}$, as

$$P_{i,j} = X_{i,j} / \sum_j X_{i,j} \quad . \qquad \text{Eq. (i)}$$

The abundance-at-age is then computed as the matrix multiplication product of a row vector of abundance-at-length and the proportioned length-age matrix P.

Since the sample of fish that are aged is a subset of those measured for length, occasionally there are abundance estimates for length classes that did not have samples that were aged, and therefore using the above procedure results in a lower total abundance-at-age than the total abundance-at-length. The relative amount of this difference is usually small, as the more abundant length classes are likely to be sampled for age. Following is the description of a Gaussian modeling process that was derived to provide estimates of the age distribution for length classes with abundance estimates that are not present in the age sample.

A historic analysis of length-at-age data for walleye pollock has shown that the distribution of fish length at a given age follows an approximately normal distribution, especially for fish samples taken from distinct geographic regions and similar times of year. This allows for the use of Gaussian distributions to model the relationship between length and age.

First, a mean length (μ) and standard deviation (σ) of the aged fish sample is computed for each age class (j). A Gaussian approximation of matrix X is then computed as

$$\hat{X}_{i,j} = \left(\frac{1}{\sigma_j \sqrt{2\pi}} e^{-\frac{\left(i-\mu_j\right)^2}{2\sigma_j{}^2}} \right) N_j \quad , \qquad \text{Eq. (ii)}$$

where N is the number of fish sampled at age j. Because Gaussian models are asymptotic, a small but non-zero value for the distribution of length at a given age extends to the full length range being considered. As it is biologically impossible to encounter certain lengths of fish at certain ages (e.g., a 10 cm pollock with an age of 5 years) the modeled distribution of lengths-at-age are truncated using the minimum and maximum observed length for that age based on historic data. If there are insufficient samples in the aged fish set for a given age (common occurrence with larger, older fish) to derive a mean and standard deviation (e.g., $N < 3$), a mean and standard deviation based on historic MACE survey data dating back to 2003 for that geographic area and season are used. Finally, a matrix $\hat{P}$ is computed using equation 1 but substituting $\hat{X}$ for X.

For length classes where the matrix P is not populated (e.g., $\sum_i P_{i,j} = 0$), the matrix $\hat{P}$ is used instead. This method allows for historic MACE data collected under similar circumstances to be used to “fill in” for missing age samples, allowing for the total abundance-at-age to equal abundance-at-length.

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