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Results of the Acoustic-Trawl Survey of Walleye Pollock (*Theragra chalcogramma*) on the U.S. and Russian Bering Sea Shelf in June - August 2012 (DY1207)

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Results of the Acoustic-Trawl Survey of Walleye Pollock (*Theragra chalcogramma*) on the U.S. and Russian Bering Sea Shelf in June - August 2012 (DY1207)

by

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ABSTRACT

Eastern Bering Sea shelf walleye pollock (*Theragra chalcogramma*) midwater abundance and distribution were assessed from Bristol Bay in the United States, to Cape Navarin, Russia, between 7 June and 10 August 2012 using acoustic-trawl techniques aboard the NOAA ship *Oscar Dyson*. Most of the pollock biomass in the U.S. exclusive economic zone (EEZ) was distributed between the Pribilof Islands and Cape Navarin, between roughly the 80 m and 200 m isobaths. Estimated pollock abundance in midwater (between 16 m from the surface and 3 m off bottom) in the U.S. EEZ portion of the Bering Sea shelf was 1.843 million metric tons (t), lower than in 2010 (2.323 million t) but higher than in 2009 or 2008 (0.924 million t, and 0.997 million t, respectively). Pollock biomass east of 170° W was 0.279 million t, the predominant length mode was 47-48 cm, and most ages ranged between 4 and 7 years. In the U.S. waters west of 170° W, pollock biomass was 1.563 million t (65.4% of total shelf-wide biomass), and dominant modal lengths were 23, 38, and 30 cm, corresponding to pollock aged 2, 4, and 3 years, respectively. In Russia (0.550 million t, 23% of total biomass), modal lengths and ages were similar, though generally smaller and younger than those in the U.S. waters west of 170° W. Vertical distribution analyses indicated that whereas 80-90% of the adults were within 50 m of the bottom only about 60% of the juveniles were observed in that depth layer. Results of a paired (midwater-bottom) trawl efficiency comparison project are presented. The preliminary spatial distribution of the euphausiid abundance index is presented, but analyses are still in progress.

CONTENTS

INTRODUCTION

Scientists from the Midwater Assessment and Conservation Engineering (MACE) Program of the Alaska Fisheries Science Center (AFSC) have conducted summer surveys to estimate the abundance and distribution of walleye pollock (*Theragra chalcogramma*) on the eastern Bering Sea (EBS) shelf since 1979. Surveys have been conducted either annually or biennially since 1994. The 2012 acoustic-trawl (AT) survey was carried out between 7 June and 10 August aboard the NOAA ship *Oscar Dyson*. Its primary objective was to collect acoustic and trawl information to estimate walleye pollock midwater abundance and distribution on the U.S. and Russian Bering Sea shelf. Additional survey sampling included conductivity-temperature-depth (CTD) and expendable bathythermograph (XBT) casts to characterize the Bering Sea shelf physical environment, and supplemental trawls to improve acoustic species classification and to obtain an index of euphausiid abundance using multiple frequency techniques. A number of specialized sampling devices were used during the survey, including light level sensors; a Simrad ME70 multibeam sonar to image fish schools; an 83-112 bottom trawl modified to sample fish in midwater; a trawl-mounted stereo camera ("Cam-Trawl") designed to identify species and determine size and density of animals as they pass by the camera during a haul, and a small, bottom-moored, trigger–camera system to autonomously collect images of fish on the seafloor. This report summarizes 2012 walleye pollock distribution and abundance estimates by size, and provides preliminary population at age estimates using 2012 EBS bottom trawl (BT) survey ages supplemented with sub-sampled juvenile AT survey ages. It also summarizes acoustic system calibration and physical oceanographic results. Walleye pollock vertical distribution, near-bottom pollock biomass trends, and spatial distribution patterns of backscatter at 38 kHz for pollock and non-pollock are shown. A preliminary distribution of the euphausiid abundance index is presented, as are preliminary results from paired midwater-bottom trawl efficiency trials; further results from these and the other secondary projects will be presented elsewhere.

METHODS

MACE scientists conducted the AT survey (cruise DY2012-07) aboard the NOAA ship *Oscar Dyson*, a 64-m stern trawler equipped for fisheries and oceanographic research. The vessel itinerary and scientific personnel list are presented in Appendices I and II.

Acoustic Equipment, Calibration, and Data Collection

Acoustic measurements were collected with a Simrad ER60 scientific echo sounding system (Simrad 2008, Bodholt and Solli 1992). Five split-beam transducers (18, 38, 70, 120, and 200 kHz) were mounted on the bottom of the vessel's retractable centerboard, which was extended 9 m below the water surface. A Simrad ME70 multibeam echosounder (Simrad 2007, Trenkel et al. 2008) was mounted on the hull 10 m forward of the centerboard at 6 m below the water surface. System electronics were housed inside the vessel in a permanent laboratory space dedicated to acoustics.

Standard sphere acoustic system calibrations were conducted to measure acoustic system performance. During calibrations, the *Oscar Dyson* was anchored at the bow and stern. A tungsten carbide sphere (38.1 mm diameter) and a copper sphere (64 mm diameter) were suspended below the transducers. The tungsten carbide sphere was used to calibrate the 38, 70, 120 and 200 kHz systems and the copper sphere was used to calibrate the 18-kHz system. After each sphere was centered on the acoustic axis, split-beam target strength and echo integration measurements were collected to estimate transducer gains following the methods of Foote et al. (1987). Transducer beam characteristics were modeled by moving each sphere through a grid of angular coordinates and collecting target-strength data using EKLOBES software (Simrad 2008).

Acoustic (raw) data were collected at the five frequencies with Simrad ER60 (v. 2.2.1). As a backup, acoustic telegram data were logged with Myriax EchoLog 500 (v. 4.70.1.14256) software. Raw multibeam acoustic data were collected with the Simrad ME70. Ping rate for the EK60 system was 1/1.4 seconds; EK60 and ME70 pinged alternately to prevent interference.

Results presented in this report, including calibration, are based on 38 kHz raw echo integration data with a post-processing S_v threshold of –70 dB. Acoustic measurements were analyzed from 16 m below the surface to within 0.25 m of the bottom using Myriax Echoview post-processing software (v. 5.2.56.21055). Acoustic data collection was limited to 500 m depth.

Trawl Gear and Oceanographic Equipment

Midwater and near-bottom acoustic backscatter were sampled using an Aleutian wing 30/26 trawl (AWT). This trawl was constructed with full-mesh nylon wings and polyethylene mesh in the codend and aft section of the body. The headrope and footrope each measured 81.7 m (268 ft). Mesh sizes tapered from 325.1 cm (128 in) in the forward section of the net to 8.9 cm (3.5 in) in the codend, where it was fitted with a single 12 mm (0.5 in) codend liner. Near-bottom backscatter was sampled with an 83-112 Eastern bottom trawl without roller gear and fitted with a 12 mm (0.5 in) codend liner. The AWT and bottom trawl were fished with 5 m^2 Fishbuster trawl doors each weighing 1,089 kg. Vertical net openings and depths were monitored with either a Simrad FS70 third-wire netsounder or a Furuno CN24 acoustic-link netsonde attached to the headrope. The AWT vertical net opening ranged from 17 to 30 m and averaged 25.5 m. The bottom trawl vertical net opening ranged from 1.5 to 3.5 m and averaged 2.5 m. Detailed trawl gear specifications are described in Honkalehto et al. (2002).

Daytime Methot trawl samples were made to ground-truth euphausiid backscatter and biomass estimates. 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 suspended below the frame 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 were used to determine the volume of water filtered during hauling. 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.

All fishing operations were conducted as specified in NOAA protocols for fisheries acoustics surveys and related sampling[1].

The stereo camera-trawl (Cam-Trawl) system was tested, modified, and subsequently used on most AWT hauls during the survey. The Cam-Trawl consists of 2-3 cameras, strobes, and associated electronics all mounted within a frame attached to the midsection of an AWT just prior to the codend (Williams et al. 2010). It operates autonomously, collecting stereo images to identify species and determine density and size of animals as they pass by the cameras en route to the codend. A small bottom-moored trigger-camera system to autonomously collect images of fish on the seafloor was also tested separately during the survey.

A paired trawl experiment was conducted to determine whether the 83-112 could potentially be fished in midwater during future EBS shelf BT surveys to: 1) catch adequate numbers of pollock and if so, 2) produce similar pollock size compositions to the AT survey AWT. The experiment was carried out aboard the *Oscar Dyson* using FishBuster trawl doors (although 6x9 foot V-doors would ultimately be used with the 83-112 during the BT survey). The first step was to determine the 83-112 door spread and trawl vertical opening with the V-doors, and then replicate this trawl configuration (using either a line (i.e., restrictor line) between the trawl warps or heavy weight (i.e., 500-lb tom weights) hung from the trawl footrope) when using FishBuster doors aboard the *Dyson*. This was accomplished during Puget Sound, Washington, gear trials (January 2012) and in the first half of the summer EBS AT survey. It was determined that the bottom trawl catch efficiency was greater when weight was attached to the footrope.

Physical oceanographic measurements were made throughout the cruise. Temperature-depth profiles were obtained at trawl sites with a Sea-Bird Electronics temperature-depth probe (SBE-39) attached to the trawl headrope. Fluorometer and CTD measurements were made with a Sea-

[1] National Marine Fisheries Service (NMFS) 2013. NOAA protocols for fisheries acoustics surveys and related sampling (Alaska Fisheries Science Center), 23 p. Prepared by Midwater Assessment and Conservation Engineering Program, Alaska Fish. Sci. Center, Natl. Mar. Fish. Serv., NOAA. Available online: http://www.afsc.noaa.gov/RACE/midwater/AFSC%20AT%20Survey%20Protocols_Feb%202013.pdf

Bird SBE 911*plus* CTD throughout the survey to describe EBS shelf habitat features associated with pollock and euphausiids. Conductivity-temperature-depth casts were made at the closest point along a survey transect to each of 19 nominal station locations. A cast was also made wherever the ship stopped surveying for the night if it was more than 20 nautical miles (nmi) from another nighttime cast. Salinity bottle samples (e.g., one bottle every other day, alternating at surface and bottom of cast) were collected from the casts. Conductivity-temperature-depth casts were also made at calibration sites. Additional temperature-depth measurements were taken with Sippican Deep Blue XBTs at various locations along the survey route. These included 9 locations near southern ends of transects 6 and 7 that, with nearby CTD casts, will be used to compute geostrophic transport through the pass. Higher-resolution, north-south XBT temperature sections were made to continue description of pollock and euphausiid habitat begun during the Bering Sea Integrated Ecosystem Research Program (BSIERP), with probes evenly spaced at 20 km (10.8 nmi) along transects 7 (19 locations), 14 (24 locations), and 17 (21 locations); 64 locations in total. Sea surface temperature (SST) was measured continuously using the vessel's Furuno T-2000 SST system, approximately 1.4 m below the vessel's waterline. These and other environmental information were recorded using the ship's Scientific Computing System (SCS). Surface temperatures from the Furuno system sampled along survey transects were subsequently averaged at 10 nmi resolution. Ambient atmospheric light levels were measured with a sensor attached to the vessel's flying bridge. Water column light levels were measured along the AWT path with a sensor attached to the trawl footrope.

Survey Design

The survey design consisted of 29 north-south transects spaced 20 nmi apart over the Bering Sea shelf from 162° W (west of Port Moller, Alaska), across the U.S.-Russia Convention Line to about 178° 20 E, including the area around Cape Navarin, Russia (hereafter "Russia") (Fig. 1). Echo integration and trawl information were collected during daylight hours (typically between 0600 and 2400 local time). Nighttime activities included collection of additional physical oceanographic data, trawl hauls for species classification, and work with other specialized sampling devices (e.g., the 83-112 modified to fish in midwater, the Simrad ME70 multibeam echosounder to measure backscatter of fish aggregations to describe school morphology over hourly time-scales, and Cam-Trawl and trigger-camera testing). Daytime Methot trawls were conducted on suspected macrozooplankton backscatter to assess the density of Bering Sea euphausiids (number per m^3) based on acoustics.

For trawls targeting walleye pollock, a portion of the catch was sampled to determine pollock sexual maturity, and fish length- and weight-at-age, by sex. If large numbers of juveniles mixed with adults were encountered in a haul, the predominant size groups were sub-sampled separately. Approximately 50 to 400 individuals were randomly sampled for length by sex measurements, and about 10 to 60 were sampled for body weight, maturity, and age. Fork lengths (FL) were measured to the nearest millimeter. An electronic motion-compensating scale (Marel M60) was used to weigh individual walleye pollock specimens to the nearest 2 g. Maturity was determined by visual inspection and fish were categorized as immature, developing, pre-spawning, spawning, or post-spawning[2]. Walleye pollock otoliths were collected and stored in individually marked vials containing a glycerol-thymol solution. Otoliths are read by AFSC scientists in the Age and Growth Program following the survey to determine fish ages. Trawl station and biological measurements were digitally recorded using the Catch Logger for Acoustic Midwater Surveys (CLAMS) customized software program developed by MACE scientists.

For Methot trawls, the catch from the net and codend was transferred to a ~ 0.5 × 1 m rectangular plastic tub. Large organisms such as jellyfish and small fishes were removed, identified to the lowest taxonomic group possible, weighed by taxon, and if jellyfish or fish (e.g., excluding salps) individually lengthed. The remainder of the catch was placed on a 1-mm mesh screen and weighed. A subsample of this zooplankton mixture was then weighed and sorted at sea into broad taxonomic groups, while a second subsample was weighed and preserved in a 5%

[2] ADP Code Book. 2012. Unpublished document. Resource Assessment and Conservation Engineering Division, Alaska Fisheries Science Center, 7600 Sand Point Way NE, Seattle WA 98115.

buffered formalin solution for more detailed enumeration at the Polish Sorting Center in Szczecin, Poland. These results will be reported elsewhere.

Data Analysis

Walleye pollock abundance was estimated by combining echo integration and trawl information. For a detailed explanation of the standard AT survey abundance estimationl procedures, refer to Honkalehto et al. 2008; the following is a summary. Acoustic backscatter classified as walleye pollock, non-pollock fishes, and an undifferentiated plankton mixture (primarily jellyfish and possibly fishes) was binned at 0.5 nmi horizontal by 10 m vertical resolution. In 2012, walleye pollock length compositions from 85 hauls were combined into 16 regional length strata based on geographic proximity, similarity of length composition, and backscatter characteristics. Results were stratified east and west of 170° W as walleye pollock have been observed historically to grow at different rates and to have different length and age compositions in these areas (Traynor and Nelson 1985, Honkalehto et al. 2002). Results east of 170° W were also examined inside and outside of the Steller sea lion Conservation Area (SCA) as walleye pollock catch quotas are determined separately for these two areas. As age data from the 2012 AT survey are still being analyzed, a single length-at-age key from the 2012 BT survey was used to generate preliminary abundance-at-age results for walleye pollock. The BT key was supplemented with data from 100 aged AT survey juveniles, as generally fewer juvenile pollock otoliths are collected in the BT survey compared with the AT survey. Mean fish weight-at-length for each length interval (nearest 1.0 cm) was estimated from the trawl information when there were six or more fish for that length interval in a length-weight key. Otherwise, weight at a given length interval was estimated from a linear regression of the natural logs of the length and weight data from all the 2012 summer EBS hauls (De Robertis and Williams 2008). One weight-at length key was used for the survey area.

For each regional length stratum, population numbers and biomass of fish were estimated as in Honkalehto et al. (2008). Total population numbers and biomass were estimated by summing the regional stratum estimates. Walleye pollock distribution and abundance were summarized into three areas: the U.S. exclusive economic zone (EEZ) east of 170° W and west of 170° W, and Russia. The AT survey results on the U.S. EBS shelf are presented for the water column down to 3 m off bottom, as the BT survey estimates the component of pollock within 3 m of the bottom (Lauth 2011, Ianelli et al. 2012). When comparing abundance estimates between the Russian EEZ near Cape Navarin and the two U.S. EEZ regions (east and west of 170° W), estimates to 3 m off bottom were used. When comparing abundance estimates within the Russian EEZ across multiple years, estimates to 0.5 m off bottom were used, as no U.S. BT survey information is available for Russia. Results were also analyzed by depth bin within the water column.

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

RESULTS AND DISCUSSION

Calibration

Acoustic system calibrations were conducted at the start and end of the summer 2012 field season (Table 1). Initial acoustic system settings for the survey were based on results from the 7 June acoustic system calibration. The end-of cruise sphere calibration on 10 August revealed a 0.17dB decrease in integration gain for the 38-kHz system. Assuming the correct integration gain to be the average of the pre- and post-cruise (linearized) gain values, a scalar correction of 1.0438 was applied to backscatter values collected in real time.

Physical Oceanographic Conditions

The summer EBS survey encompassed 2 months during which the Bering Sea was gradually stratifying and warming (Overland et al. 1999). Therefore, these ocean temperature results reflected both geographic differences and temporal changes. Temperature measurements indicated that the 2012 mean SST of 6.2°C (range 0.65°- 9.4°C; Fig. 2) was similar to that in 2010 (6.1°C, range 1.8°- 12.3°C) and 2009 (6.4°C, range 0.89° – 8.87°C), but warmer than in 2008 (4.8°C, range 0.7°- 8.3°C). This year's survey was conducted about 2 weeks later in the season than the previous three surveys (Honkalehto et al. 2009, 2010, 2012). Bottom temperatures in 2012 were coldest near St. Matthew Island (-1.6°C), as in 2008 (-1.7°C), 2009 and 2010 (-1.6°C), cool along the shelf as far east as Unimak Island and warmest midway through the survey south of the Pribilof Islands (Fig. 2). Temperature-depth profiles taken along selected transects, plotted from east to west, indicate that the water column was vertically stratified throughout the EBS with a thermocline at 20-40 m from the surface (Fig. 3).

Trawl Sampling

Biological data and specimens were collected from 140 trawl hauls (Table 2, Fig. 1). The majority of these hauls (103) targeted backscatter for species classification: 78 with an AWT, 12 with a bottom trawl, and 13 with a Methot trawl. The remaining hauls were midwater 83-112 tows paired with routine survey AWT hauls.

Catch composition by weight varied by haul type. Among midwater species classification hauls, walleye pollock was the most abundant species at 92%, followed by Pacific herring (*Clupea pallasi*) and northern sea nettle jellyfish (*Chrysaora melanaster*) (Table 3). Most Pacific herring were captured in the Russia EEZ, but the largest single catch of herring occurred south of St. Matthew Island on transect 21; haul 67. Among bottom trawls, pollock was the most abundant species (62%) followed by Pacific ocean perch (6%) and Pacific herring (4%; Table 4). Northern sea nettles were the most abundant group in Methot hauls (80%), followed by euphausiids (Table 5).

Biological information collected by haul for walleye pollock and other species is presented in Table 6. Over 32,000 lengths were measured and over 3,100 weights, gonad maturities, and otolith pairs were collected. Most U.S. EEZ pollock were either in the developing or post-spawning maturity stage. A few females ≥ 34 cm FL were actively spawning (1%, n = 10 east of 170° W, and 1%, n = 14, in the U.S. EEZ west of 170° W; Fig. 4). Walleye pollock mean weight-at- length curves plotted by area suggest very little difference between areas for fish < 43 cm FL (Fig. 5). Fish between 43 and 50 FL cm were slightly heavier east than west of 170° W in the U.S. EEZ.

Distribution and Abundance

About 61% of the summed acoustic backscatter observed during the 2012 survey was attributed to adult or juvenile walleye pollock. This was less than in 2010 (80%) but similar to that observed in 2009 (~66%; Honkalehto et al. 2012). The remaining backscatter was attributed to an undifferentiated plankton-fish mixture (38%), or in a few isolated areas, to rockfishes or other fishes (1%). The relative proportion of walleye pollock found in the U.S. west of 170° W decreased for the first time since 2002, from 92% in 2010, to 85%, similar to the proportion observed in 2007 (Table 7). However, pollock biomass east of 170° W was relatively evenly distributed between inside and outside of the SCA, unlike 2007. The majority of the 2012 biomass in the U.S. EEZ spanned a region from west of the Pribilof Islands to Pervenets Canyon, between about the 80 m and 200 m isobaths (Fig. 6). Within this area, the highest concentration of adult biomass was observed along transects between Pribilof and Zhemchug Canyons. Juveniles < 34 cm were observed in high concentrations between the 100- and 200-m isobaths south and west of St. Matthew Island to Pervenets Canyon and across the Convention Line into Russia. Very few fish > 50 cm FL in length were found west of 170° W, including Russian waters and very few fish < 20 cm FL (~ age 1s) were observed (Fig 7).

Estimated walleye pollock abundance in midwater along the U.S. Bering Sea shelf was 6.67 billion fish weighing 1.843 million metric tons (t) (Tables 7-9). Estimated midwater abundance in Russia (to 3 m off the bottom) was 2.53 billion fish weighing 0.550 million t (23% of total midwater biomass). East of 170° W (0.279 million t, 12% of total midwater biomass) the length composition ranged between 9 and 68 cm FL with modes at 48 and 41 cm, and very few juveniles present (Fig. 7). In the U.S. EEZ west of 170° W (1.563 million t, 65% of total shelf-wide midwater biomass; Fig. 7), the length composition ranged from 11 to 74 cm FL with modes at 23 cm, 38 cm, and a lesser mode at 30 cm FL. Numerically, few pollock > 43 cm FL were observed west of 170° W. The walleye pollock length composition for the fish observed in Russia (Fig. 7) ranged from 12 to 73 cm FL with the majority of fish comprising two dominant size modes at 32 and 23 cm FL. Based on the 1D analysis, the relative estimation error of the U.S. EEZ walleye pollock biomass estimate was 0.042 (Table 7).

Pollock vertical distribution in the water column was examined for the U.S. EEZ by plotting mean biomass in 10-m bins from near the surface to within 0.5 m from the bottom (Fig. 8). East of 170° W, more than 90% of adults were found within 50 m of the bottom (Fig. 8c; very few juveniles occurred east of 170° W). West of 170° W, more than 80% of adults were found within 50 m of bottom, whereas only 60% of juveniles were found in that near-bottom region (Fig. 8d). Additionally, adult biomass continually increased towards the bottom; whereas, juvenile biomass peaked at about 50 m off bottom and then decreased towards the bottom. West of 170° W, there appeared to be a slight difference in the surface-referenced depth profile for adults and juveniles; adult biomass peaked at about 85 m, while juvenile biomass at depth peaked at about 95 m (Fig. 8a,b). Since juveniles are farther off bottom than adults (Fig. 8c,d), together this suggests that on average the two size groups occupy somewhat different geographic regions of the shelf.

The preliminary estimated age composition of eastern Bering Sea pollock varied with geographic area. Inside the U.S. EEZ, young adult (age 4) and juvenile pollock (ages 2 and 3) were dominant numerically (accounting for 35%, and 28% and 26% of the population, respectively; Table 10). These three age groups represented 76% of the total biomass. Older adult pollock (ages 5+) totaled only 9% of the population numerically, and made up 24% of the total biomass. Six-year-old fish from the 2006 year class represented only a small fraction (9%) of the shelf-wide midwater biomass and was primarily observed east of 170° W, where it made up most of the biomass, followed by 4-year olds (Fig. 9). Pollock west of 170° W in the U.S. EEZ were numerically dominated by 4- and 2-year-old fish, followed closely by 3-year olds (54%, 22%, and 12% of biomass west of 170° W, respectively, Fig. 9). In Russia, the age-3s were most numerous among the mix of predominantly age-3, -4, and -2 fish.

Acoustic-trawl survey numbers-at-age estimates between 1994 and 2012 track the advance of strong year classes through the midwater pollock population (Table 10, Fig. 10). In 2007, the 2006 year class was the most numerous age-1 group detected by the AT survey since the large 1996 year class in 1997, and it was observed as 6-year-olds in 2012. In 2010, the 2008 year class was the most numerous age-2 group detected by the AT survey since 1994, and in 2012 it made up the primary adult pollock age group as 4-year olds. The 2009 and 2010 year classes were also relatively abundant in 2012 as 3- and 2-year olds, respectively.

The walleye pollock biomasses estimated in the U.S. EEZ to 3 m off bottom, and from 3 to 0.5 m off bottom, were compared east and west of 170° W and for the whole survey between 1999 and 2012 (Fig. 11). The percentage of total biomass for the U.S. EEZ between 3 and 0.5 m off bottom ranged from 19% to 35% in 1999-2009, decreased to 11% in 2010, and was 23% in 2012. East of 170° W, 50% of the pollock biomass was below 3 m off bottom, while west of 170° W, 14% was below 3 m. The higher percentage of pollock observed above 3 m west of 170° W reflects the greater abundance of juveniles in the west compared to the east; juveniles tend to aggregate higher in the water column than adults. The near-bottom estimates should be treated with caution as in previous years (Honkalehto et al. 2010), and are currently undergoing improvements.

Backscatter from the AT survey time series has typically consisted of walleye pollock, a non-pollock species mix of zooplankton and fishes (non-pollock backscatter), and occasional non-pollock fish aggregations. From 2000 to 2004, walleye pollock backscatter was relatively evenly distributed throughout the survey area (Fig. 12). Between 2006 and 2010, pollock backscatter density was generally lower but relatively more abundant west of 170° W than east of 170° W.

In 2012, densities were similar, but pollock were more evenly distributed across the survey area than in recent years. Most non-pollock backscatter (at 38 kHz) is observed in the upper part of the water column above the thermocline (Honkalehto et al. 2008). The densest layers have usually been observed in the eastern portion of the survey area, or in the central region of the shelf, west of the Pribilof Islands to slightly west of St. Matthew Island. Since 2006, during years of relatively cold Bering Sea conditions, the non-pollock backscatter in the east has largely disappeared. In 2012, non-pollock backscatter layers were denser than in 2006, 2009, or 2010, but less dense than in summers 2007-2008 (Fig. 13). This backscatter information should be interpreted with care because the exact biological composition of the scatterers is unknown (Honkalehto et al. 2008, 2009).

During analysis of the 38 kHz acoustic backscatter, comparisons between 38 and 18 kHz backscatter revealed that in the central portion of the survey area, roughly encompassing portions of transects 14-22 (see Figs. 1 and 6), some walleye pollock schools were present within the dense, non-pollock layers above the thermocline (described above; Fig. 13, 2012). These pollock were largely obscured at 38 kHz by the non-pollock backscatter and not included in the 2012 AT survey biomass estimates. These schools were much easier to identify using the lower frequency 18 kHz data. An attempt was made, using 18 kHz backscatter information, to estimate the relative magnitude of these schools compared to the total estimated population. Schools and layers were identified in Echoview, exported at 18 kHz, and scaled for 38 kHz using an Sv ratio Sv_{18}-Sv_{38} = 0.4 dB, based on the difference in pollock TS between 18 and 38 kHz (De Robertis et al. 2010). As no direct trawl information was available to scale the backscatter, it was converted to population numbers and biomass using the mean backscattering cross section of all fish west of 170° W in the U.S EEZ and a mean length-weight relationship from the 2012 survey data. Results indicated that these obscured pollock schools may have represented an additional 3% walleye pollock numbers and biomass above the estimates presented in this report.

The AFSC has surveyed the Cape Navarin area of Russia during summers 1994, 2004, 2007-2010, and 2012. In 2002, the U.S. EEZ survey took place at the same time the Russian research vessel *Professor Kaganovskiy* was conducting an acoustic-trawl survey of the Russian EEZ near Cape Navarin. The results of these surveys indicate that the distribution of pollock backscatter in this region of Russia has varied (Fig. 14). Abundance estimates have also varied, with the 2012 biomass being the highest in the time series since 1994 (Table 11). The proportion of walleye pollock biomass estimated in Russia to within 0.5 m of the bottom has ranged from 1% (2009) to 22% (2012), of the total combined U.S. and Russian Bering Sea shelf biomass (Table 11).

<u>Paired midwater-bottom trawl efficiency comparison project</u>

During the AT survey, 25 paired tows were completed using the bottom trawl fished in midwater (MWBT) and AWT. The catch efficiency of pollock was determined by integrating the pollock backscatter along the trawl path, converting this to fish numbers (expected catch), and then calculating the ratio of codend catch to expected catch of pollock. The catch efficiency of the AWT was nearly four times greater than that of the MWBT although results for both trawls were quite variable (Fig. 15). Pollock size compositions were remarkably similar (Fig. 16) with a difference in mean length of only 0.4 cm suggesting that the MWBT could be used as a suitable substitute for the AWT to sample pollock during the AFSC BT survey.

<u>An Acoustic Index of Euphausiid Abundance in the EBS</u>

Euphausiids, principally *Thysanoessa inermis* and *T. raschii*, are among the most important prey items for walleye pollock in the Bering Sea (e.g., Livingston 1991, Lang et al. 2000, Brodeur et al. 2002). Backscatter data at four frequencies (18, 38, 120, and 200 kHz) and Methot trawl sampling (2004-present), were used to create an index of euphausiid abundance on the Bering Sea shelf (De Robertis et al. 2010, Ressler et al. 2012). Thirteen Methot trawls targeted suspected euphausiid backscatter during the 2012 AT survey. Preliminary results show the spatial distribution and relative magnitude of the euphausiid backscatter across the survey area (Fig. 17).

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TABLES AND FIGURES

Table 1. -- Simrad ER60 38 kHz acoustic system description and settings during the summer 2012 walleye pollock acoustic-trawl survey of the Bering Sea shelf, and results from standard sphere acoustic system calibrations conducted before and after the survey using a 38.1 mm tungsten carbide sphere.

		Survey system settings	7-Jun Captains Bay Alaska	10-Aug Captains Bay Alaska	Final system values
Echosounder:		Simrad ER60	--	--	--
Transducer:		ES38B	--	--	--
Frequency (kHz):		38	--	--	--
Transducer depth (m):		9.15	--	--	--
Pulse length (ms):		0.512	--	--	--
Transmitted power (W):		2000	--	--	--
Angle sensitivity:	Along:	22.76	--	--	--
	Athwart:	21.37	--	--	--
2-way beam angle (dB):		-20.74	--	--	--
Gain (dB):		22.20	22.20	22.14	22.17
Sa correction (dB):		-0.48	-0.48	-0.60	-0.54
S_v gain (dB):		21.71	21.71	21.54	21.63
3 dB beamwidth (deg):	Along:	6.76	6.76	6.79	6.78
	Athwart:	7.23	7.23	7.29	7.26
Angle offset (deg):	Along:	-0.08	-0.08	-0.09	-0.09
	Athwart:	-0.05	-0.05	-0.03	-0.04
Measured standard sphere TS (dB)		--	-42.15	-42.25	--
Sphere range from transducer (m):		--	20.81	23.49	--
Absorption coefficient (dB/m):		0.0100	0.0100	0.0098	0.0100
Sound velocity (m/s):		1470	1461.6	1472.2	1470
Water temp at transducer (°C):		0.65-9.40	4.06	7.23	0.65-9.40
Water temp at standard sphere (°C):		--	2.97	4.62	--

Note: Gain and Beam pattern terms are defined in the "Operator Manual for Simrad ER60 Scientific echo sounder application (2004)" available from Simrad AS, Strandpromenaden 50, Box 111, N-3191 Horten, Norway.

Table 2. -- Trawl stations and catch data summary from the summer 2012 Bering Sea shelf walleye pollock acoustic-trawl survey aboard the NOAA ship *Oscar Dyson*.

Haul no.	Gear[a] type	Date (GMT)	Time (GMT)	Duration (minutes)	Start position Lat. (N)	Start position Long. (W)	Depth (m)[c] footrope	Depth (m)[c] bottom	Temp. (°C) headrope	Temp. (°C) surface[b]	Walleye pollock (kg)	Walleye pollock number	Other (kg)
1	Methot	9-Jun	5:13	15	55 55.45	-162 11.63	46	56	1.4	3.2	0	0	49.3
2	83-112	10-Jun	21:31	29	55 15.01	-163 59.99	57	59	2.5	4.2	128.1	94	334.5
3	Methot	11-Jun	20:02	22	56 39.80	-164 36.30	39	76	-0.6	3.0	0	0	10.9
4	83-112	12-Jun	5:27	18	55 01.28	-164 34.78	63	64	2.9	4.7	74.4	54	303.8
5	AWT	12-Jun	18:33	32	54 44.14	-165 08.90	87	94	3.4	4.5	18.1	16	113.1
6	83-112	12-Jun	20:38	15	54 41.92	-165 09.18	85	88	3.5	4.0	110.1	113	202.2
7	AWT	13-Jun	3:40	18	55 45.62	-165 11.06	97	104	2.1	4.0	467.3	592	299.8
8	83-112*	13-Jun	5:50	40	55 43.57	-165 10.84	91	104	2.1	4.5	13.9	15	115.6
9	83-112*	13-Jun	9:19	32	55 56.96	-165 11.31	79	98	1.9	3.8	1.9	2	324.2
10	83-112*	13-Jun	11:43	17	55 57.64	-165 11.42	63	98	2	3.6	0	0	604.1
11	Methot	13-Jun	19:12	30	56 43.29	-165 12.86	67	76	-0.2	3.4	0	0	8.1
12	AWT	14-Jun	9:58	14	55 58.73	-165 47.86	97	110	2.4	4.2	980.7	1613	40.4
13	83-112*	14-Jun	12:28	30	55 58.78	-165 47.78	77	109	2.4	4.2	0.8	1	107.7
14	AWT	14-Jun	20:37	29	54 56.94	-165 46.86	124	132	3.5	4.2	364.4	506	0.8
15	Methot	16-Jun	2:27	20	55 28.93	-166 22.70	97	131	2.7	4.9	0	0	0.9
16	AWT	16-Jun	8:46	35	56 07.45	-166 25.21	107	117	2.4	4.1	300.2	515	34.1
17	83-112*	16-Jun	11:33	31	56 07.51	-166 25.14	107	117	2.4	4.3	13.9	23	306.1
18	Methot	16-Jun	18:34	19	56 37.38	-166 24.77	75	88	0.3	3.9	0	0	3.2
19	Methot	17-Jun	4:00	20	57 37.22	-167 04.08	45	70	0.2	2.0	0	0	4.8
20	AWT	17-Jun	19:49	22	56 05.27	-166 59.34	121	132	2.6	4.9	394.5	520	5.0
21	83-112*	17-Jun	21:53	29	56 04.91	-167 00.26	115	133	2.6	4.9	3.2	3	22.2
22	AWT	18-Jun	23:33	37	56 25.40	-167 39.20	113	124	2.8	5.2	156.4	214	23
23	Methot	19-Jun	8:12	25	57 36.26	-167 43.81	31	71	0.3	1.4	0	0	4.3
24	Methot	19-Jun	21:52	15	57 46.96	-168 23.72	56	71	0.1	2.3	0.0	0	3.9
25	AWT	20-Jun	6:43	6	56 27.65	-168 15.71	107	127	2.9	5.2	269.6	537	2
26	83-112*	20-Jun	8:20	30	56 26.02	-168 15.47	116	130	3	5.2	1	2	2.4
27	AWT	20-Jun	19:09	40	55 42.91	-168 11.18	114	136	3	5.8	240	269	0
28	83-112	21-Jun	2:39	6	55 43.16	-168 46.95	175	177	2.7	6.7	0	0	461.6
29	AWT	21-Jun	7:23	15	56 22.80	-168 51.58	104	124	2.8	5.7	351.4	557	1.5
30	83-112*	21-Jun	9:31	30	56 21.80	-168 52.76	115	126	3	5.5	2.2	3	0
31	83-112	21-Jun	18:00	9	56 47.37	-168 54.38	93	94	0.7	3.8	21.9	41	49.2
32	83-112	21-Jun	23:31	15	57 22.71	-168 58.75	70	73	-0.1	3.8	165.1	232	68.3
33	Methot	22-Jun	6:06	11	58 15.72	-169 06.46	52	70	-0.2	3.7	0	0	6.3
34	83-112	22-Jun	20:16	25	57 36.90	-169 39.01	70	73	-0.8	4.0	319	517	70.8
35	Methot	22-Jun	22:36	5	57 28.58	-169 38.36	62	73	-0.7	3.9	0	0	6.9
36	83-112	23-Jun	3:37	20	56 50.71	-169 32.18	69	71	-0.4	4.3	464.8	680	253.4

Table 2. -- Continued.

Haul	Gear[a]	Date	Time	Duration	Start position		Depth (m)[c]		Temp. (°C)		Walleye pollock		Other
no.	type	(GMT)	(GMT)	(minutes)	Lat. (N)	Long. (W)	footrope	bottom	headrope	surface[b]	(kg)	number	(kg)
37	AWT	23-Jun	19:46	20	56 14.16	-170 03.48	106	117	2.5	4.8	507.6	929	22.7
38	83-112*	23-Jun	22:53	30	56 27.10	-170 04.68	-	108	-	5.0	1.0	2	41.7
39	AWT	24-Jun	0:51	7	56 27.52	-170 05.03	101	108	1.4	5.0	226.9	473	36.7
40	AWT	24-Jun	4:33	5	56 24.40	-170 06.21	95	110	1.4	5.2	482.6	1082	74.1
41	83-112*	24-Jun	6:01	30	56 24.32	-170 06.41	97	111	1.6	5.2	13.8	31	205.9
42	83-112*	24-Jun	7:48	30	56 24.56	-170 05.73	95	111	1.6	5.3	28.7	58	76
43	AWT	24-Jun	11:02	2	56 27.81	-170 06.90	98	110	1.5	5.0	78.0	40	81
44	83-112*	24-Jun	12:49	30	56 27.77	-170 07.88	95	111	1.8	5.0	40.2	91	110
45	AWT	3-Jul	10:23	23	58 48.70	-171 06.01	59	84	-0.8	5.5	394.4	900	0.8
46	83-112*	3-Jul	12:29	51	58 48.50	-171 03.88	34	84	-0.8	4.9	76.9	180	143.8
47	AWT	3-Jul	18:49	24	58 09.80	-170 57.36	78	87	-1.3	5.8	565.8	1326	42.6
48	83-112*	3-Jul	21:06	47	58 09.47	-170 58.22	73	87	-1.3	5.8	4.9	12	75.6
49	AWT	4-Jul	2:38	19	57 45.84	-170 52.02	78	87	0.5	5.5	643.3	1560	39.3
50	AWT	4-Jul	11:43	40	57 08.24	-170 49.14	78	87	1	3.1	157.7	338	5.8
51	AWT	4-Jul	17:16	30	56 37.85	-170 41.82	106	116	2.5	5.9	759.6	1,653	3.1
52	83-112	5-Jul	3:58	22	56 45.16	-171 20.38	118	118	2.6	6.5	1,192.2	1,950	186.5
53	AWT	5-Jul	9:45	20	57 21.98	-171 25.17	91	101	1.5	5.3	561.6	1477	1
54	83-112*	5-Jul	11:47	48	57 22.54	-171 27.24	75	102	1.2	6.0	4.1	9	0.4
55	AWT	6-Jul	19:27	18	58 56.74	-172 24.20	88	101	-0.5	6.6	3,524.7	9,401	60.4
56	83-112*	6-Jul	21:34	33	58 58.21	-172 24.32	75	100	-0.5	6.9	18.1	44	67.4
57	83-112	7-Jul	2:57	18	58 25.48	-172 17.94	101	104	0	6.5	312.5	1,259	48.2
58	AWT	7-Jul	9:11	7	57 44.56	-172 05.64	82	108	1.1	6.7	1,949.9	10,693	11.1
59	83-112*	7-Jul	10:59	30	57 44.04	-172 05.56	66	108	1.2	6.7	8.6	66	42.9
60	83-112*	7-Jul	12:47	30	57 43.37	-172 05.66	64	108	1.3	6.7	27.3	175	54.1
61	Methot	7-Jul	19:28	21	57 02.27	-172 01.35	107	117	2.4	7.0	0.0	0	4.4
62	Methot	8-Jul	4:45	5	56 42.91	-172 34.72	43	133	4.4	7.2	0.0	0	0.9
63	AWT	8-Jul	6:12	2	56 43.27	-172 35.74	99	133	3.2	7.2	7.7	25	0
64	AWT	8-Jul	8:13	78	56 42.72	-172 34.31	68	133	4.3	7.1	176.1	395	15.9
65	AWT	8-Jul	20:52	9	57 46.57	-172 47.98	102	118	1.4	7.0	662.8	1,515	5.0
66	83-112*	8-Jul	22:36	25	57 45.31	-172 47.73	80	118	1.4	7.3	2.7	6	9.4
67	AWT	9-Jul	7:39	30	58 56.16	-173 02.97	102	110	0.3	7.0	329.5	1975	2117.5
68	AWT	9-Jul	17:18	11	59 18.80	-173 07.99	-	102	-	7.4	1,298.5	5196	16.5
69	83-112*	9-Jul	18:49	24	59 17.97	-173 07.92	72	102	-0.4	7.3	28.5	95	144.2
70	AWT	9-Jul	22:44	11	59 43.94	-173 13.72	85	94	-0.9	8.2	583.9	1,268	31.9
71	83-112*	10-Jul	0:15	25	59 42.46	-173 13.32	71	95	-0.6	8.6	51.8	118	55.6
72	Methot	10-Jul	16:57	15	60 55.28	-174 10.84	72	86	-1.5	7.3	0.0	0	10.8
73	AWT	11-Jul	1:25	24	59 46.24	-173 53.74	96	104	-0.2	8.4	655.9	3956	3.9
74	AWT	11-Jul	7:10	30	59 06.88	-173 44.32	92	116	0.5	7.4	884.5	6,137	44.2

Table 2. -- Continued.

Haul no.	Gear[a] type	Date (GMT)	Time (GMT)	Duration (minutes)	Start position Lat. (N)	Long. (W)	Depth (m)[c] footrope	bottom	Temp. (°C) headrope	surface[b]	Walleye pollock (kg)	number	Other (kg)
75	83-112*	11-Jul	9:16	46	59 10.74	-173 45.76	67	115	0.4	7.5	16.0	124	201.4
76	83-112*	11-Jul	11:56	30	59 06.99	-173 44.39	70	115	0.6	7.5	7.7	54	246.9
77	AWT	11-Jul	22:35	18	58 53.47	-173 40.02	102	122	1.1	7.7	1,659.7	10,924	27.3
78	AWT	12-Jul	4:25	32	58 16.66	-173 32.26	71	116	1.3	7.5	14.7	40	0.3
79	AWT	12-Jul	6:15	39	58 22.16	-173 33.18	113	119	1.9	7.7	272.5	641	3.3
80	83-112*	12-Jul	9:23	30	58 17.53	-173 32.56	59	117	1.5	6.8	30.9	75	12.1
81	83-112*	12-Jul	11:22	30	58 17.61	-173 32.68	60	117	1.6	6.9	4.5	11	18.3
82	AWT	12-Jul	19:01	14	57 44.33	-173 24.99	134	144	1.7	7.1	1,796.0	4444	0.0
83	AWT	13-Jul	18:49	26	58 38.73	-174 16.32	125	158	1.8	7.4	558.4	1,749	16.9
84	AWT	13-Jul	22:08	3	58 48.74	-174 19.94	64	138	0.8	7.7	277.8	2,056	59
85	83-112*	13-Jul	23:35	30	58 49.74	-174 20.48	55	138	1	7.7	27.1	209	30.2
86	AWT	14-Jul	8:19	75	59 55.37	-174 36.39	100	113	0.5	8.7	642.5	2,210	3.5
87	AWT	14-Jul	17:02	22	60 15.90	-174 41.86	97	105	0.2	8.9	272.3	889	55.9
88	AWT	15-Jul	6:21	9	60 50.84	-175 33.28	100	108	-1.2	9.2	1,297.8	3,469	29.2
89	AWT	15-Jul	10:15	16	60 31.75	-175 27.09	104	112	0.3	9.1	501.6	3,192	23.1
90	83-112*	15-Jul	12:42	32	60 32.37	-175 27.04	85	112	0.3	9.0	38.0	248	61.5
91	AWT	15-Jul	18:12	21	60 03.49	-175 19.01	110	118	0.8	9.2	329.6	1,296	154.7
92	AWT	16-Jul	0:56	20	59 14.28	-175 04.89	97	134	1.2	8.0	394.1	1,339	117.5
93	AWT	16-Jul	8:48	25	58 46.94	-174 55.73	78	141	1	8.2	378.7	1,389	6.6
94	AWT	16-Jul	18:53	21	58 47.95	-175 36.84	102	133	1.7	8.4	250.9	695	0.6
95	AWT	16-Jul	23:50	2	59 15.82	-175 45.16	114	138	1.6	8.4	358.6	1,148	4.3
96	AWT	25-Jul	18:32	35	59 40.18	-175 52.85	88	139	0.5	8.6	515.5	1,755	0.1
97	AWT	26-Jul	0:11	30	60 13.40	-176 02.91	113	126	1.1	8.9	901.1	4,621	4.2
98	AWT	26-Jul	5:37	34	60 42.88	-176 12.06	104	120	0.5	8.2	1,693.0	8,371	44
99	AWT	26-Jul	18:23	26	61 19.62	-176 24.51	102	110	-1.3	8.5	1,005.2	2,752	118.5
100	83-112*	26-Jul	21:10	31	61 17.61	-176 23.64	101	111	-0.8	8.0	81.3	240	226.1
101	AWT	27-Jul	6:15	4	62 24.13	-176 46.02	90	98	-	8.5	496.9	1,897	3
102	83-112*	27-Jul	8:02	32	62 24.60	-176 45.44	80	98	0	8.5	90.2	545	22.2
103	AWT	27-Jul	19:09	50	62 57.19	-176 57.14	87	92	-1.2	8.4	292.7	1,252	98.6
104	AWT	28-Jul	8:07	13	62 13.87	-177 25.29	100	107	-0.3	8.8	369.8	2,644	26.4
105	83-112*	28-Jul	10:07	30	62 13.38	-177 25.59	92	108	0	8.8	26.0	164	24.7
106	AWT	28-Jul	20:31	10	61 24.87	-177 07.84	111	120	-0.9	8.7	447.5	1,389	48.7
107	83-112*	28-Jul	22:16	30	61 25.20	-177 07.90	107	120	-0.8	8.8	74.8	253	139.1
108	AWT	29-Jul	4:12	5	60 49.16	-176 54.53	100	127	0.5	8.7	492.4	2,235	36.2
109	AWT	29-Jul	7:41	12	60 32.67	-176 49.61	73	137	-1.1	8.8	465.8	2,743	16.8
110	AWT	29-Jul	19:02	22	60 05.42	-176 40.07	120	142	1.2	9.3	332.1	1,759	3.9

Table 2. -- Continued.

Haul no.	Gear[a] type	Date (GMT)	Time (GMT)	Duration (minutes)	Start position Lat. (N)	Long. (W)	Depth (m)[c] footrope	bottom	Temp. (°C) headrope	surface[b]	Walleye pollock (kg)	number	Other (kg)
111	AWT	29-Jul	23:09	6	59 46.07	-176 33.39	109	140	0.4	9.3	531.7	2023	8.2
112	83-112*	30-Jul	0:53	30	59 46.16	-176 33.62	89	140	0.7	9.3	8.8	32	63.2
113	AWT	30-Jul	4:49	17	59 22.70	-176 25.87	103	138	0.9	9.0	1708	5913	0
114	AWT	30-Jul	9:02	12	58 59.46	-176 18.55	88	137	0.4	8.8	699.3	5083	0.0
115	AWT	30-Jul	17:44	4	58 41.75	-176 13.71	112	136	1.5	8.7	259.6	805	0
116	83-112	31-Jul	0:24	15	58 52.92	-176 55.68	127	129	1.5	8.8	141.4	361	76
117	AWT	31-Jul	16:28	12	60 13.25	-177 23.20	111	140	0.6	8.2	483.9	3295	17
118	AWT	31-Jul	20:48	3	60 41.58	-177 34.59	92	148	-0.9	8.3	642.6	5111	7
119	AWT	1-Aug	2:52	17	61 31.30	-177 53.35	-	142	-	8.3	986.1	5669	74.9
120	AWT	1-Aug	10:51	9	62 05.90	-178 07.62	86	116	-1.5	7.9	398.5	2574	18.3
121	AWT	1-Aug	17:30	17	62 29.61	-178 15.31	96	101	-0.3	8.7	445.7	1460	13.1
122	AWT	2-Aug	2:37	25	62 18.35	-178 54.90	104	112	0	8.7	91	263	4
123	AWT	2-Aug	9:09	6	61 34.78	-178 36.10	105	147	-0.1	8.9	938.4	3626	2.1
124	83-112*	2-Aug	10:45	30	61 34.33	-178 35.84	120	151	0.7	8.9	28.4	111	19
125	AWT	2-Aug	22:32	11	60 38.31	-178 12.77	134	162	1.4	8.2	726.6	1978	2
126	AWT	3-Aug	3:54	10	60 11.33	-178 02.36	134	151	1.4	7.8	421.7	3073	22
127	83-112*	3-Aug	8:32	30	59 48.80	-177 53.29	85	146	1.1	8.1	13.9	74	3.2
128	AWT	3-Aug	10:28	22	59 48.75	-177 52.91	57	146	-	8.4	534.5	3066	0
129	AWT	3-Aug	17:45	2	59 37.70	-177 49.91	176	257	1.4	8.5	166.5	882	0.8
130	AWT	5-Aug	0:35	5	61 33.20	-179 18.39	120	141	0.2	8.7	2033.4	7205	7.6
131	AWT	5-Aug	5:50	3	62 04.56	-179 31.90	118	127	-1.3	8.6	786.2	3215	17.8
132	83-112*	5-Aug	10:44	30	62 20.29	-179 37.53	108	124	0.1	8.6	34.4	131	38.9
133	AWT	5-Aug	20:28	4	61 53.21	179 51.28 #	141	170	1.1	8.4	504.1	2293	0
134	AWT	6-Aug	2:46	4	61 08.02	-179 48.64	154	169	0.7	8.0	671.5	2836	3.6
135	AWT	6-Aug	21:15	27	61 34.72	179 15.54 #	108	179	1.4	8.3	381.2	1464	3.6
136	83-112	7-Aug	0:48	14	61 46.51	179 9.27 #	127	129	1.8	8.5	1456.7	5715	584.3
137	AWT	7-Aug	23:20	10	60 25.98	-177 27.18	146	155	0.8	8.5	1567.3	11389	20.7
138	83-112*	8-Aug	1:09	30	60 26.17	-177 26.45	141	155	0.9	8.7	47.9	337	0.3
139	AWT	8-Aug	9:57	9	59 52.65	-177 16.97	116	138	0.5	8.5	933.8	5558	1
140	83-112*	8-Aug	11:34	30	59 52.85	-177 16.21	92	137	0.6	8.5	52.7	312	11.2

[a]AWT = Aleutian wing trawl, Methot = Methot trawl, 83-112 = 83-112 bottom trawl
[b]shipboard sensor at 1.4 m depth.
[c] Bottom depth is measured by echosounder on ship's centerboard; footrope depth is measured using both Seabird SBE and net sensor attached to headrope
[#] East Longitude
*Experimental gear trawl: 83-112 trawl deployed mid-water

Table 3. -- Catch by species from 78 Aleutian wing trawl (midwater) hauls conducted during the summer 2012 walleye pollock acoustic-trawl survey of the Bering Sea shelf. Catches from experimental trawls are not included.

		Weight		
Common name	Scientific name	(kg)	(%)	Number
walleye pollock	*Theragra chalcogramma*	49,922.1	92.1	201358
Pacific herring	*Clupea palla*	2,400.3	4.4	9288
northern sea nettle	*Chrysaora melanaster*	1,524.4	2.8	1733
jellyfish unident.	Scyphozoa (class)	195.9	0.4	141
smooth lumpsucker	*Aptocyclus ventricosus*	50.7	0.1	27
rock sole sp.	*Lepidopsetta* sp.	25.0	< 0.1	48
eulachon	*Thaleichthys pacificus*	23.6	< 0.1	669
chum salmon	*Oncorhynchus keta*	17.4	< 0.1	10
chinook salmon	*Oncorhynchus tshawytscha*	7.3	< 0.1	1
Pacific cod	*Gadus macrocephalus*	3.6	< 0.1	1
arrowtooth flounder	*Atheresthes stomias*	3.4	< 0.1	3
flathead sole	*Hippoglossoides elassodon*	1.9	< 0.1	5
great sculpin	*Myoxocephalus polyacanthocephalus*	1.6	< 0.1	1
Greenland turbot	*Reinhardtius hippoglossoides*	1.4	< 0.1	8
Irish lord	*Hemilepidotus jordani*	0.9	< 0.1	2
skate unident.	Rajidae (family)	0.6	< 0.1	1
yellowfin sole	*Limanda aspera*	0.5	< 0.1	1
fried egg jellyfish	*Phacellophora camtchatica*	0.4	< 0.1	1
salp unident.	Salipidae (family)	0.3	< 0.1	56
southern rock sole	*Lepidopsetta bilineata*	0.3	< 0.1	1
sturgeon poacher	*Podothecus acipenserinus*	0.1	< 0.1	1
shrimp unident.	Decapoda (order)	< 0.1	< 0.1	8
lumpsucker unident.	*Eumicrotremus* sp.	< 0.1	< 0.1	2
Totals		54,181.7		213,366

Table 4. -- Catch by species from 12 83-112 bottom-trawl hauls conducted during the summer 2012 walleye pollock acoustic-trawl survey of the Bering Sea shelf. Catches from experimental trawls are not included.

Common name	Scientific name	Weight (kg)	Weight (%)	Number
walleye pollock	*Theragra chalcogramma*	4,386.3	62.4	11,016
Pacific ocean perch	*Sebastes alutus*	437.4	6.2	497
Pacific herring	*Clupea pallasi*	307.8	4.4	958
sea urchin unident.	*Echinacea unident.*	295.0	4.2	10,913
Chrysaora melanaster	*Chrysaora melanaster*	271.6	3.9	270
Pacific cod	*Gadus macrocephalus*	175.3	2.5	54
arrowtooth flounder	*Atheresthes stomias*	169.4	2.4	304
sand dollar unident.	Clypeasteroida (order)	100.0	1.4	3,016
snow crab	*Chionoecetes opilio*	81.3	1.2	1,386
hermit crab unident.	Paguridae (family)	74.2	1.1	1,123
rock sole sp.	Lepidopsetta sp.	55.0	0.8	182
flathead sole	*Hippoglossoides elassodon*	52.7	0.8	167
longnose skate	*Raja rhina*	50.8	0.7	2
jellyfish unident.	Scyphozoa (class)	48.5	0.7	51
sea anemone unident.	Actiniaria (order)	44.2	0.6	257
starfish unident.	Asteroidea (class)	44.0	0.6	613
Tanner crab	*Chionoecetes bairdi*	41.8	0.6	350
blue king crab	*Paralithodes platypus*	40.0	0.6	60
basketstar	*Gorgonocephalus eucnemis*	37.7	0.5	187
sea cucumber unident.	*Holothuroidea unident.*	37.4	0.5	86
sponge unident.	Porifera (phylum)	35.8	0.5	376
purple-orange sea star	*Asterias amurensis*	27.8	0.4	199
sculpin unident.	Cottidae (sub-order)	26.8	0.4	26
snail unident.	Gastropod (class)	20.6	0.3	277
Pacific halibut	*Hippoglossus stenolepis*	20.5	0.3	12
sturgeon poacher	*Podothecus acipenserinus*	17.4	0.2	40
Pacific lyre crab	*Hyas lyratus*	17.1	0.2	423
starry flounder	*Platichthys stellatus*	10.6	0.2	4
tunicate unident.	*Ascidian unident.*	9.7	0.1	127
southern rock sole	*Lepidopsetta bilineata*	9.6	0.1	34
skate unident.	Rajidae (family)	8.9	0.1	5
Alaska plaice	*Pleuronectes quadrituberculatus*	8.8	0.1	6
yellowfin sole	*Limanda aspera*	8.4	0.1	15
brittlestarfish unident.	*Ophiuroid unident.*	7.5	0.1	1,053
yellow Irish lord	*Hemilepidotus jordani*	6.1	< 0.1	20
Kamchatka flounder	*Atheresthes evermanni*	5.7	< 0.1	8
empty gastropod shells	empty gastropod shells	5.4	< 0.1	73
rex sole	*Glyptocephalus zachirus*	3.9	< 0.1	3
whelk unident.	*Buccinidae (family)*	3.8	< 0.1	56
Alaska skate	*Bathyraja parmifera*	3.0	< 0.1	2

Table 4. -- Continued.

Pteraster sp.	*Pteraster* sp.	2.7	< 0.1	12
Bering skate	*Bathyraja interrupta*	2.5	< 0.1	2
Pododesmus sp.	*Pododesmus* sp.	1.7	< 0.1	10
Octopus unident.	Octopoda (order)	1.4	< 0.1	1
poacher unident.	Agonidae (family)	1.4	< 0.1	21
dusky rockfish	*Sebastes ciliatus*	1.3	< 0.1	1
red king crab	*Paralithodes camtschaticus*	1.3	< 0.1	1
horsehair crab	*Erimacrus isenbeckii*	1.2	< 0.1	3
Irish lord	*Hemilepidotus* sp.	0.8	< 0.1	2
sea mouse unident.	Aphroditidae (family)	0.6	< 0.1	14
searcher	*Bathymaster signatus*	0.5	< 0.1	2
lamprey unident.	Petromyzontidae (family)	0.4	< 0.1	1
sawback poacher	*Leptagonus frenatus*	0.4	< 0.1	5
sea whip unident.	Pennatulacea (order)	0.3	< 0.1	38
empty bivalve shells	empty bivalve shells	0.2	< 0.1	21
sea potato	*Styela rustica*	0.2	< 0.1	6
shrimp unident.	Decapoda (order)	0.2	< 0.1	74
pandalid shrimp unident.	Pandalidae (family)	0.2	< 0.1	55
Asterias sp.	*Asterias* sp.	0.2	< 0.1	6
blotched snailfish	*Crystallichthys cyclospilus*	0.1	< 0.1	1
snail eggs	Gastropod (class)	< 0.1	< 0.1	2
coral bryozoan	*Cellepora ventricosa*	< 0.1	< 0.1	1
skate egg case unident.	Rajidae (family)	< 0.1	< 0.1	5
scallop unident.	*Pectinid* sp.	< 0.1	< 0.1	2
capelin	*Mallotus villosus*	< 0.1	< 0.1	1
snailfish unident.	Liparidae (family)	< 0.1	< 0.1	1
crangonid shrimp unident.	Crangonidae (family)	< 0.1	< 0.1	3
crab unident.	Decapoda (order)	< 0.1	< 0.1	3
Totals		7,025.0		34,545.0

Table 5. -- Catch by species from 13 Methot trawl hauls conducted during the summer 2012 walleye pollock acoustic-trawl survey on the Bering Sea shelf.

		Weight		
Common name	Scientific name	(kg)	(%)	Number
northern sea nettle	*Chrysaora melanaster*	91.6	80.0	309
euphausiid unident.	Euphausiidae (family)	19.2	16.7	322,474
jellyfish unident.	Scyphozoa (class)	3.0	2.6	262
moon jelly	*Aurelia* sp.	0.7	0.6	171
copepod unident.	Copepoda (class)	0.1	0.1	3,131
amphipod unident.	Amphipoda (order)	<0.1	<0.1	96
salps unident.	Thaliacea unident.	<0.1	<0.1	176
isopod unident.	Isopoda (order)	<0.1	<0.1	1
fish larvae unident.	Actinopterygii (class)	<0.1	<0.1	1
Totals		114.6		326,621

Table 6. -- Number of fish measured and biological samples collected during the summer 2012 acoustic-trawl survey of walleye pollock on the Bering Sea shelf.

Haul	Pollock					Other	*Chrysaora melanaster*	Energetics
no.	Length	Weight	Maturity	Stomachs	Otoliths	Length	bell diameter	study^
1	-	-	-	-	-	-	42	-
2	94	47	47	-	47	23[a]	26	-
3	-	-	-	-	-	-	-	-
4	54	54	54	-	54	-	-	-
5	16	16	16	-	16	-	21	-
6	113	48	48	-	48	-	-	-
7	358	61	61	-	42	-	38	-
8	15	-	-	-	-	-	-	-
9	2	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-
12	406	59	59	-	58	-	-	-
13	1	1	1	-	-	-	48	-
14	369	56	56	-	56	-	-	-
15	-	-	-	-	-	-	-	-
16	280	43	43	-	43	-	-	-
17	23	-	-	-	-	-	43	-
18	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	91	-
20	389	39	39	-	39	25[a]	-	-
21	3	-	-	-	-	-	-	-
22	214	33	33	-	33	68[a]	-	-
23	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-
25	537	35	35	-	35	-	-	-
26	2	-	-	-	-	-	-	-
27	269	30	30	-	30	-	-	-
28	-	-	-	-	-	79[b]	-	-
29	317	42	42	-	42	-	-	-
30	3	-	-	-	-	-	-	-
31	41	41	41	-	16	-	-	-
32	4	-	-	-	26	-	-	-
33	-	-	-	-	-	-	2	-
34	3	-	-	-	35	-	-	-
35	-	-	-	-	-	-	-	-
36	1	-	-	-	30	-	-	-
37	421	36	36	-	36	-	-	-
38	2	-	-	-	-	-	-	-
39	355	30	30	-	30	-	-	-
40	314	60	60	-	-	-	-	-
41	31	31	31	-	-	-	23	-
42	58	58	58	-	-	-	-	-
43	-	-	-	-	-	-	-	-
44	91	-	-	-	-	-	-	-
45	394	44	44	-	43	-	-	-
46	180	-	-	-	-	-	41	-
47	432	41	41	-	41	-	-	-
48	12	-	-	-	-	-	-	-
49	363	44	44	-	44	-	-	-
50	21	5	5	-	45	-	-	-

Table 6. -- Continued.

Haul No.	Pollock Length	Weight	Maturity	Stomachs	Otoliths	Other Length	*Chrysaora melanaster* bell diameter	Energetics study^
51	404	53	53	-	40	-	-	-
52	340	45	45	-	45	-	-	-
53	83	20	20	-	50	-	-	-
54	9	-	-	-	-	-	-	-
55	488	43	43	-	43	-	-	-
56	44	-	-	-	-	-	-	-
57	71	20	20	-	67	-	-	-
58	318	21	21	-	46	-	-	-
59	66	-	-	-	-	-	-	-
60	175	-	-	-	-	-	-	-
61	-	-	-	-	-	-	-	-
62	-	-	-	-	-	-	-	-
63	25	-	-	-	-	-	-	-
64	355	41	41	-	41	-	-	-
65	432	38	38	-	38	-	-	-
66	-	-	-	-	-	-	-	-
67	454	41	41	-	41	61[c]	-	-
68	429	39	39	-	39	-	-	-
69	95	-	-	-	-	-	33	-
70	431	40	40	-	40	-	-	-
71	118	-	-	-	-	-	-	-
72	-	-	-	-	-	-	-	-
73	37	20	20	-	46	-	-	-
74	1	-	-	-	49	-	-	-
75	124	-	-	-	-	-	-	-
76	54	-	-	-	-	-	-	-
77	599	40	40	-	40	-	-	-
78	40	40	40	-	40	-	-	-
79	368	41	41	-	41	-	-	-
80	75	-	-	-	-	-	-	-
81	11	-	-	-	-	-	-	5
82	383	41	41	-	41	-	-	-
83	381	43	43	-	43	-	-	-
84	335	40	40	-	40	-	25	4
85	209	-	-	-	-	-	-	-
86	426	40	40	-	40	-	-	-
87	428	40	40	-	40	-	-	-
88	412	40	40	-	40	-	-	5
89	1	-	-	-	40	-	-	-
90	248	-	-	-	-	-	-	5
91	509	36	36	-	36	106[c]	-	-
92	374	40	40	-	40	-	-	5
93	407	40	40	-	40	-	-	-
94	405	43	43	-	43	-	-	-
95	399	41	41	-	41	-	-	-
96	346	55	55	-	40	-	-	-
97	658	40	40	-	40	-	-	5
98	7	-	-	-	35	-	-	3
99	400	58	58	-	40	-	-	-
100	240	-	-	-	-	-	48	-

Table 6. -- Continued.

Haul	Pollock					Other	*Chrysaora melanaster*	Energetics
No.	Length	Weight	Maturity	Stomachs	Otoliths	Length	bell diameter	study^
101	465	62	62	-	35	-	-	5
102	545	-	-	-	-	-	-	5
103	435	40	40	-	40	52[c #]	-	6
104	501	-	-	-	-	41[c]	-	-
105	164	-	-	-	-	-	-	7
106	302	38	38	-	27	-	-	-
107	253	-	-	-	-	-	-	5
108	434	88	88	-	43	-	-	6
109	440	65	65	-	32	-	-	-
110	3	-	-	-	34	-	-	-
111	334	39	39	-	39	-	-	-
112	32	-	-	-	-	-	21	-
113	360	36	36	-	35	-	-	-
114	509	42	42	-	35	-	-	-
115	297	31	31	-	31	-	-	-
116	7	7	-	-	36	-	-	-
117	473	60	59	-	30	-	-	-
118	452	30	30	-	8	-	-	-
119	417	54	54	-	35	-	-	-
120	501	21	21	-	20	-	-	-
121	341	43	43	-	43	-	-	-
122	263	49	49	-	42	-	-	-
123	303	-	-	-	-	-	-	-
124	111	-	-	-	-	-	-	-
125	429	40	40	-	40	-	-	-
126	542	42	42	-	42	-	-	-
127	74	-	-	-	-	-	-	-
128	424	-	-	-	-	-	-	-
129	306	50	50	-	25	-	-	-
130	422	32	32	-	32	-	-	-
131	359	43	43	-	36	53[c]	-	-
132	131	-	-	-	-	-	-	-
133	360	34	34	-	34	-	-	-
134	405	47	47	-	35	-	-	-
135	389	38	38	-	38	-	-	-
136	477	28	28	-	28	10[a], 35[c]	-	-
137	564	4	4	-	4	-	-	-
138	337	-	-	-	-	-	-	-
139	370	-	-	-	-	-	-	-
140	312	-	-	-	-	-	-	-
Totals	32,245	3,156	3,148	0	3,113	-		

Other species measured - [a] eulachon, [b] Pacific ocean perch, [c] Pacific herring, [d] Pacific cod

[#] 52 Pacific herring weights recorded

^Energetics study (R. Heinz) included individual juvenile and adult pollock samples.

Table 7. -- Walleye pollock biomass from summer acoustic-trawl surveys on the U.S. EEZ portion of the Bering Sea shelf, 1994-2012. Data for the Steller sea lion Conservation Area (SCA), east of 170°W minus the SCA (E170-SCA), and the U.S. west of 170°W (W170) are estimated pollock biomass between near surface and 3 m off bottom. Relative estimation error for the biomass is indicated.

Date		Area	Biomass, million metric tons (top) and percent of total (bottom)			Total biomass	Relative estimation error
		$(nmi)^2$	SCA	E170-SCA	W170	(million metric tons)	
1994	9 Jul-19 Aug	78,251	0.312	0.399	2.176	2.886	0.047
			10.8	13.8	75.4		
1996	20 Jul-30 Aug	93,810	0.215	0.269	1.826	2.311	0.039
			9.3	11.7	79.0		
1997	17 Jul-4 Sept	102,770	0.246	0.527	1.818	2.592	0.037
			9.5	20.3	70.1		
1999	7 Jun-5 Aug	103,670	0.299	0.579	2.408	3.285	0.055
			9.1	17.6	73.3		
2000	7 Jun-2 Aug	106,140	0.393	0.498	2.158	3.049	0.032
			12.9	16.3	70.8		
2002	4 Jun -30 Jul	99,526	0.647	0.797	2.178	3.622	0.031
			17.9	22.0	60.1		
2004	4 Jun -29 Jul	99,659	0.498	0.516	2.293	3.307	0.037
			15.1	15.6	69.3		
2006	3 Jun -25 Jul	89,550	0.131	0.254	1.175	1.560	0.039
			8.4	16.3	75.3		
2007	2 Jun -30 Jul	92,944	0.084	0.168	1.517	1.769	0.045
			4.7	9.5	85.8		
2008	2 Jun -31 Jul	95,374	0.085	0.029	0.883	0.997	0.076
			8.5	2.9	88.6		
2009	9 Jun -7 Aug	91,414	0.070	0.018	0.835	0.924	0.088
			7.6	2.0	90.4		
2010	5 Jun -7 Aug	92,849	0.067	0.113	2.143	2.323	0.060
			2.9	4.8	92.3		
2012	7 Jun -10 Aug	96,852	0.142	0.138	1.563	1.843	0.042
			7.7	7.5	84.8		

Table 8. -- Numbers-at-length estimates (millions) of walleye pollock between near surface and 3 m off bottom from acoustic- trawl surveys in the U.S. EEZ, 1994-2012.

Length (cm)	**1994**	**1996**	**1997**	**1999**	**2000**	**2002**	**2004**	**2006**	**2007**	**2008**	**2009**	**2010**	**2012**
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0.03	0	0	0	0	0	0	0	0
9	0	0	0	0.01	0.03	0	0	0	0	0	4.42	0	0.23
10	0	0	2.04	0.12	0.76	0.01	0.24	0	30.12	0	45.53	0	0.12
11	0.40	0	0.19	4.78	2.30	0.77	0.20	5.29	259.94	0.74	221.44	0.92	0.83
12	5.44	0.47	30.13	14.43	5.50	4.70	2.56	59.83	662.11	2.82	768.23	8.56	3.05
13	44.79	5.44	238.10	22.71	19.26	21.36	2.38	144.42	1329.33	6.70	1112.48	65.31	5.75
14	94.23	38.20	1416.21	22.35	36.70	100.48	4.08	117.62	1497.63	9.47	1087.89	259.44	9.52
15	179.82	131.29	2949.25	16.20	56.69	194.98	1.84	84.56	803.62	6.13	1046.86	508.46	14.37
16	166.05	227.77	3364.00	5.20	79.57	178.72	1.80	27.81	563.27	4.38	535.32	799.69	14.04
17	105.16	317.31	2207.83	5.20	50.81	99.74	1.76	10.15	304.17	7.78	266.25	698.61	11.66
18	129.71	215.26	1309.13	12.92	22.39	33.47	1.12	2.90	114.52	49.99	84.01	304.04	8.78
19	212.54	115.39	569.51	44.60	30.27	40.07	4.34	4.73	133.95	128.23	82.88	155.46	24.43
20	381.96	64.79	181.06	152.57	47.16	61.90	8.40	10.85	117.76	264.22	55.95	175.31	78.52
21	589.69	37.20	74.90	251.49	92.37	162.63	23.15	17.43	145.33	402.13	77.20	228.58	188.37
22	794.28	64.41	81.07	314.31	136.41	289.69	34.90	31.71	147.44	440.61	106.28	374.84	311.68
23	788.35	60.24	150.80	288.90	185.76	485.72	47.06	37.50	129.53	568.91	135.13	629.53	391.40
24	772.58	70.32	255.93	220.31	186.04	734.73	48.21	33.77	142.76	447.11	112.14	938.65	357.38
25	581.45	47.68	408.07	164.37	207.95	859.82	39.35	30.25	91.73	357.46	114.43	1170.05	290.16
26	372.26	38.32	458.83	188.58	186.91	832.36	32.49	24.95	65.22	241.72	114.22	1174.04	224.05
27	198.97	33.63	519.67	256.04	187.68	718.04	25.99	21.77	49.83	115.47	129.48	931.46	192.24
28	122.07	60.16	422.68	302.47	168.93	516.42	29.43	25.52	32.98	79.93	139.98	578.26	207.61
29	135.90	85.07	296.50	419.16	164.76	491.26	69.82	29.78	21.87	104.00	181.74	273.70	261.16
30	138.25	122.81	175.36	435.28	167.17	507.57	90.09	35.24	18.40	129.13	205.96	131.43	304.50
31	178.83	183.98	115.83	417.13	169.72	592.86	148.82	42.19	16.21	119.63	253.04	89.40	279.21
32	234.80	240.98	79.12	410.19	167.23	539.68	151.19	45.36	35.23	135.96	243.92	103.67	223.70
33	239.39	341.56	69.15	372.65	188.70	533.40	180.25	51.47	46.64	117.44	197.30	114.41	188.73
34	291.50	408.41	68.83	393.58	221.59	421.17	185.43	68.74	61.27	112.26	149.26	129.05	200.60
35	296.57	458.38	89.48	415.94	332.90	291.90	237.90	82.66	74.85	82.94	100.61	162.44	246.99
36	326.66	477.95	146.28	433.11	360.41	239.36	302.68	111.93	64.09	40.17	76.70	233.18	311.10
37	343.99	400.98	220.62	393.54	414.22	218.57	430.24	118.70	79.64	28.85	50.97	288.73	381.18
38	305.79	333.42	321.35	403.47	369.24	222.31	476.40	124.99	75.28	23.58	34.05	382.43	397.66
39	294.82	253.70	397.12	359.07	344.63	218.51	539.43	118.56	83.27	32.67	26.29	400.38	363.86
40	311.31	214.24	397.83	304.48	297.14	209.21	499.73	126.41	106.70	23.19	20.55	359.88	304.71

Table 8. -- Continued.

Length (cm)	1994	1996	1997	1999	2000	2002	2004	2006	2007	2008	2009	2010	2012
41	271.09	168.18	350.37	243.06	331.55	200.43	511.11	140.54	113.05	24.95	15.78	278.88	200.56
42	289.53	154.99	292.97	240.38	316.41	179.46	475.59	154.29	141.30	26.81	18.00	196.02	127.26
43	273.09	149.27	222.05	265.33	331.24	186.32	453.93	163.58	191.31	38.14	14.29	127.23	78.63
44	243.93	133.46	172.49	321.32	302.44	185.26	388.07	178.01	189.44	39.27	11.12	86.81	63.74
45	256.58	117.96	125.08	328.57	290.08	197.15	339.54	170.87	210.76	44.81	11.44	57.23	58.98
46	216.09	103.48	93.20	304.97	249.82	183.59	247.30	158.64	213.99	50.85	13.24	36.97	55.40
47	177.93	98.39	74.75	238.84	235.52	182.87	196.13	146.34	185.68	54.78	12.35	21.51	57.10
48	148.15	94.29	59.37	182.91	176.81	168.36	150.84	130.84	150.01	54.71	21.23	11.68	50.86
49	73.11	83.67	45.51	122.90	143.24	154.43	113.57	105.90	128.80	47.05	22.51	7.53	42.00
50	66.74	79.87	40.23	88.16	106.27	133.48	78.29	88.25	101.90	41.79	20.42	6.85	30.46
51	33.15	72.52	33.10	60.42	78.54	117.74	64.53	73.93	73.22	39.74	19.56	6.24	21.95
52	30.35	60.21	31.72	42.15	48.15	91.92	56.33	62.45	52.96	29.92	20.66	3.61	17.31
53	18.15	50.89	29.59	33.02	35.75	88.43	41.08	45.82	41.04	23.84	15.37	2.75	12.90
54	15.68	38.44	23.91	26.90	22.09	62.98	30.20	35.31	32.46	21.89	13.54	1.69	11.94
55	18.57	25.63	19.77	16.14	16.58	44.34	19.12	23.01	23.25	16.11	16.29	3.16	7.02
56	11.05	14.07	14.58	9.26	12.58	40.16	14.43	19.33	16.43	12.38	9.96	2.24	4.88
57	9.52	7.65	10.61	9.40	8.92	24.16	8.83	14.93	13.02	10.47	8.63	3.51	4.24
58	4.85	7.68	8.60	5.68	6.41	18.77	5.83	10.63	7.51	9.21	9.24	3.05	4.61
59	2.96	3.02	5.98	3.24	5.13	11.26	6.16	8.11	4.76	8.31	5.28	2.79	3.07
60	3.47	4.71	3.45	3.04	1.87	10.58	4.00	5.39	3.72	7.39	4.50	3.20	4.16
61	6.63	2.88	4.58	2.40	2.30	7.11	2.89	4.60	1.86	4.09	2.37	4.29	2.88
62	1.39	1.79	1.55	2.12	1.72	3.92	1.95	2.07	1.13	4.94	2.41	1.76	3.00
63	0.71	0.28	2.01	0.62	1.57	2.18	2.07	1.17	1.09	2.62	1.70	1.26	1.18
64	0.49	0.59	0.47	0.57	0.98	1.74	0.08	1.98	1.06	2.12	1.21	1.55	2.04
65	1.86	0.85	0.81	0.93	0.64	1.74	0.30	0.73	0.48	1.48	1.42	1.16	1.55
66	0.77	0.35	0.32	1.42	0.70	1.16	0.55	0.85	0.60	0.67	1.15	1.26	0.72
67	0.97	0.66	1.27	0.48	0.03	0.27	0.35	0.27	0.35	0.58	0.50	1.13	0.00
68	1.46	0	0.19	0.30	0.27	0.17	0.19	0.02	0.21	0.51	0.30	1.36	0.55
69	0	0	0.59	0.29	0.59	0	0	0	0.02	0.12	0.44	0.14	0.00
70	1.93	0	0.10	0	0	0.43	0	0.02	0.30	0.21	0.04	0.36	0.40
71	0.49	0.11	0	<0.01	0	0.01	0	0.14	0.21	0.06	0	0	0
72	0.97	0	0	0.11	0.15	0	0	0.46	0	0.42	0	0.17	0
73	0.49	0	0.05	0.16	0	0	0	0.02	0	0.04	0	0.83	0
74	0	0	0	0	0.14	0	0	0	0.06	0.05	0	0.17	0.31
75	0	0	0	0.04	0	0	0	0	0	0.03	0.03	0.00	0
76	0	0	0	0	0	0	0	0	0	0	0	0.14	0
77	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0.49	0	0	0	0	0	0	0	0	0	0	0.14	0
79	0	0	0	0.39	0	0	0	0.08	0	0.06	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	10,821	6,525	18,686	9,601	7,630	12,122	6,835	3,396	9,207	4,704	8,075	12,549	6,667

Table 9. -- Biomass-at-length estimates (metric tons) of walleye pollock between near surface and 3 m off bottom on the Bering Sea shelf from acoustic-trawl surveys in the U.S. EEZ, 1994-2012.

Length (cm)	**1994**	**1996**	**1997**	**1999**	**2000**	**2002**	**2004**	**2006**	**2007**	**2008**	**2009**	**2010**	**2012**
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	<1	0	0	0	0	0	0	0	0
9	0	0	0	<1	<1	0	0	0	0	0	24	0	1
10	0	0	14	1	8	0	2	0	200	0	336	0	1
11	4	0	2	59	30	9	2	54	2,469	7	2,003	9	8
12	71	6	394	227	88	75	30	762	7,313	34	9,219	112	36
13	744	92	4,148	445	370	428	36	2,366	19,068	104	17,136	1,064	86
14	1,937	804	31,282	538	859	2,488	81	2,176	25,781	168	21,613	5,436	165
15	4,520	3,384	81,544	472	1,613	5,841	48	1,997	17,771	145	25,658	12,983	319
16	5,040	7,098	111,182	181	2,713	6,393	57	815	14,870	125	16,147	25,180	357
17	3,817	11,818	84,460	214	2,055	4,231	67	365	9,873	254	10,147	26,219	357
18	5,553	9,485	58,223	623	1,064	1,664	50	123	4,401	1,923	3,671	13,313	307
19	10,655	5,960	28,768	2,499	1,677	2,284	210	235	6,200	5,880	4,185	7,577	1,146
20	22,244	3,892	10,677	9,852	3,017	4,072	498	626	6,392	14,049	3,204	10,002	4,154
21	39,601	2,579	4,900	18,587	6,782	12,242	1,595	1,133	9,810	24,584	5,259	15,444	11,763
22	61,100	5,121	6,101	26,421	11,419	24,828	2,730	2,413	11,643	31,976	8,715	29,774	22,304
23	69,048	5,458	12,962	27,464	17,629	47,351	4,265	3,277	11,513	48,149	12,534	56,840	33,139
24	76,622	7,221	24,999	23,562	19,911	81,309	4,887	3,259	14,551	42,932	11,518	97,422	34,485
25	64,967	5,520	45,081	19,681	24,970	107,760	4,475	3,176	10,266	38,541	14,070	137,766	31,345
26	46,652	4,979	56,998	25,168	25,070	117,666	4,347	3,107	8,010	29,360	15,332	154,353	27,161
27	27,847	4,884	72,339	37,933	28,002	113,478	3,876	2,946	6,844	15,725	20,391	136,592	26,428
28	19,028	9,721	65,700	49,557	27,927	89,827	4,813	3,917	5,073	12,102	23,816	95,619	31,668
29	23,550	15,240	51,328	75,679	30,072	92,941	12,745	5,050	3,697	17,423	35,978	49,597	44,989
30	26,437	24,307	33,691	86,321	33,574	104,158	17,942	6,561	3,462	23,802	44,259	25,366	57,178
31	37,756	40,104	24,685	90,579	37,396	132,640	32,663	9,236	3,428	24,696	60,686	19,576	59,223
32	54,180	57,669	18,522	97,251	40,301	131,538	36,257	10,767	8,606	30,634	63,679	24,976	51,591
33	60,378	89,480	17,709	96,204	49,614	141,718	48,265	13,252	12,233	29,302	56,444	30,732	47,159
34	80,001	116,812	19,201	110,357	63,403	122,045	53,459	19,248	17,643	29,881	46,340	38,481	54,640
35	88,546	142,771	27,148	126,368	103,387	92,414	74,135	25,252	23,484	24,798	33,904	52,816	72,975
36	105,903	161,724	48,272	142,256	121,237	82,291	103,401	36,989	21,662	13,229	27,902	82,376	100,285
37	120,806	147,067	79,075	139,441	150,552	81,503	156,813	41,377	29,517	10,234	19,593	110,112	134,105
38	116,110	132,264	124,841	153,908	144,826	88,680	188,084	47,836	30,240	9,163	14,455	160,201	148,383
39	121,143	108,629	166,999	147,178	145,465	93,405	229,225	49,056	35,953	13,611	11,726	178,105	146,555
40	137,651	98,825	180,668	133,859	135,080	95,675	230,733	55,427	48,709	10,622	9,876	173,381	132,499

Table 9. -- Continued.

Length (cm)	1994	1996	1997	1999	2000	2002	2004	2006	2007	2008	2009	2010	2012
41	129,335	83,422	171,750	114,415	161,884	98,165	252,339	65,790	54,826	11,866	8,172	143,345	93,497
42	149,294	82,523	154,670	120,957	165,982	94,168	253,443	78,528	72,602	13,379	9,940	107,271	63,506
43	152,526	85,177	125,886	142,492	185,961	104,975	261,967	87,505	105,904	20,806	8,596	73,519	41,934
44	147,017	81,478	104,750	183,897	181,482	110,994	239,860	102,839	111,390	22,429	6,934	53,494	36,511
45	166,444	76,937	81,320	200,114	185,345	125,772	222,131	103,984	131,381	27,203	7,500	37,336	36,256
46	149,720	71,999	64,736	197,389	169,854	124,740	171,216	102,312	143,460	32,686	9,387	26,169	36,036
47	131,130	72,930	55,323	164,067	170,024	132,267	142,845	100,258	131,598	37,569	9,438	15,750	40,265
48	115,921	74,352	46,750	133,183	135,575	129,623	115,709	94,693	112,575	38,443	16,576	9,524	39,020
49	60,566	70,102	38,100	94,742	116,332	126,481	92,215	81,175	101,538	36,199	18,743	6,433	33,595
50	58,531	71,016	35,728	71,872	91,389	115,778	67,512	73,481	85,481	34,038	18,222	6,199	25,604
51	30,462	68,346	31,145	52,026	71,352	108,641	58,478	63,585	64,652	33,569	18,440	6,300	19,684
52	29,789	60,080	31,560	38,303	46,186	89,753	53,394	56,209	49,596	26,625	20,583	3,889	16,239
53	18,463	53,710	31,087	31,630	36,163	91,552	41,489	44,479	39,922	23,325	15,872	2,942	13,233
54	16,856	42,859	26,500	27,130	23,496	68,832	31,998	36,086	34,719	22,249	14,241	1,945	13,440
55	21,296	30,163	23,075	17,129	18,562	51,122	21,285	25,029	26,503	17,789	17,943	3,908	8,339
56	13,207	17,456	17,914	10,327	14,788	48,961	17,136	21,089	19,415	15,024	12,046	3,032	6,059
57	11,943	9,998	13,712	11,013	11,004	30,986	11,453	17,519	16,742	13,074	11,371	4,615	5,545
58	6,368	10,573	11,671	6,984	8,300	25,335	7,517	13,507	9,953	12,444	11,563	4,159	6,376
59	4,167	4,365	8,530	4,174	6,962	15,953	8,825	10,892	6,815	11,544	8,251	4,250	4,169
60	5,001	7,163	5,155	4,104	2,656	15,550	6,038	7,784	5,687	11,354	7,402	5,271	6,400
61	10,199	4,591	7,172	3,394	3,421	11,003	4,574	6,869	2,990	6,534	4,100	7,381	4,387
62	2,285	2,998	2,550	3,135	2,679	6,415	3,214	3,241	1,874	8,250	4,373	2,936	5,028
63	1,196	498	3,448	953	2,551	3,683	3,585	1,937	1,934	4,528	3,241	2,241	2,028
64	844	1,084	843	925	1,660	3,109	139	3,360	1,958	3,835	2,423	2,844	3,478
65	3,382	1,637	1,531	1,562	1,122	3,223	562	1,314	928	2,717	2,978	2,325	2,921
66	1,467	704	617	2,497	1,296	2,202	1,097	1,587	1,212	1,303	2,525	2,802	1,432
67	1,929	1,386	2,622	876	52	505	717	519	734	1,201	1,150	2,522	0
68	3,021	0	413	567	551	352	406	46	464	1,072	729	3,292	1,192
69	0	0	1,351	585	1,244	0	0	0	45	273	1,096	343	0
70	4,349	0	230	0	0	945	0	51	720	493	101	911	947
71	1,142	267	0	3	0	33	0	322	538	132	0	0	0
72	2,380	0	0	238	351	0	0	1,084	0	1,016	0	453	0
73	1,239	0	126	362	0	0	0	57	0	112	0	2,365	0
74	0	0	0	0	362	0	0	0	181	135	0	492	858
75	1,340	0	0	90	0	0	0	0	0	90	86	11	0
76	0	0	0	0	0	0	0	0	0	0	0	457	0
77	0	0	0	0	0	0	0	0	0	0	0	0	0
78	1,503	0	0	0	0	0	0	0	0	0	0	494	0
79	0	0	0	1,118	0	0	0	245	0	181	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0
Tota	2,886,223	2,310,728	2,592,178	3,285,138	3,048,697	3,622,072	3,306,935	1,560,174	1,769,019	996,939	923,843	2,322,643	1,842,792

Table 10. -- Estimated numbers-at-age (millions, top panel) and biomass-at-age (thousand metric tons, bottom panel) for walleye pollock observed between near surface and 3 m off bottom in the U.S. EEZ from summer Bering Sea shelf acoustic-trawl surveys 1994-2012. The 2012 estimates are preliminary using bottom trawl survey ages. Trace amounts are indicated as 'tr'.

Age	1994	1996	1997	1999	2000	2002	2004	2006	2007	2008	2009	2010	2012
1	610.2	972.3	12,360.0	111.9	257.9	634.8	15.8	455.6	5588.5	36.5	5127.9	2525.5	75.5
2	4,781.1	446.4	2,745.2	1,587.6	1,272.3	4,850.4	275.1	208.6	1026.2	2905.3	797.5	6395.2	1875.3
3	1,336.0	520.4	386.2	3,597.0	1,184.9	3,295.1	1,189.3	282.0	319.7	1031.6	1675.9	973.5	1745.3
4	1,655.7	2,686.5	490.9	1,683.6	2,480.0	1,155.0	2,933.9	610.1	430.1	144.4	202.8	2183.5	2343.5
5	1,898.1	820.7	1,921.5	582.6	899.7	507.2	1,442.1	695.3	669.2	106.9	40.1	383.6	254.1
6	296.1	509.3	384.4	273.9	243.9	756.8	416.6	551.8	588.8	170.2	44.0	46.3	245.8
7	71.2	434.4	205.2	1,169.1	234.0	436.7	199.2	319.7	305.7	132.4	62.0	6.2	62.9
8	65.2	84.9	142.5	400.2	725.1	91.4	194.0	110.1	166.2	70.7	55.5	7.4	19.0
9	31.9	16.7	32.7	104.6	190.4	110.3	68.3	53.0	60.2	58.2	32.6	6.8	8.7
10	23.2	6.3	3.9	66.9	84.7	205.4	33.5	40.3	18.8	15.0	21.2	6.5	12.1
11	8.5	5.7	4.9	14.5	35.6	52.1	24.8	23.3	20.2	15.1	8.2	6.0	9.2
12	19.3	12.1	2.0	6.5	18.1	17.9	19.8	16.2	5.7	6.9	3.8	2.6	7.2
13	4.8	1.3	2.2	1.7	1.2	3.1	12.1	8.6	1.7	4.5	2.0	1.9	5.4
14	5.7	4.8	2.3	0.0	1.4	5.9	5.8	9.9	2.1	1.9	1.2	1.3	1.1
15	1.2	2.4	2.0	0.1	0.1	0.0	4.3	5.0	1.8	0.9	0.1	1.1	1.0
16	7.9	0.5	0.0	0.1	0.3	0.0	0.0	3.8	0.2	2.0	0.0	0.3	0.2
17	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.6	0.0	0.3	tr
18	0.0	0.5	0.0	0.4	0.1	0.0	0.0	0.1	0.0	0.6	tr	0.4	0.1
19	0.7	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.6	0.4	tr	0.1	0.2
20	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.1	0.1
21+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	tr	0.0	tr	0.2
Total	10,821	6,525	18,686	9,601	7,630	12,122	6,834	3,396	9,207	4,704	8075.5	12,549	6,667

Age	1994	1996	1997	1999	2000	2002	2004	2006	2007	2008	2009	2010	2012
1	17.1	36.7	417.8	3.3	8.1	21.2	0.4	8.8	103.4	0.8	104.4	80.0	2.0
2	425.3	35.3	369.9	156.6	144.0	645.1	31.6	21.2	89.5	242.7	78.5	750.4	179.9
3	312.4	118.7	99.5	847.4	284.6	843.7	329.3	68.8	89.3	220.7	399.6	215.4	343.3
4	641.3	888.8	188.6	640.2	974.4	458.2	1349.4	230.7	188.0	58.7	84.1	963.2	880.4
5	1,067.2	396.0	921.0	271.7	488.6	286.0	820.9	366.4	389.8	61.5	23.4	216.8	135.3
6	187.2	341.8	235.0	164.3	156.0	514.5	288.7	359.8	404.3	117.3	35.7	33.4	169.5
7	50.1	359.9	161.3	751.5	166.6	351.6	153.0	244.1	240.9	106.6	56.0	5.8	52.7
8	55.3	72.5	139.5	278.9	540.8	85.6	166.3	93.2	144.8	69.4	57.0	9.9	17.7
9	30.9	16.3	34.2	84.6	149.0	111.0	62.4	49.5	58.4	56.4	36.8	10.7	11.1
10	26.4	6.6	4.4	62.5	76.3	212.5	33.1	39.2	20.7	18.9	25.1	10.5	15.4
11	10.5	6.9	6.1	14.2	39.0	59.6	25.3	23.3	22.3	18.9	10.7	10.1	12.3
12	27.9	17.1	3.4	7.2	16.7	19.7	21.9	18.7	7.1	8.6	5.5	4.9	10.0
13	6.7	1.5	4.5	1.5	1.3	4.6	12.7	10.4	2.1	6.2	3.4	3.7	7.9
14	7.7	7.0	3.8	0.0	2.6	8.5	6.2	12.7	3.7	3.2	2.5	2.5	2.0
15	2.1	3.8	2.9	0.2	0.1	0.0	5.7	5.9	2.2	1.1	0.3	2.1	1.6
16	12.5	0.9	0.0	0.2	0.3	0.0	0.0	4.3	0.3	3.3	0.0	0.7	0.3
17	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.9	0.0	0.6	0.1
18	0.0	0.9	0.0	0.7	0.3	0.0	0.0	0.3	0.0	1.1	tr	1.2	0.3
19	0.8	0.0	0.0	0.0	0.0	0.0	0.0	2.5	1.0	0.5	tr	0.2	0.4
20	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.2	0.3
21+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.1	0.0	tr	0.3
Total	2,886	2,311	2,592	3,285	3,049	3,622	3,307	1,560	1,769	997	924	2,323	1,843

Table 11. -- Estimated numbers and biomass of walleye pollock observed between near the surface and 0.5 m off bottom[1] from Bering Sea acoustic-trawl surveys in the United States and in the Cape Navarin area of Russia.

Year	Bering Sea EEZ region	Numbers (billions)	Biomass (million metric tons)	% Biomass	Survey nation	Area (nmi^2)
1994	US	12.60	3.72	85	US	78,250
	Russia	2.77	0.65	15	US	18,460
	Total	15.37	4.37			
2002	US	13.81	4.53	98	US	99,526
	Russia	0.75	0.08	2	Russia	32,270
	Total	14.56	4.61			
2004	US	7.95	4.03	91	US	99,659
	Russia	1.55	0.40	9	US	7,870
	Total	9.51	4.43			
2007	US	10.24	2.40	96	US	92,944
	Russia	1.09	0.11	4	US	12,460
	Total	11.33	2.51			
2008	US	5.47	1.54	98	US	95,374
	Russia	0.07	0.03	2	US	12,073
	Total	5.54	1.58			
2009	US	9.25	1.33	99	US	91,414
	Russia	0.02	0.01	1	US	11,714
	Total	9.27	1.34			
2010	US	13.50	2.62	95	US	92,849
	Russia	1.03	0.13	5	US	12,260
	Total	14.53	2.75			
2012	US	7.83	2.38	78	US	96,852
	Russia	2.97	0.66	22	US	15,180
	Total	10.80	3.04			

[1] Note: near bottom estimates (0.5-3 m off bottom) should be interpreted with caution as there is a greater likelihood for species contamination and fewer hauls were made in this zone than in the midwater zone above.

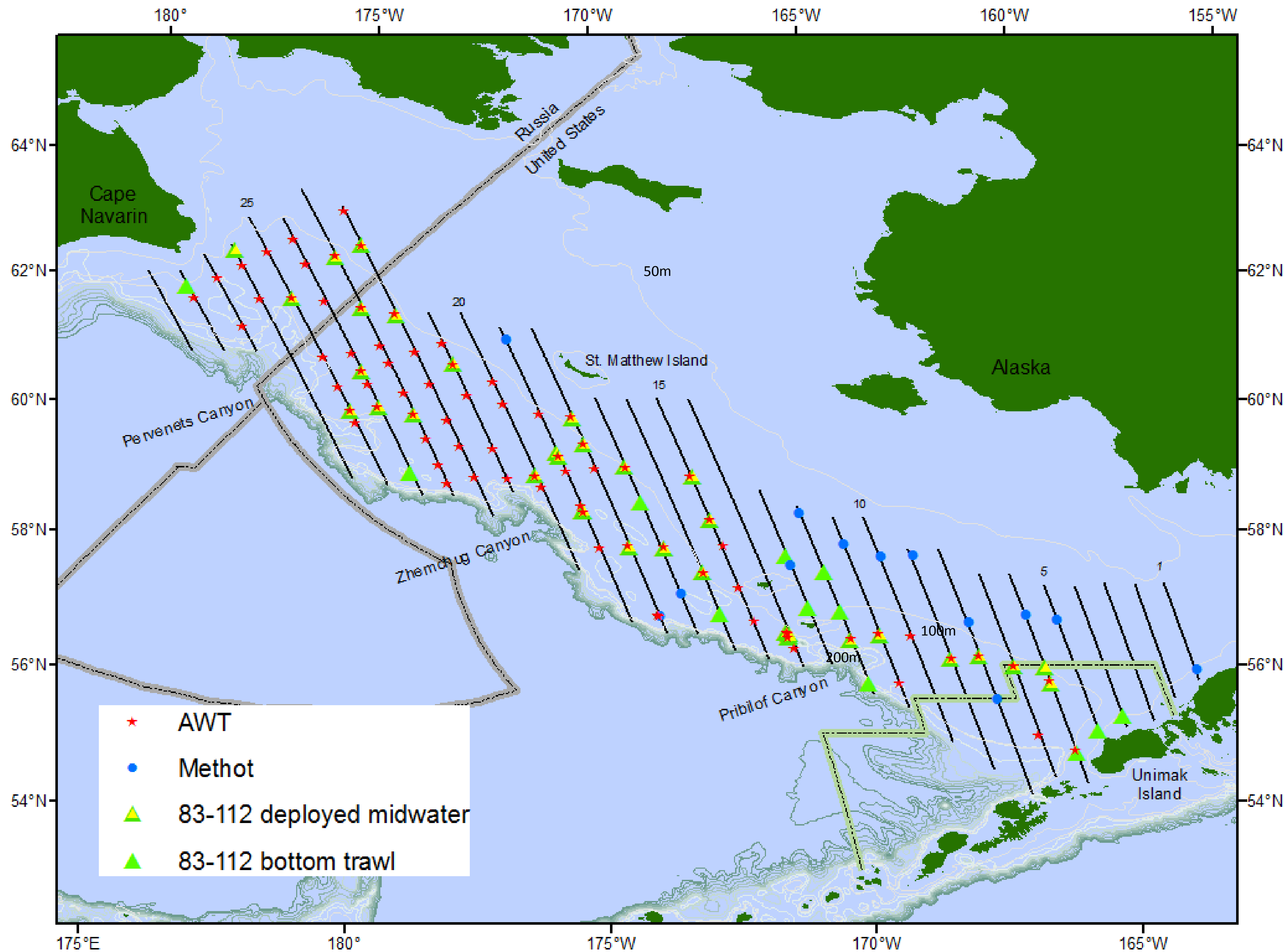


Figure 1.-- Transect lines with locations of Aleutian wing trawls, 83-112 trawls, and Methot trawls during the summer 2012 acoustic-trawl survey of walleye pollock on the eastern Bering Sea shelf. Transect numbers are noted above transects and the Steller sea lion Conservation Area (SCA) is outlined (dashed line).

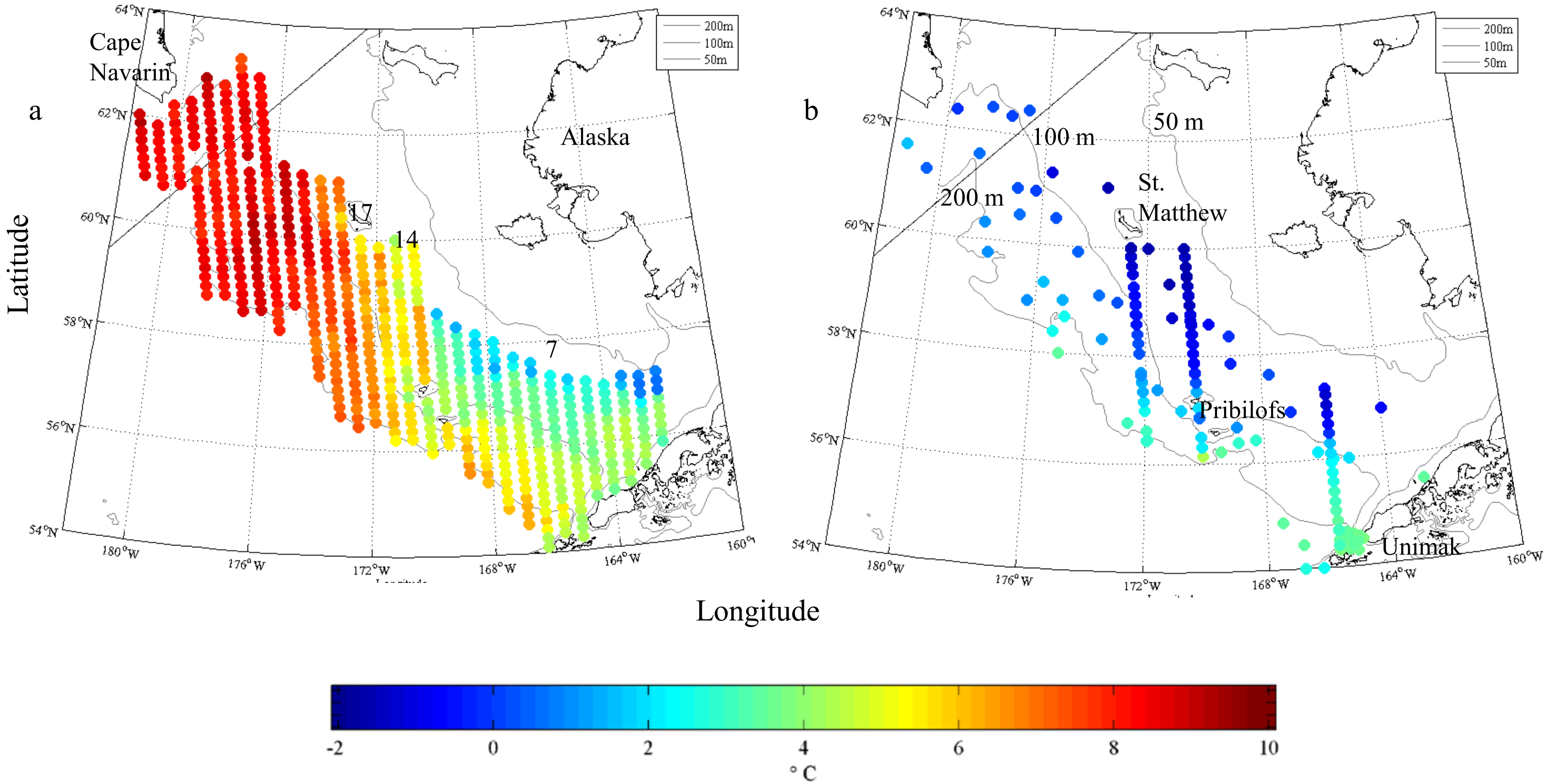


Figure 2. -- Temperature (°C) a) measured at the sea surface using shipboard surface temperature sensors along survey transects averaged at 10 nautical mile resolution, and b) at the bottom using SBE-39s at trawl locations, conductivity-temperature-depth profilers (CTDs), and expendable bathythermographs (XBTs) during the summer 2012 acoustic-trawl survey of the eastern Bering Sea shelf.

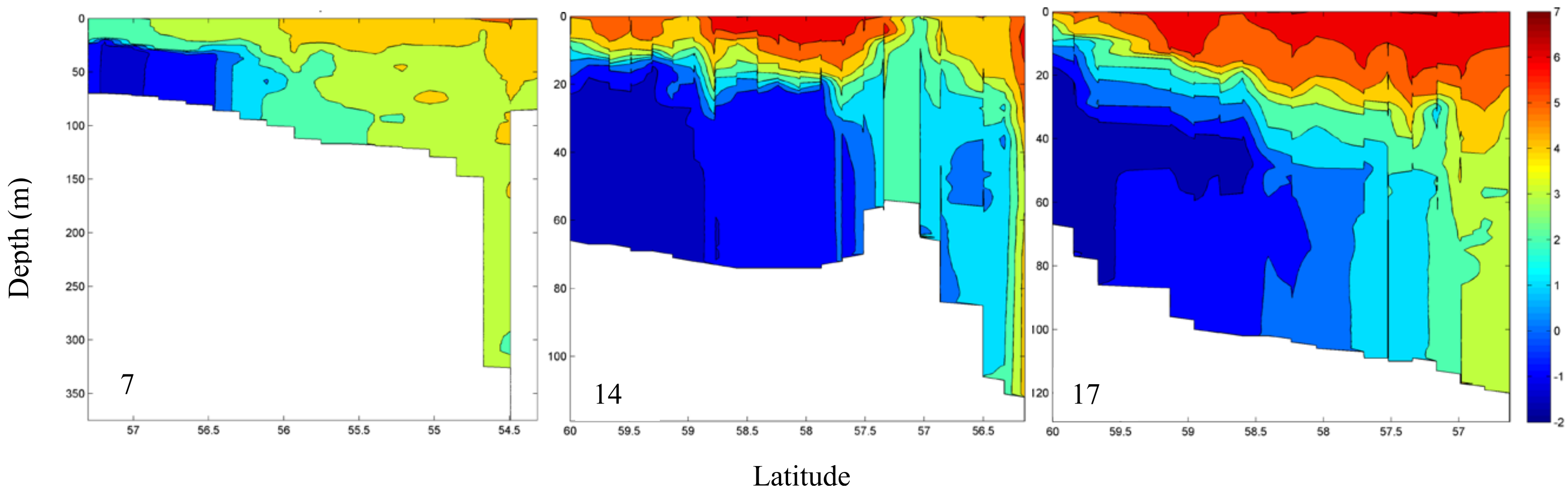


Figure 3. -- Temperature (°C) profiles measured using expendable bathythermographs (XBTs) dropped along three selected survey transects (7, 14 & 17; see Fig. 1 for locations) during the summer 2012 acoustic-trawl survey of the eastern Bering Sea shelf from June - August.

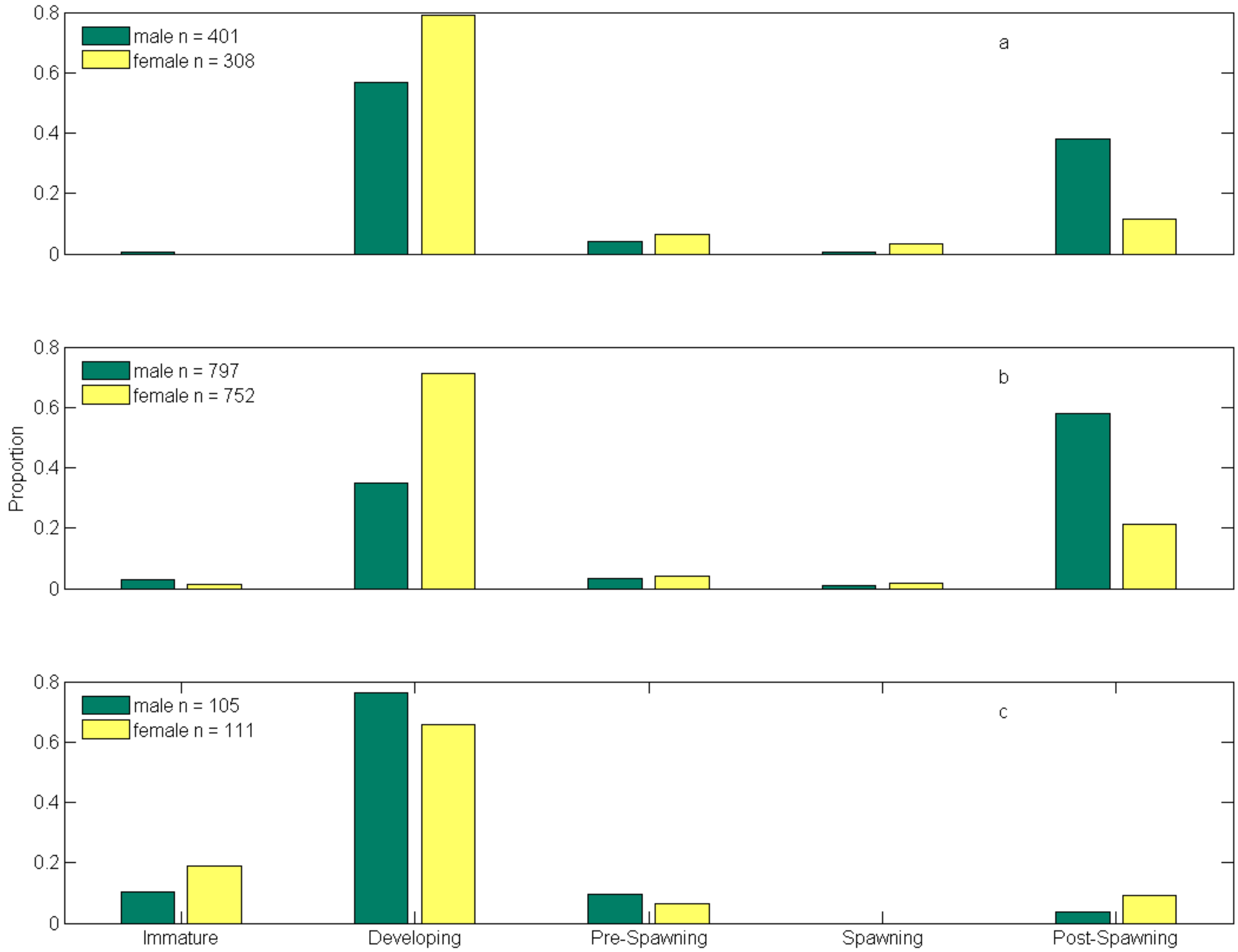


Figure 4. -- Maturity stages by sex for walleye pollock ≥ 34 cm observed during the summer 2012 eastern Bering Sea shelf acoustic-trawl survey a) east of 170° W, b) in U.S. waters west of 170° W, and c) in Russian waters.

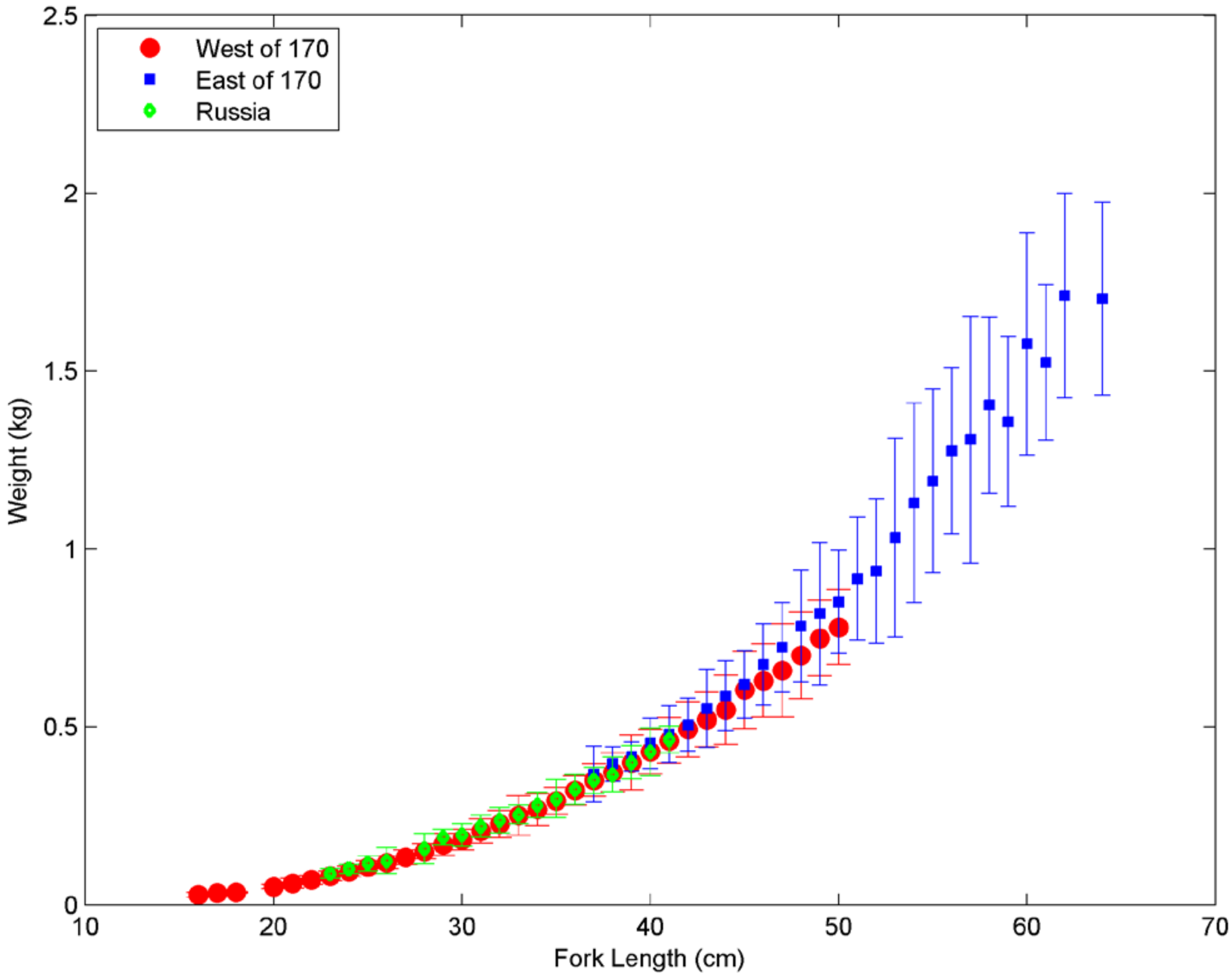


Figure 5. -- Mean weight-at-length for walleye pollock measured in the U.S. EEZ east and west of 170°W, and in Russia during the summer 2012 eastern Bering Sea shelf acoustic-trawl survey. Error bars represent ± 1 standard deviation.

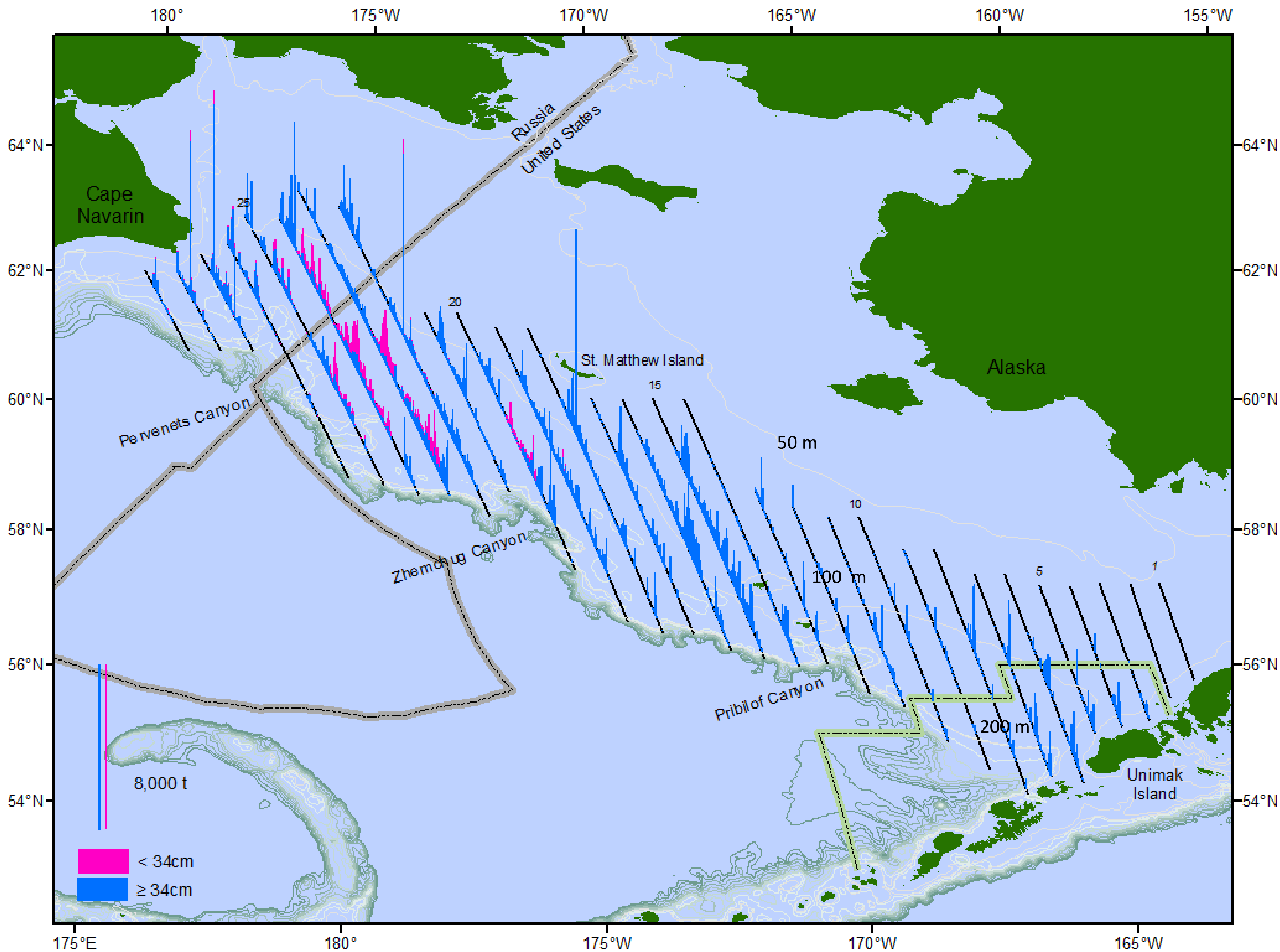


Figure 6.-- Estimated juvenile (< 34 cm, pink) and adult (≥ 34 cm, blue) walleye pollock biomass by 0.5 nautical mile intervals for the summer 2012 acoustic-trawl survey(16m from the surface to 3m off bottom). Transects are marked at their northernmost point and the Steller sea lion Conservation Area (SCA) is outlined (dashed green line).

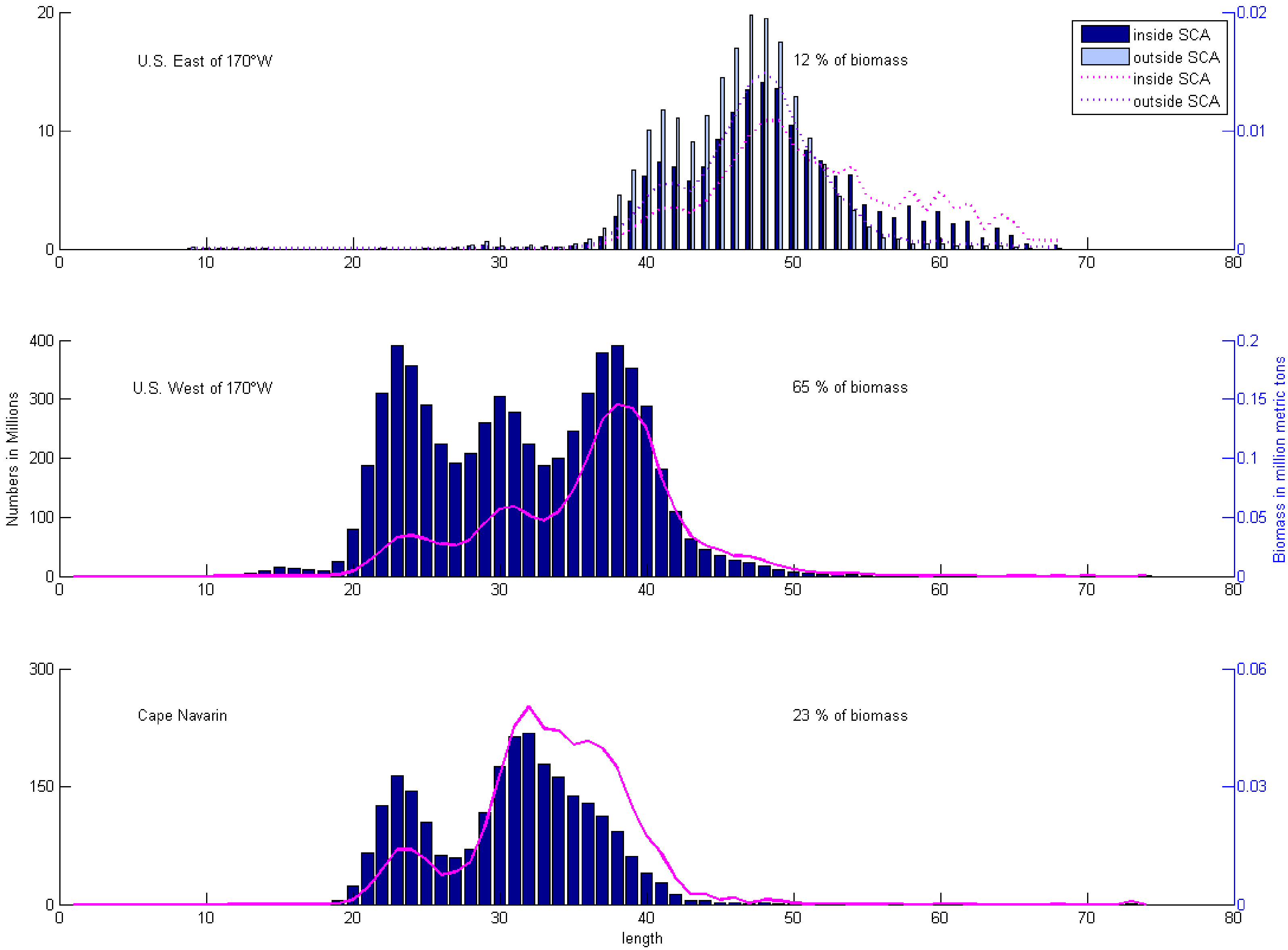


Figure 7. -- Population numbers (histogram bars) and biomass (lines) at length (cm) estimated for walleye pollock between 16 m from the surface and 3 m off the bottom from the summer 2012 eastern Bering Sea shelf acoustic-trawl survey in three geographic regions.

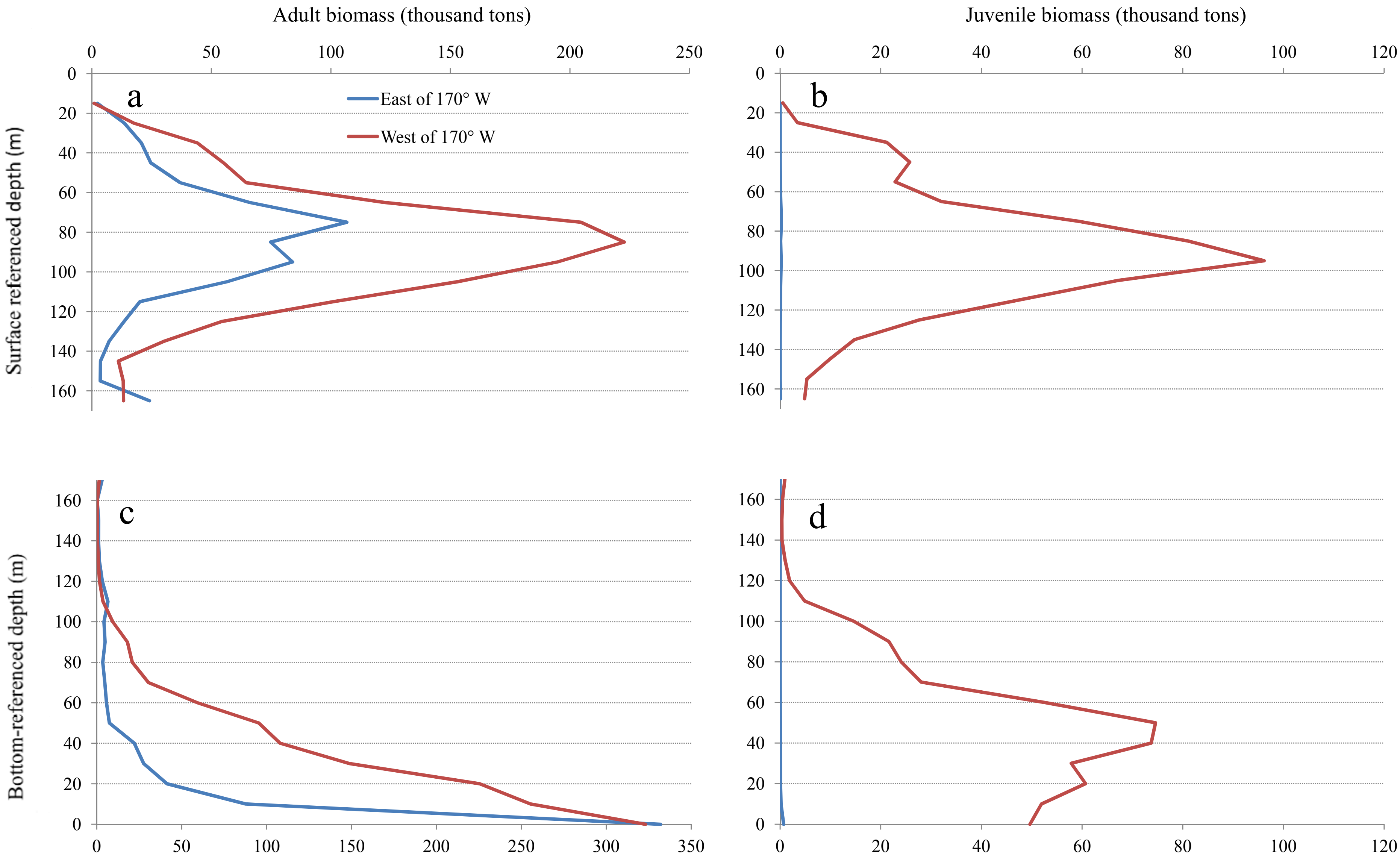


Figure 8.-- Depth distribution (m) of adult (≥ 34 cm FL) or juvenile (< 34 cm FL) walleye pollock biomass in metric tons (t) observed east and west of 170°W longitude in the U.S. EEZ of the Bering Sea shelf during the summer 2012 acoustic-trawl survey. Depth is referenced to the surface (a,b) and to the bottom (c, d) and is averaged in 10 m depth bins. Note: So few juveniles were observed east of 170°W that they do not appear on the graph. X-axes differ.

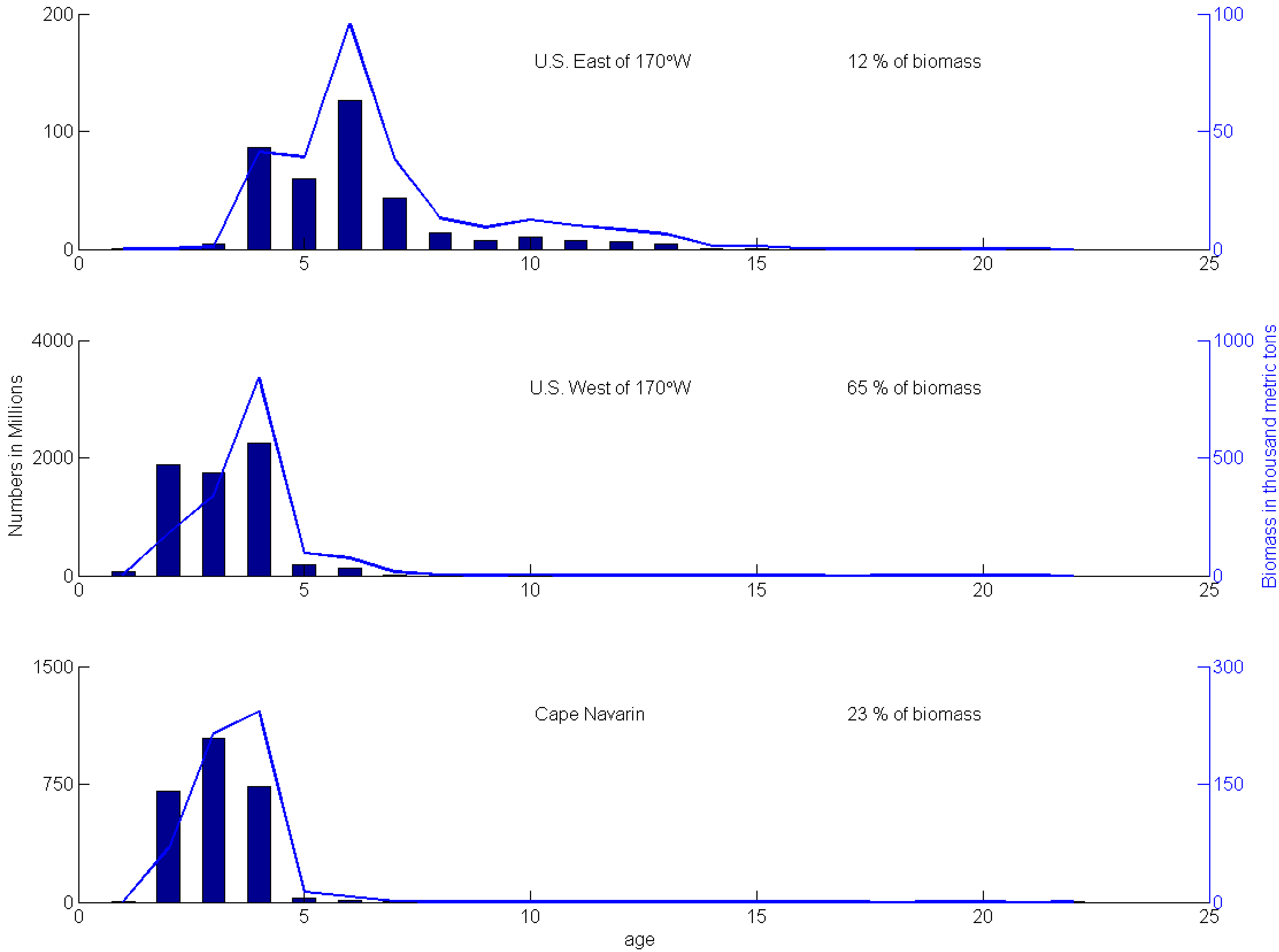


Figure 9. -- Population numbers (histogram bars) and biomass (lines) at age estimated for walleye pollock between 16 m from surface and 3 m off bottom for three different geographic regions during the summer eastern Bering Sea shelf acoustic-trawl survey. Note: Y-axes differ. Results are based on bottom trawl survey ages and should be considered preliminary.

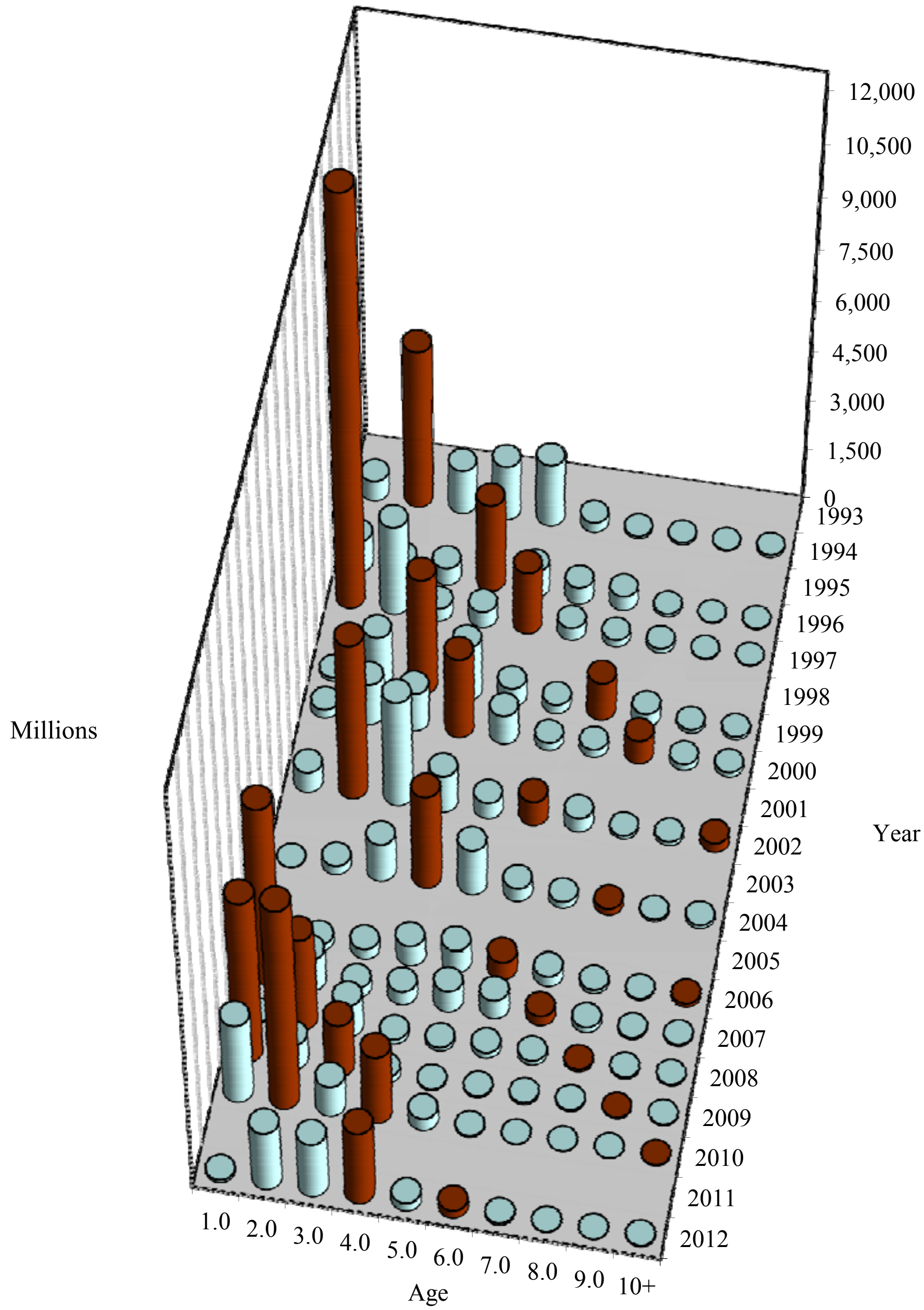
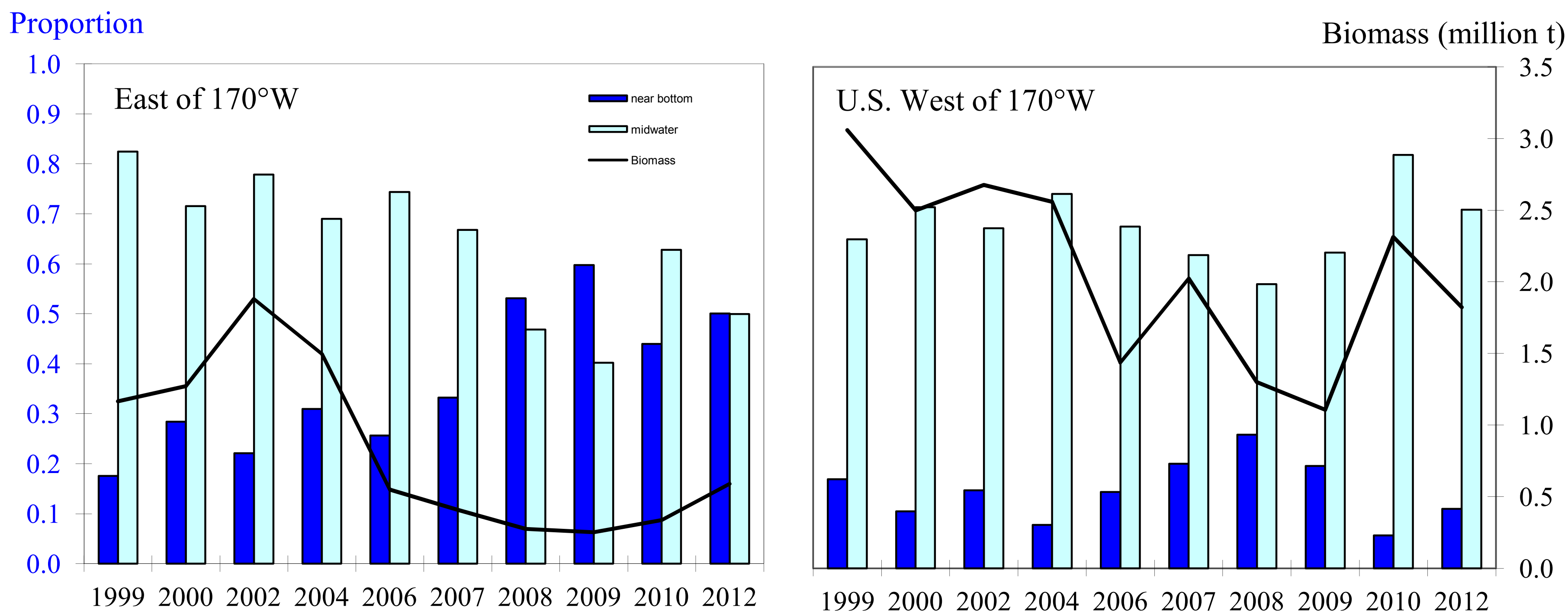


Figure 10. -- Historical numbers at age of walleye pollock between near the surface and 3 m off bottom in the U.S. EEZ for the summer eastern Bering Sea shelf acoustic-trawl surveys between 1994 and 2012. Strong year classes are indicated with dark shading. Preliminary 2012 estimates are based on bottom trawl and acoustic-trawl survey age data.



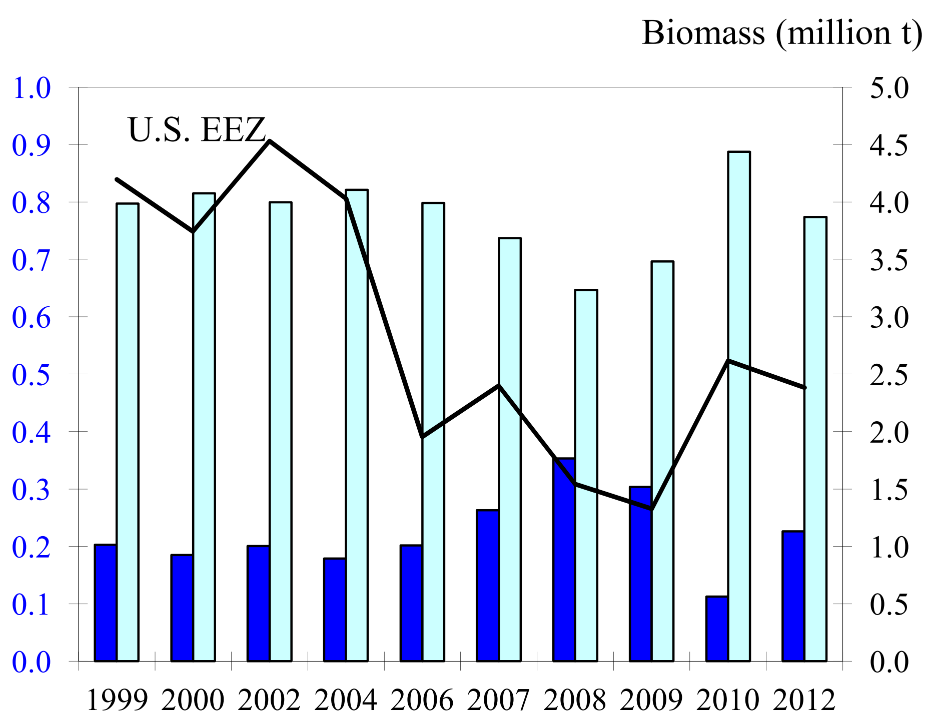


Figure 11. -- Proportion of walleye pollock biomass in midwater (surface to 3 m off the bottom), and near bottom (3 m to 0.5 m off bottom), east and west of 170°W, and in the U.S. EEZ during the 1999-2012 acoustic-trawl surveys. Total (midwater + near bottom) biomass (black lines) is plotted on right Y-axes. Note: near bottom information should be treated with caution as fewer hauls were made in this zone than in midwater, and there is a higher probability of species contamination.

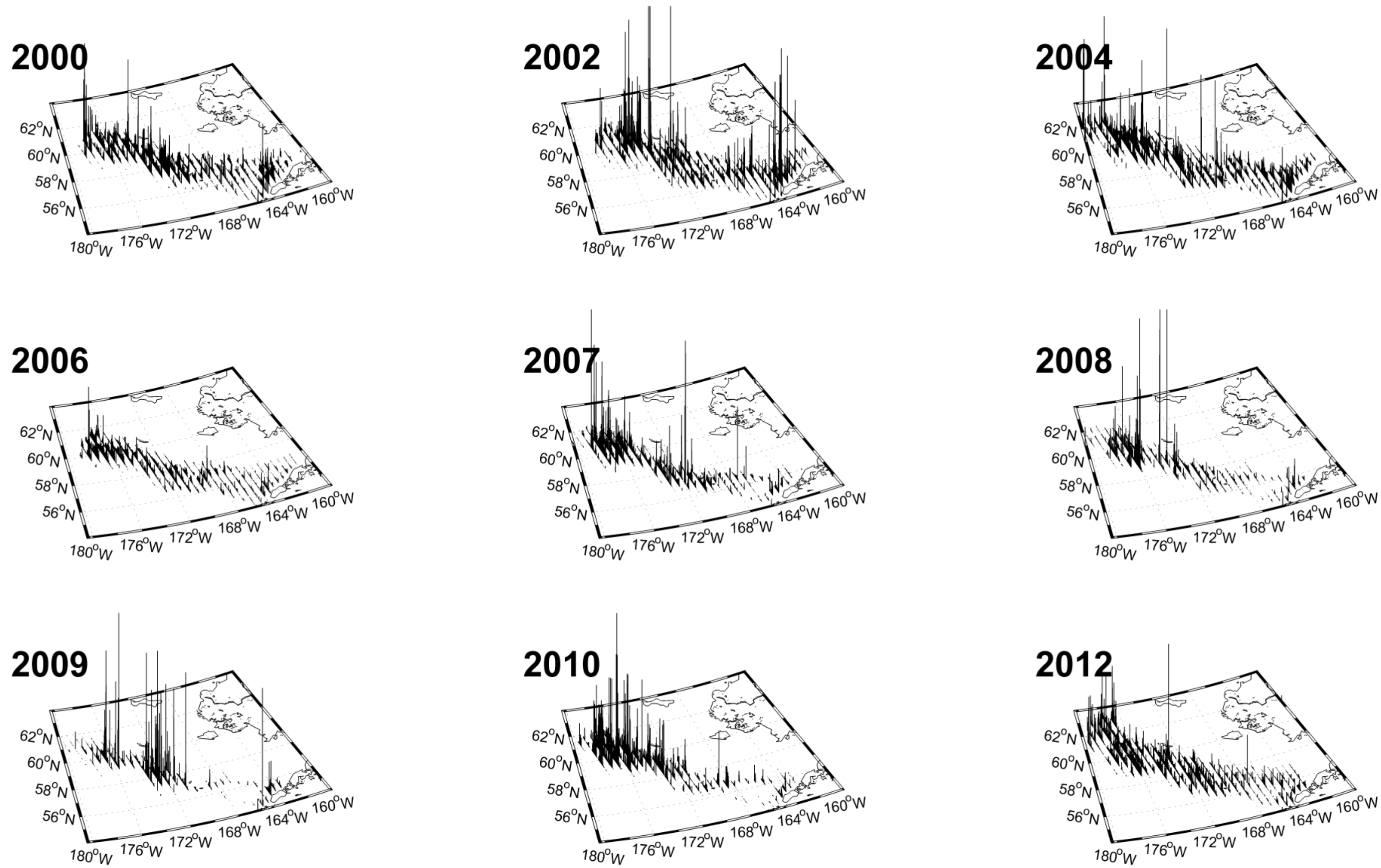


Figure 12. -- Walleye pollock backscatter (s_A) at 38 kHz observed along tracklines during the summer eastern Bering Sea acoustic-trawl surveys conducted between 2000 and 2012. Vertical axes scales are the same for all plots.

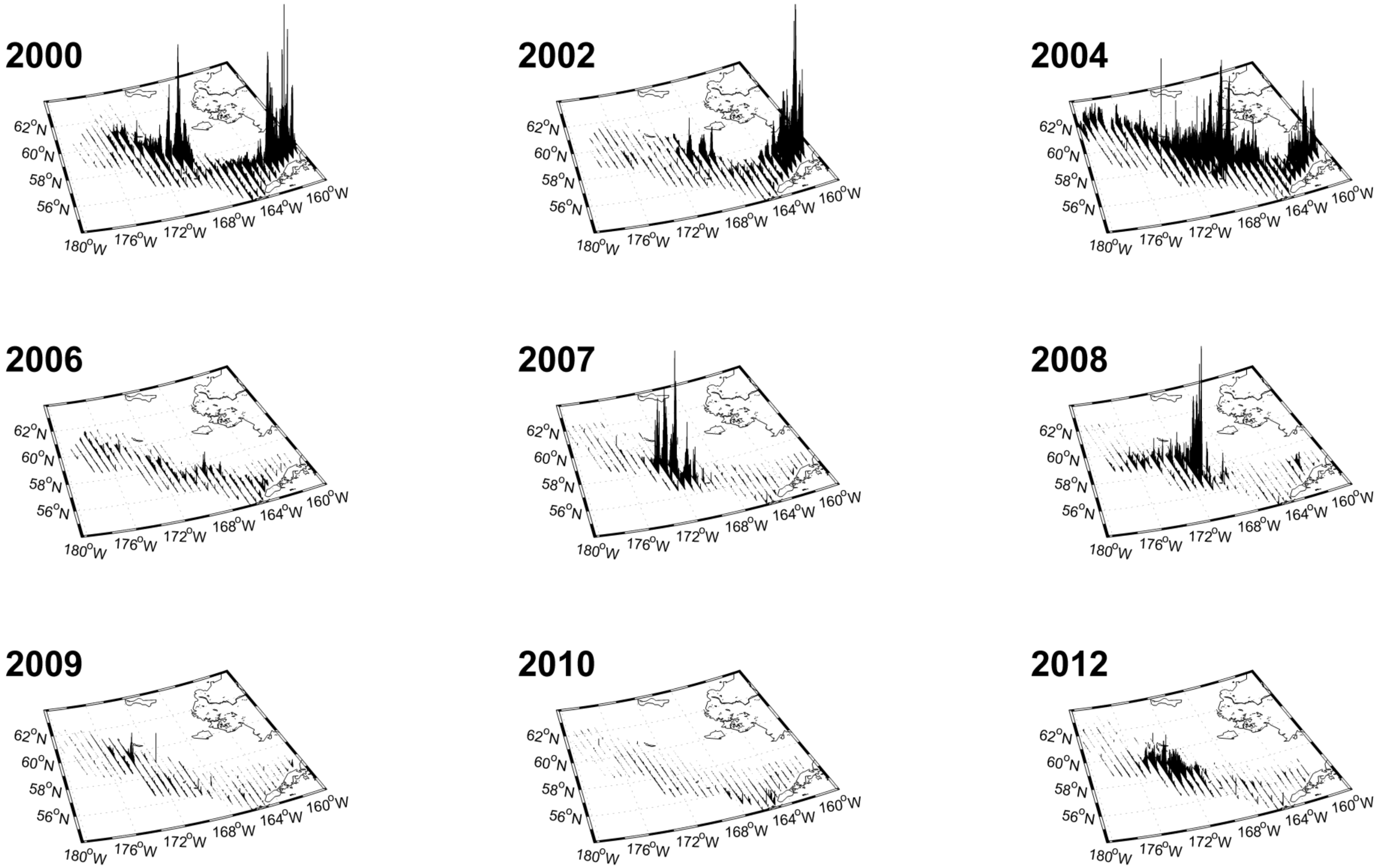


Figure 13. -- Non-pollock, non-fish, backscatter (s_A), observed at 38 kHz frequency along tracklines during summer eastern Bering Sea acoustic-trawl surveys, 2000 to 2012. Vertical axes scales are the same for all plots.

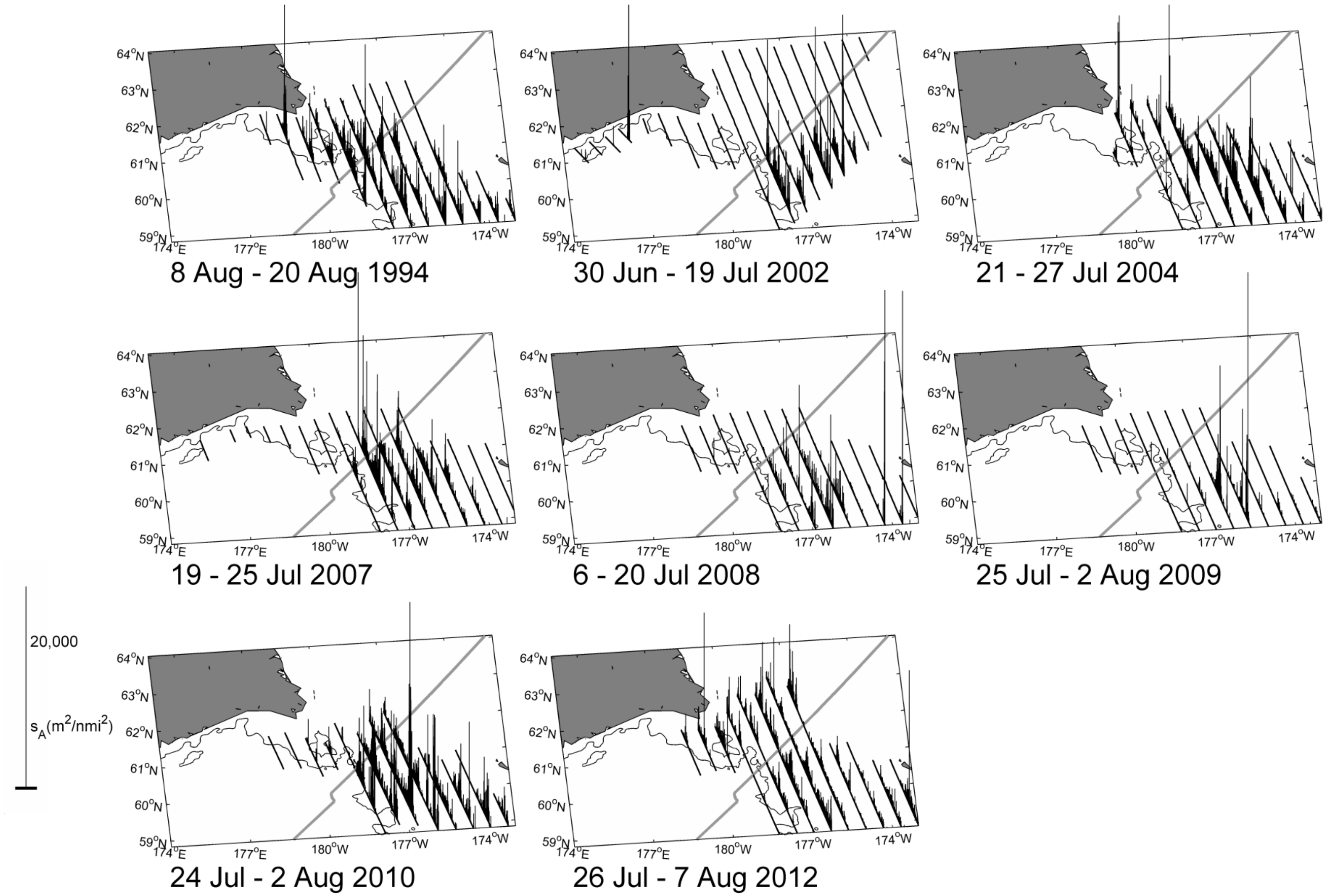


Figure 14. -- Walleye pollock acoustic backscatter (s_A) along tracklines between near surface and 0.5 m off bottom from acoustic-trawl surveys in the Cape Navarin area of Russia. The United States conducted surveys in 1994, 2004, 2007-2010, and 2012. Russia conducted the 2002 survey. Start dates are first crossing to Russia.

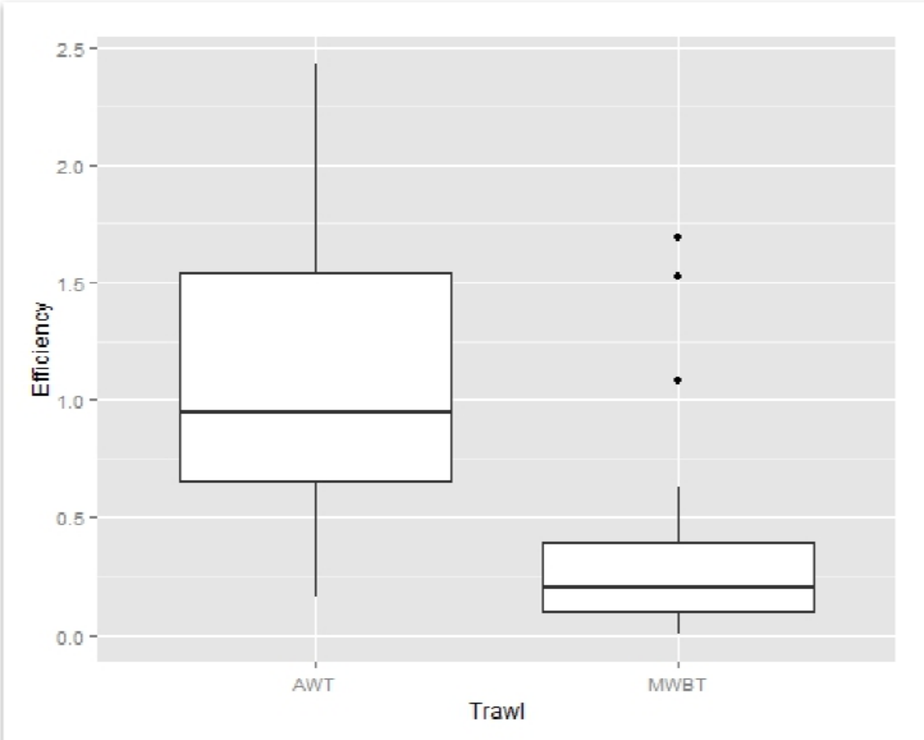


Figure 15. -- Trawl catch efficiency of the standard MACE midwater trawl used during acoustic-trawl surveys (AWT) and the standard bottom trawl used during the AFSC bottom trawl surveys and fished here in midwater (MWBT). Results are based on 21 paired AWT-MWBT tows conducted during summer 2012.

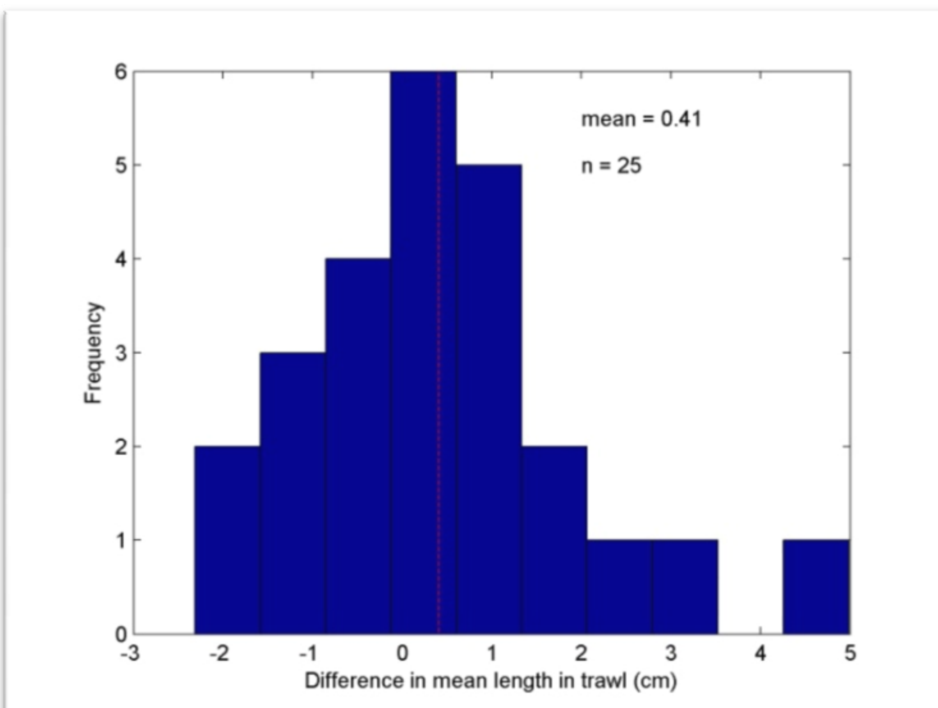


Figure 16. -- Difference in mean length for pollock caught in the standard MACE midwater trawl and the AFSC bottom trawl fished in midwater. Results are based on 25 paired AWT-MWBT tows conducted during summer 2012.

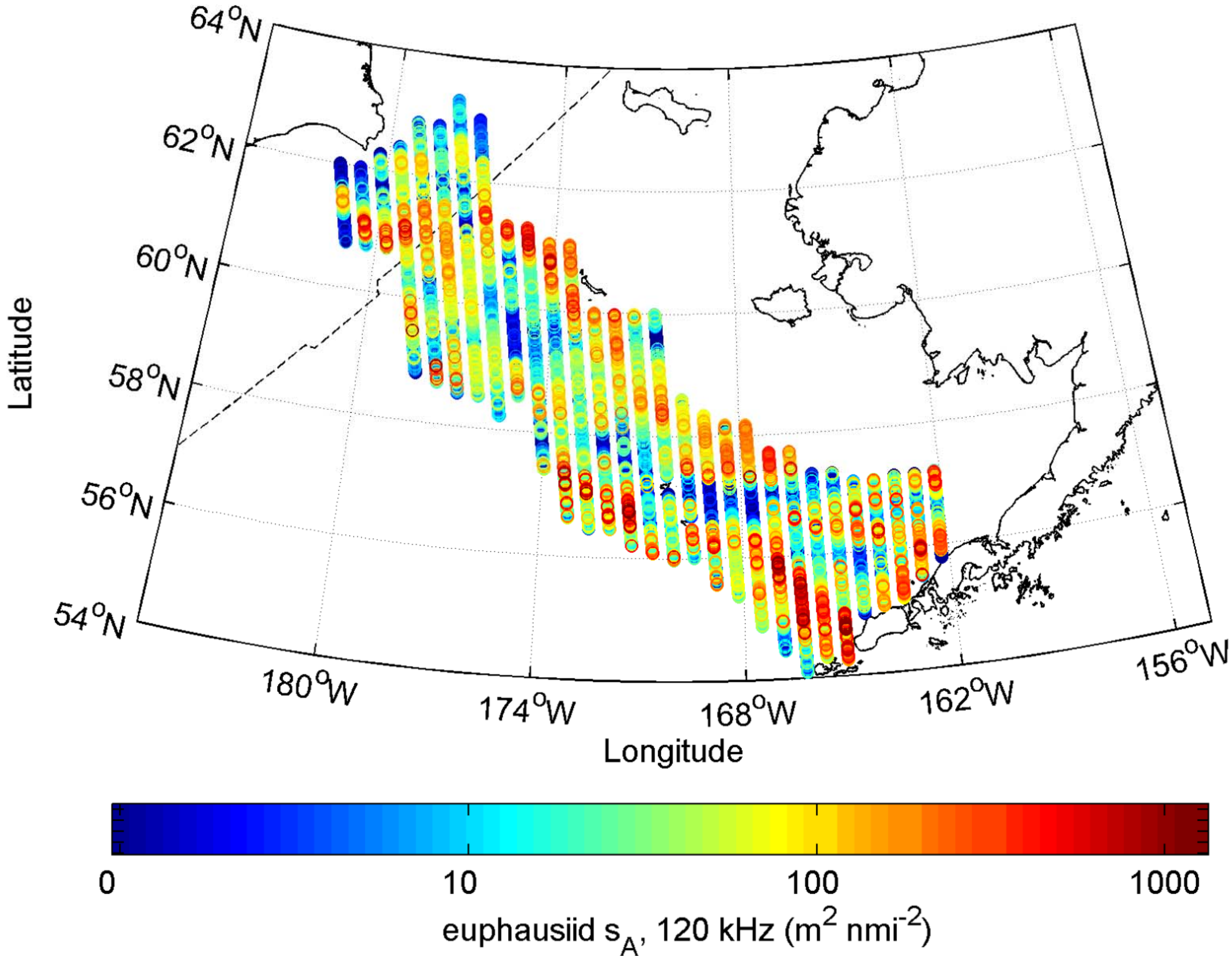


Figure 17. -- Preliminary map of the spatial distribution of euphausiid backscatter during the 2012 acoustic-trawl survey.

Appendix I. -- Itinerary

<u>Leg 1</u>

7- 8 June	Calibration in Captains Bay. Depart Dutch Harbor, AK. Transit to survey start area in Bristol Bay, eastern Bering Sea
8-25 June	Acoustic-trawl survey of the Bering Sea shelf (through south end transect 14). Scientific personnel exchange in Dutch Harbor on 14 June. Transit to Dutch Harbor
25-30 June	In port Dutch Harbor

<u>Leg 2</u>

30 June – 1 July	Transit to survey resume point
1-16 July	Acoustic-trawl survey of the Bering Sea shelf (transects 14 - 22)
16-18 July	Transit to Unalaska Island, AK
18-23 July	In port Dutch Harbor, AK

<u>Leg 3</u>

23-25 July	Transit to survey resume point
25 Jul.-7 Aug.	Acoustic-trawl survey of the Bering Sea shelf including Russian waters (transects 22 - 29)
7-10 Aug.	ME70 data collection, and comparison midwater 83-112 and AWT trawl work. Transit to Dutch Harbor, AK.
10 Aug.	Acoustic sphere calibration in Captains Bay. End of cruise.

Appendix II. -- Scientific Personnel

Name	Position	Organization	Nation
	Leg 1 (7-25 June)		
Paul Walline	Chief Scientist	AFSC	USA
Sarah Stienessen	Fishery Biologist (Jun 14-25)	AFSC	USA
Scott Furnish	Info. Tech. Specialist	AFSC	USA
Darin Jones	Fishery Biologist	AFSC	USA
Anatoli Smirnov	Fishery Biologist	TINRO	Russia
William Floering	Fishery Biologist	AFSC	USA
Taina Honkalehto	Fishery Biologist (Jun 7-14)	AFSC	USA
Kevin Taylor	Fishery Biologist (Jun 7-14)	NOAA	USA
	Leg 2 (30 June- 18 July)		
Neal Williamson	Chief Scientist		
Denise McKelvey	Fishery Biologist	AFSC	USA
Scott Furnish	Info. Tech. Specialist	AFSC	USA
Carwyn Hammond	Fishery Biologist	AFSC	USA
William Floering	Fishery Biologist	AFSC	USA
Anatoli Smirnov	Fishery Biologist	TINRO	Russia
Nate Ryan	Intern	AFSC	USA
Amanda Peretich	Teacher	NOAA	USA
	Leg 3 (23 July -10 August)		
Taina Honkalehto	Chief Scientist	AFSC	USA
Rick Towler	Info. Tech. Specialist	AFSC	USA
Darin Jones	Fishery Biologist	AFSC	USA
Anatoli Smirnov	Fishery Biologist	TINRO	Russia
Kresimir Williams	Fishery Biologist	AFSC	USA
Allan Phillips	Teacher	NOAA	USA
Johanna Mendillo	Teacher	NOAA	USA

AFSC	Alaska Fisheries Science Center, Seattle WA
TINRO	Pacific Research Institute of Fisheries and Oceanography Vladivostok, Russia
NOAA	National Oceanic and Atmospheric Administration