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November 2022

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National Oceanic and Atmospheric Administration
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Alaska Fisheries Science Center

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Abstract

In 2019, the Resource Assessment and Conservation Engineering (RACE) division of the National Marine Fisheries Service's (NMFS) Alaska Fisheries Science Center (AFSC) conducted the 38th Eastern Bering Sea Crab/Groundfish Bottom Trawl Survey (EBS) from June to July 2019, as well as the 3rd Northern Bering Sea Crab/Groundfish Survey - Eastern Bering Sea Shelf Survey Extension (NBS) from July to August 2019. The addition of the NBS survey expanded the study area to also cover the Bering Sea continental shelf (bottom depths between approximately 20 and 200 m) from the Alaska coastline to the U.S.-Russia Maritime Boundary between the Alaska Peninsula and the Bering Strait, including Norton Sound. Two stern trawlers, the 43.9-m FV *Alaska Knight* and 37.8-m FV *Vesteraalen*, were chartered for these surveys. Demersal populations of fishes and invertebrates were sampled by trawling for 30 minutes at stations arranged on a systematic grid, which consisted of 376 total stations in the EBS and 144 total stations in the NBS. At each station, species composition, length distribution, and age structure samples were collected from ecologically and commercially important species. All survey stations in the EBS and NBS were sampled successfully.

The recent trend of higher-than-average temperatures continued on the EBS shelf for the sixth consecutive year. In 2019, both the mean surface (9.2°C) and bottom (4.4°C) water temperatures were warmer than the survey long-term average of surface (6.7°C) and bottom (2.5°C). The 2019 mean bottom temperatures were the warmest observed since the beginning of the EBS shelf bottom trawl survey time series in 1982.

A total of 115 species of fishes were identified during the EBS and NBS surveys, representing 65 genera and 23 families, as well as 269 invertebrate taxa. In total, organisms representing 11 phyla were identified in the catch.

This report compares the distribution and relative abundance of 37 fish species and six invertebrate taxa with side-by-side maps from the 2017 and 2019 EBS and NBS shelf bottom trawl surveys. For select and common fish species, abundance-at-length plots comparing the 2017 and 2019 EBS and NBS surveys are also presented. Survey results reported herein include estimates of bottom trawl survey biomass for most fishes and invertebrates, and estimates of population size, geographic distributions, and abundance-at-length of select fish species. Appendices provide tables listing population estimates by sex and size group for principal fish species (Appendix Tables A2 and B2) and species encountered during the EBS and NBS surveys (Appendix Tables C1 to D10).

The total estimated animal biomass in the NBS decreased from 4.5 million metric tons (t) in 2017 to 4.4 million t in 2019. Distributional shifts of some species were likely in response to the warmer conditions resulting from diminished sea ice during the recent warm stanza that began in 2014.

Contents

Introduction

The purpose of the EBS and NBS shelf bottom trawl surveys is to collect information about the fish and invertebrate populations and environmental conditions. In 2019, the Resource Assessment and Conservation Engineering (RACE) Division of National Marine Fisheries Service's (NMFS') Alaska Fisheries Science Center AFSC conducted 38th Eastern Bering Sea Crab/Groundfish Bottom Trawl Survey (EBS) from June to July 2019, as well as the 3rd Northern Bering Sea Crab/Groundfish Survey - Eastern Bering Sea Shelf Survey Extension (NBS) from July to August 2019. The EBS survey has occurred annually since 1982 and is the longest-running, standardized time series of fish and invertebrate data in the region (Conner and Lauth 2017). The standardized NBS survey has only been conducted previously in 2010 and 2017 (Lauth 2011).

The data collected during these bottom trawl surveys are vital for managing fisheries resources and for ecosystem monitoring. Fishery-independent abundance estimates, in addition to other biological and oceanographic information from Bering Sea shelf bottom trawl surveys, are used by the AFSC, North Pacific Fishery Management Council (NPFMC), and the Alaska Department of Fish and Game (ADF&G). These organizations utilize the survey data products to manage groundfish and crab stocks, as well as conduct ecosystem forecast modeling, which are requirements of the Bering Sea and Aleutian Island (BSAI) Fishery Management Plan (FMP) established under the Magnuson-Stevens Fishery Conservation and Management Act (https://www.fisheries.noaa.gov/topic/laws-policies).

Effective management of fisheries resources and healthy ecosystems are especially important to Alaska Native communities and to the tens of thousands of people who are employed by the Alaska fishing industry. The commercial fishing industry in Alaska generates billions of dollars for the U.S. economy annually (https://www.fisheries.noaa.gov/alaska/socioeconomics/alaska-economic-and-social-sciences-research; https://www.fisheries.noaa.gov/national/sustainable-fisheries/fisheries-economics-united-states).

In this document, we compare the most recent and similar surveys within the same regions. Therefore, we compare the 2019 EBS survey results with those from the 2017 EBS shelf bottom trawl survey and the 2019 NBS survey results with those from the 2017 NBS shelf bottom trawl survey (Conner and Lauth 2017). For data referenced from previous surveys, refer to the AFSC Technical Memoranda here at the end of the report and listed on the AFSC website (https://www.fisheries.noaa.gov/resource/publication-database/alaska-fisheries-science-center-technical-memorandums).

History of Bering Sea Bottom Trawl Surveys

The Bering Sea continental shelf supports several of the most productive groundfish and crab fisheries in the world (Fissel et al. 2021). Although many species of groundfish are caught commercially in the Bering Sea, groundfish such as walleye pollock (*Gadus chalcogrammus*), Pacific cod (*Gadus macrocephalus*) and yellowfin sole (*Limanda aspera*) have been the primary target species among commercial catches. Of these catches, walleye pollock is the most abundant species. Commercial catches ranged from 0.8 million metric tons (t) in 2009 to 1.5 million t from 2003-2006 per year over the course of the EBS survey, and the marketed products represented 40% of the global whitefish market (Ianelli et al. 2017). Commercial crab stocks on the Bering Sea shelf include Tanner crab (*Chionoecetes bairdi*), snow crab (*Chionoecetes opilio*), red king crab (*Paralithodes camtschaticus*), blue king crab (*Paralithodes platypus*), and hair crab (*Erimacrus isenbeckii*; Lang et al. 2019).

The federal government has conducted bottom trawl surveys of the eastern Bering Sea continental shelf since the 1940s. These early surveys were often exploratory efforts to locate commercial fisheries resources (Zimmermann et al. 2009) and led to the development of a valuable red king crab fishery. Bottom trawl surveys by the U.S. continued into the 1970s with private industry involvement to study the biology, distribution, abundance, and best fishing practices for red king crab (Zimmermann et al. 2009). The first large-scale survey of the Bering Sea shelf was conducted in 1975 under contract from the U.S. Bureau of Land Management. The purpose was to collect baseline data for assessing the potential impact of the growth in the offshore oil industry on the development of Bering Sea groundfish and crab fishery resources (Pereyra et al. 1976). During the 1975 baseline survey, sampling was conducted over the shelf between the 20 m and 200 m isobaths from the Alaska Peninsula north to approximately 62°N.

In subsequent years, the areal coverage of the annual surveys was reduced. However, in 1979, a comprehensive survey of the Bering Sea shelf was undertaken in cooperation with the Japan Fisheries Agency (Bakkala and Wakabayashi 1985). That survey encompassed the entire region sampled in the 1975 baseline study and included the upper continental slope waters between St. Matthew and St. Lawrence islands.

Following the 1979 survey, annual bottom trawl surveys have re-sampled the same areas and stations established during the 1975 survey with slight modifications in sampling design in some years. Beginning in 1979 and continuing triennially until 1991, the survey was extended to include bottom trawl sampling of the continental slope and in the region between St. Matthew and St. Lawrence islands. After a hiatus from 1992 to 1999 due to lack of funding, the Bering Sea slope survey was resumed in 2002 as an independent, standardized bottom trawl survey series that has been conducted on a quasi-biennial basis dependent on funding (Hoff 2016; Stauffer 2004; Hoff and Britt 2011). The most recent slope survey was conducted in 2016 (Hoff 2016).

The current EBS shelf survey design has been used since 1982 and was marked by the standardization of bottom trawl gear (Stauffer 2004), survey methods, temporal stationarity, and a systematic grid design that included 356 stations arranged on a regularly-spaced 37.04 × 37.04 km (20 × 20 nautical mile) sampling grid (Figs. 2 and 1; Bakkala 1993). For these reasons, 1982 is considered to be the start of the survey time series. Beginning in 1987, 20 new stations that comprise Strata 82 and 90 (Fig. 2) were added to monitor more northerly distributions of snow crab and walleye pollock. The Bering Sea shelf region continues to be surveyed annually because the area encompasses major portions of the commercially exploited Bering Sea groundfish and crab populations that require management actions under the BSAI FMP.

The NBS shelf was also surveyed in 2010, 2017, 2018, and 2019 (Lauth 2011). However, the 2018 NBS survey was a rapid response survey, and did not employ the same sampling design as 2010 and 2017. Therefore, the survey results from the 2018 NBS survey are not directly comparable to the results from the 2010, 2017, and 2019 NBS surveys.

The most comprehensive bottom trawl survey coverage of the Bering Sea in a single year was in 2010 when three surveys (the EBS slope (Hoff and Britt 2011), the EBS shelf, and the NBS) were conducted in the Bering Sea region (Fig. 2; Lauth 2011). The NBS survey consisted of 144 additional bottom trawl stations, which extended the EBS survey grid northward to the Bering Strait and the U.S.-Russia Maritime Boundary; the region also included all of Norton Sound and the Chirikov Basin (Fig. 2). The NBS survey was initiated by the AFSC as part of the Loss of Sea Ice (LOSI) Research Plan to study the impacts of diminished sea ice on the marine ecosystem (Hollowed et al. 2007). The objective of the LOSI Research Plan was to monitor long-term climate trends in the transition zone between the temperate waters of the

eastern Bering Sea and the Arctic waters of the Chukchi Sea, where climate change can have a significant effect on physical and biological ecosystem processes (Hunt Jr. et al. 2011; Stevenson and Lauth 2012, 2019; Stabeno et al. 2012). Although LOSI funding for the NBS extension was discontinued after the 2010 NBS survey, the survey was reimplemented as a biennial survey in 2017 due to effects of changing ocean conditions on fish and crab distributions (Sigler et al. 2015).

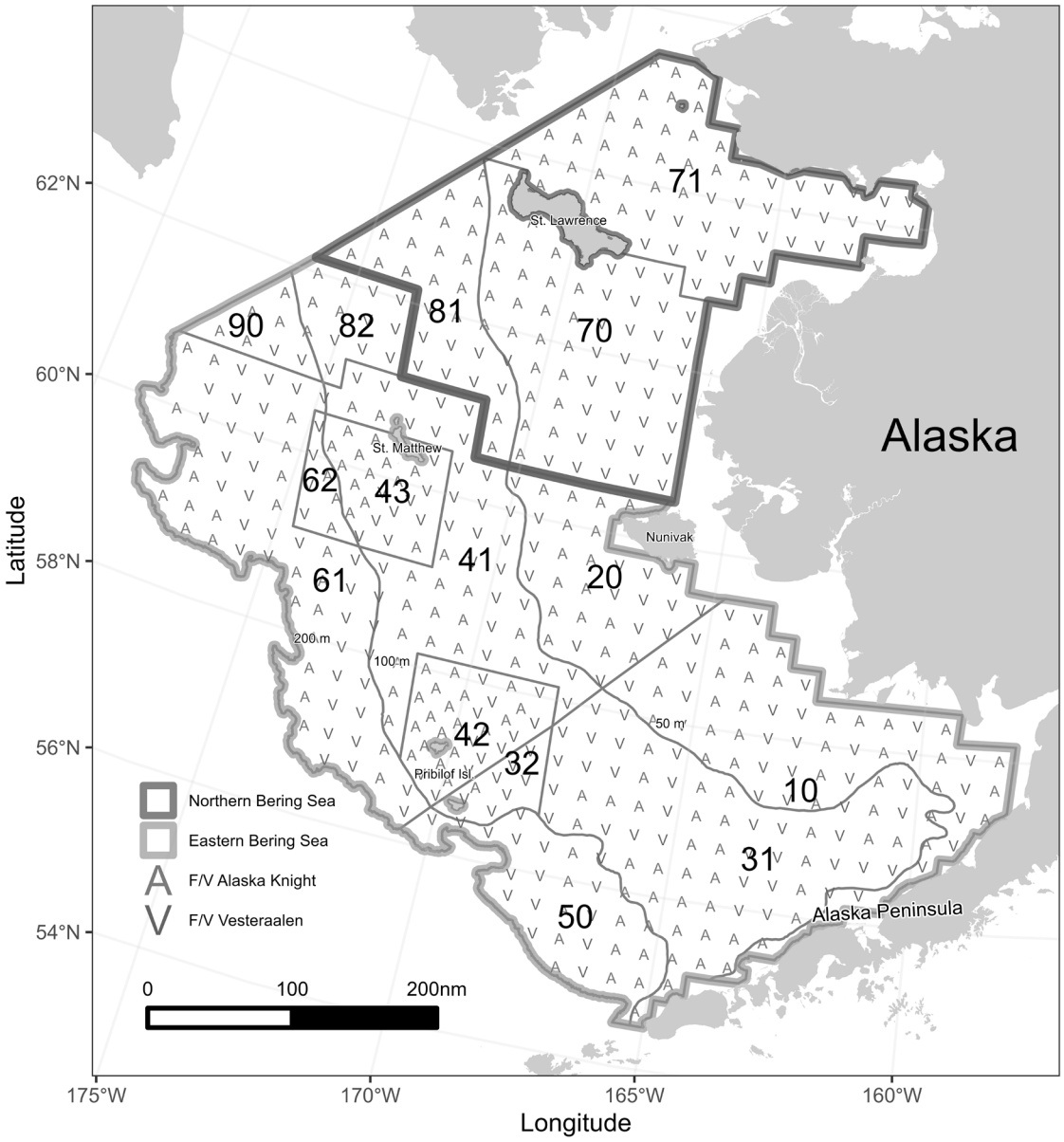

Figure 1. -- Sampled survey stations by vessel and the stratification scheme used for data analysis of the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. The map also depicts the stations sampled by the FV *Alaska Knight* (A) and FV *Vesteraalen* (V).

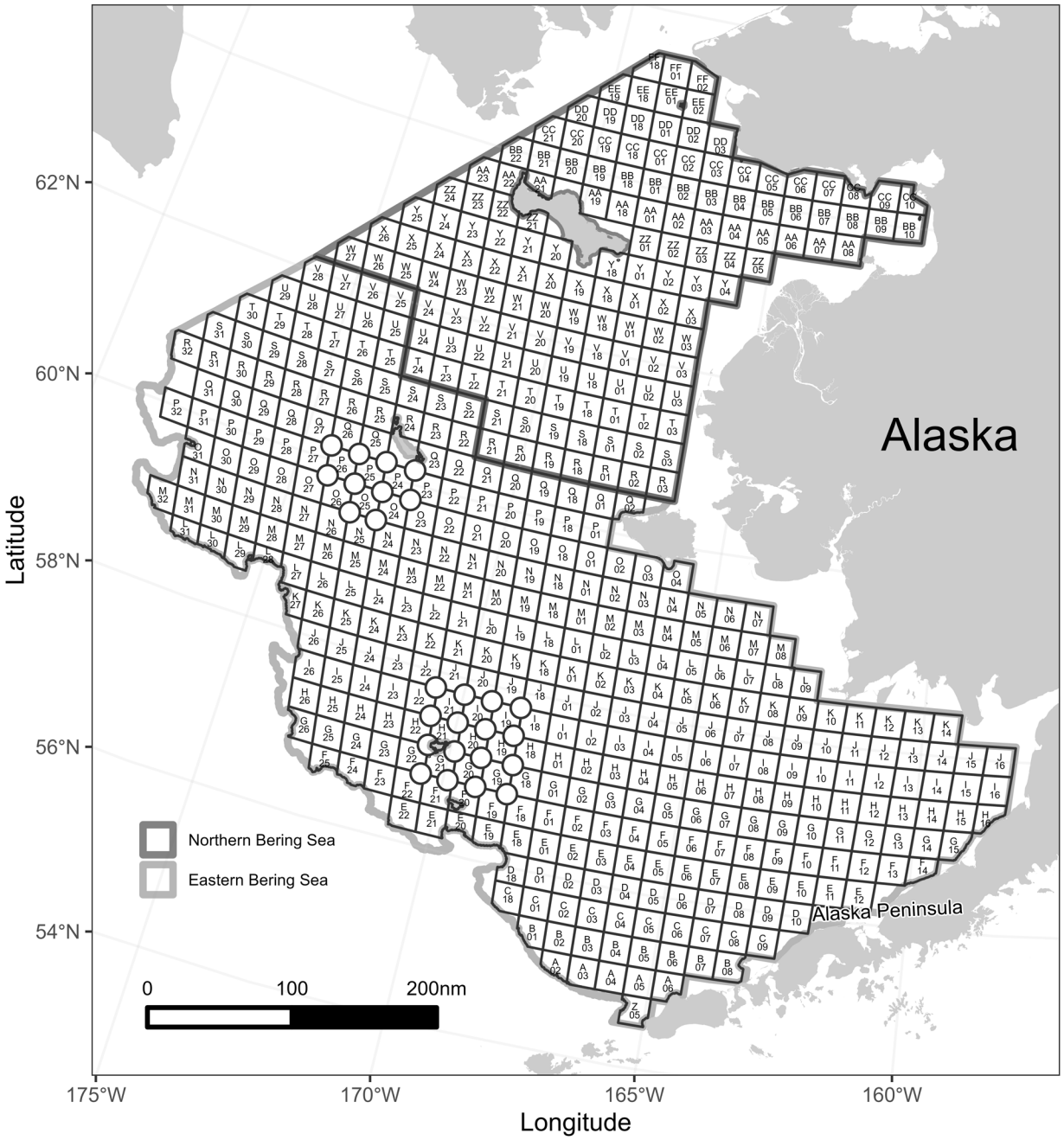

Figure 2. -- Sampling grid and station identifiers for the 2019 eastern Bering Sea and northern Bering Sea continental shelf bottom trawl surveys. Corner stations (denoted by circles) are not labeled for legibility.

Methods

Survey Area and Sampling Design

The standardized eastern and northern Bering Sea bottom trawl surveys are based on a systematic design with 376 fixed sampling stations in the EBS and 144 fixed sampling stations in the NBS centered within 37.04 × 37.04 km (20 × 20 nautical mile) grid squares (Fig. 2). Additional stations, called "corner stations", were added to the survey design in 1990 to better sample regions of historically high blue king crab abundances. There are 26 corner stations located at the intersections of the grid lines in the waters surrounding St. Matthew and the Pribilof islands (Fig. 2). These corner stations are sampled in addition to the centers of the grid cells. In addition to the EBS shelf bottom trawl survey, the 2019 NBS shelf bottom trawl survey was conducted using the same systematic sampling design for stations bounded by the U.S.-Russian Maritime Boundary, the Bering Strait, and Norton Sound.

Survey Vessels and Sampling Gear

The 2019 EBS and NBS surveys were conducted aboard the chartered commercial stern-trawlers FV *Alaska Knight* and FV *Vesteraalen* (Fig. 3). Both vessels are house-forward trawlers with stern ramps. The length overall of the FV *Alaska Knight* is 43.9 m (144 ft) and the FV *Vesteraalen* is 37.8 m (124 ft). All fishing operations were conducted in compliance with national and regional protocols detailed in Stauffer (2004). Trawl sampling was conducted using 83-112 eastern otter trawls, each with a 25.3 m (83 ft) headrope and 34.1 m (112 ft) footrope (Fig. 4). The net was attached to tail chains with 54.9 m (30 fm) paired dandylines. Each lower dandyline had a 0.61 m chain extension connected to the lower wing edge to improve bottom tending. Steel "V" doors measuring 1.8 × 2.7 m (6 × 9 ft) and weighing 816 kg (1,800 lbs) each were used for spreading the net opening while the trawl was fishing on the seafloor.

Figure 3. -- Fishing vessels FV *Alaska Knight* (left) and FV *Vesteraalen* (right) contracted to assist the 2019 eastern Bering Sea and northern Bering Sea bottom trawl survey.

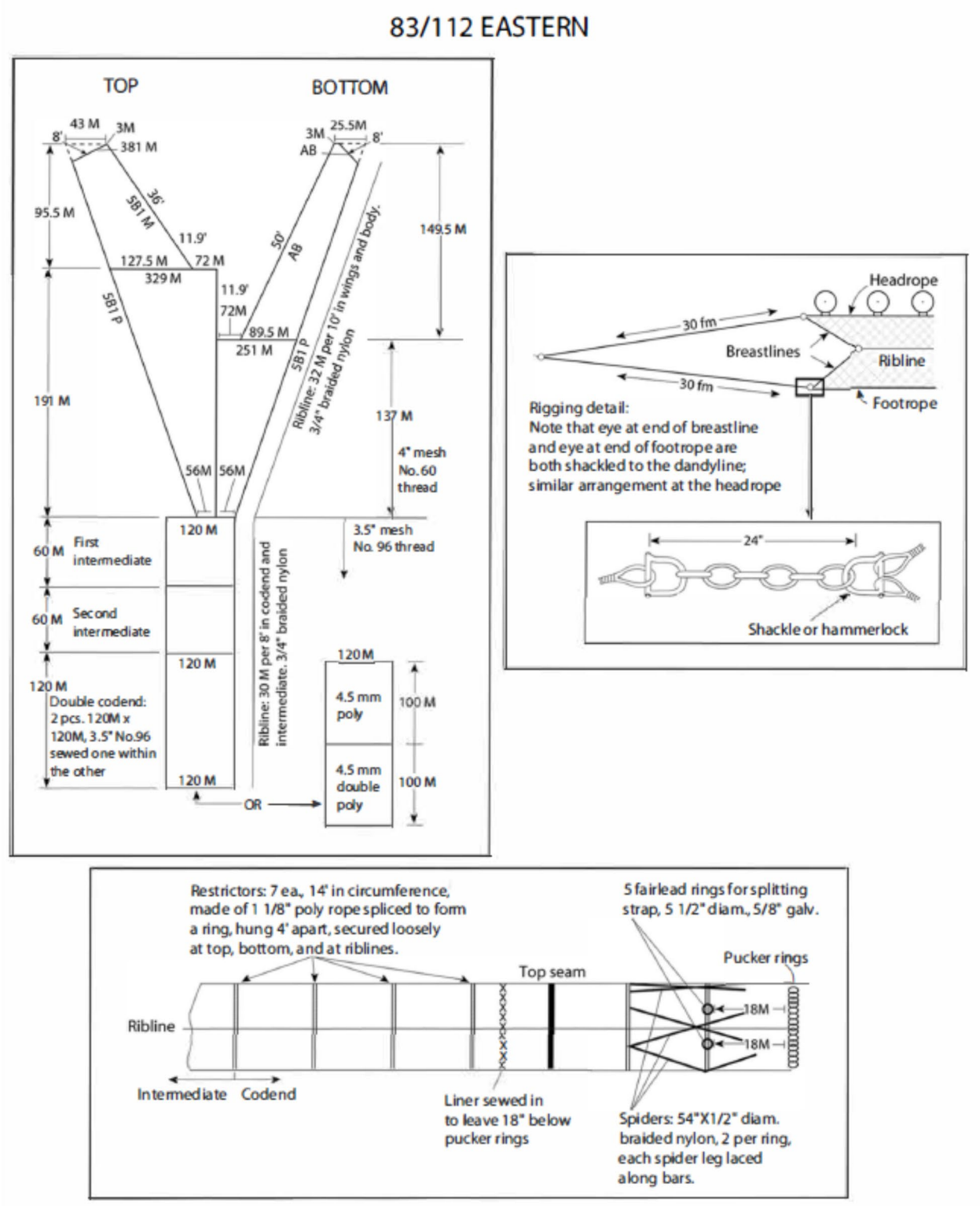

Figure 4. -- Schematic diagram of the 83-112 eastern otter trawl gear used during the 2019 eastern Bering Sea and northern Bering Sea bottom trawl surveys.

The Marport Deep Sea Technologies Inc. net mensuration system was used during each tow to record net spread and net height. Net spread was measured as the horizontal distance between two sensors attached immediately forward of the junction of the upper breastline and the dandyline, and net height was measured from the headrope to the seafloor. Mean net spread values for estimating area swept per tow were calculated according to methods described by Lauth and Kotwicki (2014). A custom-made AFSC bottom contact sensor (accelerometer) attached to the center of the footrope was used to determine tow duration based on footrope contact with the seafloor.

Temperature and depth profiles were recorded using a Sea-Bird SBE-39 temperature-depth recorder (Sea-Bird Electronics Inc., Bellevue, WA) attached to the headrope of the trawl. Observations were made at 3-second intervals at each station. Average bottom depth was calculated by adding the average net height to the average depth of the headrope.

In the EBS, the net mensuration system failed to record data for two tow on the FV *Alaska Knight*. In the NBS, the net mensuration system failed to record data for three tow on the FV *Vesteraalen*. To estimate missing net width values, the mgcv package in R (Wood 2004) was used to relate mean net width with the inverse scope (m) and mean net height (m) from valid tows following the relationship investigated by Rose and Walters (1990), where w is the net width (m), h is the net height (m), s is the scope, and ϵ represents the modeled error

$$w \sim s^{-1} + h + \frac{h}{s} + \epsilon$$

$$\epsilon \sim N(0, \sigma^2) .$$

EBS Sampling Logistics and Stratification Scheme

At the beginning of the survey, scientists boarded the chartered vessels (FV *Alaska Knight* and FV *Vesteraalen*) in Dutch Harbor, Alaska, and transited to eastern Bristol Bay to begin sampling. From Bristol Bay, the survey proceeded westward completing north-south columns of grid cells to the shelf edge (Fig. 1). The east-to-west survey progression is intended to ensure the survey moves in the opposite direction of the seasonal on-shelf (eastward) migration patterns typical of yellowfin sole and other species. This strategy reduces the likelihood of encountering a portion of these populations multiple times (Smith and Bakkala 1982; Nichol et al. 2019). In the EBS, FV *Vesteraalen* and FV *Alaska Knight* started sampling on 3 June 2019 and ended sampling on 28 July 2019.

For design-based (as opposed to model-based) index catch analysis, the EBS shelf was divided into 12 strata bounded by the 20 m, 50 m, 100 m, and 200 m isobaths and a geographic stratum line separating the northwest and southeast shelf (Fig. 1). The stratum boundaries correspond with oceanographic domains and different biological communities. This stratification scheme reflects some differences observed in Bering Sea groundfish distributions across the oceanographic domains, while the overall intention of the design was to reduce the variances of population and biomass estimates (Bakkala 1993). The purpose of high-density sampling in strata 32, 42, 43, and 62 is to increase sampling resolution and thereby reduce variance estimates for blue king crab (Stevens and MacIntosh 1990). Sampling density across the EBS shelf was one station per 1,311 km^2, ranging from one station per 775 km^2 (Stratum 42) to one per 1,496 km^2 (Stratum 82; Table 1). For some analyses (e.g., abundance-at-length), the high-density strata were grouped, resulting in eight subareas: 10, 20, 30 (31+32), 40 (41+42+43), 50, 60 (61+62), 82, and 90 (Fig. 1; Table 1).

NBS Sampling Logistics and Stratification Scheme

After the completion of the EBS shelf survey, both vessels transitioned into sampling survey stations in the southwest corner of the NBS survey region. In the NBS, the sampling started on 29 July 2019 for the FV *Vesteraalen* and on 28 July 2019 for the FV *Alaska Knight* and ended for both vessels on 20 August 2019. After the NBS survey was completed, both vessels returned to Dutch Harbor. The NBS shelf was divided into three strata: one including the area north of St. Lawrence Island and Norton Sound and two others south of St. Lawrence Island separated by the 50 m isobath (Fig. 1). Sampling density was 1,367 km^2/station for stratum 70, 1,401 km^2/station for stratum 71, and 1,370 km^2/station for stratum 81 and 1,381 km^2/station for the total NBS (Table 1).

Table 1. -- Stratum areas and sampling densities used during the 2019 eastern Bering Sea and northern Bering Sea bottom trawl surveys. Stratum areas were calculated in 2019.

	Stratum	Representative area (km^2)	Stations successfully sampled	Sampling density (km^2/Stations successfully sampled)
EBS				
Inner Shelf	10	77,871	58	1,343
	20	41,027	31	1,323
Middle Shelf	31	94,526	69	1,370
	32	8,774	8	1,097
	41	62,703	44	1,425
	42	24,011	31	775
	43	21,108	22	959
	82	17,954	12	1,496
Outer Shelf	50	38,792	26	1,492
	61	88,134	60	1,469
	62	6,429	7	918
	90	11,568	8	1,446
Total		492,897	376	1,311
NBS				
Shelf	70	79,261	58	1,367
	71	81,245	58	1,401
	81	38,352	28	1,370
Total		198,858	144	1,381
EBS and NBS				
Total		691,755	520	1,330

Catch Sampling Procedures

Standard catch sampling procedures used in RACE Bering Sea assessment surveys are described in detail by Wakabayashi et al. (1985) and Stauffer (2004). In summary, samples were collected by trawling near the center of each grid square (or intersection of grid lines, in the case of high-density corner stations) for a target fishing time of 30 minutes at a speed of 1.54 m/sec (3 knots). If a station was not considered trawlable due to obstructions visible on the depth sounder, the nearest trawlable site within the same grid

square was used. Hauls that resulted in significant gear damage or contained debris, such as derelict crab pots, generating visible changes in net mensuration were redeployed to obtain a successful sample.

Catches estimated to be less than approximately 1,200 kg (2,650 lbs) were entirely sorted and enumerated, while larger catches were weighed in aggregate or volumetrically measured and subsampled before sorting. The goal of subsampling is to obtain a representative sample, which requires some variation in catch processing methods among hauls and is dependent on the overall size and species composition of the catches. After sorting subsampled catches, individual species were weighed and counted in aggregate, and these weights and numbers were then expanded proportionally to the total catch. Fish and invertebrate species were sorted and identified to the lowest, reliable taxonomic level.

All commercial crab species were weighed and enumerated from each catch. Other select species including Pacific halibut (*Hippoglossus stenolepis*), Greenland turbot (*Reinhardtius hippoglossoides*), large skates, rockfish (*Sebastes spp.*), Atka mackerel (*Pleurogrammus monopterygius*), prowfish (*Zaprora silenus*), Bering wolffish (*Anarhichas orientalis*), giant wrymouth (*Cryptacanthodes giganteus*), Pacific cod (*Gadus macrocephalus*), some sculpins, sharks, and any other large, rare species that are not represented in the subsample were completely sorted from the catch in most cases.

Length measurements were obtained from a random subsample of select fish species from every haul (Tables 2a and 2b). The number of fish in a random length subsample for a species was dependent on the size range of that species in the haul, up to a maximum target of 300 specimens. For each fish in a length subsample, sex was determined and then the fork length or total length (depending on the species) was measured to the nearest 1.0 cm. Unless retained for biological sampling by the International Pacific Halibut Commission (IPHC), Pacific halibut were measured to fork length upon capture and 50% were randomly selected to receive a preopercle tag, then immediately returned to the sea in an effort to reduce mortality. The weights of all Pacific halibut were estimated using an IPHC length-weight regression (Courcelles 2011).

Sagittal otoliths were collected from 12 fish species in the EBS and 11 fish species in the NBS (Tables 2a, 2b, 5a, and 5b). Otolith samples were collected following length/region-stratified (cm/sex/southeast and northwest regions) and random-by-haul sampling methods in the EBS and length-stratified (cm/sex) and random-by-haul sampling methods in the NBS (Table 2a and 2b). Otoliths were preserved in a glycerol-thymol solution and then later shipped to the Age and Growth Program of the AFSC's Resource Ecology and Fisheries Management (REFM) division for age determination. Individual fish weights and lengths were collected for each fish from which age structures were taken. For walleye pollock, age structure sampling effort was further divided into low-density and high-density regions based on historical population densities and an isobath of approximately 70 m.

Stomachs were collected in the field from four fish species (Table 3) and were preserved in the field in 10% formalin. Arrowtooth flounder and Kamchatka flounder (*Atheresthes* spp.) stomachs were collected as one genus because they occupy a similar trophic niche in the Bering Sea.

Table 2a. -- Otolith collection types and counts during the 2019 eastern Bering Sea shelf bottom trawl survey.

Common name	Target collection number per haul	Collect when ≥ n individuals caught in each haul
length/region-stratified (cm/sex/southeast and northwest regions)		
yellowfin sole	5	1
northern rock sole	3	1
Alaska plaice	3	1
Greenland turbot	3	1
Kamchatka flounder	2	1
yellow Irish lord	3	1
random-by-haul		
walleye pollock	3 adults and 1 juvenile in low-density area, and 5 adults and 1 juvenile in high-density area	20
Pacific cod	4 and 1 juvenile	4
flathead sole	3	10
Bering flounder	3	10
arrowtooth flounder	3	10
Pacific halibut	0.5	1

Table 2b. -- Otolith collection types and counts during the 2019 northern Bering Sea shelf bottom trawl survey.

Common name	Target collection number per haul	Collect when ≥ n individuals caught in each haul
length-stratified (cm/sex)		
yellowfin sole	5	1
northern rock sole	3	1
Alaska plaice	1	1
Greenland turbot	3	1
Kamchatka flounder	2	1
random-by-haul		
walleye pollock	3 adults and 1 juvenile	20
Pacific cod	4 adults and 1 juvenile	4
flathead sole	3	10
Bering flounder	3	10
arrowtooth flounder	3	10
Pacific halibut	0.5	1

Table 3. -- Stomach collection targets during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Common name	EBS	NBS
Pacific halibut	600	600
arrowtooth flounder and Kamchatka flounder	1250	1250
Pacific cod	1750	1750
walleye pollock	2500	2500

Catch Data Analysis

Design-based estimates of biomass, population, and size structure of fishes and invertebrate species were calculated from EBS and NBS survey data. A brief description of the procedures used in the analysis of RACE Bering Sea survey data follows (Wakabayashi et al. 1985). Some species were grouped by family for catch data analysis because of their limited commercial value or an inability to identify to lower taxonomic level while in the field.

Mean catch per unit effort (CPUE) for each species was calculated in kilograms per hectare (1 ha = 10,000 m^2) and number of fish per hectare for each stratum (Alverson and Pereyra 1969; Lauth and Kotwicki 2014). Area swept (hectares) was computed as the linear distance towed multiplied by the mean net width (Alverson and Pereyra 1969; Lauth and Kotwicki 2014). Mean CPUE was calculated for individual strata and summed proportionally for the overall survey area. Design-based biomass and population estimates were calculated for each stratum by multiplying the stratum mean CPUE by the stratum area. Stratum estimates were then summed for total survey area estimates in the EBS and NBS. Disparities between the number of hauls when a species was weighed, counted, and measured may occur due to processing errors during sampling.

For size composition estimates, the proportion of fish at each centimeter length interval (from subsamples at each station), weighted by CPUE (number of fish/ha), was expanded to the stratum population. Stratum abundance-at-length estimates were summed for the total estimated size composition for the overall survey area in the EBS and NBS.

Otolith samples collected during the survey were read for age estimates by Age and Growth Program staff in the AFSC's REFM division for all fish except for Pacific halibut, whose otoliths are processed by the IPHC. The most current information about age, growth, and population analyses are presented in the 2018 NPFMC Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Bering Sea/Aleutian Islands Region (Groundfish Fisheries of the Bering Sea and Aleutian Islands 2019).

Additional Research Projects

In addition to standard survey operations, 23 research projects were undertaken in both the EBS and NBS, 6 research projects were undertaken in only the EBS, and 2 research projects were undertaken in only the NBS during the 2019 survey season (Table 4). A solicitation for research proposals was issued on February 1, 2019. Project requests were prioritized and modified based on their potential support of AFSC strategic science plans and mission and their expected impact on survey resources and available time to complete the project. Some of the approved projects were new for 2019, while many continued multi-year observations of supplementary data. Data for additional research projects were collected at sea and

disseminated to the requesting principal investigator(s). To acquire the details about a special project or collection, please contact the investigator(s) designated in Table 4.

Table 4. -- Special projects and collections undertaken during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey, sorted by principal investigator and agency.

Project title	Principal investigator	Agency[1]
EBS		
Chionoecetes black eye disease	Tyler Jackson	ADF&G
Population genomic structure of eastern Bering Sea tanner crab	Tyler Jackson	ADF&G
US-Russia transboundary mooring deployment	Alex De Robertis	AFSC-MACE
Observer crab specimen collection	Duane Stevenson	AFSC-RACE
Observer training collection	Duane Stevenson	AFSC-RACE
Immature bairdi collection for gene expression pattern study	Pam Jensen	AFSC-RACE
EBS & NBS		
Spatial variance in shell structure of snow and tanner crab	Bob Foy	AFSC
Population genetics of sleeper and salmon sharks	Cindy Tribuzio	AFSC-ABL
Invertebrate collection for stable isotope analysis	Todd Miller	AFSC-ABL
Use of EBS bottom trawl survey acoustic data to augment the MACE acoustic-trawl survey time series of walleye pollock abundance (“AVO”, Acoustic vessels of opportunity)	MACE	AFSC-MACE
Collection of mature tanner and snow crab	Cliff Ryer	AFSC-RACE
Juvenile flatfish habitat	Cynthia Yeung	AFSC-RACE
Snow crab condition	Erin Fedewa	AFSC-RACE
Fishermen's Fall Festival collection	Jason Conner	AFSC-RACE
Proportion of female snow crab that are on an annual vs. biennial reproductive cycle	Jen Newby	AFSC-RACE
Fish condition index-pollock/cod	Jerry Hoff	AFSC-RACE
Morphological and genetic identification of larval stages of sandlance species, Ammodytes hexapterus and A. personatus	Melanie Paquin	AFSC-RACE
Light meter calibration	Ned Laman	AFSC-RACE
Bitter crab syndrome in eastern Bering Sea Chionoecetes spp.	Pam Jensen	AFSC-RACE
Pacific cod tissue collection	Beth Matta	AFSC-REFM
Arctic and saffron cod growth	Craig Kastelle	AFSC-REFM
Pacific cod maturity scans and ovary collection	Sandy Neidetcher	AFSC-REFM
Bering Strait HAB samples	Gay Sheffield	ASG
IPHC Pacific halibut data collection and tagging on NMFS trawl surveys	Lauri Sadorus	IPHC
NWFSC voucher collection	Abigail Wells	NWFSC
Molecular species identification of deepwater corals	Ewann Berntson	NWFSC
Pacific lamprey collection	Laurie Weitkamp	NWFSC
CTD oceanographic sampling	Ned Cokelet	PMEL
Mollusk collection	Roger Clark	SBMNH
NBS		
Pacific halibut tissue sample collection	Liz Dawson	AFSC-RACE
Pacific cod satellite tagging	Susanne McDermott	AFSC-RACE

[1]ADF&G - Alaska Department of Fish & Game; AFSC - Alaska Fisheries Science Center; AFSC-ABL - Auke Bay Laboratories; AFSC-RACE - Resource Assessment & Conservation Engineering Division; AFSC-REFM - Resource Ecology & Fisheries Management Division; ASG - Alaska Sea Grant; IPHC - International Pacific Halibut Commission; NWFSC - Northwest Fisheries Science Center; PMEL - Pacific Marine Environmental Laboratory; SBMNH - Santa Barbara Museum of Natural History

Results and Discussion

A total of 376 EBS stations and 144 NBS stations were successfully sampled in 2019 (Fig. 1). Haul and catch sample data for successfully trawled stations used in the analyses can be found and downloaded from the Fisheries One Stop Shop (https://www.fisheries.noaa.gov/foss/f?p=215:200:1099772399154:Mail:NO:::).

Ocean Temperatures and the Cold Pool

Sea surface temperatures recorded during the 2019 EBS and NBS survey ranged from 2.7° to 15.6°C, and near-bottom temperatures (hereafter referred to as bottom temperatures) ranged from -0.6° to 15.3°C. The mean sea surface temperature for the EBS in 2019 was 9.2°C, which was 1.6°C higher than 2018 (7.6°C) and 2.5°C higher than the time series mean (6.7°C; Figures 5, 6, 7a, and 7b). In the EBS south of 60°N, surface temperatures increased from east to west across the shelf (Fig. 8b). An average of 13.5°C was observed in Norton Sound (Fig. 8b). During the EBS time series (1982–2019), mean summer bottom temperatures were highly variable, ranging from a low of 0.7°C to a high of 4.4°C. The grand mean for all years was 2.5°C (Fig. 5). The mean survey bottom temperature for the EBS in 2019 was 4.4°C (Fig. 5), which was 1.9°C warmer than the long term mean (Rohan et al. in review).

The size of the cold pool each summer is defined by the extent of bottom temperatures below 2°C and depends on sea ice coverage from the previous winter, the timing of sea ice retreat during the spring and early summer, as well as other oceanographic and meteorological conditions (Wyllie-Echeverria and Wooster 1998). During the coldest years, sea ice extended farther south and lasted later into spring resulting in cold pools that extended farther south through the middle domain into Bristol Bay and near the Alaska Peninsula (Fig. 7a and 7b). Interannual variability in the dynamics of seasonal ice is a major environmental driver on the Bering Sea shelf (Stabeno et al. 2001; Stabeno, Farley Jr, et al. 2012; Stabeno, Kachel, et al. 2012) that can change recruitment and migration patterns, as well as cause major distributional shifts in groundfish and crab species (Kotwicki and Lauth 2013; Nichol et al. 2019; Stevenson and Lauth 2019).

During the last 14 years, 2006-2013 were colder than average (“cold stanza”; Figure 7a), while 2014-2019 were warmer than average (“warm stanza”; Figure 7b). The highly variable survey bottom temperatures in the EBS shelf are related to the area occupied by the summer cold pool (Fig. 6). Over the period of the 38-year time series, the areal coverage of the summer survey cold pool in the EBS has varied in size from 6,150 km^2 in 2018 to 385,975 km^2 in 1999, respectively comprising 1.2% to 78.2% of EBS shelf area (Fig. 6). In 2019, the cold pool covered 26,625 km^2 (5.4%) of the EBS shelf survey area, which was the second lowest areal coverage in the 38-year time series followed by 2018 (first).

The 2017 and 2019 EBS and NBS surveys provided a quasi-synoptic view of the spatial pattern of bottom temperatures across the entire EBS and NBS shelf, providing an index of annual differences in demersal fauna distribution patterns. The seasonal cold pool, which is a cold water mass that occupies the middle domain of the EBS shelf annually to a varying extent, may play a role in restricting the movements of some species both across the shelf (east-west) and along the inner domain of the shelf (north-south). Thus, tracking the position and spatial extent of this water mass is critically important.

The 2017 cold pool was composed of colder water that occupied 34.3% of the EBS shelf survey area (Fig. 6), with < 1°C bottom temperatures extending north of St. Lawrence Island into Chirikov Basin, east to Nunivak Island, and south to the Alaska Peninsula (Figs. 7a and 7b). The 2019 cold pool occupied 5.4% of

the EBS shelf survey area (Fig. 6). The 2019 cold pool was concentrated in the northwestern portion of the northern Bering Sea south and west of St. Lawrence Island where bottom temperatures were < 2°C (Fig. 7b). In 2019, there were also warmer bottom temperatures (> 6°C) along the inner domain from Bristol Bay to Chirikov Basin compared to 2017 when slightly cooler bottom temperatures (between 4°C and 5°C) were found along the inner domain of Bristol Bay and butted against the west side of Nunivak Island (Fig. 7a). Warmer bottom temperatures across all domains in the southeastern Bering Sea in 2019 allowed for potential north-south and east-west movement of demersal marine fauna. Warmer bottom temperatures along most of the inner domain and around Nunivak Island from 2014 to 2016 may have also increased opportunities for northward movement (Fig. 7a and 7b).

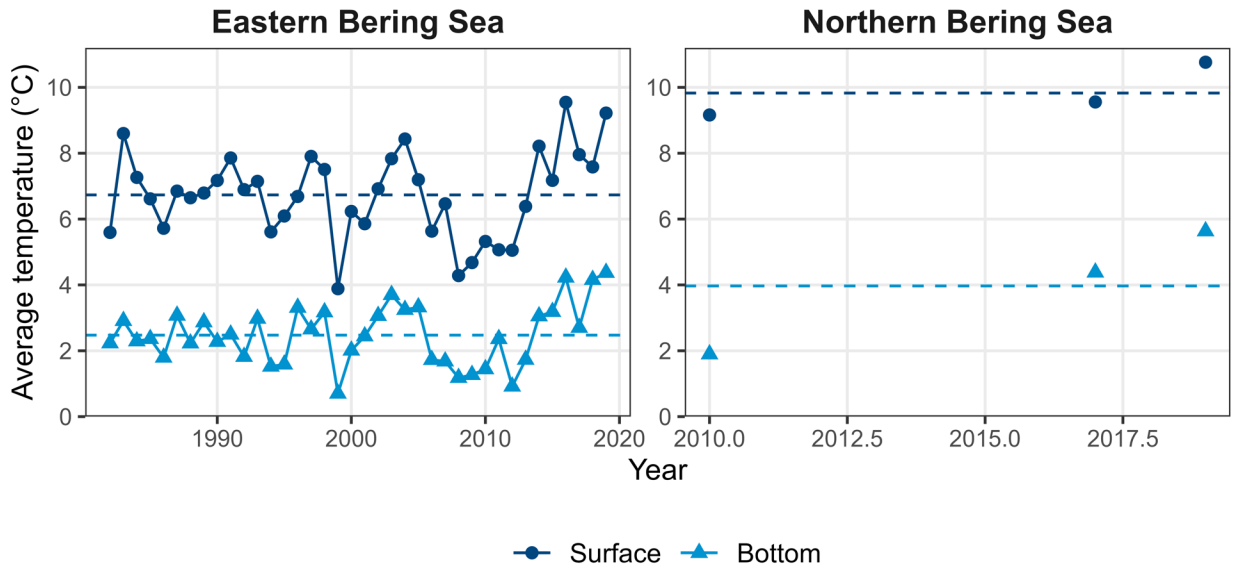

Figure 5. -- Average summer surface (light blue triangles) and bottom (dark blue circles) and long-term mean surface (dark blue dashed line) and bottom (light blue dashed line) temperatures (°C) on the eastern Bering Sea shelf, based on data collected during standardized summer bottom trawl surveys from 1982–2019 (left), and northern Bering Sea shelf based on data collected during standardized summer bottom trawl surveys from 2010, 2017, and 2019 (right).

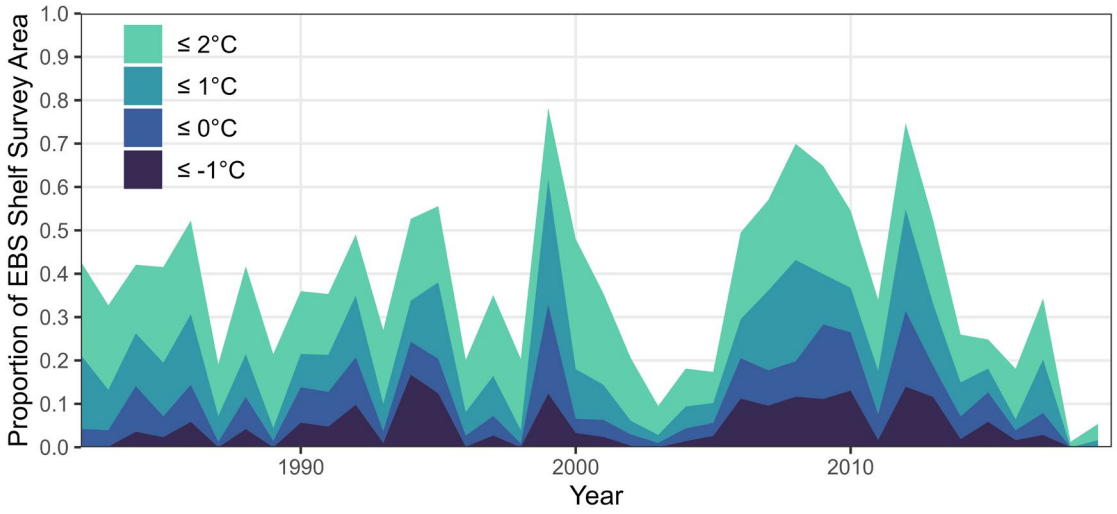

Figure 6. -- Annual cold pool extent on the eastern Bering Sea shelf, based on observations from the eastern Bering Sea bottom trawl survey. The extent of the cold pool is shown in proportion to the total southeastern Bering Sea shelf survey area. Shading denotes near-bottom temperatures ≤ 2°C (aqua blue), ≤ 1°C (cerulean blue), ≤ 0°C (cobalt blue), and ≤ -1°C (dark navy blue).

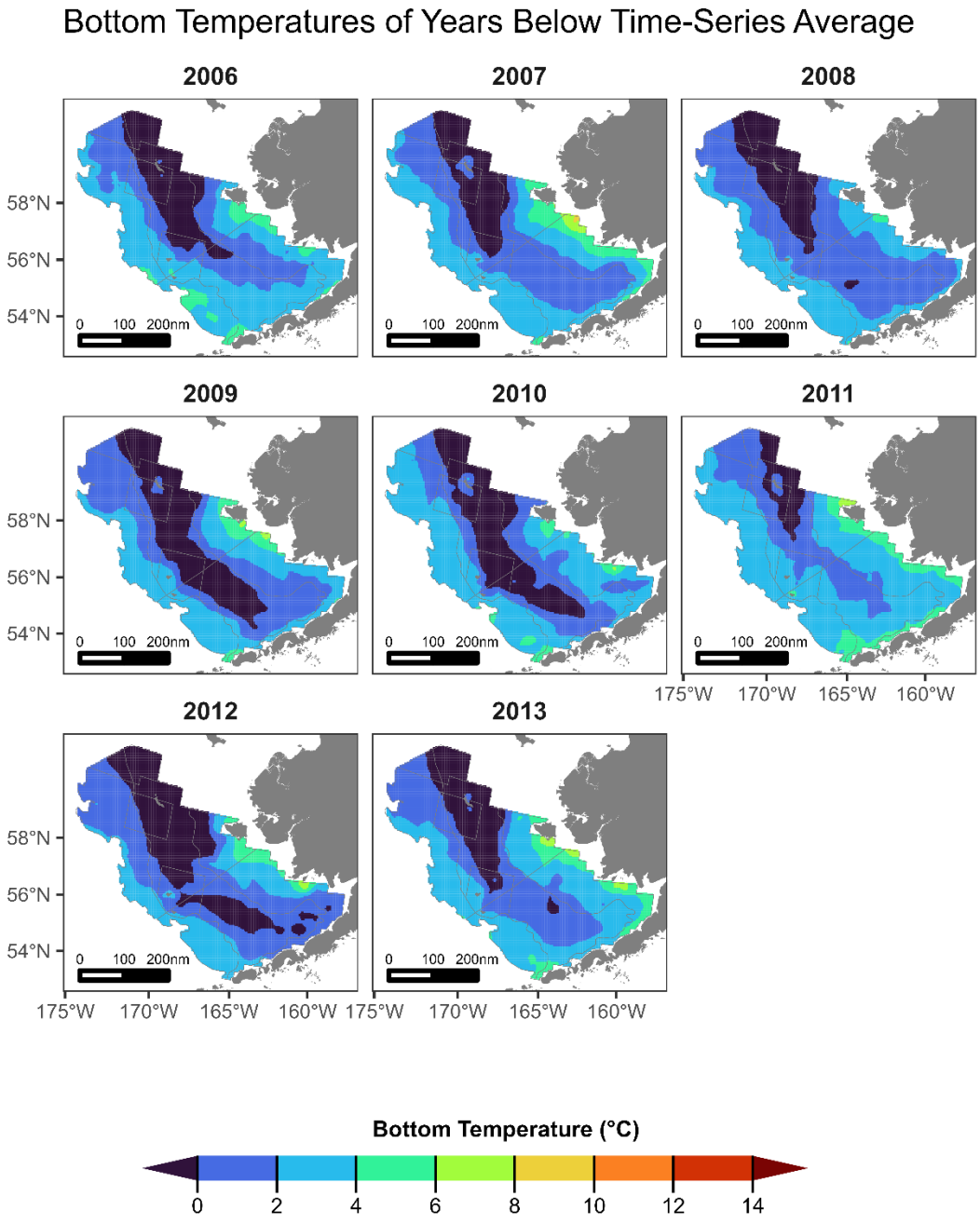

Figure 7a. – Eastern Bering Sea shelf bottom trawl survey near-bottom temperatures in years below the long-term mean (2006, 2007, 2008, 2009, 2010, 2011, 2012, and 2013).

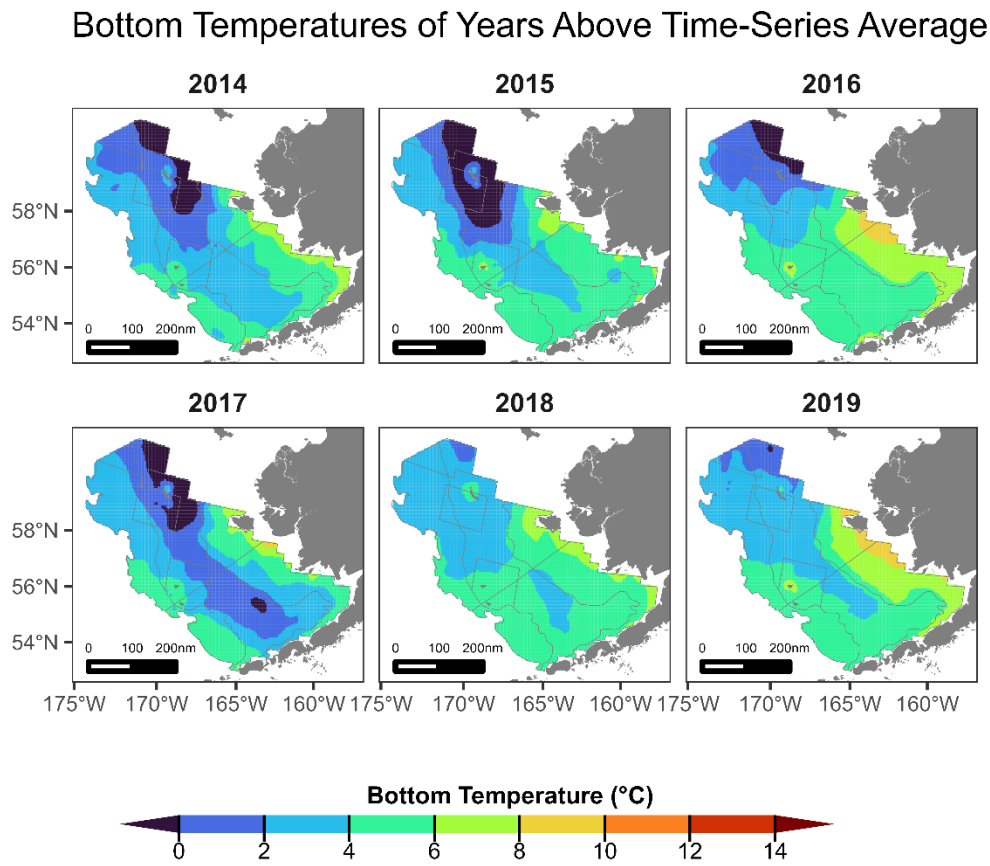

Figure 7b. – Eastern Bering Sea shelf bottom trawl survey near-bottom temperatures in years above the long-term mean (2014, 2015, 2016, 2017, 2018, and 2019).

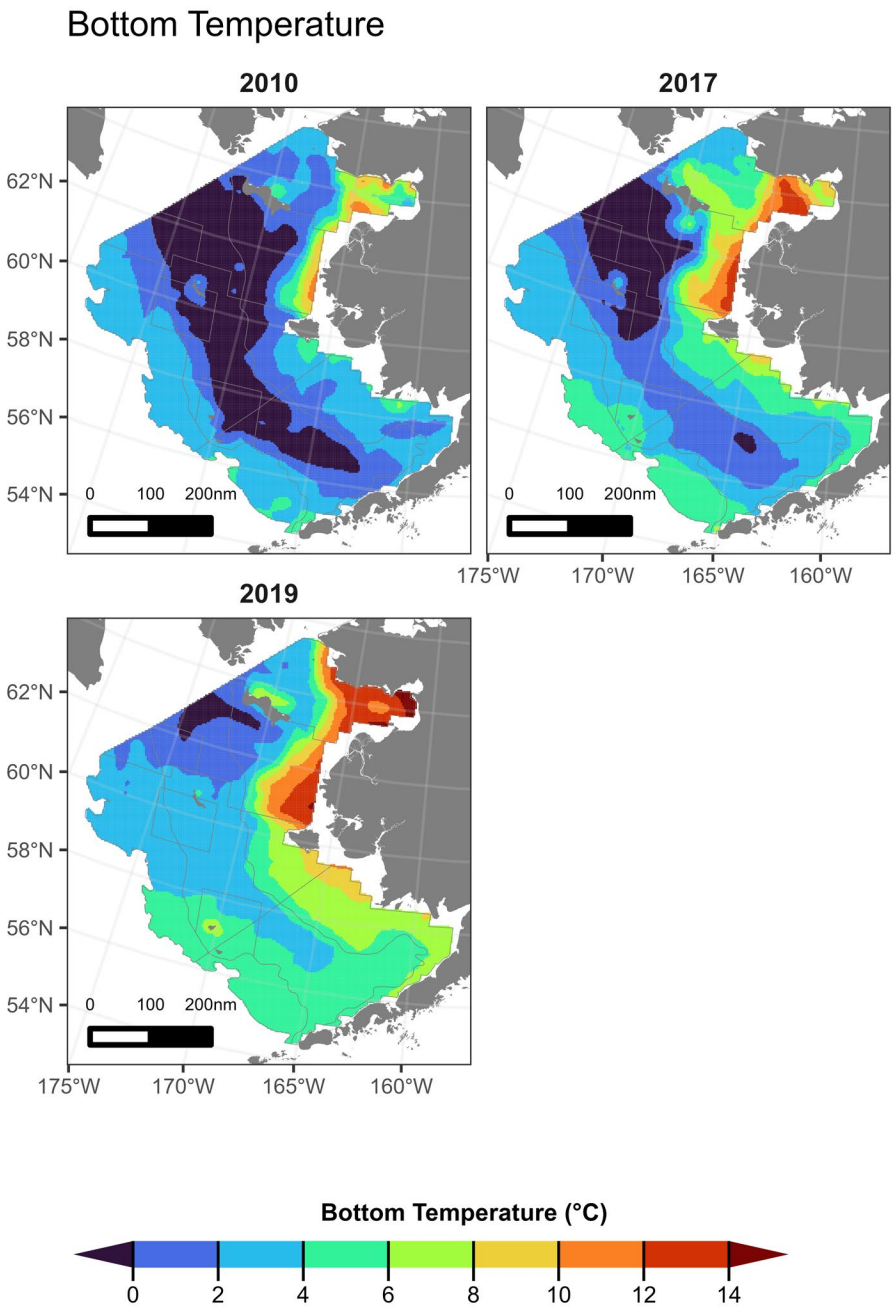

Figure 8a. -- Bottom temperatures (°C) in the eastern Bering Sea and northern Bering Sea during the 2010, 2017, and 2019 surveys, which included the full NBS shelf bottom trawl survey.

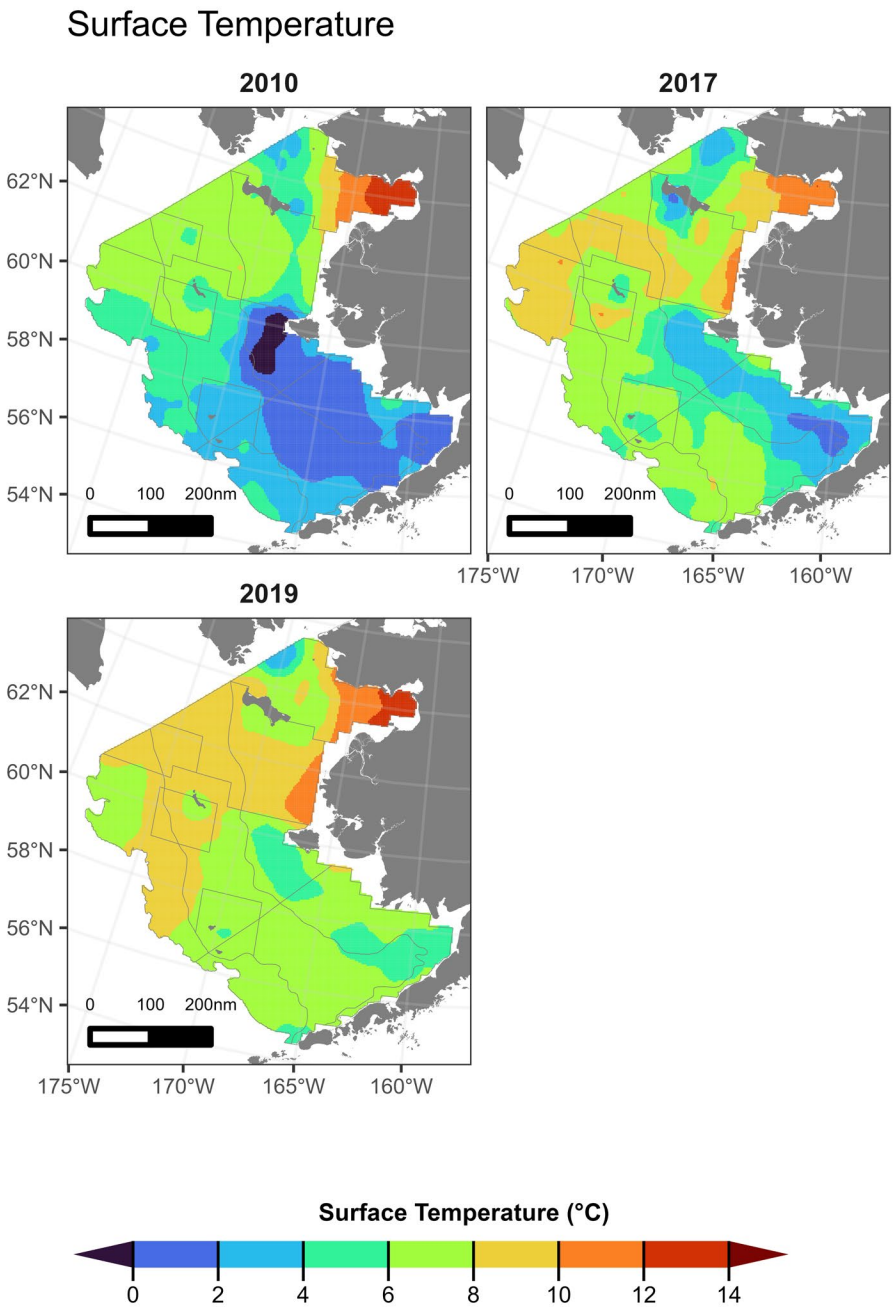

Figure 8b. -- Surface temperatures (°C) in the eastern Bering Sea and northern Bering Sea during the 2010, 2017, and 2019 surveys, which included the full NBS shelf bottom trawl survey.

Survey Data and Specimen Collections

Specimens collected during the EBS and NBS shelf trawl survey are shown in Tables 5a and 5b. A total of 271,872 lengths were collected from 51 taxa; 9,246 otolith age structures were collected from 11 taxa; 6,398 stomach samples were collected from four taxa; and 1,675 pathobiology blood samples were collected from one taxon. Other special collections are listed in Table 4.

Table 5a. -- Biological data collected during the 2019 eastern Bering Sea (EBS) shelf bottom trawl survey.

EBS	Length measurements	Otolith age structure measurements	Stomach samples	Pathobiology blood samples
Alaska plaice	9,071	525	-	-
Alaska skate	3,651	-	-	-
Aleutian skate	58	-	-	-
Arctic cod	1	-	-	-
arrowtooth flounder	14,276	700	-	-
arrowtooth flounder/Kamchatka flounder	-	-	1,187	-
Atka mackerel	1	-	-	-
Bathyraja sp.	1	-	-	-
Bering flounder	753	65	-	-
Bering skate	171	-	-	-
big skate	16	-	-	-
bigmouth sculpin	258	-	-	-
blackspotted rockfish	14	-	-	-
blue king crab	326	-	-	-
butter sole	825	-	-	-
butterfly sculpin	1	-	-	-
chinook salmon	1	-	-	-
Chionoecetes spp.	-	-	-	1,474
chum salmon	30	-	-	-
Dover sole	13	-	-	-
English sole	1	-	-	-
flathead sole	20,587	804	-	-
great sculpin	931	-	-	-
Greenland turbot	165	113	-	-
horsehair crab	104	-	-	-
hybrid Tanner crab	371	-	-	-
Kamchatka flounder	1,945	448	-	-
longhead dab	523	-	-	-
mud skate	14	-	-	-
northern rock sole	23,017	545	-	-
northern rockfish	10	-	-	-
Pacific cod	11,235	1,505	1,282	-
Pacific halibut	2,522	-	144	-
Pacific ocean perch	186	-	-	-
pink salmon	1	-	-	-
plain sculpin	1,961	-	-	-
red Irish lord	1	-	-	-
red king crab	716	-	-	-
rex sole	2,240	-	-	-
rougheye rockfish	3	-	-	-
sablefish	128	-	-	-
saffron cod	216	-	-	-
Sakhalin sole	8	-	-	-
shorthorn sculpin	214	-	-	-

Table 5a. -- Biological data collected during the 2019 eastern Bering Sea (EBS) shelf bottom trawl survey.

EBS	Length measurements	Otolith age structure measurements	Stomach samples	Pathobiology blood samples
snow crab	16,999	-	-	-
southern rock sole	241	-	-	-
starry flounder	1,032	-	-	-
Tanner crab	11,394	-	-	-
walleye pollock	42,382	1,541	2,259	-
yellow Irish lord	993	231	-	-
yellowfin sole	25,669	836	-	-
Total	**195,276**	**7,313**	**4,872**	**1,474**

Table 5b. -- Biological data collected during the 2019 northern Bering Sea (NBS) shelf bottom trawl survey.

NBS	Length measurements	Otolith age structure measurements	Stomach samples	Pathobiology blood samples
Alaska plaice	8,315	142	-	-
Alaska skate	755	-	-	-
Arctic cod	46	-	-	-
Arctic flounder	5	-	-	-
arrowtooth flounder	24	-	-	-
Atka mackerel	1	-	-	-
Bering flounder	2,314	115	-	-
blue king crab	59	-	-	-
butterfly sculpin	10	-	-	-
chinook salmon	1	-	-	-
Chionoecetes spp.	-	-	-	201
chum salmon	8	-	-	-
flathead sole	52	6	-	-
great sculpin	119	-	-	-
Greenland turbot	7	3	-	-
horsehair crab	25	-	-	-
Kamchatka flounder	1	-	-	-
longhead dab	916	-	-	-
northern rock sole	7,702	266	-	-
Pacific cod	5,325	435	514	-
Pacific halibut	248	-	-	-
pink salmon	1	-	-	-
plain sculpin	2,677	-	-	-
red king crab	256	-	-	-
saffron cod	6,264	-	-	-
Sakhalin sole	576	-	-	-
salmon unid.	1	-	-	-
shorthorn sculpin	335	-	-	-
snow crab	12,315	-	-	-
starry flounder	1,038	-	-	-
walleye pollock	15,603	427	1,012	-
yellow Irish lord	2	-	-	-
yellowfin sole	11,595	539	-	-
Total	**76,596**	**1,933**	**1,526**	**201**

Species Composition

A total of 115 different fish species representing 23 families and 65 genera were identified during the 2019 EBS and NBS surveys (Appendix Tables A1 and B1). In 2019, the EBS survey recorded 90 total taxa, of which 79 were identified to the species level and the NBS survey recorded 70 total taxa, of which 60 were identified to the species level. The remaining fish taxa in each survey area were identified to the genus level or higher. Of the fish species found in the EBS, 38 did not occur in the NBS (Table 6). In comparison, zero species were present in the NBS but absent in EBS (Table 6). In 2019, 13 flatfish species were present in EBS and NBS (Alaska plaice (*Pleuronectes quadrituberculatus*), arrowtooth flounder (*Atheresthes stomias*), Bering flounder (*Hippoglossoides robustus*), flathead sole (*Hippoglossoides elassodon*), Greenland turbot (*Reinhardtius hippoglossoides*), hybrid starry flounder X Alaska plaice (*Platichthys stellatus X Pleuronectes quadrituberculatus hybrid*), Kamchatka flounder (*Atheresthes evermanni*), longhead dab (*Limanda proboscidea*), northern rock sole (*Lepidopsetta polyxystra*), Pacific halibut (*Hippoglossus stenolepis*), Sakhalin sole (*Limanda sakhalinensis*), starry flounder (*Platichthys stellatus*), and yellowfin sole (*Limanda aspera*)); five flatfish species were present in EBS but absent in NBS (butter sole (*Isopsetta isolepis*), Dover sole (*Microstomus pacificus*), English sole (*Parophrys vetulus*), rex sole (*Glyptocephalus zachirus*), and southern rock sole (*Lepidopsetta bilineata*)); and one flatfish species was present in NBS but absent in EBS (Arctic flounder (*Liopsetta glacialis*); Table 6).

Two hundred and sixty nine different invertebrate taxa representing 11 phyla were identified during the 2019 EBS and NBS survey (Appendix Tables A2 and B2). In 2019, the EBS survey recorded a total of 225 taxa of which 130 were identified to the species level and the NBS survey recorded a total of 159 taxa of which 95 were identified to the species level. The remaining invertebrate taxa in each survey area were identified to the genus level or higher. The lack of species level identifications among invertebrates was due to a variety of factors that are outlined in Stevenson and Hoff (2009) and Stevenson et al. (2016). Additionally, trawl catchability of small invertebrates is not known.

Table 6. -- Fish taxa from survey catches exclusive to the eastern Bering Sea shelf (EBS) and northern Bering Sea shelf (NBS).

Present in EBS but absent in NBS **Common name *(Scientific Name)***	**Present in NBS but absent in EBS** **Common name *(Scientific Name)***
Aleutian alligatorfish *(Aspidophoroides monopterygius)*	antlered sculpin *(Enophrys diceraus)*
Aleutian skate *(Bathyraja aleutica)*	Arctic alligatorfish *(Ulcina olrikii)*
armorhead sculpin *(Gymnocanthus galeatus)*	Arctic flounder *(Liopsetta glacialis)*
Bering skate *(Bathyraja interrupta)*	Arctic sculpin *(Myoxocephalus scorpioides)*
big skate *(Beringraja binoculata)*	Arctic shanny *(Stichaeus punctatus)*
bigmouth sculpin *(Hemitripterus bolini)*	Arctic staghorn sculpin *(Gymnocanthus tricuspis)*
blackspotted rockfish *(Sebastes melanostictus)*	bearded warbonnet *(Chirolophis snyderi)*
butter sole *(Isopsetta isolepis)*	belligerent sculpin *(Megalocottus platycephalus)*
Canadian eelpout *(Lycodes polaris)*	eyeshade sculpin *(Nautichthys pribilovius)*
darkfin sculpin *(Malacocottus zonurus)*	fourline snakeblenny *(Eumesogrammus praecisus)*
daubed shanny *(Lumpenus maculatus)*	hamecon *(Artediellus scaber)*
Dover sole *(Microstomus pacificus)*	ninespine stickleback *(Pungitius pungitius)*
English sole *(Parophrys vetulus)*	Pacific sand lance *(Ammodytes personatus)*
eulachon *(Thaleichthys pacificus)*	polar eelpout *(Lycodes turneri)*
gray starsnout *(Bathyagonus alascanus)*	smoothcheek sculpin *(Eurymen gyrinus)*
kelp greenling *(Hexagrammos decagrammus)*	snake prickleback *(Lumpenus sagitta)*
kelp snailfish *(Liparis tunicatus)*	spiny lumpsuckers *(Eumicrotremus sp.)*
mud skate *(Bathyraja taranetzi)*	veteran poacher *(Podothecus veternus)*
northern rockfish *(Sebastes polyspinis)*	
Pacific ocean perch *(Sebastes alutus)*	
Pacific sandfish *(Trichodon trichodon)*	
Pacific staghorn sculpin *(Leptocottus armatus)*	
prowfish *(Zaprora silenus)*	
red Irish lord *(Hemilepidotus hemilepidotus)*	
rex sole *(Glyptocephalus zachirus)*	
rougheye rockfish *(Sebastes aleutianus)*	
roughspine sculpin *(Triglops macellus)*	
sablefish *(Anoplopoma fimbria)*	
salmon snailfish *(Careproctus rastrinus)*	
searcher *(Bathymaster signatus)*	
shortfin eelpout *(Lycodes brevipes)*	
southern rock sole *(Lepidopsetta bilineata)*	
spatulate sculpin *(Icelus spatula)*	
spectacled sculpin *(Triglops scepticus)*	
spinycheek starsnout *(Bathyagonus infraspinatus)*	
spinyhead sculpin *(Dasycottus setiger)*	
thorny sculpin *(Icelus spiniger)*	
whitebarred prickleback *(Poroclinus rothrocki)*	

Biomass, Abundance, and Catch per Unit Effort

The total demersal animal biomass for the EBS was estimated at 15.1 million t and total demersal animal biomass for the NBS was estimated at 4.3 million t. In the EBS, the proportion of fishes (78%; Table 7a) was higher than invertebrates (22%; Table 8a) and in the NBS, the proportion of fishes (67%; Table 7b) was also higher than invertebrates (33%; Table 8b). The lower relative fish biomass in the NBS than in the EBS is consistent with results of a broader analysis of all survey years in Stevenson and Lauth (2012) showing decreasing fish biomass with increasing latitude on the Bering Sea continental shelf (Tables 7a and 7b). This trend may change over time with warming ocean temperatures.

Gadidae (cods) and Pleuronectidae (flatfishes) were the fish families with greatest biomass in both the EBS (39.6% and 32% of the total biomass, respectively), and the NBS (37.6% and 23.7% of the total biomass, respectively; 7a and 7b). In the EBS, the family Gadidae was primarily comprised of walleye pollock (*Gadus chalcogrammus*, 36.1%) and Pacific cod (*Gadus macrocephalus*, 3.4%) the family Pleuronectidae was primarily comprised of yellowfin sole (*Limanda aspera*, 13.3%), northern rock sole (*Lepidopsetta polyxystra*, 6.5%), and flathead sole (*Hippoglossoides elassodon*, 4%; 7a and 7b). In the NBS, the family Gadidae was primarily comprised of walleye pollock (*Gadus chalcogrammus*, 27.2%), Pacific cod (*Gadus macrocephalus*, 8.5%), and other cods (1.9%) the family Pleuronectidae was primarily comprised of yellowfin sole (*Limanda aspera*, 12.1%) and northern rock sole (*Lepidopsetta polyxystra*, 2.3%; 7a and 7b).

Noticeable changes were observed in both the EBS and NBS the benthic communities between 2017 and 2019. The total estimated biomass in the EBS decreased from 16.5 million t in 2017 to 15.3 million t in 2019. Taxa that significantly increased in biomass included blue king crab (115%), plain sculpin (48%), other sculpins (35%), Pacific herring (31%), and other flatfishes (23%; Table 9a). Large decreases in biomass were observed for starry flounder (-65%), all tunicates (-65%), Bering flounder (-70%), corals (-79%), and Arctic cod (-100%; Table 9a). The total estimated biomass in the NBS decreased from 4.5 million t in 2017 to 4.4 million t in 2019. Taxa that significantly increased in biomass included all worms (1,074%), Pacific herring (152%), northern rock sole (79%), Pacific halibut (39%), and red king crab (29%; Table 9b). Large decreases in biomass were observed for eelpouts (-83%), snailfishes (-84%), shorthorn sculpin (-87%), Arctic cod (-99%), and tanner crab (-100%; Table 9b). While all efforts are made at standardizing catch processing over time, some inconsistencies may exist between years, vessels, and crews which may affect the interpretation of these differences.

The top 10 fish taxa in the EBS accounted for 73% (an average of 228 kg/ha per station) of total mean fish and invertebrate CPUE (an average of 311 kg/ha per station) and 96% of total mean fish CPUE (an average of 238 kg/ha per station; Table 10a). The top 10 fish taxa in the NBS accounted for 63% (an average of 138 kg/ha per station) of total mean fish and invertebrate CPUE (an average of 219 kg/ha per station) and 95% of total mean fish CPUE (an average of 145 kg/ha per station; Table 10a).

Table 7a. -- Biomass estimates (t) for major fish taxa collected during the 2019 eastern Bering Sea shelf bottom trawl survey.

Taxon		Estimated total biomass (t) ± 95% confidence interval		Proportion of total animal biomass[1]	Estimated biomass by stratum (t)							
					10	20	30	40	50	60	82	90
Agonidae (poachers)		12,634 ±	2,784	0.0008	2,120	1,337	2,821	5,201	981	153	14	7
Cottidae (sculpins)		230,307 ±	51,237	0.0152	22,311	11,572	61,991	62,685	2,126	60,557	4,524	4,540
Gadidae (cods)	Pacific cod	516,910 ±	46,055	0.0342	70,746	23,356	115,263	165,478	16,341	89,707	24,961	11,059
	walleye pollock	5,458,366 ±	925,433	0.3612	60,851	31,765	1,285,803	1,867,601	187,173	1,540,677	263,772	220,722
	other cods	1,371 ±	1,274	<0.0001	1,094	271	0	7	0	0	0	0
	total Gadidae (cods)	5,976,647 ±	903,664	0.3955	132,691	55,392	1,401,066	2,033,086	203,514	1,630,384	288,733	231,781
Hexagrammidae (greenlings)		357 ±	231	<0.0001	246	62	15	10	24	0	0	0
Liparidae (snailfishes)		647 ±	352	<0.0001	2	0	0	102	0	210	139	194
Osmeridae (smelts)		1,956 ±	849	0.0001	1,230	85	103	38	477	20	4	0
Pleuronectidae (flatfishes)	Alaska plaice	368,787 ±	58,450	0.0244	48,295	31,114	116,132	157,316	209	4,993	10,074	654
	arrowtooth flounder	578,390 ±	77,090	0.0383	3,226	540	195,253	115,259	137,419	118,823	3,757	4,112
	Bering flounder	8,269 ±	3,503	0.0005	0	9	41	2,017	0	24	3,884	2,293
	flathead sole	611,483 ±	171,550	0.0405	17,108	354	181,417	121,486	53,375	218,517	11,259	7,967
	Kamchatka flounder	44,870 ±	7,639	0.0030	29	0	4,631	12,578	7,916	15,607	2,074	2,035
	northern rock sole	976,686 ±	184,437	0.0646	451,616	145,668	211,186	152,788	2,770	6,146	5,815	696
	Pacific halibut	113,855 ±	15,366	0.0075	29,820	25,671	23,963	16,607	5,810	11,123	0	860
	yellowfin sole	2,006,505 ±	424,239	0.1328	839,682	273,368	513,005	373,544	174	382	6,208	142
	other flatfish	121,460 ±	34,862	0.0080	52,001	9,065	34,568	28	15,005	10,736	56	0
	total Pleuronectidae (flatfishes)	4,830,303 ±	491,352	0.3197	1,441,777	485,790	1,280,197	951,624	222,678	386,351	43,126	18,759
Rajidae (skates)	Alaska skate	491,109 ±	48,112	0.0325	52,677	49,332	94,708	113,098	53,334	114,224	6,796	6,939
	other skates	38,127 ±	12,018	0.0025	2,557	4	11,654	506	11,168	12,061	0	178
	total Rajidae (skates)	529,236 ±	48,467	0.0350	55,233	49,336	106,362	113,604	64,502	126,284	6,796	7,117
Scorpaenidae (rockfishes)	Pacific ocean perch	5,400 ±	6,753	0.0004	0	0	0	0	738	4,662	0	0
	other rockfish	463 ±	528	<0.0001	0	0	0	0	223	240	0	0
	total Scorpaenidae (rockfishes)	5,863 ±	6,962	0.0004	0	0	0	0	961	4,902	0	0
Stichaeidae (blennies)		39 ±	22	<0.0001	0	12	4	5	1	17	0	0
Zoarcidae (eelpouts)		35,629 ±	13,695	0.0024	0	2	539	17,649	129	13,866	1,109	2,336
Other		103,955 ±	50,316	0.0069	35,885	32,046	3,468	13,416	5,498	7,005	3,851	2,785
Total		**11,727,572 ±**	**1,034,305**	**0.7761**	**1,691,496**	**635,633**	**2,856,567**	**3,197,420**	**500,891**	**2,229,750**	**348,296**	**267,519**

[1]Proportion of total estimated biomass is 15,110,496 t for fish and invertebrates in the EBS bottom trawl survey.

Table 7b. -- Biomass estimates (t) for major fish taxa collected during the 2019 northern Bering Sea shelf bottom trawl survey.

Taxon		Estimated total biomass (t) ± 95% confidence interval		Proportion of total animal biomass[1]	Estimated biomass by stratum (t)		
					70	71	81
Agonidae (poachers)		1,346 ±	432	0.0003	806	197	343
Cottidae (sculpins)		60,658 ±	12,117	0.0141	19,959	35,552	5,147
Cyclopteridae (lumpsuckers)		1 ±	1	<0.0001	0	1	0
Gadidae (cods)	Pacific cod	364,982 ±	108,086	0.0851	107,098	194,823	63,061
	walleye pollock	1,167,099 ±	261,959	0.2721	371,830	314,002	481,267
	other cods	81,316 ±	23,661	0.0190	12,722	68,577	16
	total Gadidae (cods)	1,613,398 ±	278,050	0.3762	491,650	577,402	544,345
Hexagrammidae (greenlings)		1,496 ±	1,000	0.0003	421	1,075	0
Liparidae (snailfishes)		777 ±	499	0.0002	132	310	335
Osmeridae (smelts)		4,891 ±	1,498	0.0011	2,472	2,413	6
Pleuronectidae (flatfishes)	Alaska plaice	321,571 ±	83,636	0.0750	194,627	59,887	67,057
	arrowtooth flounder	1,443 ±	1,380	0.0003	606	0	837
	Bering flounder	18,526 ±	7,099	0.0043	3,024	2,845	12,657
	flathead sole	463 ±	317	0.0001	131	0	332
	Kamchatka flounder	61 ±	123	<0.0001	0	0	61
	northern rock sole	99,040 ±	35,709	0.0231	50,914	8,425	39,701
	Pacific halibut	25,722 ±	11,549	0.0060	19,742	5,561	419
	yellowfin sole	520,029 ±	125,125	0.1213	370,724	64,381	84,925
	other flatfish	31,612 ±	10,812	0.0074	4,782	25,567	1,264
	total Pleuronectidae (flatfishes)	1,018,467 ±	151,926	0.2375	644,549	166,666	207,253
Rajidae (skates)	Alaska skate	95,102 ±	29,127	0.0222	58,911	21,950	14,241
	other skates	31 ±	25	<0.0001	29	1	0
	total Rajidae (skates)	95,132 ±	28,813	0.0222	58,940	21,951	14,241
Stichaeidae (blennies)		2,015 ±	902	0.0005	73	1,942	0
Zoarcidae (eelpouts)		1,707 ±	711	0.0004	40	962	705
Other		89,819 ±	57,678	0.0209	29,030	7,621	53,169
Total		**2,889,706 ±**	**325,334**	**0.6738**	**1,248,072**	**816,090**	**825,544**

[1]Proportion of total estimated biomass is 4,288,871 t for fish and invertebrates in the NBS bottom trawl survey.

Table 8a. -- Biomass estimates (t) for major invertebrate taxa collected during the 2019 eastern Bering Sea shelf bottom trawl survey. Crab data is summarized under other crustaceans and discussed in detail in the annual crab technical memorandum produced by the shellfish assessment program.

Taxon		Estimated total biomass (t) ± 95% confidence interval		Proportion of total animal biomass[1]	Estimated biomass by stratum (t)							
					10	20	30	40	50	60	82	90
Ascidiacea		131,126 ±	41,930	0.0087	9,386	2,592	55,437	63,705	0	4	1	0
Coelenterata		306,111 ±	109,038	0.0203	26,591	792	152,505	105,187	5,918	8,297	6,363	459
Crustacea	crabs	833,799 ±	110,775	0.0552	33,506	39,688	122,612	371,469	15,473	130,877	114,746	5,429
	shrimps	2,879 ±	1,474	0.0002	10	3	36	541	229	1,968	7	85
	other crustaceans	901 ±	564	<0.0001	580	2	16	110	116	77	0	0
	total Crustacea	837,579 ±	110,739	0.0554	34,096	39,693	122,663	372,120	15,819	132,921	114,753	5,514
Echinodermata	Asteroidea (sea stars)	1,125,743 ±	159,385	0.0745	359,952	156,929	203,981	199,243	997	195,340	3,389	5,913
	Echinoidea (sea urchins)	31,806 ±	26,685	0.0021	28	0	6,547	15,038	7,996	2,121	0	76
	Holothuroidea (sea cucumbers)	11,081 ±	8,099	0.0007	1,994	0	2,847	6,239	0	1	0	0
	Ophiuroidea (brittle stars)	403,292 ±	106,711	0.0267	23,414	2,448	90,845	108,997	736	174,528	1,907	418
	total Echinodermata	1,571,922 ±	193,684	0.1040	385,388	159,377	304,220	329,516	9,729	371,990	5,296	6,407
Mollusca	Gastropoda (snails)	457,590 ±	67,563	0.0303	8,955	6,522	134,946	160,652	7,522	131,424	2,240	5,329
	octopuses	5,930 ±	2,823	0.0004	0	0	136	690	4	4,924	104	71
	Pelecypoda (bivalves)	7,075 ±	2,996	0.0005	892	192	3,129	2,400	132	265	61	5
	squids	35 ±	31	<0.0001	0	0	0	0	0	35	0	0
	total Mollusca	470,630 ±	67,699	0.0311	9,847	6,714	138,210	163,742	7,659	136,647	2,405	5,405
Porifera (sponges)		59,803 ±	73,771	0.0040	1,093	215	57,790	234	252	219	0	0
Other		5,753 ±	2,388	0.0004	167	48	1,131	933	465	2,900	13	96
Total		**3,382,924 ±**	**271,615**	**0.2239**	**466,570**	**209,431**	**831,957**	**1,035,436**	**39,842**	**652,977**	**128,831**	**17,880**

[1]Proportion of total estimated biomass is 15,110,496 t for fish and invertebrates in the EBS bottom trawl survey.

Table 8b. -- Biomass estimates (t) for major invertebrate taxa collected during the 2019 northern Bering Sea shelf bottom trawl survey. Crab data is summarized under other crustaceans and discussed in detail in the annual crab technical memorandum produced by the shellfish assessment program.

Taxon		Estimated total biomass (t) ± 95% confidence interval		Proportion of total animal biomass[1]	Estimated biomass by stratum (t)		
					70	71	81
Ascidiacea		27,260 ±	10,327	0.0064	4,324	22,319	617
Coelenterata		102,213 ±	23,148	0.0238	43,785	49,662	8,766
Crustacea	crabs	330,602 ±	62,009	0.0771	87,522	100,833	142,246
	shrimps	2,436 ±	1,035	0.0006	78	2,341	17
	other crustaceans	2,969 ±	2,831	0.0007	1,614	1,355	0
	total Crustacea	336,008 ±	62,128	0.0783	89,214	104,530	142,263
Echinodermata	Asteroidea (sea stars)	499,084 ±	120,449	0.1164	195,812	293,994	9,277
	Echinoidea (sea urchins)	96,016 ±	87,260	0.0224	171	95,845	0
	Holothuroidea (sea cucumbers)	2,564 ±	3,735	0.0006	25	2,538	1
	Ophiuroidea (brittle stars)	39,802 ±	20,131	0.0093	3,660	30,052	6,089
	total Echinodermata	637,465 ±	150,060	0.1486	199,669	422,430	15,367
Mollusca	Gastropoda (snails)	193,855 ±	48,299	0.0452	82,541	82,900	28,414
	Pelecypoda (bivalves)	6,662 ±	4,533	0.0016	897	5,701	63
	other mollusks	292 ±	344	<0.0001	6	286	0
	total Mollusca	200,809 ±	48,579	0.0468	83,445	88,887	28,477
Porifera (sponges)		2,368 ±	1,681	0.0006	900	1,468	0
Other		93,061 ±	131,395	0.0217	134	92,925	3
Total		**1,399,184 ±**	**217,464**	**0.3262**	**421,471**	**782,220**	**195,493**

[1]Proportion of total estimated biomass is 4,288,871 t for fish and invertebrates in the NBS bottom trawl survey.

Table 9a. -- Total estimated biomass in metric tons (t) and the percent change between the 2017 and 2019 eastern Bering Sea shelf bottom trawl surveys for predominant fish and invertebrate taxa.

Fish taxon	2017	2019	Change (2019, 2017)	Invertebrate taxon	2017	2019	Change (2019, 2017)
great sculpin	50,668	91,875	81.3%	other sea stars	250,837	274,107	9.3%
other flatfishes	32,368	55,589	71.7%	hermit crabs	301,972	298,921	-1.0%
plain sculpin	33,962	50,402	48.4%	basket sea stars	326,069	305,923	-6.2%
arrowtooth flounder	424,194	578,390	36.4%	other crabs	572,178	534,878	-6.5%
Pacific herring	58,710	76,743	30.7%	all sea anemones	65,128	58,121	-10.8%
flathead sole	538,018	611,483	13.7%	other snails	473,578	405,435	-14.4%
walleye pollock	4,814,372	5,458,366	13.4%	purple-orange sea star	1,033,882	851,636	-17.6%
other sculpins	75,842	79,234	4.5%	all shrimps	4,977	2,879	-42.1%
Kamchatka flounder	48,084	44,870	-6.7%	all worms	10,068	5,753	-42.9%
Alaska skate	544,657	491,109	-9.8%	northern Neptune whelk	98,887	52,154	-47.3%
Pacific halibut	126,684	113,855	-10.1%	all tunicates	377,071	131,126	-65.2%
saffron cod	1,571	1,370	-12.8%	corals	4,229	871	-79.4%
all poachers	14,714	12,634	-14.1%				
Pacific cod	643,953	516,910	-19.7%				
shorthorn sculpin	11,305	8,795	-22.2%				
eelpouts	46,017	35,629	-22.6%				
Alaska plaice	491,050	368,787	-24.9%				
Greenland turbot	21,519	16,053	-25.4%				
northern rock sole	1,331,780	976,686	-26.7%				
yellowfin sole	2,787,687	2,006,505	-28.0%				
starry flounder	188,933	65,871	-65.1%				
Bering flounder	27,404	8,269	-69.8%				
Arctic cod	3,362	2	-100.0%				

Table 9b. -- Total estimated biomass in metric tons (t) and the percent change between the 2017 and 2019 northern Bering Sea shelf bottom trawl surveys for predominant fish and invertebrate taxa.

Fish taxon	2017	2019	Change (2019, 2017)	Invertebrate taxon	2017	2019	Change (2019, 2017)
arrowtooth flounder	0	1,443	Inf%	all worms	7,924	93,061	1,074.5%
Greenland turbot	59	424	618.8%	purple-orange sea star	331,261	414,423	25.1%
flathead sole	79	463	488.0%	basket sea stars	40,455	36,653	-9.4%
Pacific herring	34,914	87,918	151.8%	hermit crabs	162,368	139,243	-14.2%
great sculpin	2,013	3,804	88.9%	other sea stars	103,116	84,661	-17.9%
northern rock sole	55,466	99,040	78.6%	northern Neptune whelk	178,930	146,344	-18.2%
Pacific halibut	18,507	25,722	39.0%	other crabs	267,962	191,359	-28.6%
Pacific cod	287,535	364,982	26.9%	other snails	73,187	47,511	-35.1%
yellowfin sole	434,086	520,029	19.8%	all shrimps	4,118	2,436	-40.8%
plain sculpin	36,206	41,636	15.0%	all sea anemones	20,920	10,377	-50.4%
Alaska skate	83,255	95,102	14.2%	corals	8,519	2,823	-66.9%
saffron cod	76,238	81,269	6.6%	all tunicates	102,585	27,260	-73.4%
Alaska plaice	330,728	321,571	-2.8%				
Bering flounder	19,803	18,526	-6.5%				
walleye pollock	1,319,062	1,167,099	-11.5%				
starry flounder	31,430	26,472	-15.8%				
all poachers	2,027	1,346	-33.6%				
Kamchatka flounder	94	61	-35.2%				
other flatfishes	8,388	5,140	-38.7%				
eelpouts	9,759	1,707	-82.5%				
shorthorn sculpin	111,350	14,159	-87.3%				
other sculpins	8,379	1,058	-87.4%				
Arctic cod	3,906	47	-98.8%				

Table 10a. -- Mean CPUE by weight (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL) and upper (UCL) confidence limits for other common groundfish species for the 2019 eastern Bering Sea and northern Bering Sea shelf trawl surveys.

Species	Shelf area	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass	SD biomass	95% LCL	95% UCL	Hauls with weights	Hauls with counts	Hauls with lengths
walleye pollock	EBS	110.74	9.33	5,458,366	459,752	4,548,056	6,368,675	374	374	374
	NBS	58.69	6.55	1,167,099	130,215	909,274	1,424,925	132	132	132
Pacific cod	EBS	10.49	0.46	516,910	22,880	471,608	562,212	365	365	365
	NBS	18.35	2.70	364,982	53,728	257,527	472,438	114	114	114
yellowfin sole	EBS	40.71	4.28	2,006,505	210,761	1,584,984	2,428,027	270	270	270
	NBS	26.15	3.13	520,029	62,197	395,634	644,424	141	141	140
northern rock sole	EBS	19.82	1.86	976,686	91,628	795,263	1,158,108	320	320	318
	NBS	4.98	0.89	99,040	17,750	62,794	135,286	121	121	121
flathead sole	EBS	12.41	1.73	611,483	85,225	414,953	808,013	331	331	331
	NBS	0.02	0.01	463	157	145	781	15	15	14
Bering flounder	EBS	0.17	0.04	8,269	1,740	4,751	11,786	59	59	58
	NBS	0.93	0.18	18,526	3,529	11,394	25,657	92	92	91
Alaska plaice	EBS	7.48	0.59	368,787	29,038	311,292	426,282	277	277	277
	NBS	16.17	2.09	321,571	41,574	238,423	404,718	138	138	137
Greenland turbot	EBS	0.33	0.04	16,053	1,889	12,313	19,793	66	66	66
	NBS	0.02	0.01	424	183	57	790	6	6	6
arrowtooth flounder	EBS	11.73	0.78	578,390	38,298	502,559	654,220	284	284	284
	NBS	0.07	0.03	1,443	686	71	2,815	8	8	8
Kamchatka flounder	EBS	0.91	0.08	44,870	3,795	37,356	52,384	210	210	207
	NBS	0.00	0.00	61	61	0	184	1	1	1
Pacific halibut	EBS	2.31	0.15	113,855	7,634	98,739	128,970	244	244	244
	NBS	1.29	0.29	25,722	5,741	14,240	37,204	40	40	40
Bering skate	EBS	0.20	0.02	10,091	1,182	7,751	12,432	81	81	81
Alaska skate	EBS	9.96	0.48	491,109	23,902	443,784	538,434	348	348	348
	NBS	4.78	0.73	95,102	14,478	66,145	124,058	73	73	73
longhead dab	EBS	0.03	0.01	1,611	615	393	2,830	31	31	31
	NBS	0.10	0.03	2,004	588	828	3,181	54	54	53
starry flounder	EBS	1.34	0.29	65,871	14,460	36,951	94,790	78	78	78
	NBS	1.33	0.27	26,472	5,326	15,820	37,124	54	54	54
yellow Irish lord	EBS	0.84	0.40	41,561	19,893	0	88,607	85	85	84
	NBS	0.00	0.00	26	24	0	74	2	2	2
plain sculpin	EBS	1.02	0.09	50,402	4,226	42,034	58,770	163	163	163

Table 10a. -- Mean CPUE by weight (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL) and upper (UCL) confidence limits for other common groundfish species for the 2019 eastern Bering Sea and northern Bering Sea shelf trawl surveys.

Species	Shelf area	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass	SD biomass	95% LCL	95% UCL	Hauls with weights	Hauls with counts	Hauls with lengths
	NBS	2.09	0.25	41,636	5,023	31,591	51,682	110	110	110
great sculpin	EBS	1.86	0.32	91,875	15,532	60,812	122,938	193	193	193
	NBS	0.19	0.06	3,804	1,291	1,222	6,385	32	32	30
shorthorn sculpin	EBS	0.18	0.04	8,795	2,199	4,396	13,194	49	49	49
	NBS	0.71	0.17	14,159	3,351	7,387	20,931	46	46	46
Pacific ocean perch	EBS	0.11	0.07	5,400	3,355	0	12,042	16	16	16
rex sole	EBS	0.60	0.09	29,819	4,608	20,696	38,942	85	85	85
Sakhalin sole	EBS	0.00	0.00	62	56	0	174	2	2	2
	NBS	0.09	0.03	1,870	516	838	2,903	44	44	43
butterfly sculpin	EBS	0.00	0.00	8	8	0	23	1	1	1
	NBS	0.00	0.00	90	38	13	167	10	10	7
bigmouth sculpin	EBS	0.72	0.10	35,437	4,737	25,963	44,911	99	99	99
Arctic cod	EBS	0.00	0.00	2	2	0	5	1	1	1
	NBS	0.00	0.00	47	12	23	71	23	23	21
saffron cod	EBS	0.03	0.01	1,370	642	99	2,641	16	16	12
	NBS	4.09	0.60	81,269	11,919	57,432	105,106	78	78	76

Table 10b. -- Mean CPUE by number (no./ha) with standard deviation, and estimated population with standard deviation and 95% lower (LCL) and upper (UCL) confidence limits for other common groundfish species for the 2019 eastern Bering Sea shelf (EBS; 376 stations completed) and northern Bering Sea shelf (NBS; 144 stations completed) trawl surveys.

Species	Shelf area	Mean CPUE (no/ha)	SD CPUE	Estimated population	SD population	95% LCL	95% UCL	Hauls with weights	Hauls with counts	Hauls with lengths
walleye pollock	EBS	185.25	13.72	9,130,704,519	676,477,610	7,791,278,851	10,470,130,187	374	374	374
	NBS	146.12	13.64	2,905,734,172	271,219,719	2,368,719,128	3,442,749,216	132	132	132
Pacific cod	EBS	10.67	1.28	525,687,502	63,091,870	400,765,599	650,609,404	365	365	365
	NBS	10.17	1.15	202,148,480	22,889,512	156,369,456	247,927,503	114	114	114
yellowfin sole	EBS	129.14	12.95	6,365,104,936	638,448,497	5,088,207,942	7,642,001,929	270	270	270
	NBS	102.61	9.98	2,040,569,595	198,470,947	1,643,627,702	2,437,511,488	141	141	140
northern rock sole	EBS	115.15	9.26	5,675,779,712	456,187,402	4,772,528,656	6,579,030,769	320	320	318
	NBS	31.86	3.82	633,488,720	75,901,558	478,497,737	788,479,702	121	121	121
flathead sole	EBS	44.98	3.42	2,217,215,819	168,798,252	1,827,967,050	2,606,464,588	331	331	331
	NBS	0.12	0.03	2,406,853	683,773	1,024,947	3,788,758	15	15	14
Bering flounder	EBS	0.73	0.12	35,804,730	5,886,900	23,907,306	47,702,154	59	59	58
	NBS	6.13	0.97	121,825,445	19,318,332	82,783,097	160,867,793	92	92	91
Alaska plaice	EBS	10.13	0.83	499,173,854	41,024,911	417,944,531	580,403,177	277	277	277
	NBS	26.78	2.63	532,599,819	52,348,833	427,902,154	637,297,484	138	138	137
Greenland turbot	EBS	0.10	0.01	5,101,316	597,425	3,918,415	6,284,217	66	66	66
	NBS	0.01	0.00	219,909	87,060	45,790	394,029	6	6	6
arrowtooth flounder	EBS	20.57	1.60	1,014,099,126	79,090,252	857,500,427	1,170,697,824	284	284	284
	NBS	0.07	0.03	1,425,145	636,736	151,674	2,698,616	8	8	8
Kamchatka flounder	EBS	1.60	0.16	78,749,337	7,738,653	63,426,803	94,071,870	210	210	207
	NBS	0.00	0.00	83,515	83,515	0	250,545	1	1	1
Pacific halibut	EBS	1.51	0.12	74,458,928	5,820,142	62,935,047	85,982,810	244	244	244
	NBS	0.40	0.08	7,897,066	1,682,814	4,531,439	11,262,693	40	40	40
Bering skate	EBS	0.10	0.01	5,089,237	569,494	3,961,638	6,216,835	81	81	81
Alaska skate	EBS	2.09	0.10	102,980,250	4,841,627	93,393,828	112,566,672	348	348	348
	NBS	1.13	0.18	22,484,245	3,521,676	15,440,893	29,527,597	73	73	73
longhead dab	EBS	0.42	0.17	20,606,845	8,152,250	4,465,389	36,748,300	31	31	31
	NBS	1.83	0.61	36,374,387	12,135,273	12,103,840	60,644,933	54	54	53
starry flounder	EBS	0.85	0.17	42,120,120	8,178,274	25,763,571	58,476,669	78	78	78
	NBS	2.59	1.01	51,426,126	20,165,295	11,095,535	91,756,716	54	54	54
yellow Irish lord	EBS	1.05	0.51	51,818,635	25,041,009	0	111,040,622	85	85	84
	NBS	0.00	0.00	56,280	39,065	0	134,410	2	2	2

Table 10b. -- Mean CPUE by number (no./ha) with standard deviation, and estimated population with standard deviation and 95% lower (LCL) and upper (UCL) confidence limits for other common groundfish species for the 2019 eastern Bering Sea shelf (EBS; 376 stations completed) and northern Bering Sea shelf (NBS; 144 stations completed) trawl surveys.

Species	Shelf area	Mean CPUE (no/ha)	SD CPUE	Estimated population	SD population	95% LCL	95% UCL	Hauls with weights	Hauls with counts	Hauls with lengths
plain sculpin	EBS	1.23	0.11	60,493,435	5,313,520	49,972,665	71,014,205	163	163	163
	NBS	4.42	0.56	87,931,292	11,224,463	65,482,366	110,380,217	110	110	110
great sculpin	EBS	0.68	0.12	33,294,896	5,855,815	21,583,266	45,006,525	193	193	193
	NBS	0.25	0.13	4,972,386	2,486,808	0	9,946,003	32	32	30
shorthorn sculpin	EBS	0.12	0.03	6,060,811	1,574,107	2,912,597	9,209,024	49	49	49
	NBS	0.72	0.18	14,340,933	3,485,913	7,295,903	21,385,963	46	46	46
Pacific ocean perch	EBS	0.16	0.08	7,725,512	4,169,366	0	15,980,857	16	16	16
rex sole	EBS	2.05	0.31	101,077,852	15,137,857	71,104,895	131,050,808	85	85	85
Sakhalin sole	EBS	0.01	0.01	650,589	592,702	0	1,824,139	2	2	2
	NBS	1.40	0.38	27,838,431	7,620,852	12,596,727	43,080,136	44	44	43
butterfly sculpin	EBS	0.00	0.00	35,571	35,571	0	105,289	1	1	1
	NBS	0.03	0.01	586,885	212,151	158,127	1,015,643	10	10	7
bigmouth sculpin	EBS	0.15	0.02	7,463,654	909,217	5,645,219	9,282,089	99	99	99
Arctic cod	EBS	0.00	0.00	31,384	31,384	0	93,524	1	1	1
	NBS	0.08	0.02	1,595,610	410,769	774,071	2,417,149	23	23	21
saffron cod	EBS	0.28	0.13	13,931,153	6,495,349	1,070,362	26,791,944	16	16	12
	NBS	64.55	9.06	1,283,561,599	180,140,955	923,279,689	1,643,843,509	78	78	76

Summary of Results for Selected Eastern Bering Sea and Northern Bering Sea Fish and Invertebrate Fauna

An interactive map of species CPUE can be found at https://apps-st.fisheries.noaa.gov/dismap/. The CPUE data with associated station information including position, surface and bottom temperatures, and bottom depth can be downloaded from the NOAA Fisheries One Stop Shop data platform (FOSS; https://www.fisheries.noaa.gov/foss/f?p=215:200:1099772399154:Mail:NO:::). Users can interactively select, view, and download data on the platform for this survey and others.

Selected Fish Species Estimates

Plots of the spatial distribution and tables of CPUE (kg/hectare and no./hectare) for 35 major fish species caught during the EBS and NBS continental shelf survey are presented in the subsections below (Figs. 9a to 58 and Tables 11a to 47b). Differences in sums of estimates and totals are due to rounding. Total abundance-at-length and mean length estimates for major fish species are also presented in the subsections below (Figs. 10 to 34). Appendix Tables C1 to D10 contain population estimates by sex and size class for 11 fish species.

Selected Invertebrates Estimates

Plots of spatial distribution and tables of CPUE (kg/hectare and no./hectare) for two major invertebrate species caught during the EBS and NBS continental shelf are presented below (Figs. 58 and 59 and Tables 47a and 47b). Differences in sums of estimates and totals are due to rounding. The crab species listed in this report and others are discussed and analyzed in more detail in a report prepared by the AFSC Shellfish Assessment Program (Zacher et al. 2019).

The purple-orange sea star (Asterias amurensis) is common in the Bering and Chukchi seas (Feder et al., 2005; Hamazaki et al., 2005) and was the invertebrate taxon with the highest catch rate by weight in the EBS and NBS (Tables 9a and 9b). Catch rates for the purple-orange sea star were highest in the inner shelf (Figure 58 and Tables 47a and 47b).

Detailed information on bottom trawl survey results for commercial crab species are reported elsewhere (Chilton et al., 2011; Lang et al., 2018; Zacher et al., 2019). Commercial crab stocks are managed by the ADF&G with federal oversight by NOAA Fisheries. The most recent modeling results on the status of these commercial crab stocks are reported in the annual Stock Assessment and Fishery Evaluation report prepared by the NPFMC (The Plan Team for the Groundfish Fisheries of the Bering Sea and Aleutian Islands 2019).

Walleye Pollock (*Gadus chalcogrammus*)

During the 2019 survey, walleye pollock were present at 99.5% of EBS stations and 91.7% of NBS stations. Spatial patterns of pollock distribution during the summer trawl survey have varied considerably in response to cold (Figs. 7a and 9a) and warm (Figs. 7b and 9b) stanzas. During the colder years (2006 to 2013, the highest densities of pollock were observed along the outer half of the EBS shelf (> 70 m) and the lowest densities of pollock were along the inner half of the shelf, as well as throughout the NBS when it was first surveyed in 2010 (Figs. 7a and 9a). Since 2014, and during the warm stanza from 2002 to 2005, pollock were more spread out across the shelf compared to cold years. In these instances, high catch densities sometimes reached into the inner domain close to Nunivak Island and up against the northern edge of the standard EBS survey area (Fig. 9b). These distribution patterns are consistent with shoreward and northward feeding migrations typical of pollock during the spring and summer (Kotwicki et al. 2005). Similar warm stanza distribution patterns were observed in 2019 (Fig. 9b).

In the EBS during 2019, walleye pollock were found in depths between 21 m and 176 m, and at bottom temperatures between -0.3°C and 9.7°C. In 2019, walleye pollock biomass in the EBS was concentrated in the middle domain with additional concentrations in the outer domain to the south, west, and north of the Pribilof Islands (Fig. 9b). Since 2002, the EBS shelf survey biomass estimate for walleye pollock has varied dramatically. Compared with 2017 (4.8 million t), walleye pollock biomass in 2019 (5.5 million t) in the EBS experienced a 13% increase (Table 9a).

In the NBS during 2019, walleye pollock were found in depths between 12 m and 80 m, and at bottom temperatures between 2.7°C and 14.2°C. In 2019, walleye pollock biomass in the NBS was concentrated south of St. Lawrence, and in the Chirikov Basin just south of the Bering Strait (Fig. 9b). Walleye pollock estimated biomass in 2019 (1.2 million t) was similar to that observed in 2017 (1.3 million t) (Table 9b). These biomass estimates of walleye pollock for 2017 and 2019 are much higher than observed in the NBS in 2010 (21,141 t).

The vertical availability of pollock to the survey trawl depends on environmental factors and can be affected by bottom depth, light conditions, fish size, and fish density (Kotwicki et al. 2014; Kotwicki et al. 2015). Pollock in the 20-35 cm size range (representing 2-3 year-olds) are generally absent or in low abundance from survey catch samples in both the EBS and NBS (Fig. 10) because they typically occupy a position much higher in the water column where they are unavailable to the survey trawl (Kotwicki et al. 2015).

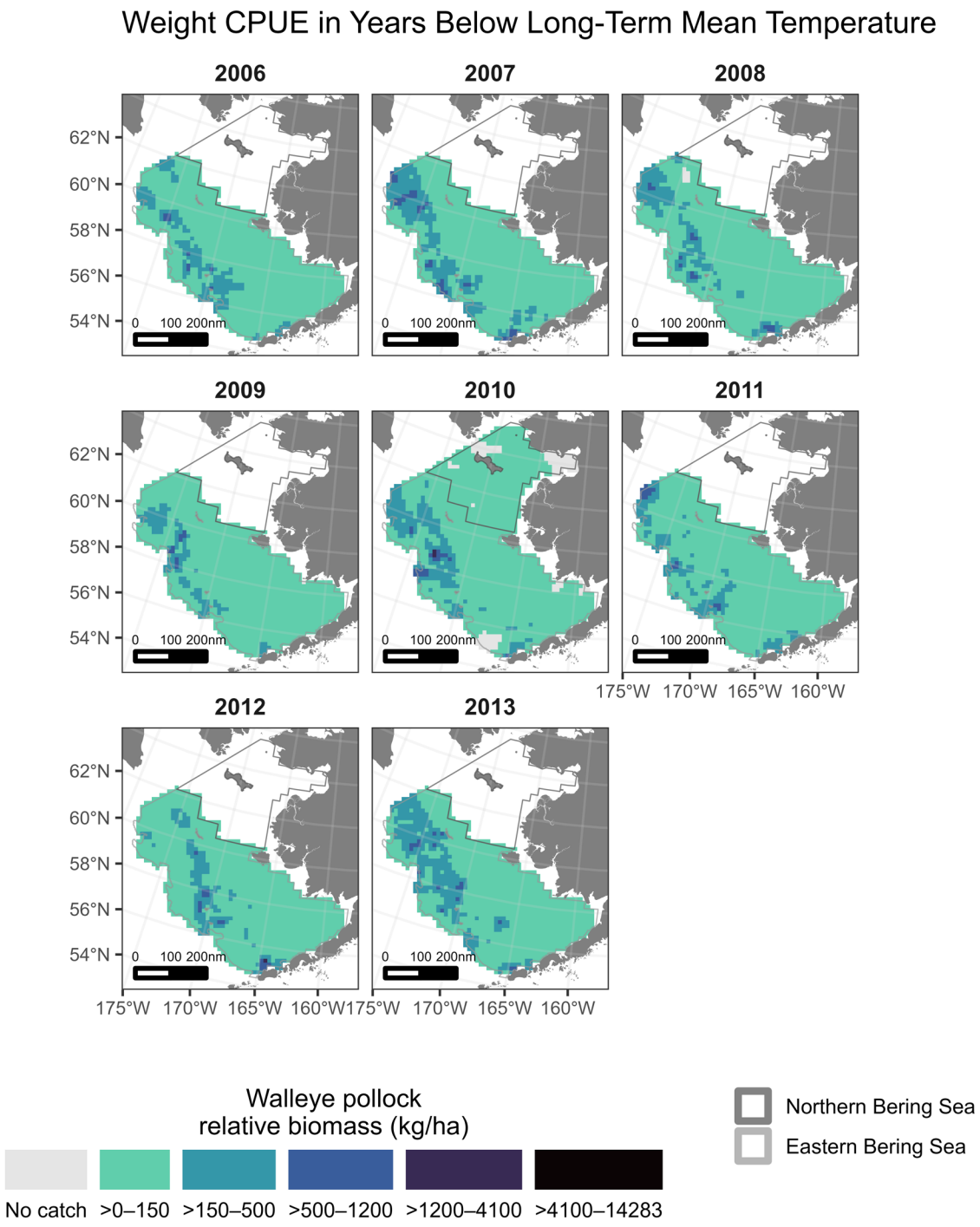

Figure 9a. -- Walleye pollock (*Gadus chalcogrammus*) distribution and weight CPUE (kg/ha) in years when the survey mean bottom temperature was below the long-term mean 2006, 2007, 2008, 2009, 2010, 2011, 2012, and 2013 during the Bering Sea shelf bottom trawl surveys.

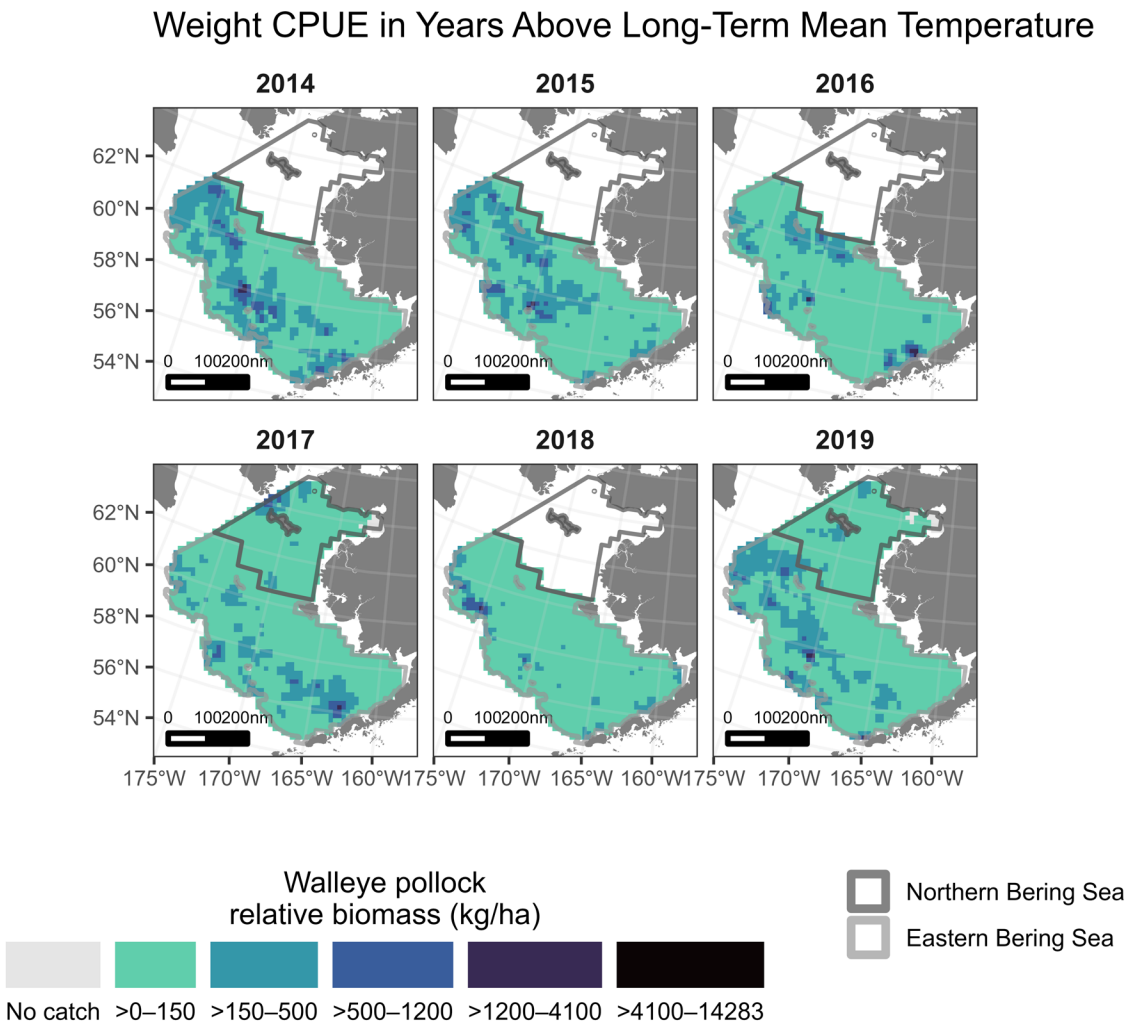

Figure 9b. -- Walleye pollock (*Gadus chalcogrammus*) distribution and weight CPUE (kg/ha) in years when the survey mean bottom temperature was above the long-term mean 2014, 2015, 2016, 2017, 2018, and 2019 during the Bering Sea shelf bottom trawl surveys.

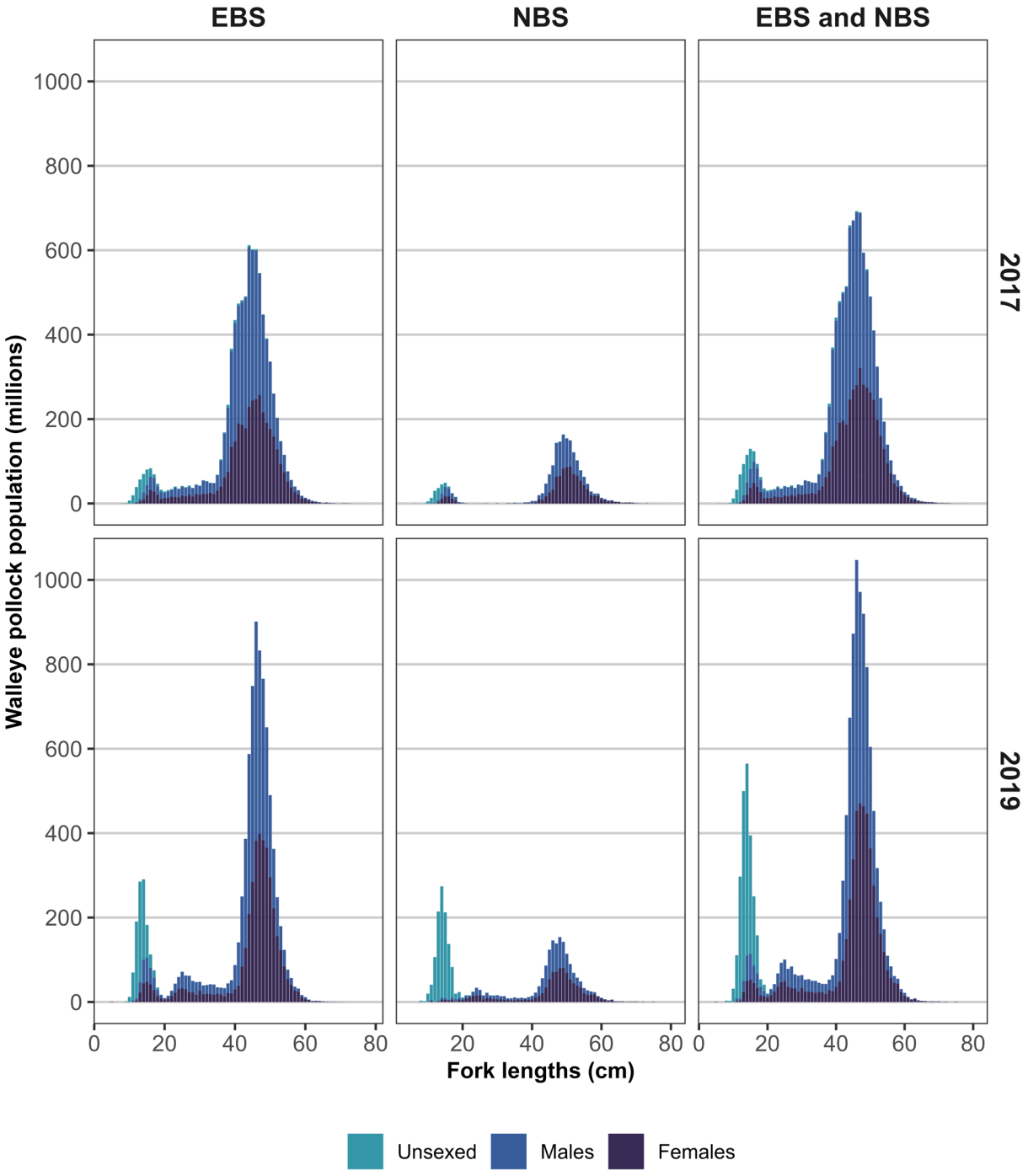

Figure 10. -- Total abundance-at-length estimates of walleye pollock (*Gadus chalcogrammus*) by sex (males, females, and unsexed) observed during the 2017 and 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 11a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (thousand t) with standard deviation (thousands) and 95% lower (LCL; thousand t) and upper (UCL; thousand t) confidence limits for walleye pollock (*Gadus chalcogrammus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (thousand t)	SD biomass (thousands)	95% LCL (thousand t)	95% UCL (thousand t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	7.81	2.05	60.85	15.97	28.57	93.13	58	58	58
20	7.74	1.76	31.77	7.24	16.96	46.57	31	31	31
31	126.74	28.11	1,198.05	265.68	666.70	1,729.40	69	69	69
32	100.02	63.07	87.75	55.34	0.00	218.63	8	8	8
41	170.26	26.72	1,067.57	167.57	728.91	1,406.23	44	44	44
42	230.57	89.84	553.62	215.71	112.49	994.76	30	30	30
43	116.74	13.37	246.41	28.23	187.53	305.29	22	22	22
50	48.25	21.65	187.17	83.98	13.83	360.51	25	25	25
61	156.42	23.73	1,378.62	209.14	955.95	1,801.28	60	60	60
62	252.09	125.58	162.06	80.73	0.00	369.62	7	7	7
82	146.92	35.39	263.77	63.54	123.92	403.63	12	12	12
90	190.80	22.28	220.72	25.78	159.76	281.68	8	8	8
Total	**110.74**	**9.33**	**5,458.37**	**459.75**	**4,548.06**	**6,368.68**	**374**	**374**	**374**
NBS									
70	46.91	10.91	371.83	86.50	197.02	546.64	58	58	58
71	38.65	9.98	314.00	81.05	150.21	477.79	46	46	46
81	125.49	14.06	481.27	53.90	370.66	591.88	28	28	28
Total	**58.69**	**6.55**	**1,167.10**	**130.21**	**909.27**	**1,424.92**	**132**	**132**	**132**

Table 11b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (millions) with standard deviation (millions) and 95% lower (LCL; millions) and upper (UCL; millions) confidence limits for walleye pollock (*Gadus chalcogrammus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (millions)	SD population (millions)	95% LCL (millions)	95% UCL (millions)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	53.87	26.87	419.46	209.21	0.00	842.27	58	58	58
20	55.73	18.95	228.65	77.73	69.69	387.61	31	31	31
31	174.56	32.34	1,650.07	305.68	1,038.71	2,261.43	69	69	69
32	139.25	90.17	122.18	79.12	0.00	309.30	8	8	8
41	320.31	48.13	2,008.46	301.82	1,398.48	2,618.44	44	44	44
42	317.95	124.78	763.44	299.61	150.74	1,376.13	30	30	30
43	197.18	24.85	416.20	52.46	306.78	525.63	22	22	22
50	61.14	27.18	237.16	105.45	19.52	454.80	25	25	25
61	229.78	31.00	2,025.13	273.25	1,472.90	2,577.37	60	60	60
62	387.08	200.37	248.84	128.81	0.00	580.01	7	7	7
82	357.27	79.37	641.44	142.51	327.78	955.10	12	12	12
90	319.56	36.84	369.67	42.62	268.88	470.46	8	8	8
Total	**185.25**	**13.72**	**9,130.70**	**676.48**	**7,791.28**	**10,470.13**	**374**	**374**	**374**
NBS									
70	166.30	22.05	1,318.08	174.76	964.89	1,671.27	58	58	58
71	70.56	15.95	573.25	129.61	311.31	835.19	46	46	46
81	264.50	42.22	1,014.40	161.93	682.12	1,346.68	28	28	28
Total	**146.12**	**13.64**	**2,905.73**	**271.22**	**2,368.72**	**3,442.75**	**132**	**132**	**132**

Pacific Cod (*Gadus macrocephalus*)

Pacific cod are a highly mobile, semi-pelagic fish whose spatial distribution can vary with bottom temperature and abundance (Kotwicki and Lauth 2013). During the 2019 survey, Pacific cod were present at 97.1% of stations in the EBS and 79.2% of stations in the NBS. Pacific cod were generally absent from the northern middle domain during the cold stanza and concentrated along the perimeter of the cold pool where bottom temperatures were greater than 0°C (Fig. 11a). During the cold stanza in 2010, Pacific cod were caught at 44% of the NBS stations. Densities were relatively low compared to the warm stanza in 2017, when Pacific cod were caught at 78% of the NBS stations, with areas of highest density in the Chirikov Basin and just south of St. Lawrence Island (Fig. 11b). During the previous warm stanza from 2002 to 2005, the highest densities of Pacific cod were observed in the northern half of the EBS survey area surrounding the Pribilofs and St. Matthew Island and the lowest densities were in the southeastern EBS (Fig. 11b). A similar pattern in the EBS was observed in 2017, 2018 and 2019. However, 2017 was preceded by three warm years when Pacific cod abundance and biomass were relatively high and large aggregations were present in the middle and inner domains close to the northern border between the EBS and NBS survey areas (Fig. 11b). During the latter warm stanza, higher than average bottom temperatures in the southeastern shelf created thermal corridors (between 1° and 6°C) for Pacific cod to move into the middle and inner domains, where they likely fed on capelin (Ciannelli and Bailey 2005). Forage fish species such as capelin, Pacific herring, and smelt were found in high density in the inner domain (Figs. 52, 53, and 54). A change was observed in the estimates of survey biomass and abundance at length that accompanied the northerly shift in Pacific cod distribution in the 2017 survey.

In 2019, Pacific cod comprised 3% (516,910 t, 9a) of the EBS survey biomass. Compared with 2017 (643,953 t), Pacific cod biomass in 2019 (516,910 t) in the EBS experienced a 20% decrease (Table 9a). In the EBS in 2019, Pacific cod were found in waters with depths between 21 m and 176 m, and at bottom temperatures as warm as 9.3°C and as cold as -0.3°C. The fork lengths of Pacific cod measured during the 2019 EBS survey were between 4 and 112 cm.

In the NBS during 2019, Pacific cod were found in waters with depths between 21 m and 80 m, and at bottom temperatures as warm as 12.5°C and as cold as -0.6°C. The fork lengths of Pacific cod measured during the 2019 NBS survey were between 5 and 102 cm. In 2019, Pacific cod biomass in the NBS was concentrated to the southeast of St. Lawrence, and in the Chirikov Basin just south of the Bering Strait (Fig. 11b). Compared with 2017 (287,535 t), Pacific cod biomass in 2019 (364,982 t) in the NBS experienced a 27% increase (Table 9b). Previously, Pacific cod biomass in 2017 experienced an 887% increase when compared to biomass in 2010 (29,124 t).

From 2010 to 2016, the estimated survey biomass and abundance of Pacific cod in the EBS shelf continued to increase reaching maximums of 1.1 million t (2014-2015) and 1.1 trillion cod (2014). However, in 2017, both biomass and abundance declined to 0.64 million t and 364 billion cod. This decline in the EBS biomass was accompanied by an increase in the NBS survey biomass (0.3 million t) and abundance (133 million) in 2010. Moreover, unlike in 2010, the NBS population in 2017 and 2019 had almost an identical size composition to that of the EBS (Fig. 12). The decreased Pacific cod abundance in the EBS, along with the concomitant increase of the same-sized Pacific cod in the adjacent NBS, was likely a result of migration from the EBS (Stevenson and Lauth 2019). These migrations to the NBS were potentially already taking place prior to 2017, as high densities of Pacific cod were observed along the northern edge of the EBS survey area during 2014-2016.

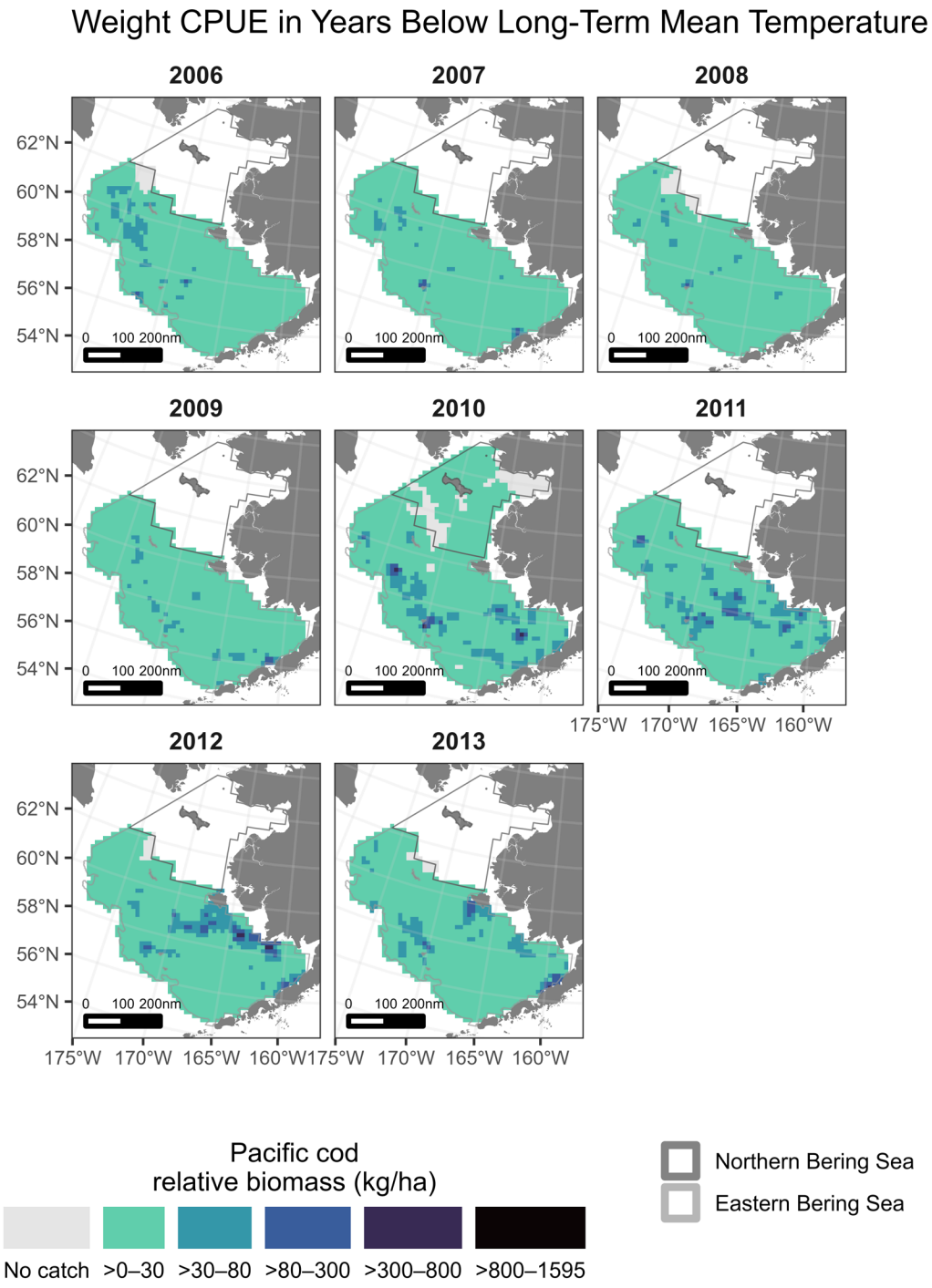

Figure 11a. -- Pacific cod (*Gadus macrocephalus*) distribution and weight CPUE (kg/ha) in years when the survey mean bottom temperature was below the long-term mean 2006, 2007, 2008, 2009, 2010, 2011, 2012, and 2013 during the Bering Sea shelf bottom trawl surveys.

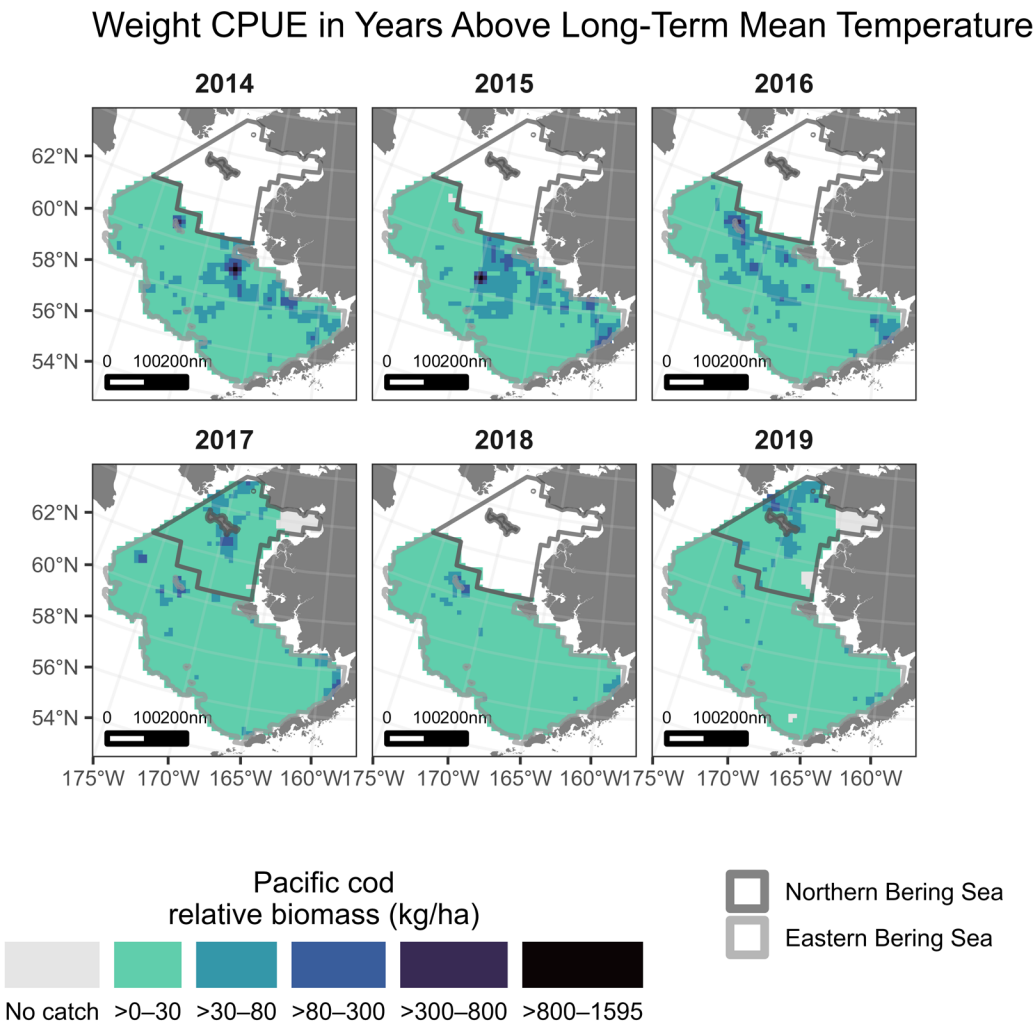

Figure 11b. -- Pacific cod (*Gadus macrocephalus*) distribution and weight CPUE (kg/ha) in years when the survey mean bottom temperature was above the long-term mean 2014, 2015, 2016, 2017, 2018, and 2019 during the Bering Sea shelf bottom trawl surveys.

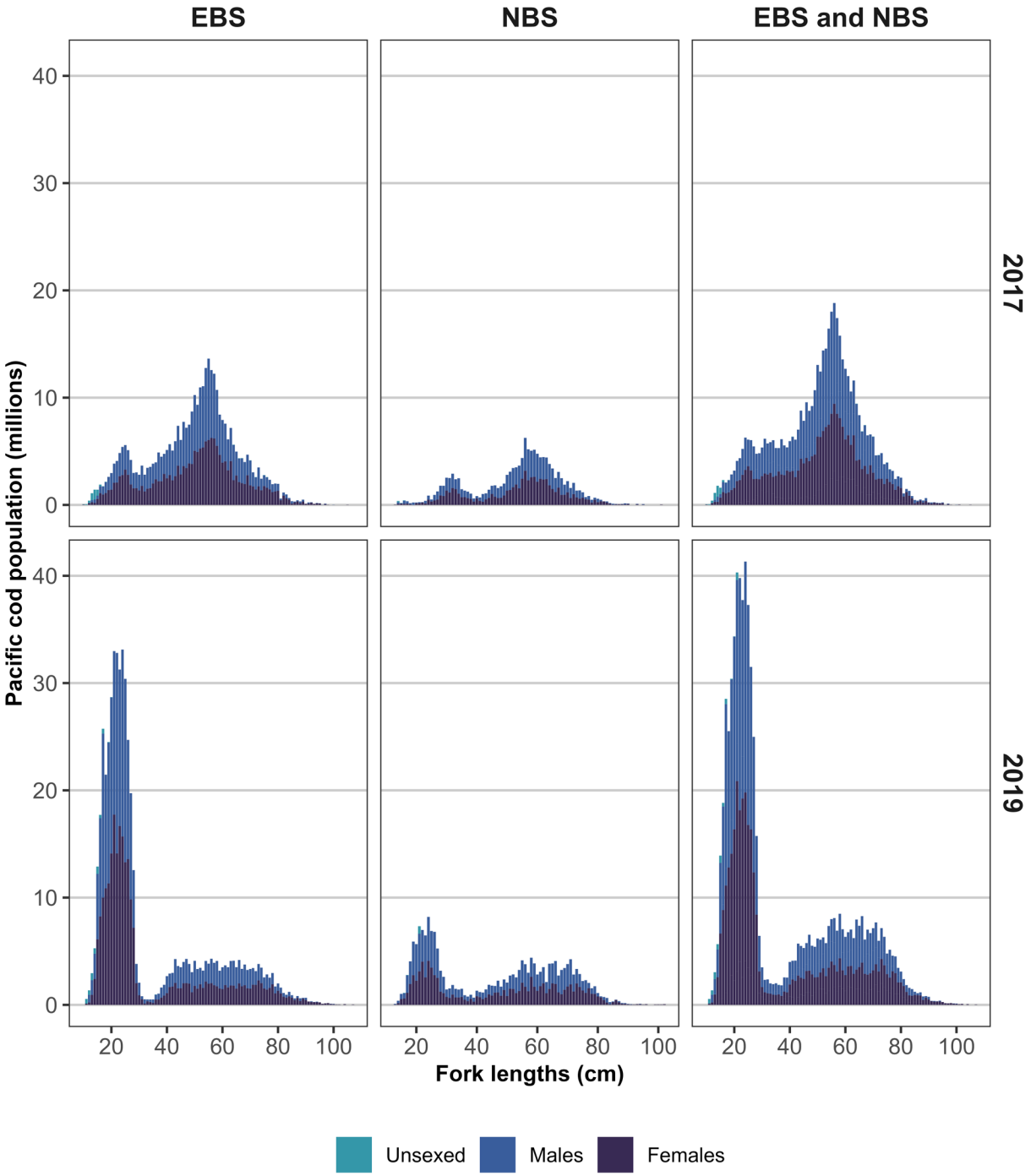

Figure 12. -- Total abundance-at-length estimates of Pacific cod (*Gadus macrocephalus*) by sex (males, females, and unsexed) observed during the 2017 and 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 12a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (thousand t) with standard deviation and 95% lower (LCL; thousand t) and upper (UCL; thousand t) confidence limits for Pacific cod (*Gadus macrocephalus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (thousand t)	SD biomass	95% LCL (thousand t)	95% UCL (thousand t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	9.09	1.50	70.75	11,645	47.21	94.28	56	56	56
20	5.69	0.95	23.36	3,896	15.39	31.32	31	31	31
31	11.18	1.27	105.69	11,979	81.73	129.65	69	69	69
32	10.91	1.94	9.57	1,703	5.55	13.60	8	8	8
41	15.59	1.57	97.74	9,819	77.90	117.59	44	44	44
42	12.00	1.46	28.80	3,515	21.61	35.99	31	31	31
43	18.44	1.96	38.93	4,130	30.31	47.54	22	22	22
50	4.21	1.14	16.34	4,415	7.25	25.44	18	18	18
61	9.39	0.81	82.73	7,147	68.28	97.17	59	59	59
62	10.86	1.44	6.98	927	4.71	9.25	7	7	7
82	13.90	2.85	24.96	5,125	13.68	36.24	12	12	12
90	9.56	1.44	11.06	1,670	7.11	15.01	8	8	8
Total	**10.49**	**0.46**	**516.91**	**22,880**	**471.61**	**562.21**	**365**	**365**	**365**
NBS									
70	13.51	2.01	107.10	15,944	74.88	139.32	46	46	46
71	23.98	6.20	194.82	50,405	92.95	296.69	40	40	40
81	16.44	2.50	63.06	9,583	43.36	82.76	28	28	28
Total	**18.35**	**2.70**	**364.98**	**53,728**	**257.53**	**472.44**	**114**	**114**	**114**

Table 12b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (millions) with standard deviation (thousands) and 95% lower (LCL; millions) and upper (UCL; millions) confidence limits for Pacific cod (*Gadus macrocephalus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (millions)	SD population (thousands)	95% LCL (millions)	95% UCL (millions)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	27.85	4.80	216.84	37,396.91	141.26	292.41	56	56	56
20	14.20	2.34	58.26	9,590.55	38.65	77.87	31	31	31
31	14.17	5.21	133.90	49,249.45	35.40	232.40	69	69	69
32	3.46	0.47	3.03	416.44	2.05	4.02	8	8	8
41	5.58	0.54	34.99	3,371.50	28.17	41.80	44	44	44
42	8.35	2.18	20.05	5,246.01	9.33	30.78	31	31	31
43	9.20	1.92	19.42	4,055.25	10.96	27.88	22	22	22
50	1.55	0.42	6.01	1,643.89	2.62	9.39	18	18	18
61	2.43	0.22	21.43	1,940.76	17.50	25.35	59	59	59
62	2.93	0.48	1.88	305.90	1.13	2.63	7	7	7
82	4.12	0.86	7.40	1,541.02	4.01	10.79	12	12	12
90	2.15	0.31	2.48	353.80	1.65	3.32	8	8	8
Total	**10.67**	**1.28**	**525.69**	**63,091.87**	**400.77**	**650.61**	**365**	**365**	**365**
NBS									
70	12.96	1.81	102.74	14,316.54	73.80	131.67	46	46	46
71	9.04	2.15	73.49	17,496.07	38.13	108.85	40	40	40
81	6.76	0.93	25.93	3,585.25	18.56	33.30	28	28	28
Total	**10.17**	**1.15**	**202.15**	**22,889.51**	**156.37**	**247.93**	**114**	**114**	**114**

Yellowfin Sole (*Limanda aspera*)

Yellowfin sole is a target of the largest commercial flatfish fishery in the world (Wilderbuer et al. 2018) and is one of the most abundant flatfish species in the EBS (Table 7a) and NBS (Table 7b). In 2019, the population was distributed along the inner and middle domain of the Bering Sea between Norton Sound and the Alaska Peninsula; the population also shifted more towards the inner domain in 2017 than in 2019 (Fig. 13). The total estimated survey biomass in the EBS was 2.0 million t in 2019, which was a 28% decrease from 2017 (2.8 million t; Table 13a). The 2019 NBS proportion of yellowfin biomass (10%) was less than the 2017 NBS proportion of yellowfin biomass (12%). The estimated 2019 survey abundance of EBS yellowfin sole was 6.4 billion yellowfin sole, which is a 34% decrease from 2017 (9.7 billion). The 2019 EBS and NBS size composition estimates show prevalent size modes of yellowfin sole at 10-25 cm and 30-40 cm with a higher proportion of smaller yellowfin sole in the NBS and a higher proportion of the larger ones in the EBS (Fig. 14).

The cross-shelf distribution of yellowfin sole, and the availability of sexually mature males and females to the summer bottom trawl survey, varies from year to year because of temperature-mediated differences in their spring-summer spawning migration into shallow waters (Nichol et al. 2019), where most spawning activity occurs at bottom depths less than 30 m (Nichol 1995) outside of the minimum bottom trawl survey depth (50 m). Size segregation among spawning and non-spawning portions of the population can also affect the spatial distribution of yellowfin sole (Nichol et al. 2019). This segregation occurs because length or age at sexual maturity differs for males and females (Nichol 1998) and sexually immature individuals undergo a gradual (multi-year) ontogenetic migration away from the nearshore that differs from the annual spawning migrations of mature individuals (Nichol 1997). Interannual differences in the proportion of the yellowfin sole population that is available to the EBS survey, as well as the sex and size composition of this available population may bias survey estimates. Bottom temperature and the survey start date are both used in the stock assessment model to adjust the catchability (q) parameter (Wilderbuer et al. 2018; Nichol et al. 2019).

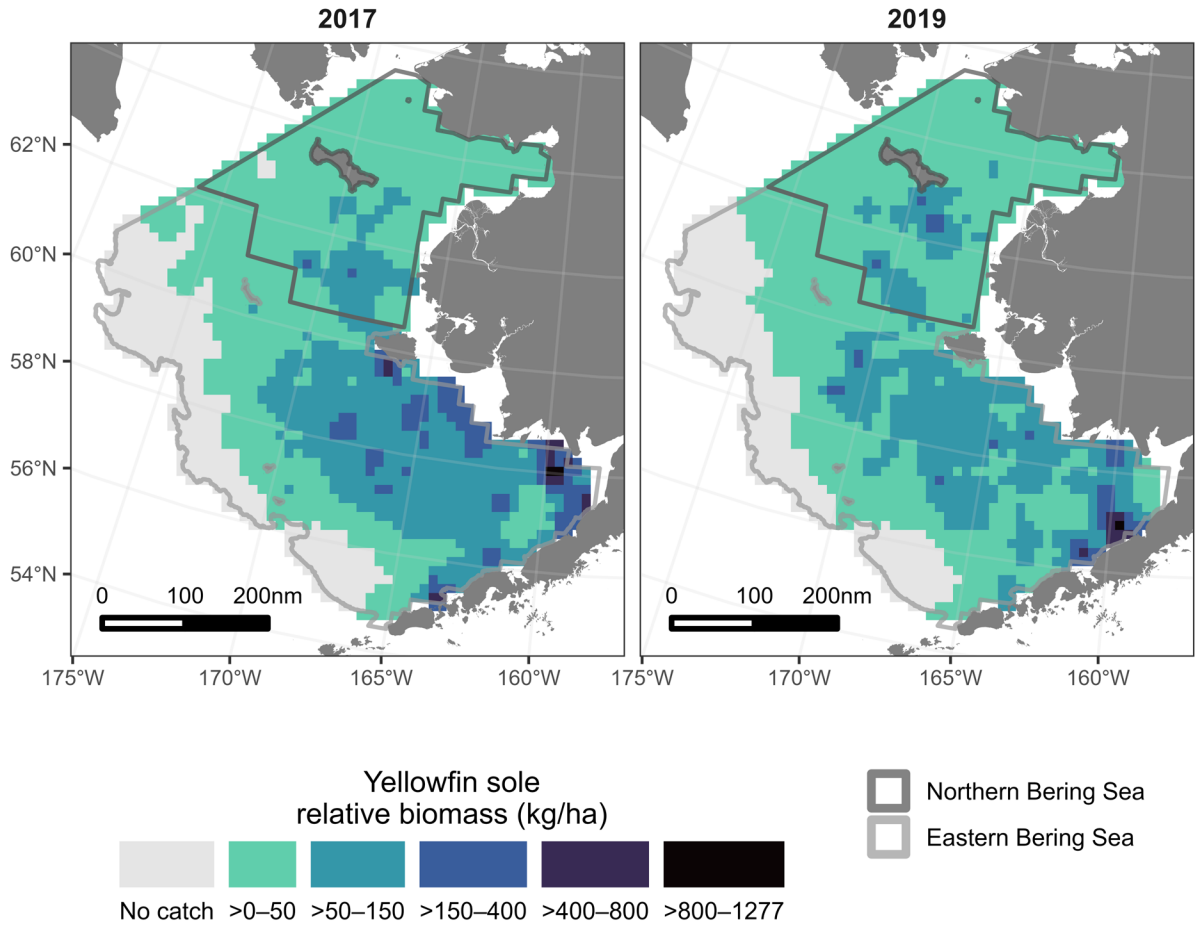

Figure 13. -- Yellowfin sole (*Limanda aspera*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

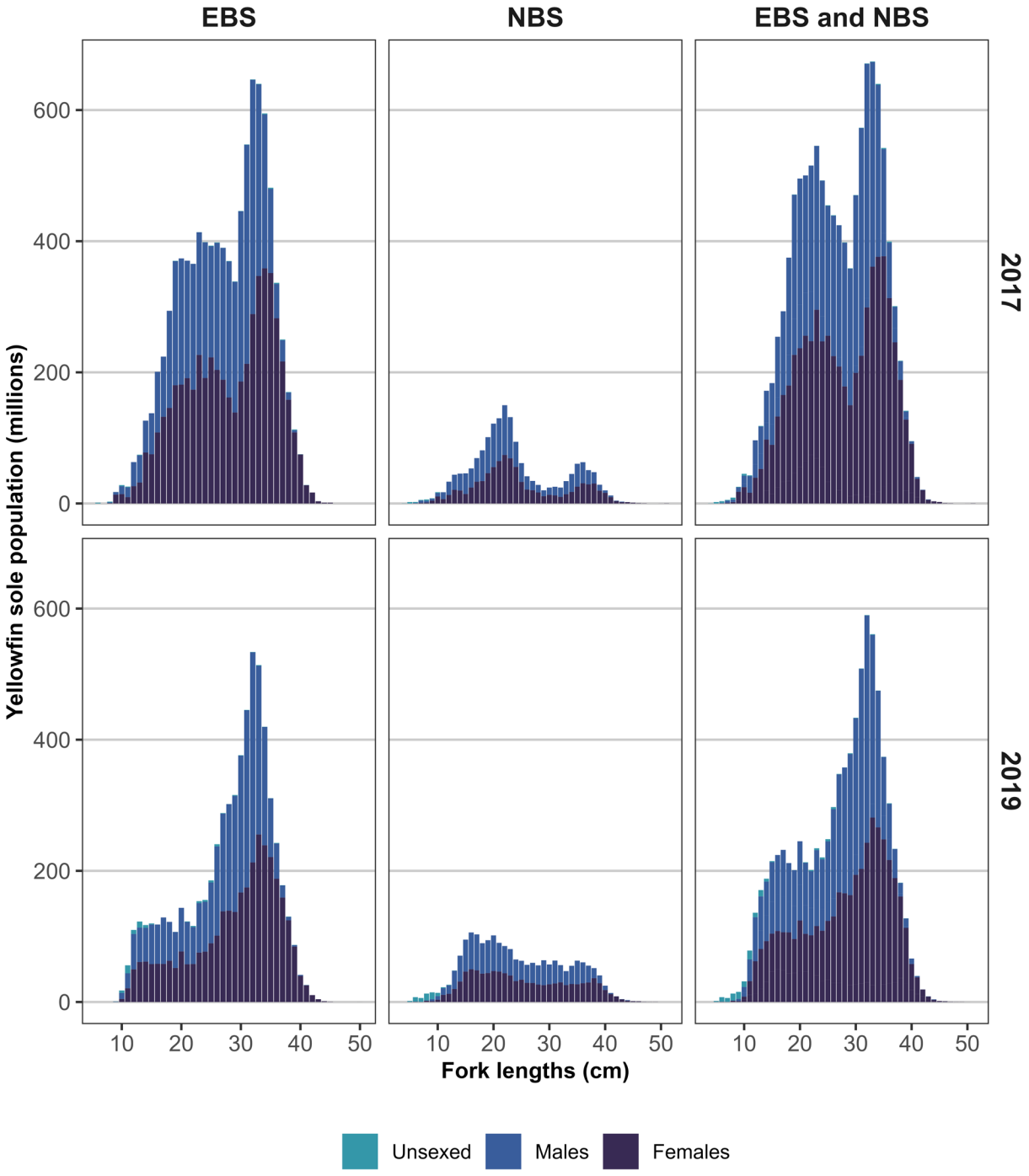

Figure 14. -- Total abundance-at-length estimates of yellowfin sole (*Limanda aspera*) by sex (males, females, and unsexed) observed during the 2017 and 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 13a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for yellowfin sole (*Limanda aspera*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	107.83	24.69	839,682	192,287	451,070	1,228,293	58	58	58
20	66.63	6.22	273,368	25,503	221,291	325,445	31	31	31
31	52.64	6.71	497,603	63,453	370,697	624,508	66	66	66
32	17.55	4.95	15,403	4,341	5,136	25,669	8	8	8
41	45.15	8.07	283,078	50,599	180,817	385,339	42	42	42
42	29.11	5.07	69,905	12,185	44,987	94,822	27	27	27
43	9.74	2.82	20,561	5,944	8,198	32,924	22	22	22
50	0.04	0.04	174	174	0	533	1	1	1
61	0.02	0.02	180	180	0	545	1	1	1
62	0.31	0.27	202	172	0	622	2	2	2
82	3.46	1.38	6,208	2,473	765	11,651	11	11	11
90	0.12	0.12	142	142	0	490	1	1	1
Total	**40.71**	**4.28**	**2,006,505**	**210,761**	**1,584,984**	**2,428,027**	**270**	**270**	**270**
NBS									
70	46.77	6.04	370,724	47,879	273,960	467,487	58	58	58
71	7.92	1.68	64,381	13,630	36,834	91,927	55	55	54
81	22.14	9.72	84,925	37,287	8,412	161,438	28	28	28
Total	**26.15**	**3.13**	**520,029**	**62,197**	**395,634**	**644,424**	**141**	**141**	**140**

Table 13b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for yellowfin sole (*Limanda aspera*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	402.63	76.38	3,135,335.79	594,748.56	1,933,348.94	4,337,322.63	58	58	58
20	244.41	22.64	1,002,756.82	92,891.61	813,072.15	1,192,441.49	31	31	31
31	143.61	18.65	1,357,513.05	176,334.27	1,004,844.50	1,710,181.60	66	66	66
32	32.87	8.56	28,841.76	7,512.29	11,075.19	46,608.32	8	8	8
41	102.82	18.39	644,736.66	115,336.49	411,641.60	877,831.71	42	42	42
42	59.22	10.60	142,184.61	25,445.40	90,148.75	194,220.46	27	27	27
43	19.18	5.51	40,479.71	11,638.73	16,271.15	64,688.27	22	22	22
50	0.07	0.07	285.39	285.39	0.00	873.29	1	1	1
61	0.02	0.02	194.84	194.84	0.00	588.60	1	1	1
62	0.67	0.61	429.75	390.63	0.00	1,385.62	2	2	2
82	6.74	2.83	12,106.31	5,079.70	925.88	23,286.73	11	11	11
90	0.21	0.21	240.26	240.26	0.00	828.17	1	1	1
Total	**129.14**	**12.95**	**6,365,104.94**	**638,448.50**	**5,088,207.94**	**7,642,001.93**	**270**	**270**	**270**
NBS									
70	169.68	18.13	1,344,920.96	143,661.61	1,054,580.84	1,635,261.08	58	58	58
71	59.69	11.51	484,974.50	93,506.76	295,997.34	673,951.65	55	55	54
81	54.93	26.09	210,674.13	100,042.71	5,386.49	415,961.77	28	28	28
Total	**102.61**	**9.98**	**2,040,569.59**	**198,470.95**	**1,643,627.70**	**2,437,511.49**	**141**	**141**	**140**

Northern Rock Sole (*Lepidopsetta polyxystra*)

In 2019, the highest densities of northern rock sole were observed in the southeast portion of the inner domain, in the vicinity of the Pribilof and St. Matthew islands, and along the Alaska Peninsula (Fig. 15). Although very few bottom temperatures below 2°C were recorded during the 2019 surveys, and those that were recorded were restricted to the very northern area of the EBS survey area, historically relatively low densities of northern rock sole have been observed where bottom temperatures were < 1°C in the middle and outer domains (Fig. 15 and Tables 14a and 14b). In years such as 2010, when the cold pool was large and touched the western tip of Nunivak Island (Fig. 11a), the highest concentrations of rock sole were in the southwest EBS shelf (Fig. 15). In warmer years, such as 2017 and 2019, when bottom temperatures along the inner domain were much higher and there was an area in the middle domain where bottom temperatures were > 1°C (Fig. 11b), high densities of rock sole were farther north around Nunivak Island and southeast of St. Lawrence Island.

Survey estimates of northern rock sole biomass and population in the EBS have declined between 2010 (2.1 million t and 9.3 billion) and 2019 (976 thousand t and 5.67 billion; Tables 14a and 14b). In contrast, biomass and population have increased in the NBS from 2010 (21 thousand t and 41 million) to 2019 (99 thousand t and 633 million; Tables 14a and 14b). This increase in the NBS may be attributed to the presence of small 3 to 4 year-old northern rock sole at sizes 14 to 16 cm (Wilderbuer et al. 2018) (Fig. 16) in the inner domain (Fig. 15). This higher density of juvenile northern rock sole in the NBS may represent recruitment during the most recent warm stanza starting in 2014 (Stevenson and Lauth 2019). Warmer bottom temperatures during the settlement phase are correlated with more northerly spatial distributions of 3 to 5 year-old northern rock sole (Cooper and Nichol 2016). Thus, the warmer temperatures in the inner domain observed from 2014 to 2019 may have been favorable to settlement and recruitment into the NBS. The successful recruitment of northern rock sole to the NBS may be an indication that the population is expanding or shifting northward.

While spawning and feeding migrations for northern rock sole are poorly understood, northern rock sole are believed to use active tidal stream transport during nighttime hours (Nichol and Somerton 2009) to migrate from shallow summer feeding grounds to deep winter and spring spawning grounds (Fadeev 1965; Shubnikov and Lisovenko 1964). Northern rock sole are affected by bottom temperatures < 1°C and are typically distributed more southwest during colder years (Spencer 2008; Kotwicki and Lauth 2013).

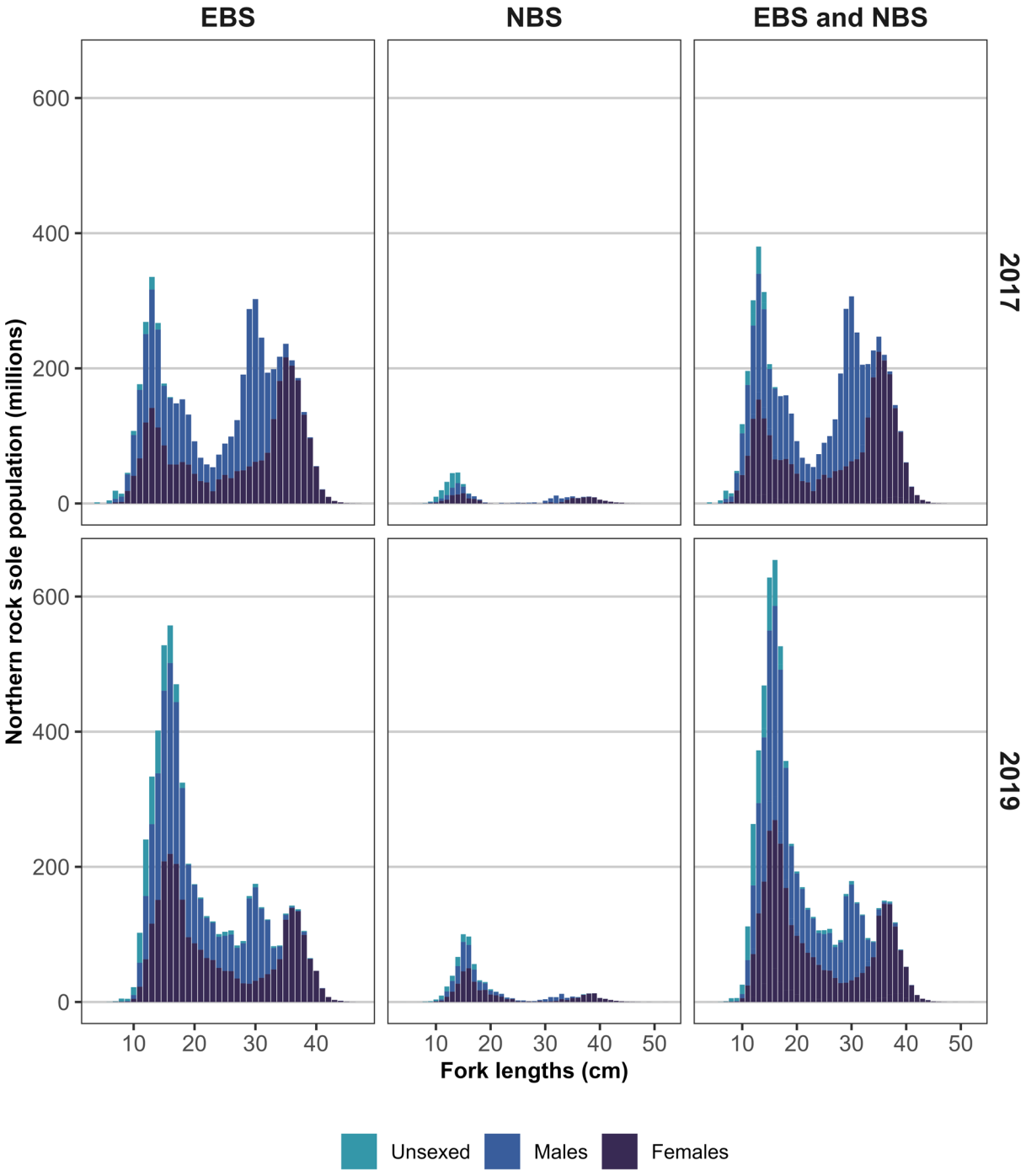

Figure 16. -- Total abundance-at-length estimates of northern rock sole (*Lepidopsetta polyxystra*) by sex (males, females, and unsexed) observed during the 2017 and 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 14a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for northern rock sole (*Lepidopsetta polyxystra*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	58.00	7.83	451,616	60,961	328,413	574,819	58	58	57
20	35.51	5.94	145,668	24,354	95,863	195,472	31	31	31
31	20.75	5.61	196,139	53,014	90,110	302,168	68	68	68
32	17.15	6.56	15,047	5,757	961	29,134	8	8	8
41	4.09	1.02	25,638	6,406	12,693	38,584	43	43	42
42	43.32	14.03	104,026	33,699	35,111	172,940	28	28	28
43	10.96	3.39	23,125	7,152	8,249	38,000	22	22	22
50	0.71	0.39	2,770	1,499	0	5,857	7	7	7
61	0.61	0.16	5,349	1,426	2,466	8,232	34	34	34
62	1.24	0.79	797	509	0	2,042	4	4	4
82	3.24	1.76	5,815	3,168	0	12,873	12	12	12
90	0.60	0.35	696	409	0	1,663	5	5	5
Total	**19.82**	**1.86**	**976,686**	**91,628**	**795,263**	**1,158,108**	**320**	**320**	**318**
NBS									
70	6.42	0.73	50,914	5,811	39,170	62,658	57	57	57
71	1.04	0.23	8,425	1,867	4,653	12,198	37	37	37
81	10.35	4.35	39,701	16,668	5,431	73,970	27	27	27
Total	**4.98**	**0.89**	**99,040**	**17,750**	**62,794**	**135,286**	**121**	**121**	**121**

Table 14b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (millions) with standard deviation (thousands) and 95% lower (LCL; millions) and upper (UCL; millions) confidence limits for northern rock sole (*Lepidopsetta polyxystra*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (millions)	SD population (thousands)	95% LCL (millions)	95% UCL (millions)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	372.25	40.72	2,898.78	317,076.50	2,257.97	3,539.59	58	58	57
20	247.40	26.92	1,015.01	110,446.21	789.15	1,240.87	31	31	31
31	130.36	31.35	1,232.28	296,293.01	639.69	1,824.86	68	68	68
32	50.86	17.51	44.63	15,362.19	7.03	82.22	8	8	8
41	22.03	7.47	138.14	46,851.53	43.45	232.83	43	43	42
42	105.58	28.54	253.50	68,519.45	113.38	393.63	28	28	28
43	27.81	8.08	58.69	17,052.07	23.22	94.16	22	22	22
50	1.37	0.78	5.31	3,031.78	0.00	11.56	7	7	7
61	1.00	0.25	8.81	2,198.92	4.36	13.25	34	34	34
62	1.79	1.05	1.15	673.13	0.00	2.80	4	4	4
82	10.23	6.82	18.36	12,243.38	0.00	45.64	12	12	12
90	0.97	0.54	1.12	629.01	0.00	2.60	5	5	5
Total	**115.15**	**9.26**	**5,675.78**	**456,187.40**	**4,772.53**	**6,579.03**	**320**	**320**	**318**
NBS									
70	59.99	7.72	475.46	61,178.22	351.81	599.10	57	57	57
71	4.91	1.21	39.90	9,807.51	20.08	59.72	37	37	37
81	30.80	11.43	118.14	43,841.59	28.00	208.27	27	27	27
Total	**31.86**	**3.82**	**633.49**	**75,901.56**	**478.50**	**788.48**	**121**	**121**	**121**

Flathead Sole (*Hippoglossoides elassodon*)

Flathead sole and Bering flounder (*Hippoglossoides robustus*) are congeners and can be difficult to distinguish from each other based on morphology in the field. Consequently, the accuracy of their identification in commercial fishery data is unknown and the two species are combined into a single stock assessment by the NPFMC (McGilliard et al. 2018). However, since bottom trawl survey scientists are trained to make reliable field identifications for flathead sole and Bering flounder, the results here are presented by species. Despite belonging to the same genus and having a similar appearance, the two species have differing geographic distributions and environmental associations, although they do co-occur (Fig. 17; compare with Bering flounder in Figure 19). Bering flounder tend to occupy arctic regions, while flathead sole are more subarctic/boreal (Baker and Hollowed 2014). In 2019, flathead sole were present at 88% of the EBS stations, as well as 10% of the NBS stations, and the highest catch rates were at depths greater than 70 m on the outer half of the EBS shelf (Fig. 17). Flathead sole in the EBS had an estimated biomass of 611,483 t (Table 15a) and population size of 2.2 billion sole (Table 15b). In 2019, there were two distinct modes within the size composition of flathead sole caught in the EBS, at 18 cm and 33 cm (Fig. 18). Very few flathead sole were caught in the NBS in 2019.

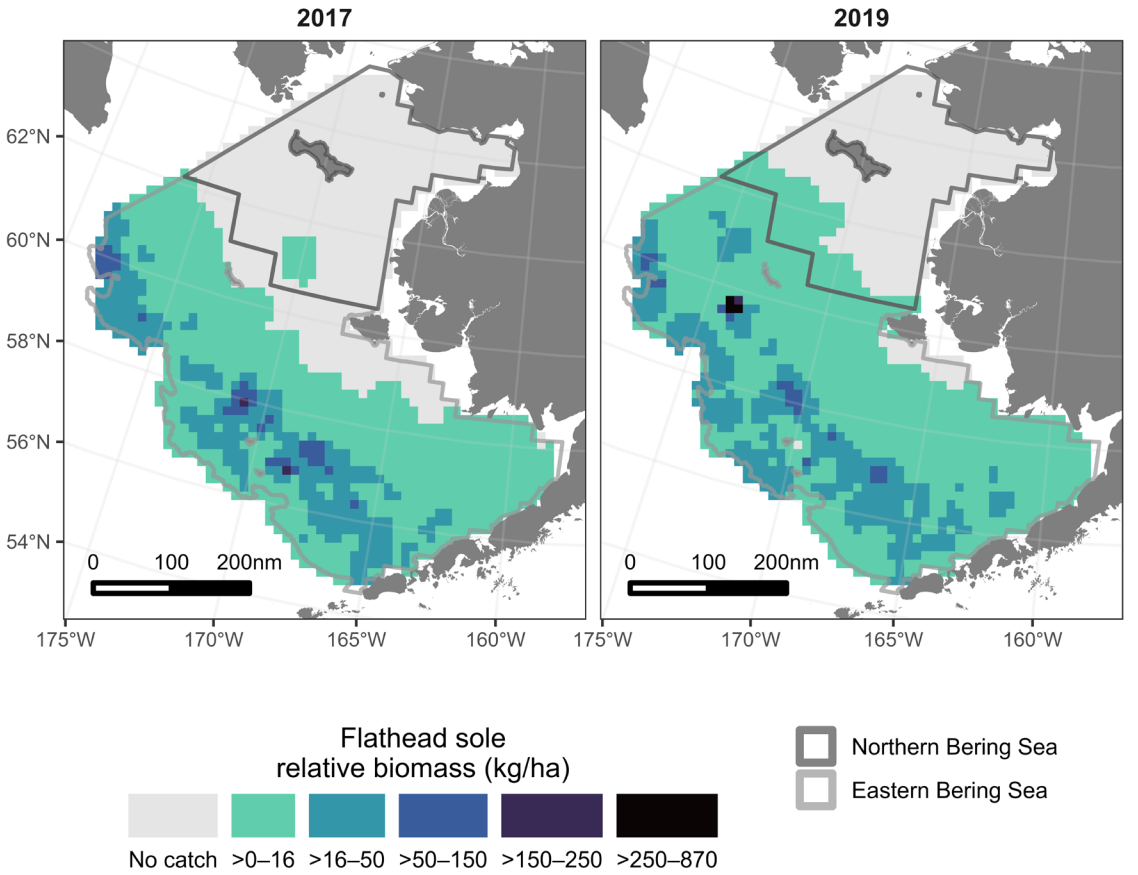

Figure 17. -- Flathead sole (*Hippoglossoides elassodon*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

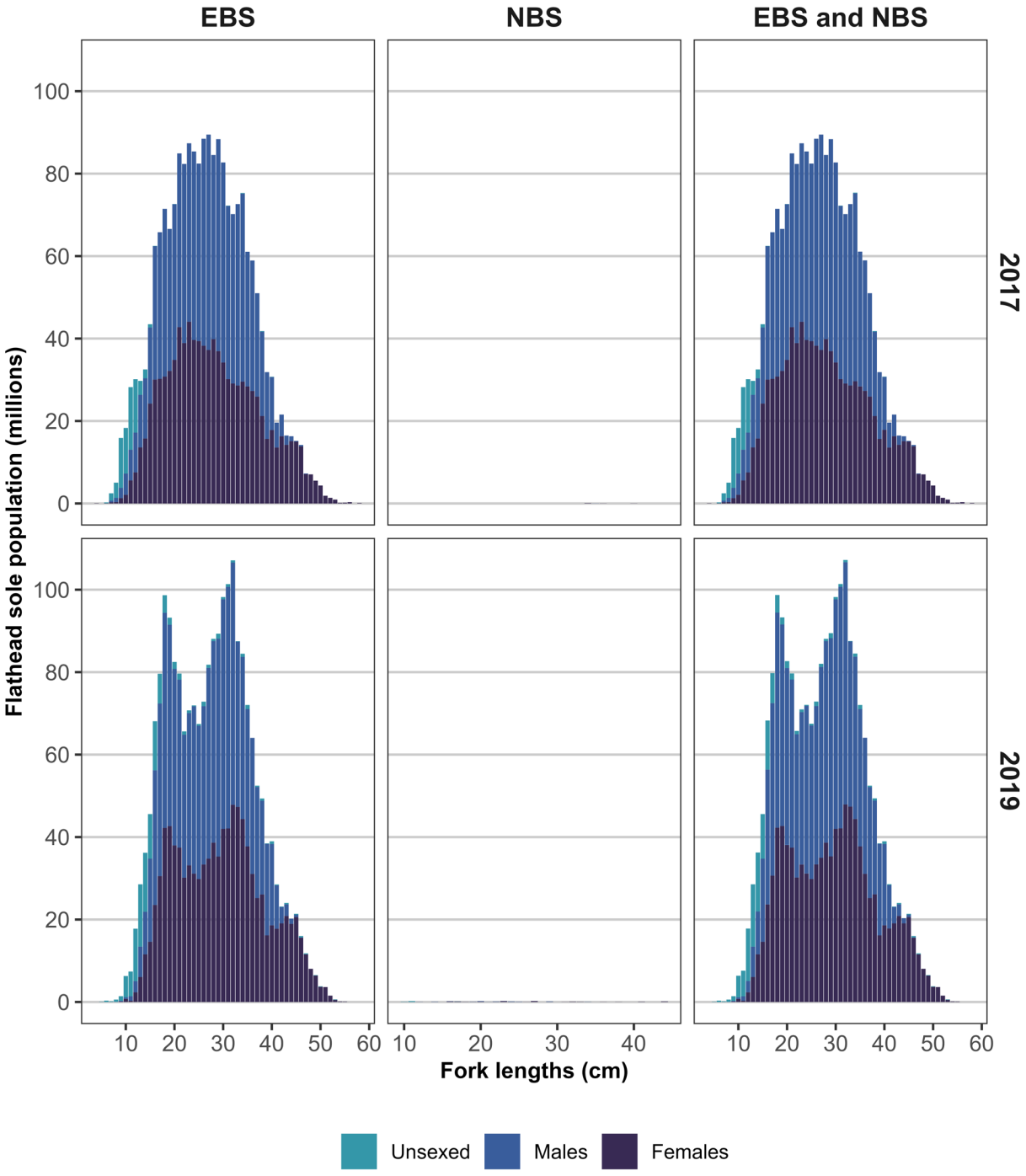

Figure 18. --Total abundance-at-length estimates of flathead sole (*Hippoglossoides elassodon*) by sex (males, females, and unsexed) observed during the 2017 and 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 15a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for flathead sole (*Hippoglossoides elassodon*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	2.20	0.49	17,108	3,849	9,328	24,887	38	38	38
20	0.09	0.06	354	230	0	823	17	17	17
31	17.18	1.92	162,382	18,195	125,991	198,772	69	69	69
32	21.69	7.09	19,035	6,219	4,327	33,744	8	8	8
41	9.44	2.20	59,215	13,766	31,395	87,036	41	41	41
42	19.53	3.83	46,888	9,194	28,087	65,689	26	26	26
43	7.29	2.24	15,382	4,730	5,544	25,220	21	21	21
50	13.76	1.52	53,375	5,877	41,244	65,506	26	26	26
61	15.24	1.81	134,323	15,966	102,057	166,589	59	59	59
62	130.97	123.05	84,194	79,107	0	277,768	7	7	7
82	6.27	2.65	11,259	4,766	770	21,748	11	11	11
90	6.89	3.04	7,967	3,516	0	16,283	8	8	8
Total	**12.41**	**1.73**	**611,483**	**85,225**	**414,953**	**808,013**	**331**	**331**	**331**
NBS									
70	0.02	0.01	131	72	0	276	5	5	4
71	0.00	0.00	0	0	0	0	0	0	0
81	0.09	0.04	332	140	44	620	10	10	10
Total	**0.02**	**0.01**	**463**	**157**	**145**	**781**	**15**	**15**	**14**

Table 15b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for flathead sole (*Hippoglossoides elassodon*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	5.13	1.14	39,950.22	8,897.33	21,968.72	57,931.72	38	38	38
20	0.50	0.14	2,039.95	584.47	846.45	3,233.44	17	17	17
31	60.84	7.03	575,095.92	66,468.03	442,159.86	708,031.97	69	69	69
32	39.24	9.40	34,431.25	8,249.66	14,920.80	53,941.70	8	8	8
41	19.18	3.65	120,291.14	22,873.07	74,064.68	166,517.61	41	41	41
42	46.04	10.61	110,541.46	25,470.38	58,454.52	162,628.39	26	26	26
43	21.65	5.24	45,688.87	11,063.72	22,676.32	68,701.42	21	21	21
50	93.94	11.20	364,434.18	43,463.55	274,725.42	454,142.95	26	26	26
61	82.59	8.86	727,867.45	78,070.62	570,086.73	885,648.18	59	59	59
62	212.86	186.91	136,837.54	120,159.96	0.00	430,868.96	7	7	7
82	15.56	5.50	27,945.35	9,866.98	6,228.13	49,662.58	11	11	11
90	27.74	9.19	32,092.48	10,634.45	6,942.01	57,242.95	8	8	8
Total	**44.98**	**3.42**	**2,217,215.82**	**168,798.25**	**1,827,967.05**	**2,606,464.59**	**331**	**331**	**331**
NBS									
70	0.12	0.06	975.39	507.36	0.00	2,000.77	5	5	4
71	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
81	0.37	0.12	1,431.46	458.40	488.99	2,373.93	10	10	10
Total	**0.12**	**0.03**	**2,406.85**	**683.77**	**1,024.95**	**3,788.76**	**15**	**15**	**14**

Bering Flounder (*Hippoglossoides robustus*)

Bering flounder were most concentrated in the north and northwest of the EBS and NBS survey areas, as well as in the middle domain south of Nunivak Island (Fig. 19). Bering flounder were present at 15.7% of the EBS stations and 63.9% of the NBS stations. The total estimated EBS and NBS biomass for Bering flounder in 2019 was 8,269 t and 18,526 t, respectively (totaling 26,794 t; Table 16a), and the total population number was 35,804,730 fish and 121,825,445 fish, respectively (totaling nearly 158 billion fish; Tables 16b). The EBS and NBS Bering flounder biomass decreased by 69.8% (Table 9a) and by 6.5% (Table 9b) from 2017 to 2019, respectively. Previously, EBS and NBS Bering flounder biomass experienced a 95% increase in 2017 when compared to the biomass in 2010 (Lauth et al. 2019). In addition, 2019 EBS and NBS size composition estimates indicate low recruitment of smaller (<20 cm) Bering flounder when compared to abundance-at-length estimates in both 2010 and 2017 (Fig. 20).

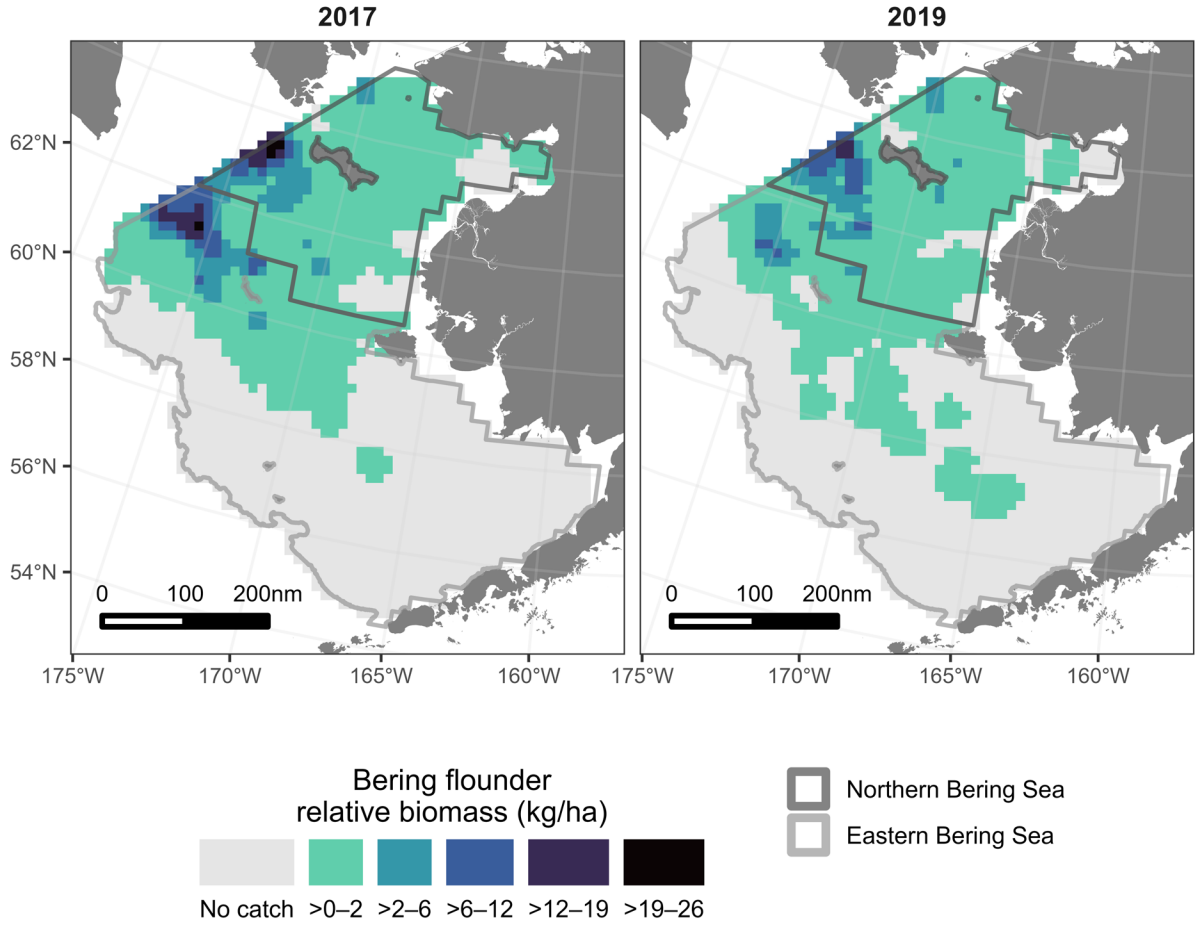

Figure 19. --Bering flounder (*Hippoglossoides robustus*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

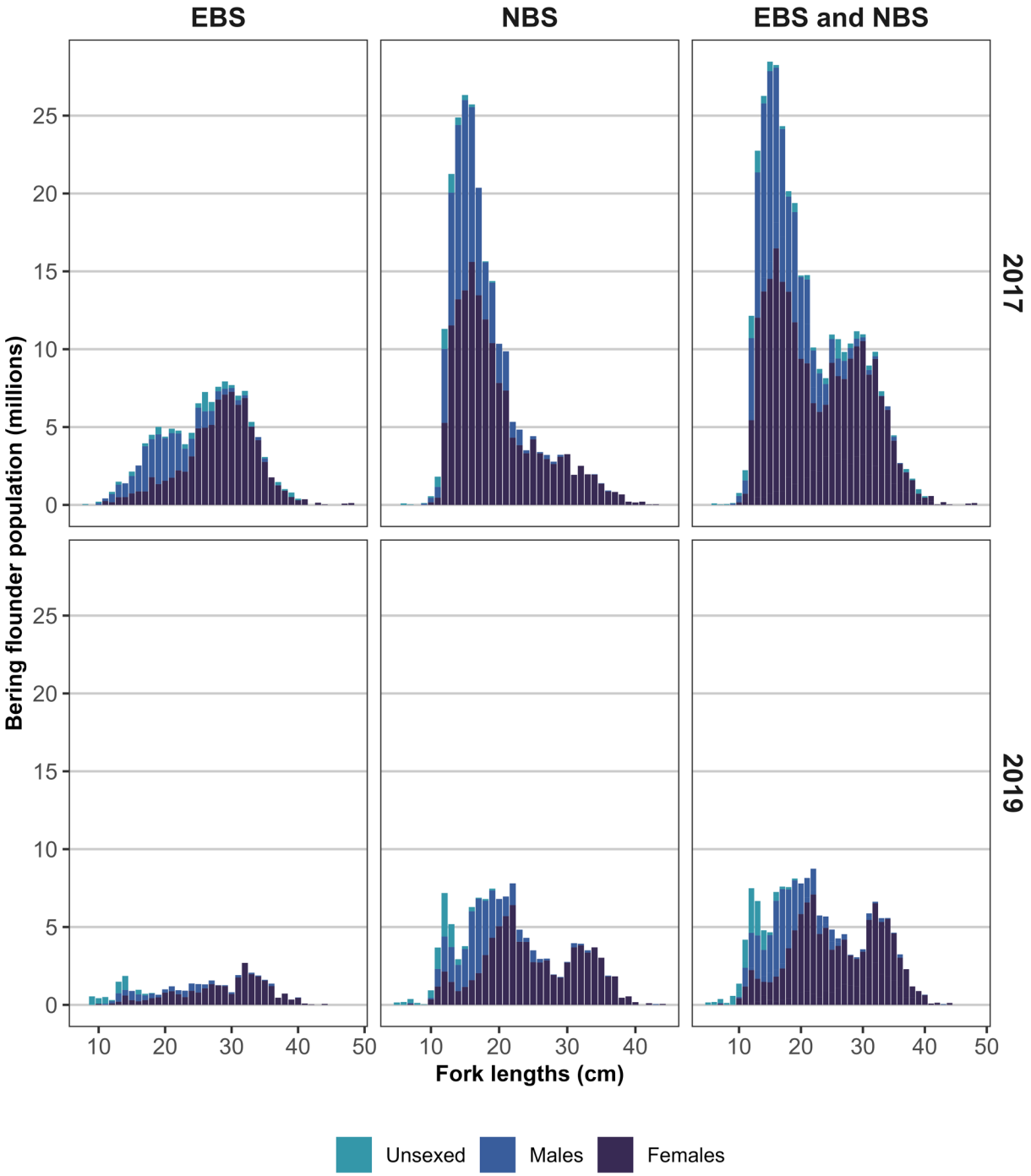

Figure 20. -- Total abundance-at-length estimates of Bering flounder (*Hippoglossoides robustus*) by sex (males, females, and unsexed) observed during the 2017 and 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 16a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for Bering flounder (*Hippoglossoides robustus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.00	0.00	0	0	0	0	0	0	0
20	0.00	0.00	9	5	0	18	4	4	3
31	0.00	0.00	41	25	0	91	5	5	5
32	0.00	0.00	0	0	0	0	0	0	0
41	0.30	0.11	1,898	683	517	3,279	22	22	22
42	0.00	0.00	10	10	0	29	1	1	1
43	0.05	0.03	110	57	0	228	7	7	7
50	0.00	0.00	0	0	0	0	0	0	0
61	0.00	0.00	19	14	0	47	2	2	2
62	0.01	0.01	5	5	0	17	1	1	1
82	2.16	0.61	3,884	1,091	1,483	6,285	12	12	12
90	1.98	1.01	2,293	1,169	0	5,059	5	5	5
Total	**0.17**	**0.04**	**8,269**	**1,740**	**4,751**	**11,786**	**59**	**59**	**58**
NBS									
70	0.38	0.17	3,024	1,378	239	5,808	32	32	32
71	0.35	0.10	2,845	782	1,264	4,425	33	33	33
81	3.30	0.82	12,657	3,153	6,187	19,127	27	27	26
Total	**0.93**	**0.18**	**18,526**	**3,529**	**11,394**	**25,657**	**92**	**92**	**91**

Table 16b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for Bering flounder (*Hippoglossoides robustus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
20	0.10	0.06	402.64	242.45	0.00	898.44	4	4	3
31	0.16	0.10	1,523.33	922.32	0.00	3,367.98	5	5	5
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
41	1.66	0.41	10,378.94	2,572.38	5,180.15	15,577.72	22	22	22
42	0.16	0.16	382.94	382.94	0.00	1,166.05	1	1	1
43	0.22	0.10	465.17	203.68	40.29	890.05	7	7	7
50	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
61	0.01	0.01	123.17	97.23	0.00	319.67	2	2	2
62	0.02	0.02	15.61	15.61	0.00	53.81	1	1	1
82	8.09	1.85	14,532.08	3,315.72	7,234.18	21,829.97	12	12	12
90	6.90	3.45	7,980.86	3,992.14	0.00	17,422.26	5	5	5
Total	**0.73**	**0.12**	**35,804.73**	**5,886.90**	**23,907.31**	**47,702.15**	**59**	**59**	**58**
NBS									
70	2.90	1.14	22,995.22	9,009.09	4,787.85	41,202.60	32	32	32
71	5.35	1.32	43,442.95	10,738.88	21,739.68	65,146.23	33	33	33
81	14.44	3.47	55,387.26	13,293.26	28,109.50	82,665.03	27	27	26
Total	**6.13**	**0.97**	**121,825.45**	**19,318.33**	**82,783.10**	**160,867.79**	**92**	**92**	**91**

Alaska Plaice (*Pleuronectes quadrituberculatus*)

Alaska plaice were present in patchy concentrations throughout the middle domain of the survey area (Fig. 21). The highest densities of Alaska plaice in the NBS occurred just south of St. Lawrence Island in < 50 m of water during both 2017 and 2019 (Fig. 21). However, concentrations in the EBS for those same years were located offshore in the middle domain and just south of St. Matthew Island (Fig. 21).

In 2019, the total estimated biomass of Alaska plaice in the EBS was 368,787 t and the population was approximately 500 million fish, while the estimated population of Alaska plaice in the NBS was 321,571 t and approximately 533 million fish (Tables 17a and 17b).

Alaska plaice in the EBS had a length mode around 33-38 cm in both 2017 and 2019. Alaska plaice in the NBS had a similar length distribution mode of about 33-37 cm in both 2017 and 2019, as well (Fig. 22). Overall, the size and sex composition of Alaska plaice varies by depth in the EBS with males more prevalent in the inner domain and females more prevalent in the middle and outer domains increasing in average size with depth (Zhang et al. 1998). The 2019 survey indicates a slight increase in recruitment of smaller Alaska plaice (<20 cm) in the NBS when compared to 2017 (Fig. 22).

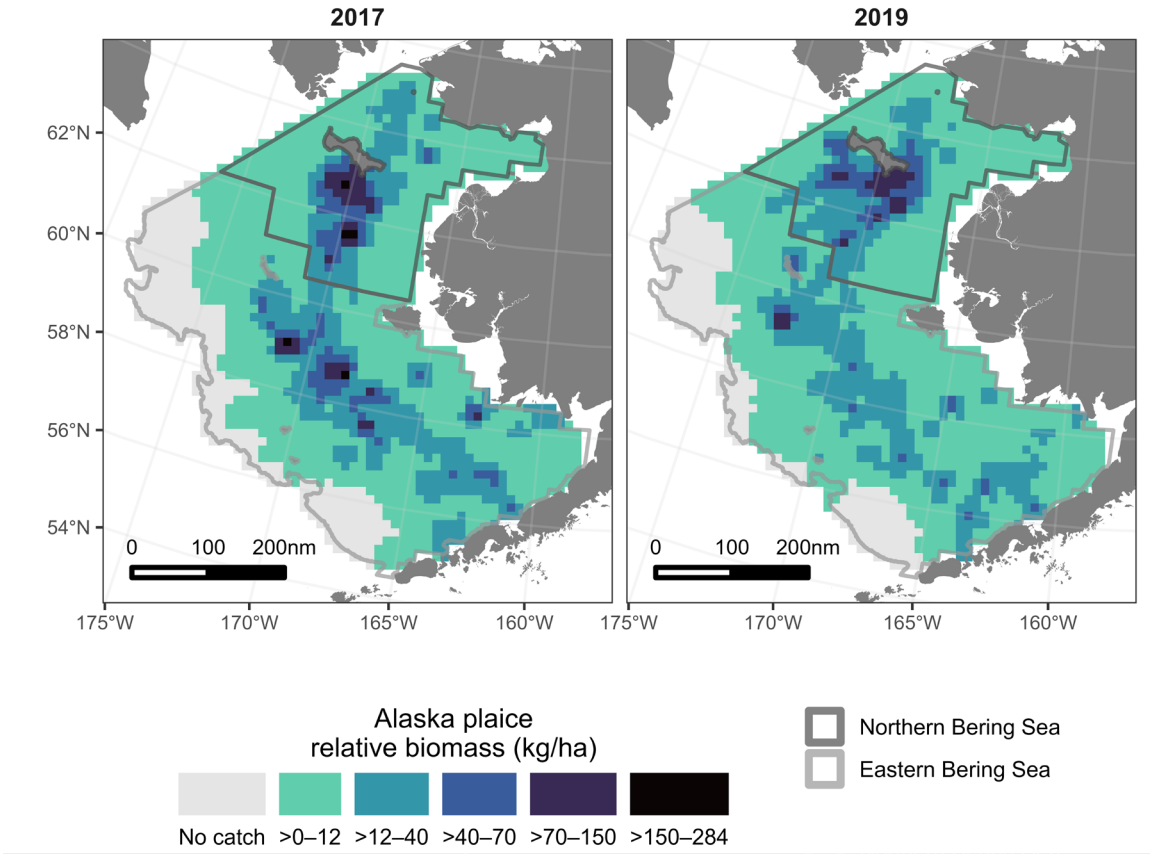

Figure 21. -- Alaska plaice (*Pleuronectes quadrituberculatus*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

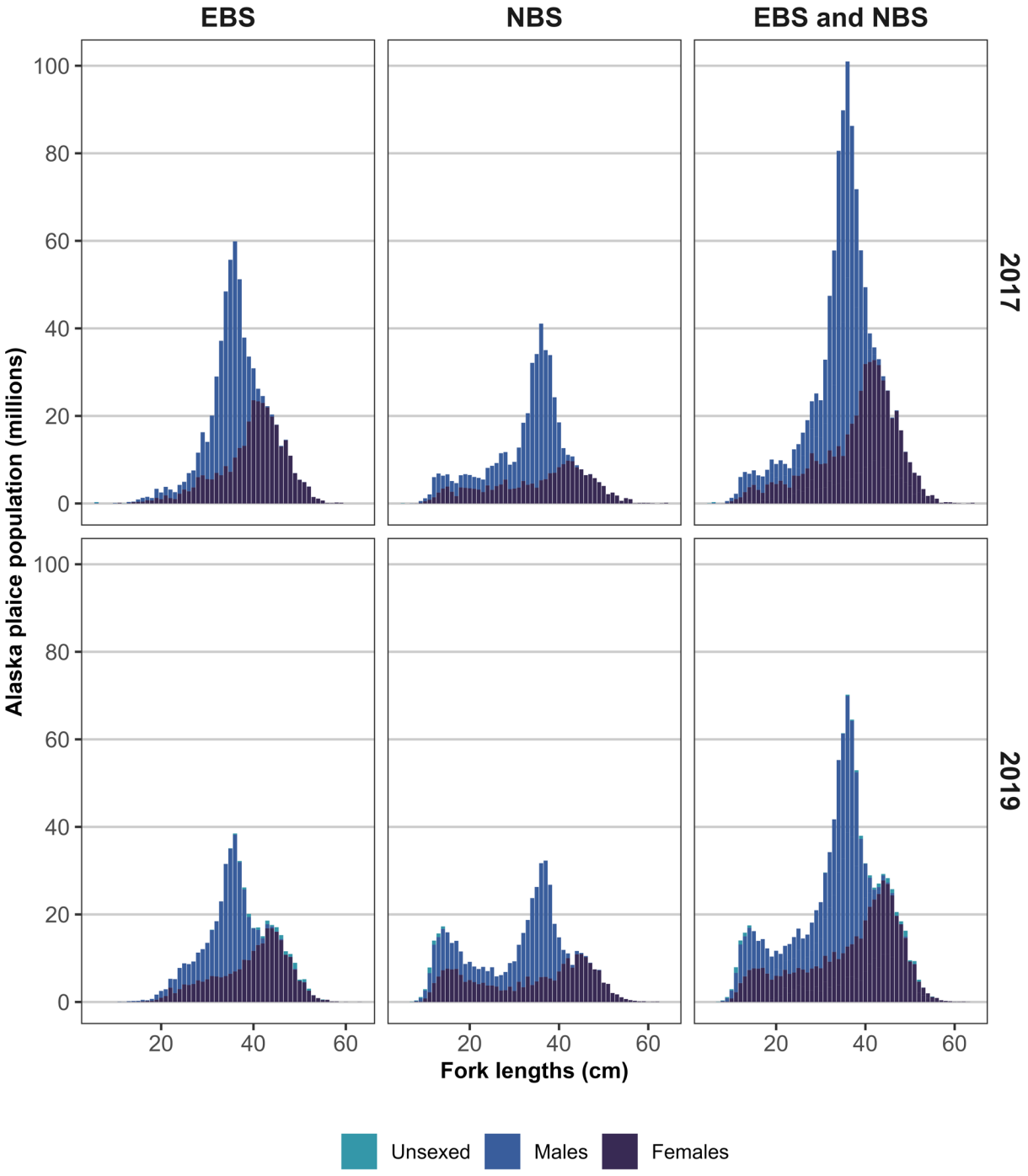

Figure 22. --Total abundance-at-length estimates of Alaska plaice (*Pleuronectes quadrituberculatus*) by sex (males, females, and unsexed) observed during the 2017 and 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 17a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for Alaska plaice (*Pleuronectes quadrituberculatus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	6.20	1.51	48,295	11,783	24,482	72,108	55	55	55
20	7.58	1.77	31,114	7,246	16,297	45,931	31	31	31
31	11.65	1.62	110,106	15,278	79,551	140,661	62	62	62
32	6.87	1.08	6,026	950	3,779	8,273	8	8	8
41	14.19	2.01	88,987	12,611	63,501	114,474	43	43	43
42	8.78	2.05	21,087	4,934	10,998	31,177	24	24	24
43	22.38	6.91	47,241	14,588	16,810	77,672	21	21	21
50	0.05	0.04	209	153	0	525	2	2	2
61	0.40	0.15	3,485	1,329	799	6,172	11	11	11
62	2.35	1.47	1,508	947	0	3,824	4	4	4
82	5.61	2.40	10,074	4,315	576	19,571	11	11	11
90	0.57	0.21	654	237	93	1,215	5	5	5
Total	**7.48**	**0.59**	**368,787**	**29,038**	**311,292**	**426,282**	**277**	**277**	**277**
NBS									
70	24.56	4.57	194,627	36,226	121,415	267,840	58	58	58
71	7.37	1.55	59,887	12,599	34,425	85,349	56	56	55
81	17.48	4.18	67,057	16,042	34,139	99,974	24	24	24
Total	**16.17**	**2.09**	**321,571**	**41,574**	**238,423**	**404,718**	**138**	**138**	**137**

Table 17b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for Alaska plaice (*Pleuronectes quadrituberculatus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	15.77	3.75	122,775.98	29,168.90	63,825.64	181,726.32	55	55	55
20	14.37	2.93	58,956.72	12,000.76	34,415.16	83,498.28	31	31	31
31	12.88	1.61	121,773.66	15,246.85	91,279.96	152,267.36	62	62	62
32	5.48	0.89	4,804.53	777.76	2,965.13	6,643.93	8	8	8
41	17.88	2.66	112,112.16	16,663.18	78,435.87	145,788.46	43	43	43
42	9.55	2.27	22,924.95	5,440.64	11,798.84	34,051.06	24	24	24
43	20.84	5.57	43,985.11	11,747.62	19,479.58	68,490.65	21	21	21
50	0.06	0.04	229.25	163.91	0.00	567.56	2	2	2
61	0.27	0.10	2,342.74	878.13	568.04	4,117.44	11	11	11
62	1.48	0.88	950.50	566.91	0.00	2,337.74	4	4	4
82	4.37	1.64	7,838.82	2,951.20	1,343.24	14,334.40	11	11	11
90	0.41	0.15	479.43	176.88	61.11	897.74	5	5	5
Total	**10.13**	**0.83**	**499,173.85**	**41,024.91**	**417,944.53**	**580,403.18**	**277**	**277**	**277**
NBS									
70	37.64	5.47	298,343.79	43,338.90	210,755.88	385,931.71	58	58	58
71	19.51	2.50	158,518.49	20,333.06	117,425.39	199,611.60	56	56	55
81	19.75	5.52	75,737.53	21,182.70	32,270.62	119,204.44	24	24	24
Total	**26.78**	**2.63**	**532,599.82**	**52,348.83**	**427,902.15**	**637,297.48**	**138**	**138**	**137**

Greenland Turbot (*Reinhardtius hippoglossoides*)

During the 2019 survey, Greenland turbot were present at 17.6% of stations in the EBS (66 of 376 stations), and 4.2% of stations in the NBS (6 of 144 stations). Greenland turbot were distributed primarily in the northwest portion of the middle and outer domains (Fig. 23), in waters with depths between 61 m and 176 m in the EBS, and 55 m and 80 m in the NBS. Greenland turbot were caught where bottom temperatures were between -0.3°C and 3.8°C in the EBS, and -0.1°C and 1.8°C in the NBS. The fork lengths of Greenland turbot measured during the 2019 survey were between 61 and 176 cm in the EBS, and 9 and 73 cm in the NBS (Fig. 24).

The 2019 Greenland turbot biomass estimate decreased from 21,519 t in 2017 to 16,477 t (Table 18a) and the population estimate decreased from 10.5 million in 2017 to 5.3 million (Table 18b). In 2010, a strong year class was observed as 12-16 cm juveniles, and this cohort has been observed in subsequent years as it recruited to the fishery (Fig. 24). Greenland turbot are typically most abundant on the upper continental slope outside of the standard EBS survey area, although juveniles may spend several years on the continental shelf before moving to deeper water (Sohn et al. 2010; Vestfals et al. 2016). Thus, the order of magnitude decrease in estimated population since 2010 may be attributed in part to the ontogenetic movement of this year class out of the survey area and into the upper continental slope waters (Alton et al. 1998).

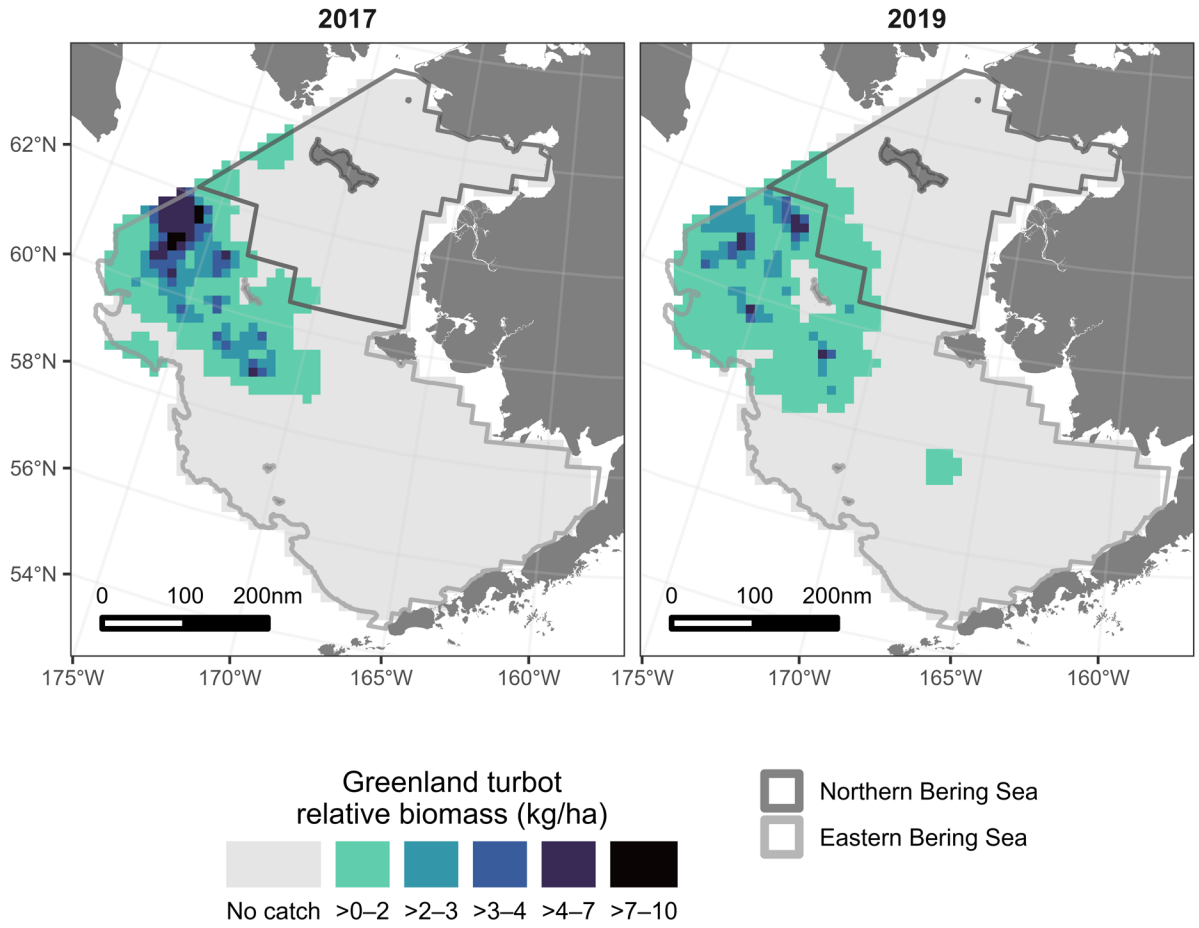

Figure 23. --Greenland turbot (*Reinhardtius hippoglossoides*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

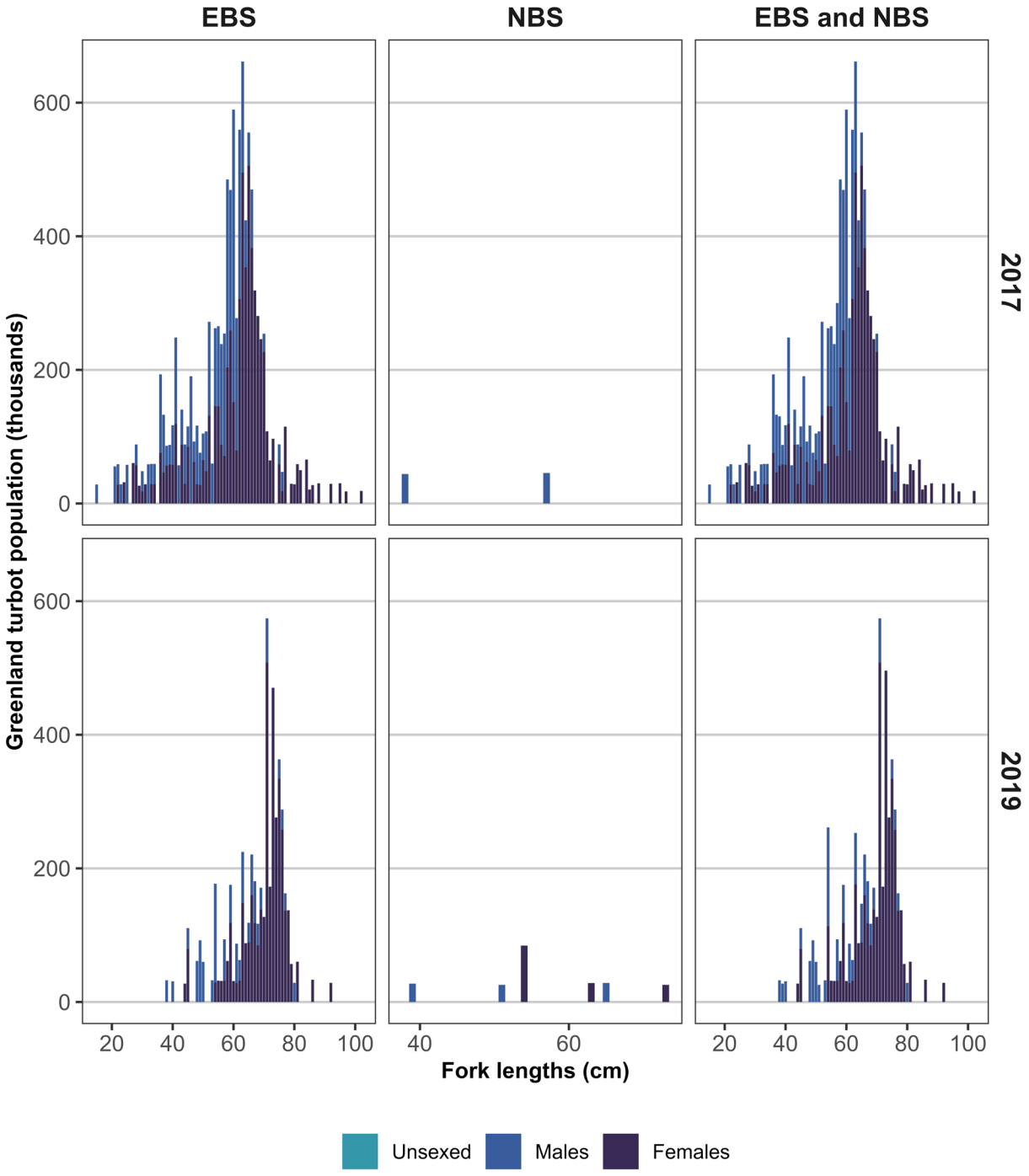

Figure 24. --Total abundance-at-length estimates of Greenland turbot (*Reinhardtius hippoglossoides*) by sex (males, females, and unsexed) observed during the 2017 and 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 18a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for Greenland turbot (*Reinhardtius hippoglossoides*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.00	0.00	0	0	0	0	0	0	0
20	0.00	0.00	0	0	0	0	0	0	0
31	0.01	0.01	63	63	0	190	1	1	1
32	0.00	0.00	0	0	0	0	0	0	0
41	0.42	0.13	2,661	824	997	4,325	11	11	11
42	0.00	0.00	0	0	0	0	0	0	0
43	0.64	0.26	1,342	547	204	2,480	9	9	9
50	0.00	0.00	0	0	0	0	0	0	0
61	0.59	0.13	5,182	1,161	2,835	7,529	23	23	23
62	0.58	0.34	372	220	0	910	3	3	3
82	2.09	0.51	3,746	920	1,722	5,770	11	11	11
90	2.32	0.51	2,686	587	1,299	4,074	8	8	8
Total	**0.33**	**0.04**	**16,053**	**1,889**	**12,313**	**19,793**	**66**	**66**	**66**
NBS									
70	0.00	0.00	0	0	0	0	0	0	0
71	0.00	0.00	0	0	0	0	0	0	0
81	0.11	0.05	424	183	47	800	6	6	6
Total	**0.02**	**0.01**	**424**	**183**	**57**	**790**	**6**	**6**	**6**

Table 18b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for Greenland turbot (*Reinhardtius hippoglossoides*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
31	0.00	0.00	28.58	28.58	0.00	85.73	1	1	1
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
41	0.14	0.04	878.26	265.95	340.77	1,415.75	11	11	11
42	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
43	0.19	0.08	400.28	164.86	57.37	743.18	9	9	9
50	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
61	0.15	0.03	1,310.89	300.52	703.53	1,918.24	23	23	23
62	0.14	0.08	88.86	52.17	0.00	216.52	3	3	3
82	0.80	0.21	1,429.21	374.57	604.80	2,253.63	11	11	11
90	0.83	0.14	965.24	157.66	592.37	1,338.12	8	8	8
Total	**0.10**	**0.01**	**5,101.32**	**597.42**	**3,918.41**	**6,284.22**	**66**	**66**	**66**
NBS									
70	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
71	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
81	0.06	0.02	219.91	87.06	41.26	398.56	6	6	6
Total	**0.01**	**0.00**	**219.91**	**87.06**	**45.79**	**394.03**	**6**	**6**	**6**

Arrowtooth Flounder (*Atheresthes stomias*)

Arrowtooth flounder are similar in appearance to the congeneric Kamchatka flounder (Yang 1988), and it wasn't until 1994 that field characteristics were established to reliably distinguish between the two species during AFSC bottom trawl surveys. In 2019, arrowtooth flounder (Fig. 25) appear to occupy similar areas as Kamchatka flounder (Fig. 27), although arrowtooth flounder are much more abundant than Kamchatka flounder.

Arrowtooth flounder are generally a deeper water species as adults, but primarily occupy the shelf waters until age four. As individuals mature, they begin to recruit to the upper continental slope waters (Spies et al. 2018). Thus, the shelf survey estimates are not synoptically inclusive of the entire population. Arrowtooth flounder were absent from the NBS because they prefer deeper waters, further indicated by their distributions in the EBS where 99% of the total estimated biomass occurs in the middle and outer domains (Fig. 25; Table 19a). Arrowtooth flounder were more confined to the outer domain in 2010, when there was a large cold pool (Fig. 25; Lauth 2011). In 2019, arrowtooth flounder biomass in the EBS was estimated at 578,390 t and population abundance was estimated at 1 billion fish (Tables 19a and 19b). As with all previous years, females outnumbered males, at a rate of approximately 2:1, with females attaining larger average sizes (Fig. 26). This disparity in sex ratio has been attributed to sex-specific differences in natural mortality rates, but the issue requires further research (Zimmermann and Goddard 1996; Spies et al. 2018).

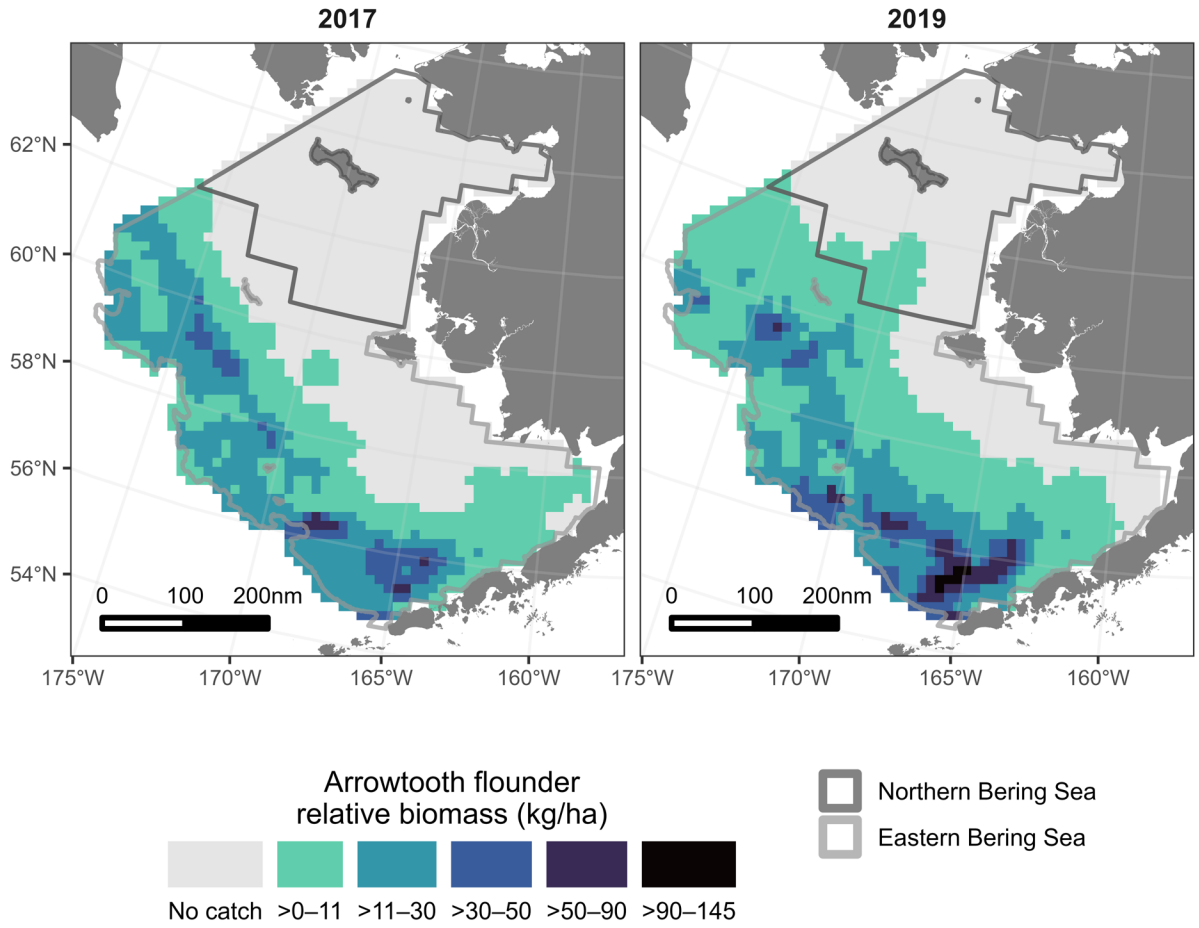

Figure 25. --Arrowtooth flounder (*Atheresthes stomias*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

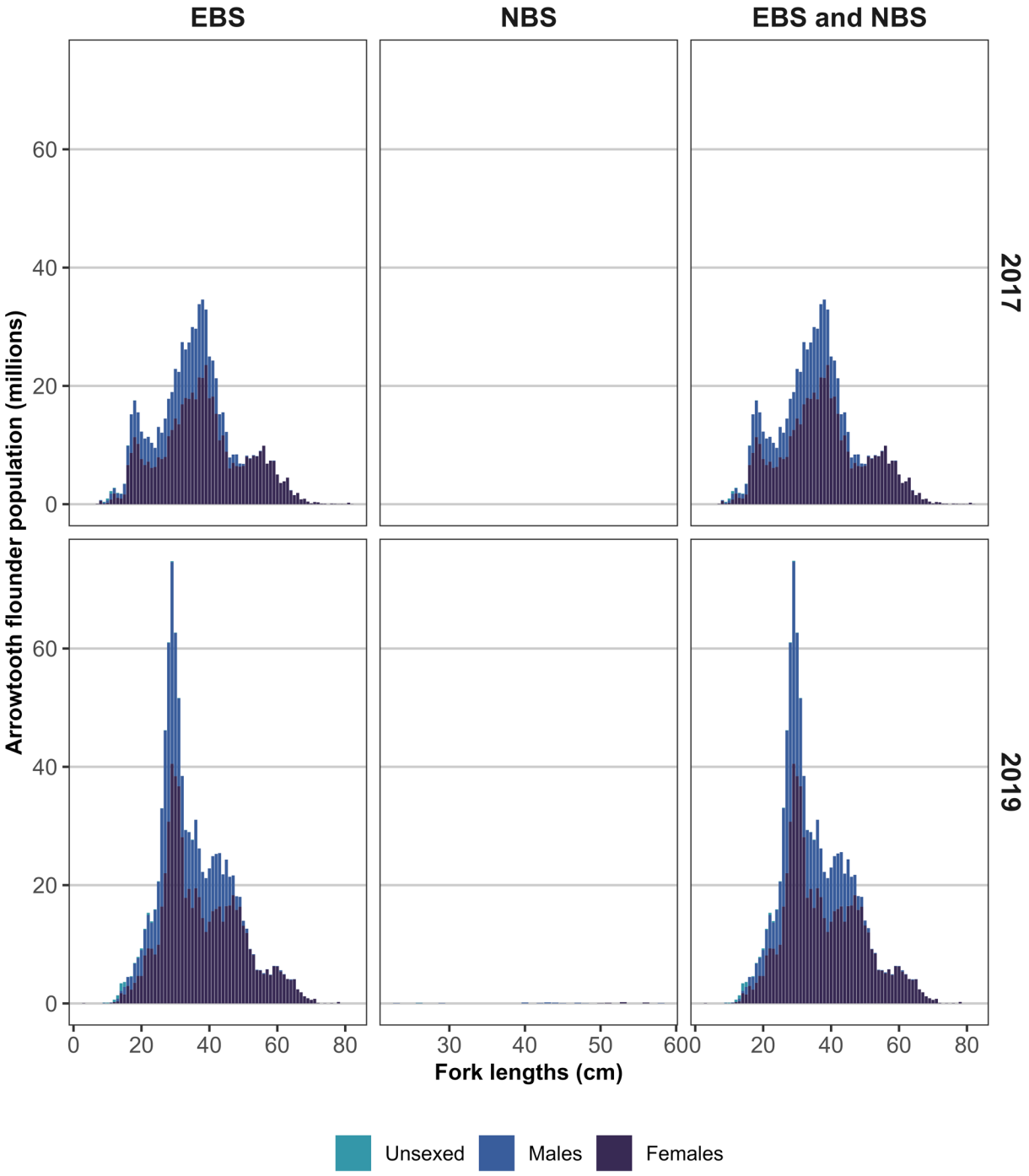

Figure 26. -- Total abundance-at-length estimates of arrowtooth flounder (*Atheresthes stomias*) by sex (males, females, and unsexed) observed during the 2017 and 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 19a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for arrowtooth flounder (*Atheresthes stomias*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.41	0.17	3,226	1,347	503	5,949	10	10	10
20	0.13	0.08	540	334	0	1,224	3	3	3
31	18.72	3.03	176,965	28,683	119,599	234,331	66	66	66
32	20.84	4.36	18,288	3,823	9,247	27,330	8	8	8
41	8.56	1.28	53,663	8,015	37,464	69,862	41	41	41
42	15.79	3.01	37,909	7,220	23,144	52,673	30	30	30
43	11.22	2.29	23,688	4,830	13,641	33,735	21	21	21
50	35.42	4.60	137,419	17,854	100,640	174,198	26	26	26
61	11.29	1.28	99,542	11,268	76,769	122,315	58	58	58
62	29.99	9.66	19,281	6,210	4,086	34,476	7	7	7
82	2.09	0.91	3,757	1,638	152	7,362	6	6	6
90	3.55	0.78	4,112	901	1,982	6,242	8	8	8
Total	**11.73**	**0.78**	**578,390**	**38,298**	**502,559**	**654,220**	**284**	**284**	**284**
NBS									
70	0.08	0.04	606	333	0	1,279	5	5	5
71	0.00	0.00	0	0	0	0	0	0	0
81	0.22	0.16	837	600	0	2,070	3	3	3
Total	**0.07**	**0.03**	**1,443**	**686**	**71**	**2,815**	**8**	**8**	**8**

Table 19b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for arrowtooth flounder (*Atheresthes stomias*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.55	0.21	4,272.87	1,664.86	908.19	7,637.55	10	10	10
20	0.13	0.08	533.11	313.73	0.00	1,174.69	3	3	3
31	36.77	7.28	347,545.49	68,776.23	209,993.03	485,097.95	66	66	66
32	42.92	7.32	37,655.92	6,423.41	22,464.56	52,847.27	8	8	8
41	8.98	1.54	56,287.11	9,687.36	36,708.96	75,865.26	41	41	41
42	31.10	5.42	74,674.85	13,022.23	48,044.38	101,305.32	30	30	30
43	9.63	1.90	20,321.10	4,012.44	11,975.22	28,666.98	21	21	21
50	71.36	6.88	276,807.96	26,702.59	221,800.62	331,815.30	26	26	26
61	19.38	2.41	170,768.91	21,219.07	127,885.18	213,652.65	58	58	58
62	28.19	9.23	18,122.42	5,936.29	3,596.32	32,648.52	7	7	7
82	1.84	0.82	3,295.36	1,473.86	51.39	6,539.32	6	6	6
90	3.30	0.75	3,814.03	869.24	1,758.28	5,869.78	8	8	8
Total	**20.57**	**1.60**	**1,014,099.13**	**79,090.25**	**857,500.43**	**1,170,697.82**	**284**	**284**	**284**
NBS									
70	0.09	0.05	683.24	356.91	0.00	1,404.56	5	5	5
71	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
81	0.19	0.14	741.90	527.30	0.00	1,826.04	3	3	3
Total	**0.07**	**0.03**	**1,425.14**	**636.74**	**151.67**	**2,698.62**	**8**	**8**	**8**

Kamchatka Flounder (*Atheresthes evermanni*)

Kamchatka flounder are similar in appearance to the congeneric arrowtooth flounder (Yang 1988), and it wasn't until 1994 that field characteristics were established to reliably distinguish between the two species during AFSC bottom trawl surveys. Kamchatka flounder (Fig. 27) appeared to occupy similar areas as arrowtooth flounder in 2019 (Fig. 25), although Kamchatka flounder are much less abundant than arrowtooth flounder in the Bering Sea. From 2017 to 2019, the Kamchatka flounder biomass estimate decreased by 6.7% to 44,870 t (Table 20a; Lauth et al. 2019) and the population estimate decreased by 29% to 78.7 million fish (Table 20b; Lauth, Dawson, and Conner 2019). Unlike arrowtooth flounder, the Kamchatka flounder sex ratio was roughly 1:1 (Fig. 28).

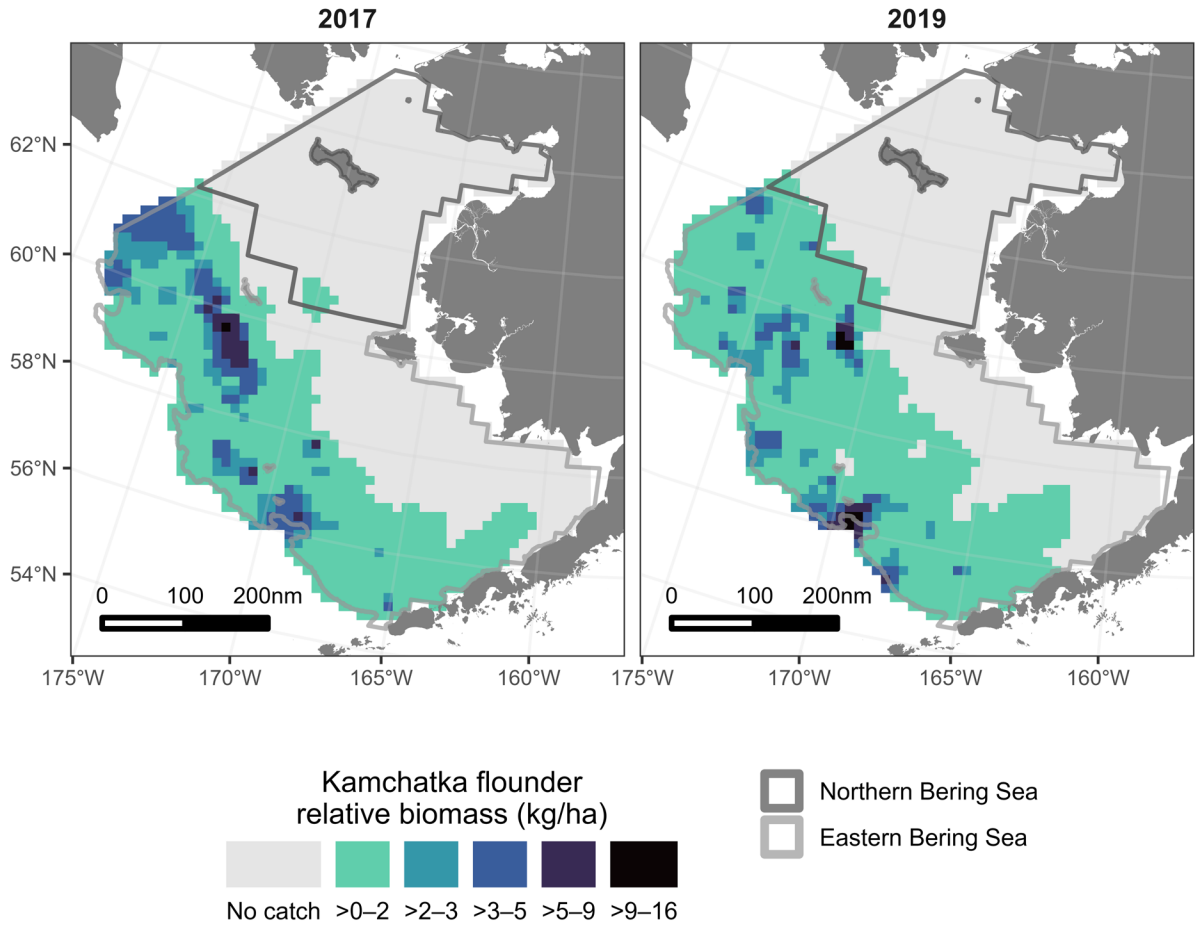

Figure 27. -- Kamchatka flounder (*Atheresthes evermanni*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

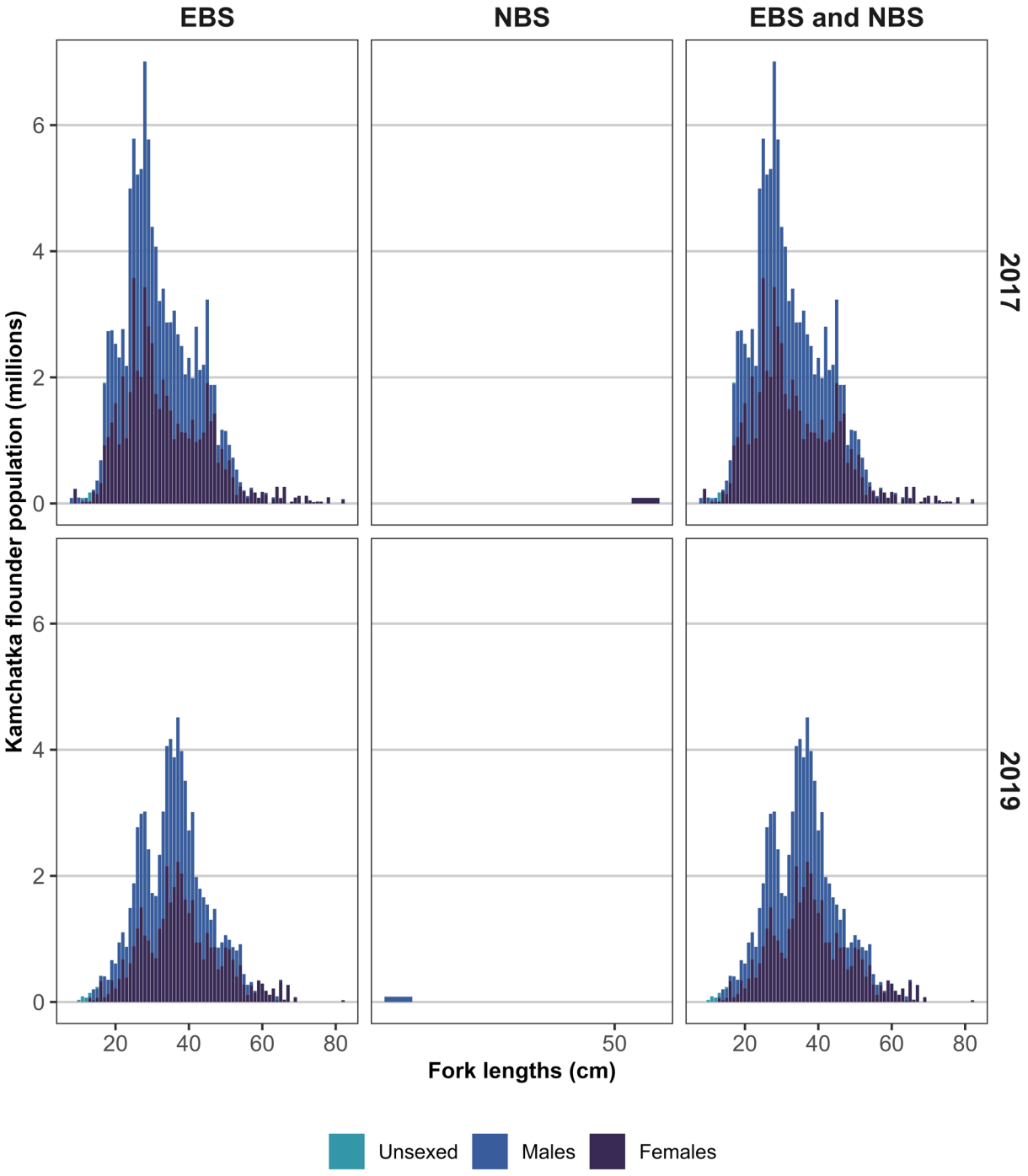

Figure 28. -- Total abundance-at-length estimates of Kamchatka flounder (*Atheresthes evermanni*) by sex (males, females, and unsexed) observed during the 2017 and 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 20a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for Kamchatka flounder (*Atheresthes evermanni*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.00	0.00	29	26	0	82	2	2	2
20	0.00	0.00	0	0	0	0	0	0	0
31	0.37	0.09	3,524	817	1,890	5,157	32	32	32
32	1.26	0.57	1,107	501	0	2,291	6	6	6
41	1.31	0.37	8,187	2,298	3,543	12,832	30	30	29
42	0.55	0.16	1,331	384	546	2,116	17	17	17
43	1.45	0.29	3,060	615	1,780	4,339	19	19	19
50	2.04	0.59	7,916	2,275	3,229	12,603	25	25	25
61	1.59	0.15	14,055	1,318	11,392	16,718	56	56	55
62	2.41	0.65	1,552	417	531	2,573	7	7	6
82	1.16	0.31	2,074	552	858	3,289	9	9	9
90	1.76	0.46	2,035	532	777	3,293	7	7	7
Total	**0.91**	**0.08**	**44,870**	**3,795**	**37,356**	**52,384**	**210**	**210**	**207**
NBS									
70	0.00	0.00	0	0	0	0	0	0	0
71	0.00	0.00	0	0	0	0	0	0	0
81	0.02	0.02	61	61	0	187	1	1	1
Total	**0.00**	**0.00**	**61**	**61**	**0**	**184**	**1**	**1**	**1**

Table 20b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for Kamchatka flounder (*Atheresthes evermanni*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.02	0.02	182.03	152.27	0.00	489.76	2	2	2
20	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
31	0.98	0.20	9,229.10	1,918.35	5,392.41	13,065.79	32	32	32
32	3.64	1.88	3,189.99	1,649.61	0.00	7,091.33	6	6	6
41	1.09	0.23	6,808.51	1,422.70	3,933.24	9,683.78	30	30	29
42	0.92	0.24	2,199.85	584.67	1,004.20	3,395.50	17	17	17
43	1.30	0.26	2,752.61	540.54	1,628.28	3,876.95	19	19	19
50	5.92	1.67	22,966.83	6,464.63	9,649.70	36,283.96	25	25	25
61	3.05	0.33	26,915.41	2,936.96	20,979.82	32,851.00	56	56	55
62	2.31	0.55	1,486.14	353.25	621.73	2,350.56	7	7	6
82	0.72	0.20	1,287.18	350.97	514.70	2,059.67	9	9	9
90	1.50	0.32	1,731.68	373.01	849.52	2,613.84	7	7	7
Total	**1.60**	**0.16**	**78,749.34**	**7,738.65**	**63,426.80**	**94,071.87**	**210**	**210**	**207**
NBS									
70	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
71	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
81	0.02	0.02	83.52	83.52	0.00	255.22	1	1	1
Total	**0.00**	**0.00**	**83.52**	**83.52**	**0.00**	**250.54**	**1**	**1**	**1**

Pacific Halibut (*Hippoglossus stenolepis*)

Pacific halibut are widely distributed across the shelf. They were collected at 64.9% of the stations sampled in the EBS (244 of 376 stations) and 27.8% of stations in the NBS (40 of 144 stations). The highest density catches of Pacific halibut in 2019 were north of St. Paul Island, northwest of the Alaska Peninsula between Nelson Lagoon and Port Heiden, south of Nunivak Island, and in the Chirikov Basin (Fig. 29). From 2017 to 2019, the Pacific halibut biomass estimate within the EBS survey area decreased 10% from 126,684 t to 113,855 t. However, in the NBS the biomass estimate increased 39% from 18,507 t to 25,722 t (Table 21a).

In 2019, Pacific halibut were found in waters with depths between 21 m and 176 m in the EBS, and between 14 m and 63 m within the NBS. Pacific halibut were found at bottom temperatures from 9.3°C and 1.6°C in the EBS, and from 13.5°C and -0.5°C in the NBS. The fork lengths of Pacific halibut measured during the 2019 survey were between 5 and 198 cm in the EBS, and between 16 and 137 cm in the NBS.

The length distribution of Pacific halibut in 2010 was bimodal. However, beginning in 2017, and similarly in 2019, there were several modes in the size composition (Fig. 30). To ensure a majority of the halibut caught at sea could be released alive, many of these animals were deliberately left unsexed by survey teams. As a result, the abundance-at-length data are categorized as unsexed. Lethal sampling for otoliths and sex was only conducted by the IPHC sampler on a subset of Pacific halibut caught on one vessel.

The EBS bottom trawl survey provides annual estimates of biomass, population, and length composition for Pacific halibut on the EBS shelf (Stewart and Martell 2015). Management of Pacific halibut stocks is the purview of the IPHC, and their stock assessments include all available fisheries and scientific survey data from both the United States and Canada, including a longline survey they conduct.

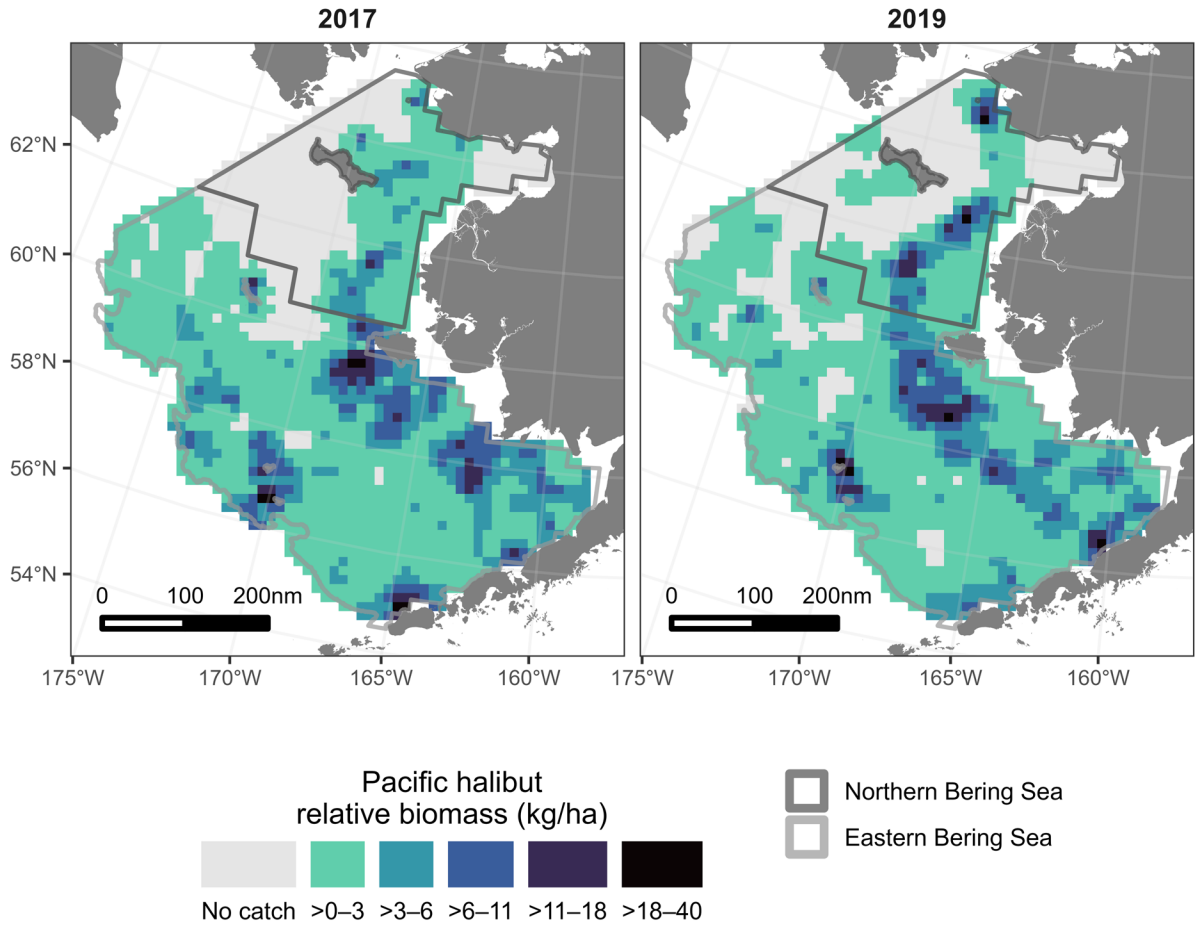

Figure 29. --Pacific halibut (*Hippoglossus stenolepis*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

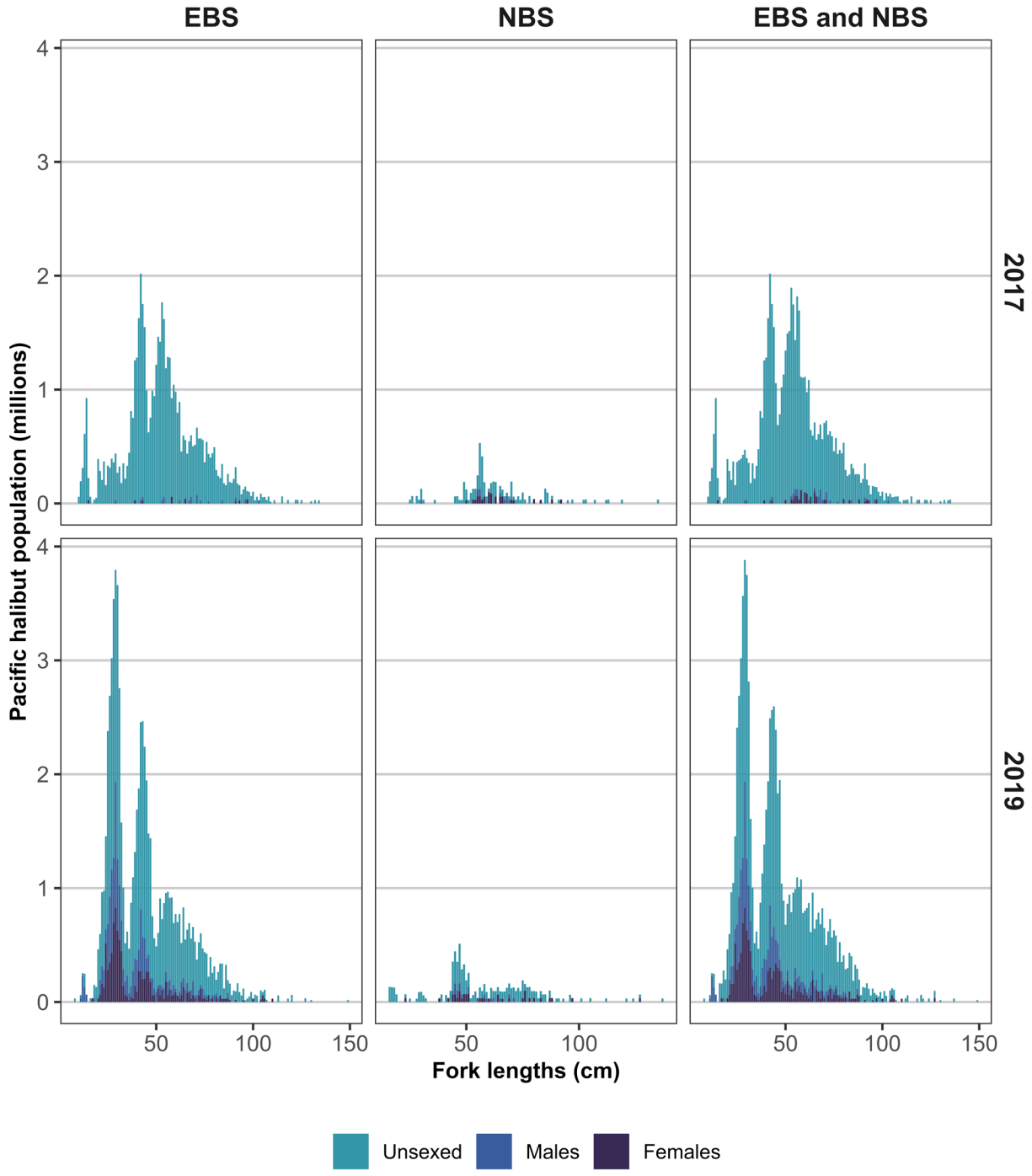

Figure 30. -- Total abundance-at-length estimates of Pacific halibut (*Hippoglossus stenolepis*) by sex (males, females, and unsexed) observed during the 2017 and 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. Sexed length data were collected on only one of the two vessels; the other collected unsexed lengths.

Table 21a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for Pacific halibut (*Hippoglossus stenolepis*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	3.83	0.42	29,820	3,251	23,251	36,390	54	54	54
20	6.26	0.99	25,671	4,054	17,381	33,962	31	31	31
31	2.14	0.39	20,237	3,710	12,816	27,657	51	51	51
32	4.25	1.56	3,727	1,371	373	7,081	8	8	8
41	0.76	0.26	4,793	1,635	1,489	8,098	15	15	15
42	4.54	1.08	10,901	2,587	5,609	16,192	25	25	25
43	0.43	0.18	913	371	141	1,685	6	6	6
50	1.50	0.35	5,810	1,373	2,983	8,638	17	17	17
61	1.24	0.22	10,906	1,943	6,979	14,833	34	34	34
62	0.34	0.34	217	217	0	774	1	1	1
82	0.00	0.00	0	0	0	0	0	0	0
90	0.74	0.56	860	645	0	2,385	2	2	2
Total	**2.31**	**0.15**	**113,855**	**7,634**	**98,739**	**128,970**	**244**	**244**	**244**
NBS									
70	2.49	0.60	19,742	4,749	10,144	29,339	27	27	27
71	0.68	0.40	5,561	3,218	0	12,064	9	9	9
81	0.11	0.06	419	235	0	901	4	4	4
Total	**1.29**	**0.29**	**25,722**	**5,741**	**14,240**	**37,204**	**40**	**40**	**40**

Table 21b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for Pacific halibut (*Hippoglossus stenolepis*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	4.88	0.55	38,017.02	4,300.73	29,325.23	46,708.80	54	54	54
20	3.96	0.60	16,252.41	2,445.49	11,251.38	21,253.44	31	31	31
31	1.03	0.22	9,725.02	2,083.55	5,557.92	13,892.11	51	51	51
32	0.89	0.21	783.28	186.48	326.96	1,239.60	8	8	8
41	0.17	0.06	1,079.37	379.83	311.73	1,847.01	15	15	15
42	2.10	0.90	5,042.43	2,157.76	629.81	9,455.05	25	25	25
43	0.10	0.04	207.54	88.40	23.68	391.41	6	6	6
50	0.30	0.08	1,163.87	296.60	552.87	1,774.88	17	17	17
61	0.24	0.04	2,094.64	350.28	1,386.72	2,802.55	34	34	34
62	0.06	0.06	35.41	35.41	0.00	126.45	1	1	1
82	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
90	0.05	0.03	57.94	37.96	0.00	147.72	2	2	2
Total	**1.51**	**0.12**	**74,458.93**	**5,820.14**	**62,935.05**	**85,982.81**	**244**	**244**	**244**
NBS									
70	0.85	0.20	6,706.95	1,613.73	3,445.61	9,968.30	27	27	27
71	0.13	0.06	1,023.08	468.11	77.03	1,969.12	9	9	9
81	0.04	0.02	167.04	92.83	0.00	357.53	4	4	4
Total	**0.40**	**0.08**	**7,897.07**	**1,682.81**	**4,531.44**	**11,262.69**	**40**	**40**	**40**

Bering Skate (*Bathyraja interrupta*)

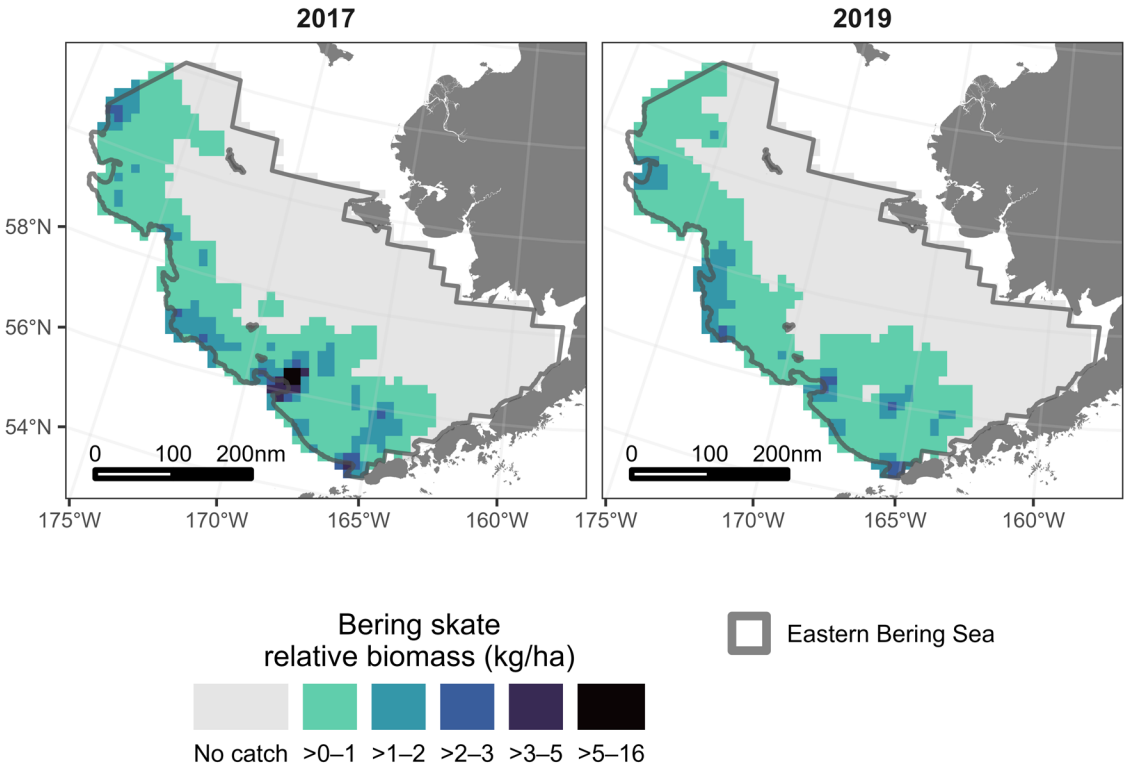

Figure 31. --Bering skate (*Bathyraja interrupta*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea shelf bottom trawl survey.

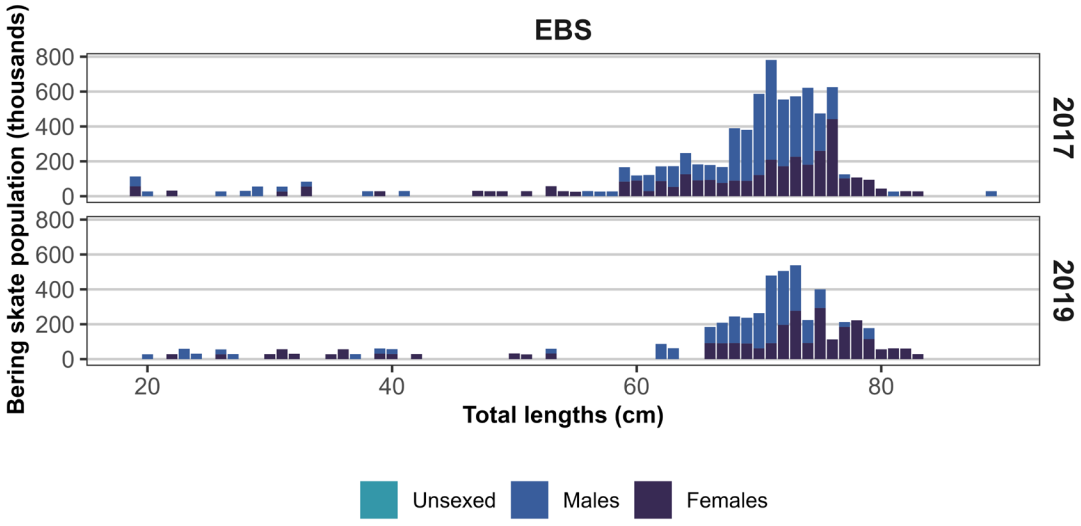

Figure 32. --Total abundance-at-length estimates of Bering skate (*Bathyraja interrupta*) by sex (males, females, and unsexed) observed during the 2017 and 2019 eastern Bering Sea shelf bottom trawl surveys.

Table 22a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for Bering skate (*Bathyraja interrupta*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species was not found in the NBS shelf trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
10	0.00	0.00	0	0	0	0	0	0	0
20	0.00	0.00	0	0	0	0	0	0	0
31	0.28	0.07	2,645	665	1,315	3,975	19	19	19
32	0.08	0.08	71	71	0	239	1	1	1
41	0.02	0.02	141	141	0	426	1	1	1
42	0.14	0.07	336	160	9	663	5	5	5
43	0.00	0.00	0	0	0	0	0	0	0
50	0.58	0.16	2,266	616	997	3,536	16	16	16
61	0.49	0.08	4,325	709	2,891	5,759	34	34	34
62	0.20	0.14	128	92	0	353	2	2	2
82	0.00	0.00	0	0	0	0	0	0	0
90	0.15	0.10	178	113	0	446	3	3	3
Total	**0.20**	**0.02**	**10,091**	**1,182**	**7,751**	**12,432**	**81**	**81**	**81**

Table 22b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for Bering skate (*Bathyraja interrupta*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species was not found in the NBS shelf trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
10	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
31	0.13	0.03	1,227.79	315.25	597.28	1,858.30	19	19	19
32	0.03	0.03	24.28	24.28	0.00	81.70	1	1	1
41	0.01	0.01	52.05	52.04	0.00	157.23	1	1	1
42	0.06	0.03	141.30	71.11	0.00	286.72	5	5	5
43	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
50	0.34	0.08	1,305.25	309.72	667.23	1,943.28	16	16	16
61	0.25	0.04	2,171.33	340.30	1,483.58	2,859.07	34	34	34
62	0.08	0.06	53.22	37.63	0.00	145.29	2	2	2
82	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
90	0.10	0.05	114.02	58.63	0.00	252.69	3	3	3
Total	**0.10**	**0.01**	**5,089.24**	**569.49**	**3,961.64**	**6,216.84**	**81**	**81**	**81**

Alaska Skate (*Bathyraja parmifera*)

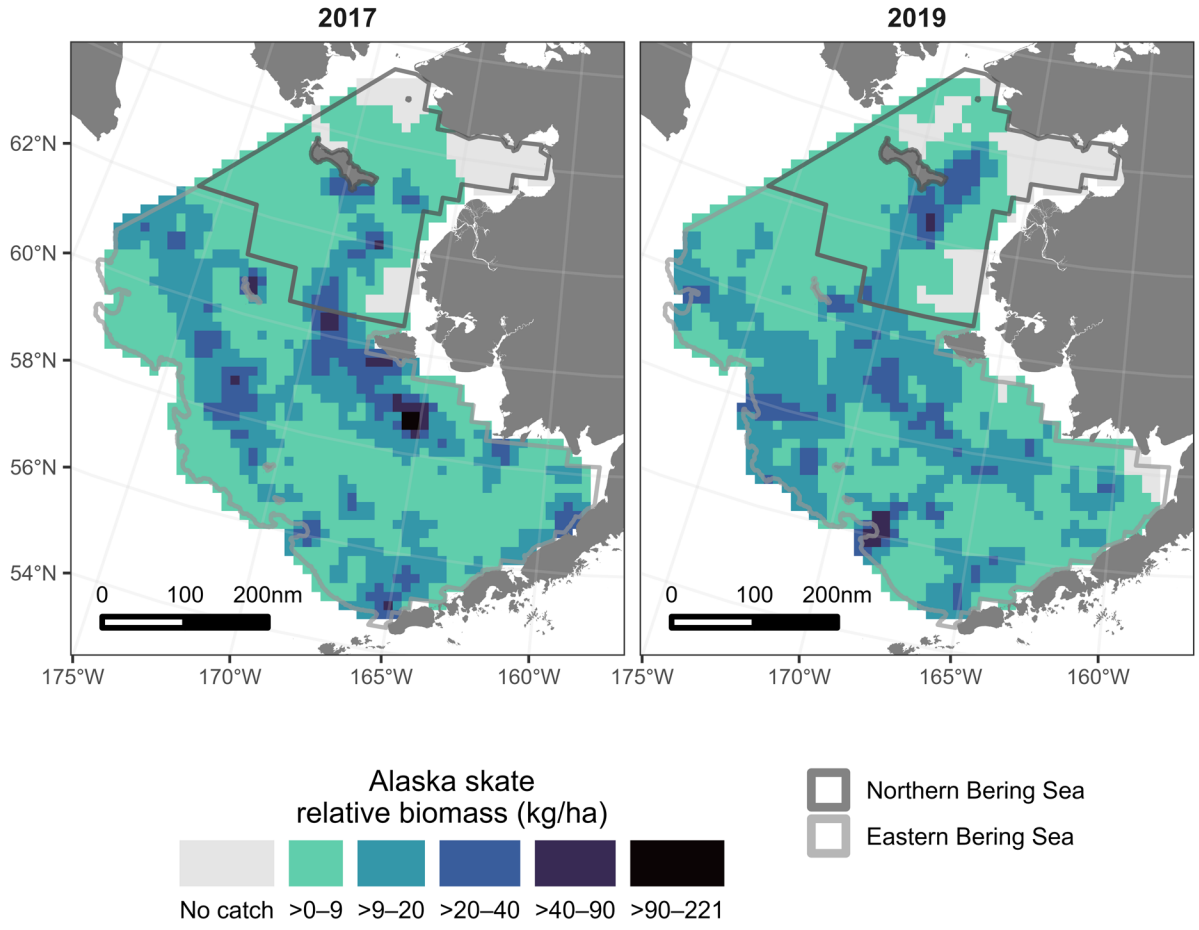

Figure 33. -- Alaska skate (*Bathyraja parmifera*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

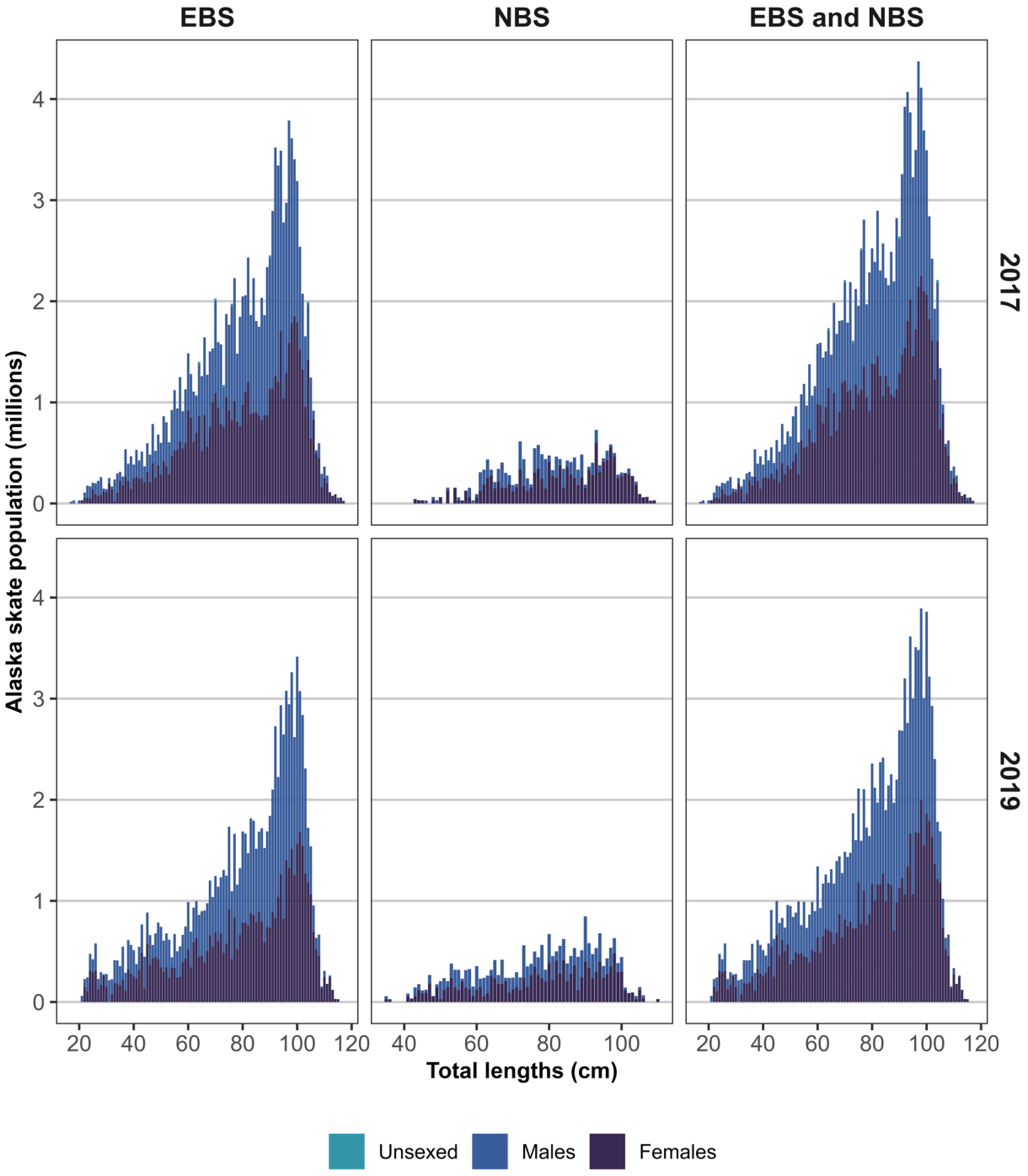

Figure 34. -- Total abundance-at-length estimates of Alaska skate (*Bathyraja parmifera*) by sex (males, females, and unsexed) observed during the 2017 and 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 23a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (thousand t) with standard deviation and 95% lower (LCL; thousand t) and upper (UCL; thousand t) confidence limits for Alaska skate (*Bathyraja parmifera*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (thousand t)	SD biomass	95% LCL (thousand t)	95% UCL (thousand t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	6.76	0.96	52.68	7,487	37.54	67.81	41	41	41
20	12.02	1.53	49.33	6,278	36.51	62.15	29	29	29
31	9.45	0.98	89.31	9,223	70.87	107.76	66	66	66
32	6.15	1.31	5.40	1,154	2.67	8.13	8	8	8
41	12.47	1.28	78.16	8,047	61.90	94.43	44	44	44
42	6.55	0.90	15.72	2,153	11.31	20.12	28	28	28
43	9.10	1.56	19.22	3,283	12.39	26.05	22	22	22
50	13.75	3.66	53.33	14,191	24.10	82.57	25	25	25
61	12.36	1.14	108.98	10,037	88.69	129.26	60	60	60
62	8.16	1.95	5.25	1,252	2.03	8.46	7	7	7
82	3.79	0.53	6.80	949	4.68	8.91	12	12	12
90	6.00	1.87	6.94	2,165	1.82	12.06	6	6	6
Total	**9.96**	**0.48**	**491.11**	**23,902**	**443.78**	**538.43**	**348**	**348**	**348**
NBS									
70	7.43	1.46	58.91	11,536	35.60	82.23	35	35	35
71	2.70	0.99	21.95	8,015	5.75	38.15	13	13	13
81	3.71	0.91	14.24	3,507	7.04	21.44	25	25	25
Total	**4.78**	**0.73**	**95.10**	**14,478**	**66.15**	**124.06**	**73**	**73**	**73**

Table 23b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for Alaska skate (*Bathyraja parmifera*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	1.68	0.26	13,078.26	1,991.20	9,054.04	17,102.47	41	41	41
20	3.14	0.45	12,890.34	1,838.87	9,135.37	16,645.32	29	29	29
31	1.79	0.17	16,920.64	1,631.76	13,657.11	20,184.17	66	66	66
32	1.31	0.49	1,150.78	434.15	124.02	2,177.53	8	8	8
41	3.09	0.32	19,355.41	2,036.66	15,239.32	23,471.51	44	44	44
42	1.42	0.15	3,416.93	368.75	2,662.83	4,171.03	28	28	28
43	3.10	0.75	6,540.12	1,588.81	3,235.40	9,844.84	22	22	22
50	1.85	0.50	7,165.23	1,932.57	3,184.13	11,146.32	25	25	25
61	2.06	0.16	18,145.01	1,400.86	15,313.88	20,976.13	60	60	60
62	1.50	0.26	966.20	169.73	529.82	1,402.59	7	7	7
82	0.88	0.13	1,586.94	232.18	1,069.65	2,104.24	12	12	12
90	1.53	0.70	1,764.39	809.74	0.00	3,679.42	6	6	6
Total	**2.09**	**0.10**	**102,980.25**	**4,841.63**	**93,393.83**	**112,566.67**	**348**	**348**	**348**
NBS									
70	1.92	0.40	15,185.13	3,186.14	8,745.94	21,624.32	35	35	35
71	0.42	0.16	3,409.51	1,263.63	855.71	5,963.31	13	13	13
81	1.01	0.21	3,889.60	808.67	2,230.21	5,548.99	25	25	25
Total	**1.13**	**0.18**	**22,484.24**	**3,521.68**	**15,440.89**	**29,527.60**	**73**	**73**	**73**

Longhead Dab (*Limanda proboscidea*)

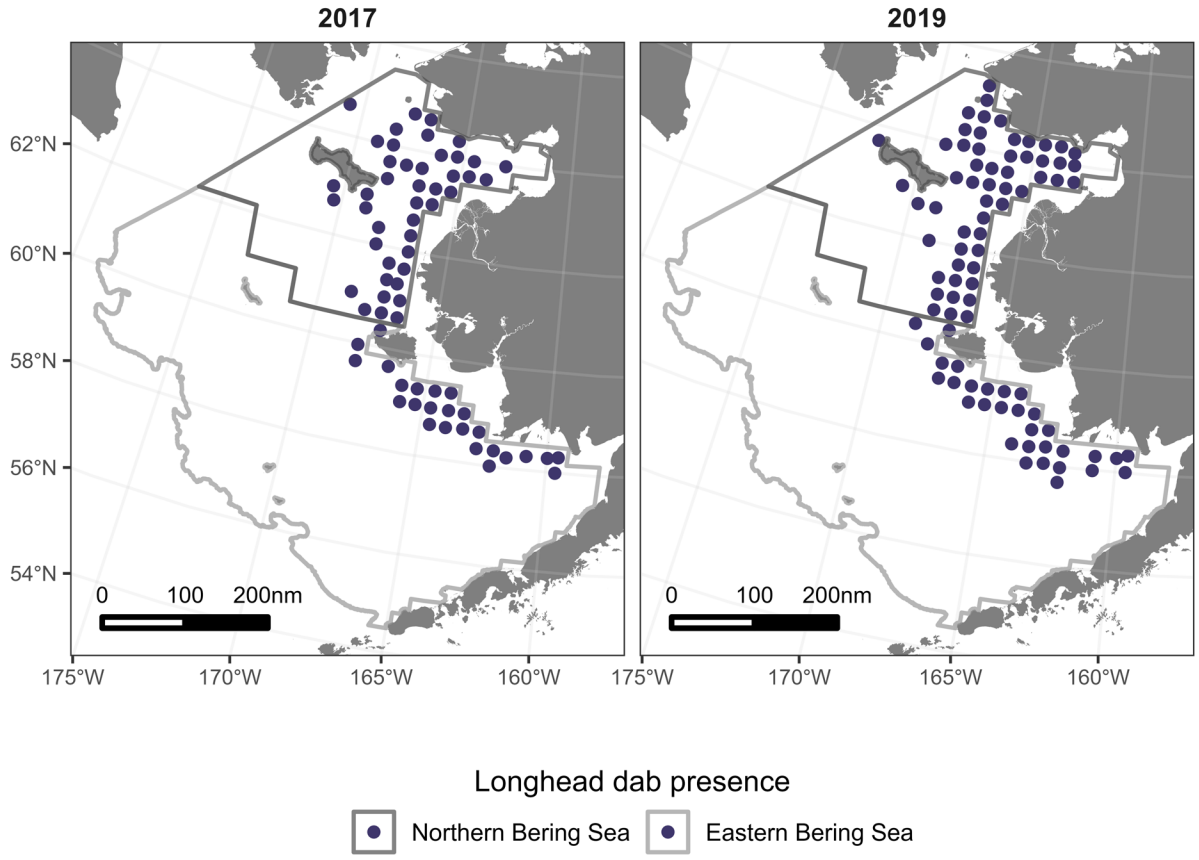

Figure 35. --Longhead dab (*Limanda proboscidea*) presence from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species has not been caught in enough quantity or at enough stations to adequately characterize a distribution.

Table 24a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for longhead dab (*Limanda proboscidea*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.19	0.08	1,507	613	268	2,747	21	21	21
20	0.03	0.01	104	51	0	209	10	10	10
31	0.00	0.00	0	0	0	0	0	0	0
32	0.00	0.00	0	0	0	0	0	0	0
41	0.00	0.00	0	0	0	0	0	0	0
42	0.00	0.00	0	0	0	0	0	0	0
43	0.00	0.00	0	0	0	0	0	0	0
50	0.00	0.00	0	0	0	0	0	0	0
61	0.00	0.00	0	0	0	0	0	0	0
62	0.00	0.00	0	0	0	0	0	0	0
82	0.00	0.00	0	0	0	0	0	0	0
90	0.00	0.00	0	0	0	0	0	0	0
Total	**0.03**	**0.01**	**1,611**	**615**	**393**	**2,830**	**31**	**31**	**31**
NBS									
70	0.15	0.05	1,157	409	330	1,984	23	23	22
71	0.10	0.05	847	423	0	1,701	31	31	31
81	0.00	0.00	0	0	0	0	0	0	0
Total	**0.10**	**0.03**	**2,004**	**588**	**828**	**3,181**	**54**	**54**	**53**

Table 24b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (millions) with standard deviation (thousands) and 95% lower (LCL; millions) and upper (UCL; millions) confidence limits for longhead dab (*Limanda proboscidea*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (millions)	SD population (thousands)	95% LCL (millions)	95% UCL (millions)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	2.46	1.04	19.12	8,122.25	2.71	35.54	21	21	21
20	0.36	0.17	1.48	698.76	0.06	2.91	10	10	10
31	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
41	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
42	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
43	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
50	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
61	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
82	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
90	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**0.42**	**0.17**	**20.61**	**8,152.25**	**4.47**	**36.75**	**31**	**31**	**31**
NBS									
70	2.05	0.69	16.26	5,441.37	5.26	27.26	23	23	22
71	2.48	1.34	20.12	10,846.95	0.00	42.04	31	31	31
81	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**1.83**	**0.61**	**36.37**	**12,135.27**	**12.10**	**60.64**	**54**	**54**	**53**

Starry Flounder (*Platichthys stellatus*)

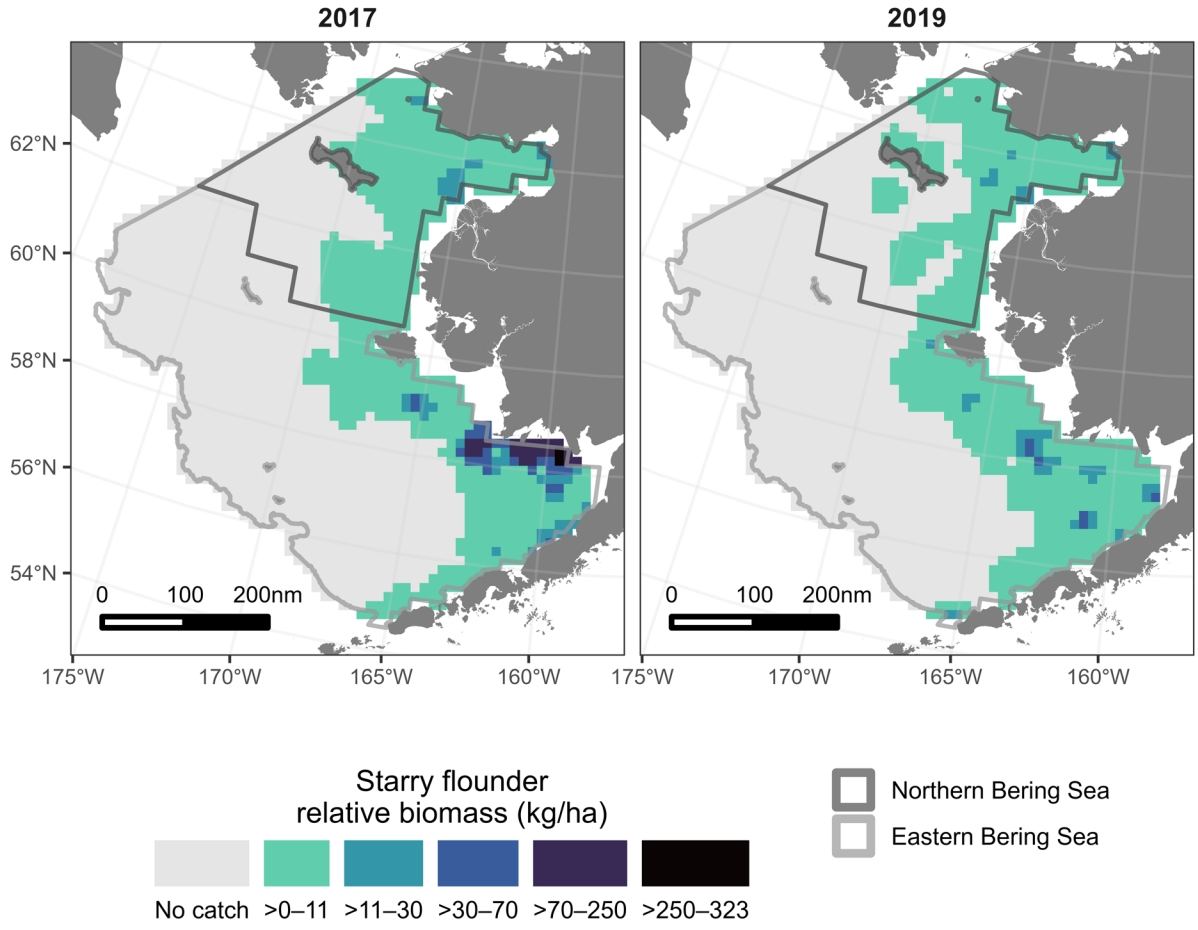

Figure 36. --Starry flounder (*Platichthys stellatus*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 25a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (thousand t) with standard deviation (thousands) and 95% lower (LCL; thousand t) and upper (UCL; thousand t) confidence limits for starry flounder (*Platichthys stellatus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (thousand t)	SD biomass (thousands)	95% LCL (thousand t)	95% UCL (thousand t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	5.55	1.51	43.22	11.72	19.53	66.92	47	47	47
20	2.18	0.89	8.96	3.66	1.48	16.45	16	16	16
31	1.45	0.81	13.69	7.63	0.00	28.95	15	15	15
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
41	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
42	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
43	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
50	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
61	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
82	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
90	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**1.34**	**0.29**	**65.87**	**14.46**	**36.95**	**94.79**	**78**	**78**	**78**
NBS									
70	0.39	0.14	3.10	1.11	0.85	5.34	16	16	16
71	2.88	0.64	23.37	5.21	12.85	33.90	38	38	38
81	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**1.33**	**0.27**	**26.47**	**5.33**	**15.82**	**37.12**	**54**	**54**	**54**

Table 25b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (millions) with standard deviation (millions) and 95% lower (LCL; millions) and upper (UCL; millions) confidence limits for starry flounder (*Platichthys stellatus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (millions)	SD population (millions)	95% LCL (millions)	95% UCL (millions)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	3.74	0.88	29.12	6.82	15.34	42.90	47	47	47
20	1.32	0.47	5.43	1.94	1.47	9.39	16	16	16
31	0.80	0.43	7.57	4.08	0.00	15.72	15	15	15
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
41	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
42	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
43	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
50	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
61	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
82	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
90	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**0.85**	**0.17**	**42.12**	**8.18**	**25.76**	**58.48**	**78**	**78**	**78**
NBS									
70	0.41	0.14	3.28	1.12	1.02	5.53	16	16	16
71	5.93	2.48	48.15	20.13	7.46	88.84	38	38	38
81	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**2.59**	**1.01**	**51.43**	**20.17**	**11.10**	**91.76**	**54**	**54**	**54**

Yellow Irish Lord (*Hemilepidotus jordani*)

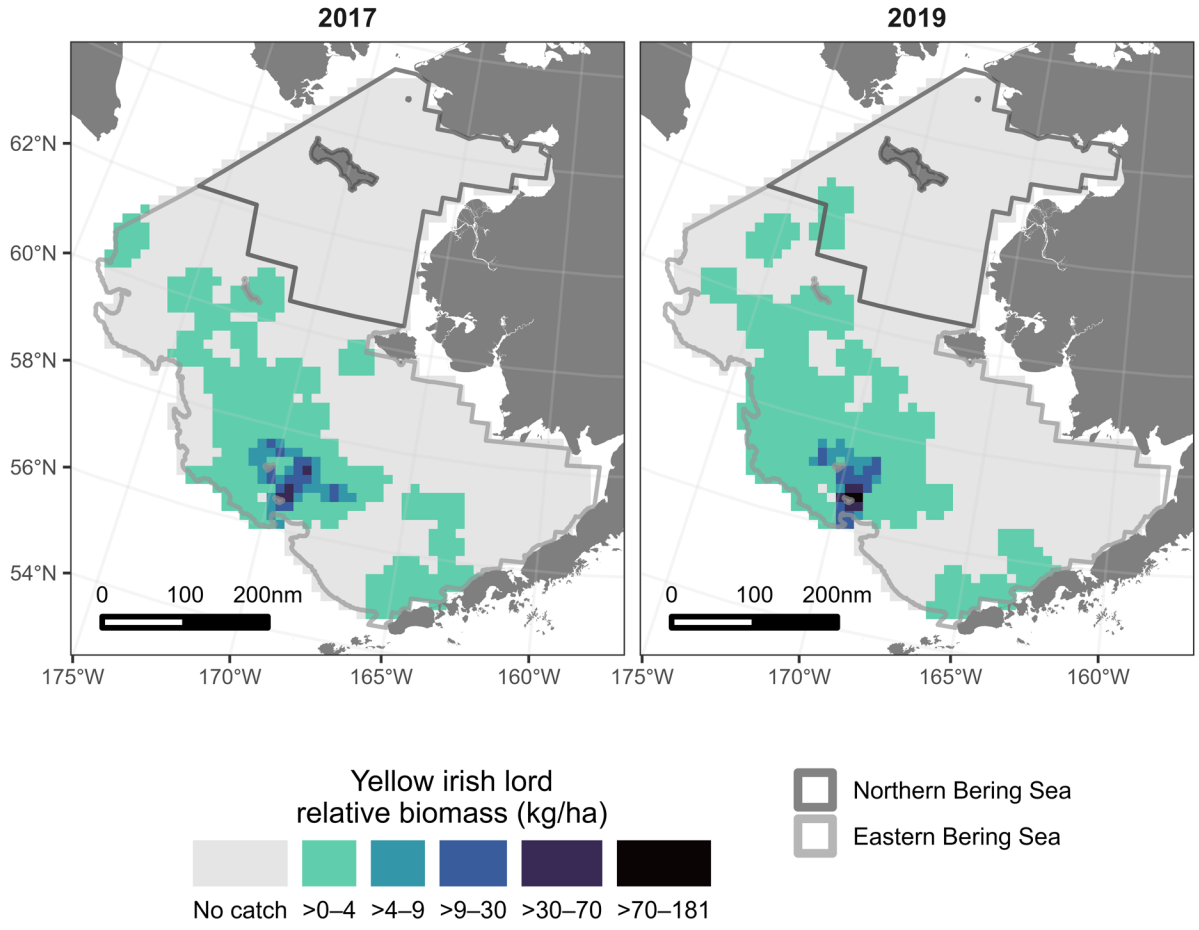

Figure 37. -- Yellow irish lord (*Hemilepidotus jordani*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 26a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for yellow Irish lord (*Hemilepidotus jordani*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.00	0.00	0	0	0	0	0	0	0
20	0.00	0.00	0	0	0	0	0	0	0
31	0.12	0.07	1,087	627	0	2,342	10	10	10
32	30.24	22.42	26,536	19,668	0	73,050	8	8	8
41	0.11	0.05	714	335	38	1,390	8	8	7
42	4.72	1.18	11,344	2,825	5,566	17,122	28	28	28
43	0.08	0.04	173	83	1	344	7	7	7
50	0.04	0.02	136	92	0	325	3	3	3
61	0.16	0.07	1,435	624	174	2,696	16	16	16
62	0.14	0.11	92	69	0	261	3	3	3
82	0.01	0.02	27	27	0	86	1	1	1
90	0.02	0.02	18	18	0	60	1	1	1
Total	**0.84**	**0.40**	**41,561**	**19,893**	**0**	**88,607**	**85**	**85**	**84**
NBS									
70	0.00	0.00	0	0	0	0	0	0	0
71	0.00	0.00	0	0	0	0	0	0	0
81	0.01	0.01	26	24	0	75	2	2	2
Total	**0.00**	**0.00**	**26**	**24**	**0**	**74**	**2**	**2**	**2**

Table 26b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for yellow Irish lord (*Hemilepidotus jordani*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
31	0.12	0.07	1,109.69	639.97	0.00	2,389.62	10	10	10
32	37.28	28.19	32,708.30	24,733.90	0.00	91,203.96	8	8	8
41	0.12	0.06	782.65	375.10	24.58	1,540.72	8	8	7
42	5.67	1.52	13,608.30	3,653.23	6,137.44	21,079.15	28	28	28
43	0.35	0.19	741.50	409.46	0.00	1,593.17	7	7	7
50	0.05	0.03	183.84	129.69	0.00	450.99	3	3	3
61	0.28	0.12	2,492.61	1,093.08	283.49	4,701.73	16	16	16
62	0.21	0.15	133.44	96.06	0.00	368.51	3	3	3
82	0.02	0.02	29.28	29.28	0.00	93.72	1	1	1
90	0.03	0.03	29.04	29.04	0.00	97.73	1	1	1
Total	**1.05**	**0.51**	**51,818.64**	**25,041.01**	**0.00**	**111,040.62**	**85**	**85**	**84**
NBS									
70	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
71	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
81	0.01	0.01	56.28	39.07	0.00	136.44	2	2	2
Total	**0.00**	**0.00**	**56.28**	**39.07**	**0.00**	**134.41**	**2**	**2**	**2**

Plain Sculpin (*Myoxocephalus jaok*)

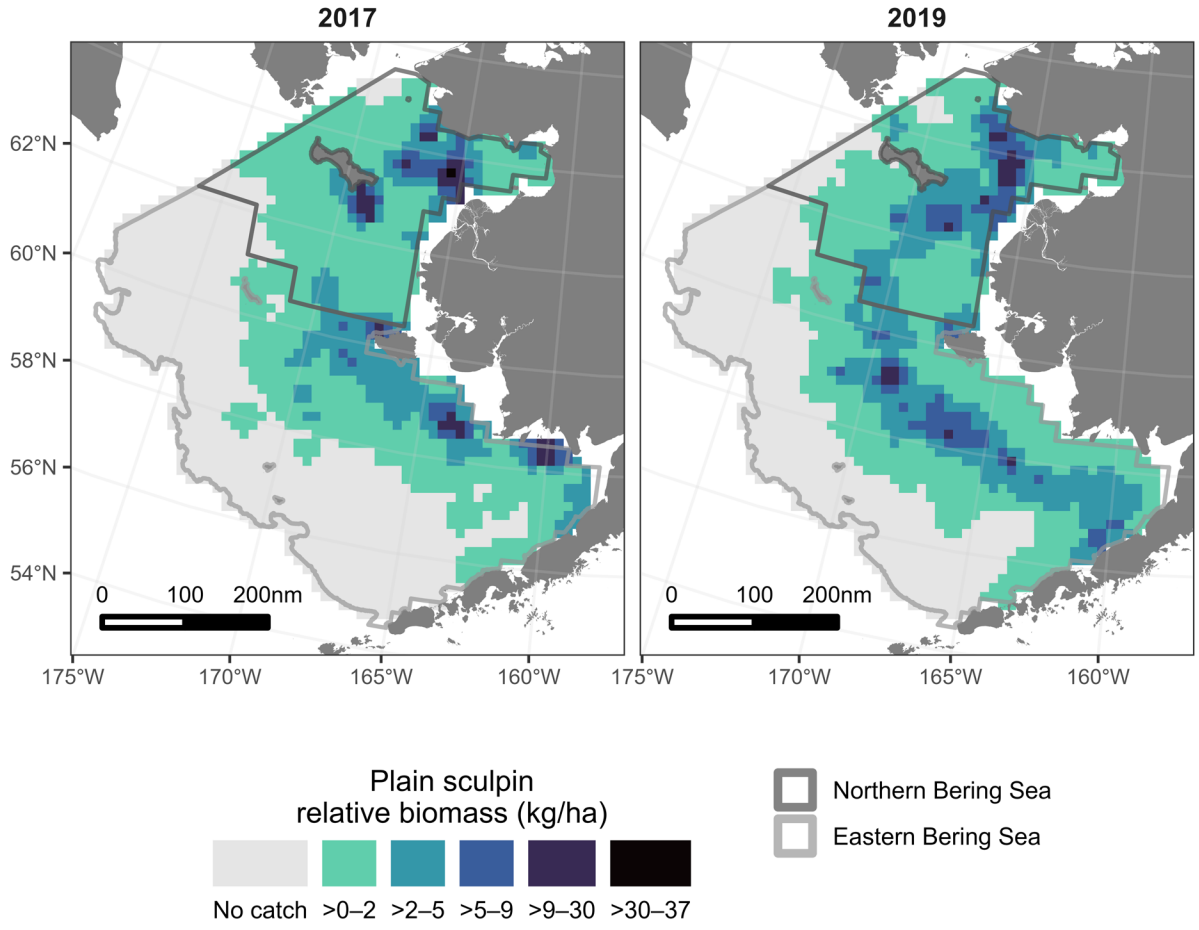

Figure 38. --Plain sculpin (*Myoxocephalus jaok*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 27a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for plain sculpin (*Myoxocephalus jaok*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	2.61	0.30	20,288	2,321	15,597	24,979	56	56	56
20	2.81	0.50	11,522	2,033	7,371	15,673	30	30	30
31	0.74	0.18	6,998	1,724	3,551	10,446	30	30	30
32	0.00	0.00	0	0	0	0	0	0	0
41	1.65	0.36	10,356	2,276	5,756	14,957	30	30	30
42	0.26	0.15	614	355	0	1,339	9	9	9
43	0.27	0.12	573	245	62	1,083	7	7	7
50	0.00	0.00	0	0	0	0	0	0	0
61	0.00	0.00	0	0	0	0	0	0	0
62	0.00	0.00	0	0	0	0	0	0	0
82	0.03	0.03	51	51	0	162	1	1	1
90	0.00	0.00	0	0	0	0	0	0	0
Total	**1.02**	**0.09**	**50,402**	**4,226**	**42,034**	**58,770**	**163**	**163**	**163**
NBS									
70	2.36	0.33	18,672	2,618	13,382	23,963	54	54	54
71	2.45	0.51	19,886	4,110	11,579	28,193	43	43	43
81	0.80	0.32	3,078	1,218	580	5,577	13	13	13
Total	**2.09**	**0.25**	**41,636**	**5,023**	**31,591**	**51,682**	**110**	**110**	**110**

Table 27b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for plain sculpin (*Myoxocephalus jaok*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	3.45	0.41	26,827.17	3,183.54	20,393.23	33,261.11	56	56	56
20	3.76	0.65	15,408.91	2,663.63	9,969.79	20,848.04	30	30	30
31	0.77	0.18	7,302.76	1,707.12	3,888.51	10,716.99	30	30	30
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
41	1.59	0.45	9,981.14	2,821.35	4,279.19	15,683.08	30	30	30
42	0.23	0.13	554.66	316.72	0.00	1,202.35	9	9	9
43	0.18	0.08	384.12	166.97	36.81	731.42	7	7	7
50	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
61	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
82	0.02	0.02	34.68	34.68	0.00	111.01	1	1	1
90	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**1.23**	**0.11**	**60,493.43**	**5,313.52**	**49,972.67**	**71,014.21**	**163**	**163**	**163**
NBS									
70	4.10	0.64	32,500.23	5,079.72	22,234.12	42,766.35	54	54	54
71	6.53	1.23	53,068.55	9,963.16	32,933.01	73,204.08	43	43	43
81	0.62	0.25	2,362.51	959.45	393.73	4,331.30	13	13	13
Total	**4.42**	**0.56**	**87,931.29**	**11,224.46**	**65,482.37**	**110,380.22**	**110**	**110**	**110**

Great Sculpin (*Myoxocephalus polyacanthocephalus*)

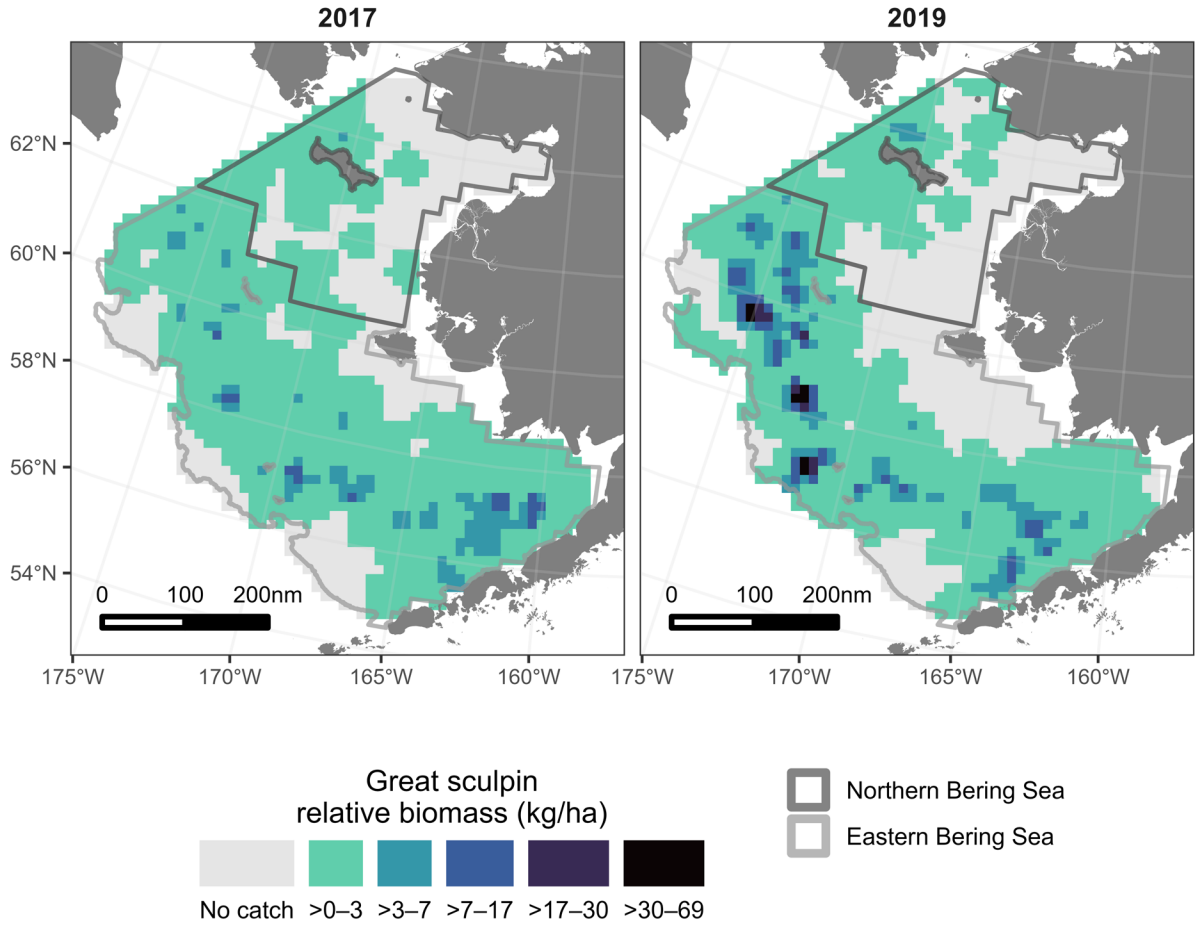

Figure 39. -- Great sculpin (*Myoxocephalus polyacanthocephalus*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 28a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for great sculpin (*Myoxocephalus polyacanthocephalus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.23	0.07	1,818	550	706	2,929	15	15	15
20	0.01	0.01	46	46	0	139	1	1	1
31	2.18	0.34	20,611	3,225	14,161	27,062	48	48	48
32	3.63	1.73	3,187	1,518	0	6,776	7	7	7
41	1.16	0.27	7,256	1,704	3,813	10,700	25	25	25
42	1.35	0.36	3,253	860	1,494	5,012	19	19	19
43	4.14	1.39	8,735	2,934	2,632	14,837	21	21	21
50	0.12	0.07	452	265	0	998	3	3	3
61	3.93	1.63	34,658	14,382	5,592	63,724	30	30	30
62	6.38	3.59	4,101	2,309	0	9,752	7	7	7
82	2.27	0.88	4,083	1,585	596	7,571	9	9	9
90	3.18	0.95	3,674	1,101	1,071	6,277	8	8	8
Total	**1.86**	**0.32**	**91,875**	**15,532**	**60,812**	**122,938**	**193**	**193**	**193**
NBS									
70	0.06	0.02	472	177	115	829	10	10	8
71	0.29	0.15	2,332	1,200	0	4,757	12	12	12
81	0.26	0.12	1,000	442	91	1,909	10	10	10
Total	**0.19**	**0.06**	**3,804**	**1,291**	**1,222**	**6,385**	**32**	**32**	**30**

Table 28b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for great sculpin (*Myoxocephalus polyacanthocephalus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.09	0.02	668.02	166.41	331.70	1,004.34	15	15	15
20	0.01	0.01	28.46	28.46	0.00	86.66	1	1	1
31	0.62	0.08	5,904.20	792.23	4,319.75	7,488.66	48	48	48
32	0.71	0.27	619.36	239.26	53.50	1,185.21	7	7	7
41	0.45	0.10	2,850.70	654.26	1,528.43	4,172.96	25	25	25
42	0.39	0.09	947.23	205.49	527.00	1,367.45	19	19	19
43	1.71	0.58	3,600.40	1,216.29	1,070.52	6,130.27	21	21	21
50	0.04	0.02	149.31	86.60	0.00	327.70	3	3	3
61	1.50	0.62	13,212.30	5,442.13	2,213.75	24,210.84	30	30	30
62	2.84	1.64	1,825.43	1,054.29	0.00	4,405.28	7	7	7
82	0.98	0.40	1,767.52	717.26	188.83	3,346.22	9	9	9
90	1.49	0.53	1,721.98	614.24	269.31	3,174.64	8	8	8
Total	**0.68**	**0.12**	**33,294.90**	**5,855.81**	**21,583.27**	**45,006.53**	**193**	**193**	**193**
NBS									
70	0.05	0.02	428.04	135.55	154.10	701.98	10	10	8
71	0.49	0.30	4,016.29	2,477.47	0.00	9,023.26	12	12	12
81	0.14	0.04	528.06	167.24	184.22	871.89	10	10	10
Total	**0.25**	**0.13**	**4,972.39**	**2,486.81**	**0.00**	**9,946.00**	**32**	**32**	**30**

Shorthorn Sculpin (*Myoxocephalus scorpius*)

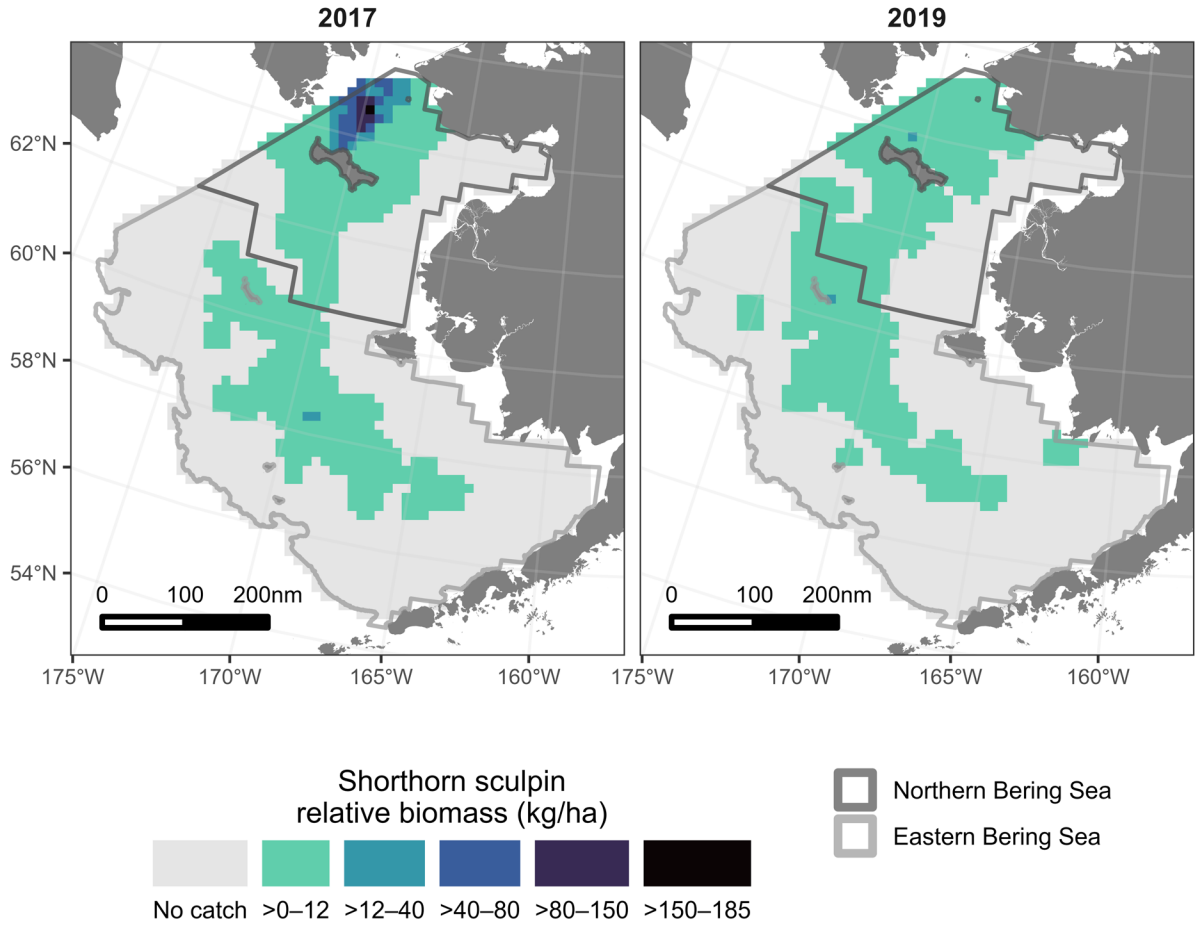

Figure 40. -- Shorthorn sculpin (*Myoxocephalus scorpius*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 29a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for shorthorn sculpin (*Myoxocephalus scorpius*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.00	0.00	9	9	0	27	1	1	1
20	0.00	0.00	0	0	0	0	0	0	0
31	0.02	0.01	172	76	20	324	5	5	5
32	0.00	0.00	0	0	0	0	0	0	0
41	0.71	0.19	4,423	1,166	2,067	6,779	26	26	26
42	0.04	0.03	100	62	0	227	4	4	4
43	1.45	0.79	3,064	1,674	0	6,557	8	8	8
50	0.00	0.00	0	0	0	0	0	0	0
61	0.10	0.09	848	810	0	2,485	2	2	2
62	0.00	0.00	0	0	0	0	0	0	0
82	0.10	0.06	179	99	0	400	3	3	3
90	0.00	0.00	0	0	0	0	0	0	0
Total	**0.18**	**0.04**	**8,795**	**2,199**	**4,396**	**13,194**	**49**	**49**	**49**
NBS									
70	0.10	0.03	799	245	303	1,295	12	12	12
71	1.53	0.41	12,408	3,329	5,681	19,135	23	23	23
81	0.25	0.08	952	295	345	1,559	11	11	11
Total	**0.71**	**0.17**	**14,159**	**3,351**	**7,387**	**20,931**	**46**	**46**	**46**

Table 29b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for shorthorn sculpin (*Myoxocephalus scorpius*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.00	0.00	29.36	29.36	0.00	88.69	1	1	1
20	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
31	0.02	0.01	176.48	80.36	15.75	337.21	5	5	5
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
41	0.48	0.12	2,994.21	731.59	1,515.66	4,472.75	26	26	26
42	0.04	0.02	104.56	58.29	0.00	223.59	4	4	4
43	1.06	0.64	2,235.21	1,340.79	0.00	5,032.09	8	8	8
50	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
61	0.04	0.04	387.01	358.14	0.00	1,110.81	2	2	2
62	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
82	0.07	0.04	133.99	76.78	0.00	305.05	3	3	3
90	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**0.12**	**0.03**	**6,060.81**	**1,574.11**	**2,912.60**	**9,209.02**	**49**	**49**	**49**
NBS									
70	0.11	0.03	846.05	271.72	296.91	1,395.20	12	12	12
71	1.58	0.43	12,839.75	3,470.14	5,826.60	19,852.91	23	23	23
81	0.17	0.05	655.13	189.43	265.65	1,044.60	11	11	11
Total	**0.72**	**0.18**	**14,340.93**	**3,485.91**	**7,295.90**	**21,385.96**	**46**	**46**	**46**

Pacific Ocean Perch (*Sebastes alutus*)

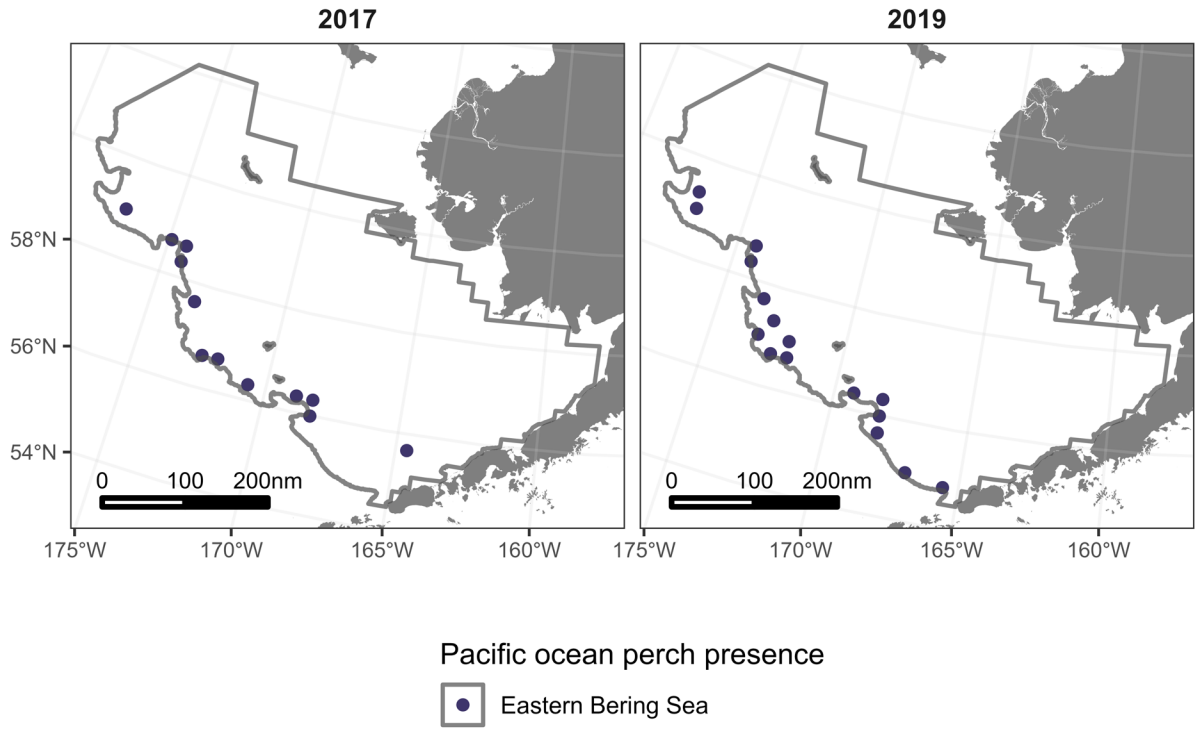

Figure 41. --Pacific ocean perch (*Sebastes alutus*) presence from the 2017 (left) and 2019 (right) eastern Bering Sea shelf bottom trawl survey. This species has not been caught in enough quantity or at enough stations to adequately characterize a distribution.

Table 30a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for Pacific ocean perch (*Sebastes alutus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species was not found in the NBS shelf trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
10	0.00	0.00	0	0	0	0	0	0	0
20	0.00	0.00	0	0	0	0	0	0	0
31	0.00	0.00	0	0	0	0	0	0	0
32	0.00	0.00	0	0	0	0	0	0	0
41	0.00	0.00	0	0	0	0	0	0	0
42	0.00	0.00	0	0	0	0	0	0	0
43	0.00	0.00	0	0	0	0	0	0	0
50	0.19	0.11	738	423	0	1,611	6	6	6
61	0.53	0.38	4,662	3,328	0	11,387	10	10	10
62	0.00	0.00	0	0	0	0	0	0	0
82	0.00	0.00	0	0	0	0	0	0	0
90	0.00	0.00	0	0	0	0	0	0	0
Total	**0.11**	**0.07**	**5,400**	**3,355**	**0**	**12,042**	**16**	**16**	**16**

Table 30b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (millions) with standard deviation (millions) and 95% lower (LCL; millions) and upper (UCL; millions) confidence limits for Pacific ocean perch (*Sebastes alutus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species was not found in the NBS shelf trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (millions)	SD population (millions)	95% LCL (millions)	95% UCL (millions)	Hauls with weights	Hauls with counts	Hauls with lengths
10	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
31	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
41	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
42	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
43	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
50	0.44	0.30	1.72	1.17	0.00	4.13	6	6	6
61	0.68	0.45	6.00	4.00	0.00	14.09	10	10	10
62	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
82	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
90	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**0.16**	**0.08**	**7.73**	**4.17**	**0.00**	**15.98**	**16**	**16**	**16**

Rex Sole (*Glyptocephalus zachirus*)

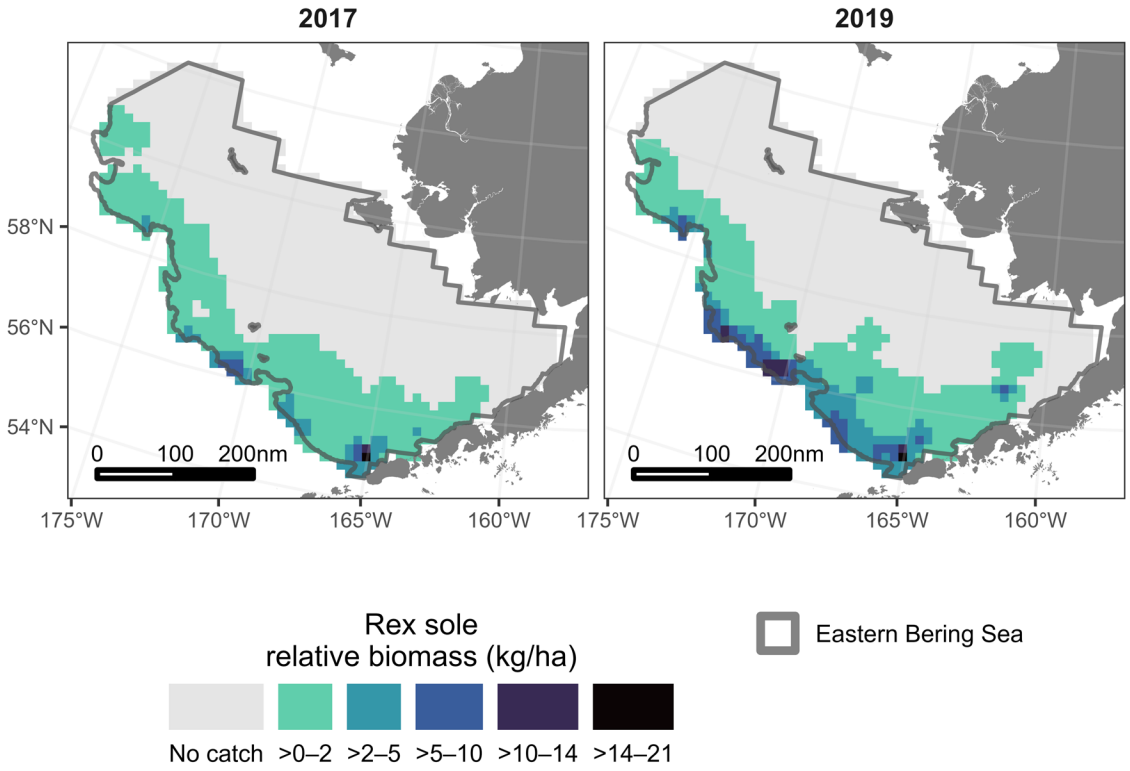

Figure 42. --Rex sole (*Glyptocephalus zachirus*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea shelf bottom trawl survey.

Table 31a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for rex sole (*Glyptocephalus zachirus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species was not found in the NBS shelf trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
10	0.00	0.00	0	0	0	0	0	0	0
20	0.00	0.00	0	0	0	0	0	0	0
31	0.43	0.15	4,065	1,400	1,264	6,865	24	24	24
32	0.11	0.09	100	75	0	277	2	2	2
41	0.00	0.00	0	0	0	0	0	0	0
42	0.01	0.01	18	12	0	43	2	2	2
43	0.00	0.00	0	0	0	0	0	0	0
50	3.85	0.78	14,926	3,010	8,726	21,126	26	26	26
61	1.22	0.36	10,710	3,195	4,254	17,166	31	31	31
62	0.00	0.00	0	0	0	0	0	0	0
82	0.00	0.00	0	0	0	0	0	0	0
90	0.00	0.00	0	0	0	0	0	0	0
Total	**0.60**	**0.09**	**29,819**	**4,608**	**20,696**	**38,942**	**85**	**85**	**85**

Table 31b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for rex sole (*Glyptocephalus zachirus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species was not found in the NBS shelf trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
10	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
31	1.08	0.32	10,170.71	3,010.62	4,149.47	16,191.96	24	24	24
32	0.47	0.32	412.38	281.81	0.00	1,078.85	2	2	2
41	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
42	0.03	0.02	65.38	45.49	0.00	158.41	2	2	2
43	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
50	12.83	2.26	49,783.46	8,759.59	31,738.70	67,828.21	26	26	26
61	4.61	1.36	40,645.93	11,969.92	16,454.72	64,837.14	31	31	31
62	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
82	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
90	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**2.05**	**0.31**	**101,077.85**	**15,137.86**	**71,104.90**	**131,050.81**	**85**	**85**	**85**

Sakhalin Sole (*Limanda sakhalinensis*)

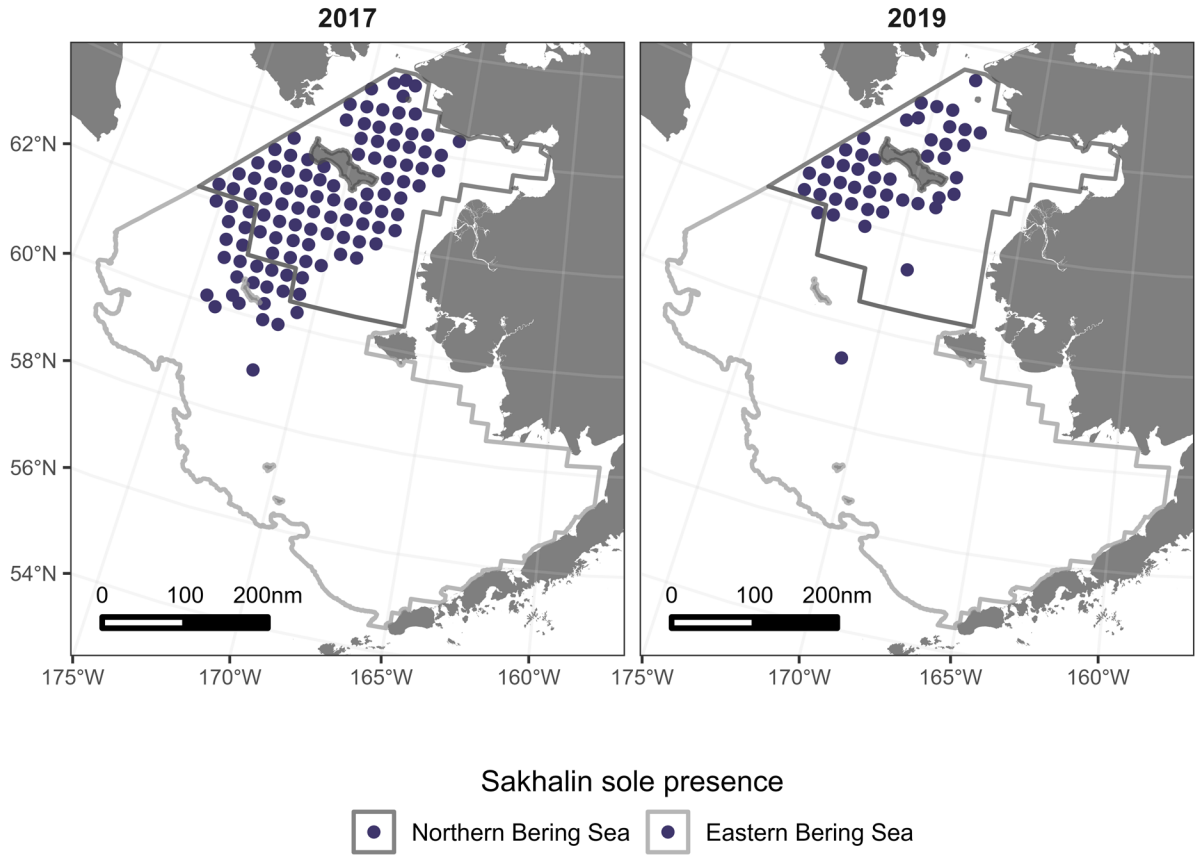

Figure 43. -- Sakhalin sole (*Limanda sakhalinensis*) presence from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species has not been caught in enough quantity or at enough stations to adequately characterize a distribution.

Table 32a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for Sakhalin sole (*Limanda sakhalinensis*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.00	0.00	0	0	0	0	0	0	0
20	0.00	0.00	0	0	0	0	0	0	0
31	0.00	0.00	0	0	0	0	0	0	0
32	0.00	0.00	0	0	0	0	0	0	0
41	0.00	0.00	6	6	0	18	1	1	1
42	0.00	0.00	0	0	0	0	0	0	0
43	0.00	0.00	0	0	0	0	0	0	0
50	0.00	0.00	0	0	0	0	0	0	0
61	0.00	0.00	0	0	0	0	0	0	0
62	0.00	0.00	0	0	0	0	0	0	0
82	0.03	0.03	56	56	0	180	1	1	1
90	0.00	0.00	0	0	0	0	0	0	0
Total	**0.00**	**0.00**	**62**	**56**	**0**	**174**	**2**	**2**	**2**
NBS									
70	0.07	0.04	527	353	0	1,239	13	13	13
71	0.01	0.00	80	24	30	129	15	15	15
81	0.33	0.10	1,264	376	492	2,036	16	16	15
Total	**0.09**	**0.03**	**1,870**	**516**	**838**	**2,903**	**44**	**44**	**43**

Table 32b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for Sakhalin sole (*Limanda sakhalinensis*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
31	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
41	0.01	0.01	61.04	61.04	0.00	184.40	1	1	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
43	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
50	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
61	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
82	0.33	0.33	589.55	589.55	0.00	1,887.15	1	1	1
90	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**0.01**	**0.01**	**650.59**	**592.70**	**0.00**	**1,824.14**	**2**	**2**	**2**
NBS									
70	1.14	0.68	9,011.22	5,428.73	0.00	19,982.68	13	13	13
71	0.21	0.06	1,672.86	523.10	615.67	2,730.05	15	15	15
81	4.47	1.39	17,154.35	5,322.84	6,231.88	28,076.83	16	16	15
Total	**1.40**	**0.38**	**27,838.43**	**7,620.85**	**12,596.73**	**43,080.14**	**44**	**44**	**43**

Sturgeon Poacher (*Podothecus accipenserinus*)

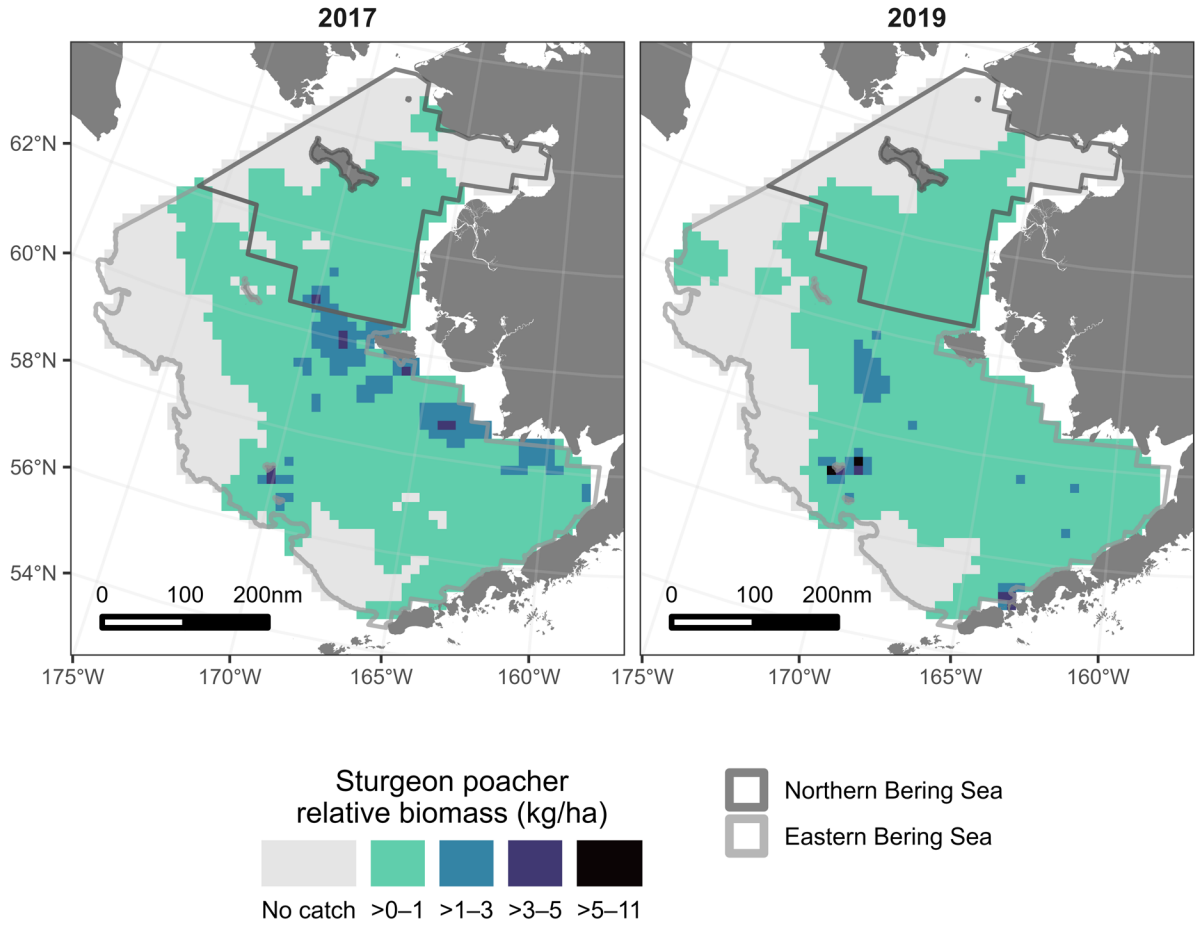

Figure 44. --Sturgeon poacher (*Podothecus accipenserinus*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 33a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for sturgeon poacher (*Podothecus accipenserinus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey. No lengths were collected for this taxon.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts
EBS								
10	0.27	0.04	2,092	299	1,489	2,696	51	51
20	0.33	0.05	1,335	187	952	1,717	31	31
31	0.25	0.07	2,383	692	999	3,766	55	55
32	0.28	0.16	243	140	0	574	8	8
41	0.42	0.08	2,647	501	1,634	3,660	32	32
42	0.96	0.39	2,305	947	369	4,241	27	27
43	0.06	0.03	126	55	11	241	11	11
50	0.00	0.00	0	0	0	0	0	0
61	0.00	0.00	8	8	0	25	1	1
62	0.00	0.00	0	0	0	1	1	1
82	0.01	0.01	14	11	0	38	2	2
90	0.00	0.00	0	0	0	0	0	0
Total	**0.23**	**0.03**	**11,153**	**1,332**	**8,517**	**13,790**	**219**	**219**
NBS								
70	0.08	0.02	622	144	332	913	44	44
71	0.00	0.00	5	4	0	13	4	4
81	0.09	0.04	339	154	23	655	12	12
Total	**0.05**	**0.01**	**967**	**210**	**546**	**1,387**	**60**	**60**

Table 33b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for sturgeon poacher (*Podothecus accipenserinus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey. No lengths were collected for this taxon.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts
EBS								
10	4.54	0.67	35,327.66	5,242.95	24,731.67	45,923.66	51	51
20	6.75	1.03	27,689.10	4,206.32	19,087.18	36,291.02	31	31
31	6.03	2.18	57,005.74	20,571.58	15,862.58	98,148.91	55	55
32	4.14	2.01	3,631.50	1,763.78	0.00	7,802.85	8	8
41	7.12	1.49	44,616.32	9,367.95	25,683.70	63,548.95	32	32
42	12.95	4.74	31,091.60	11,371.20	7,837.51	54,345.70	27	27
43	1.06	0.42	2,238.48	876.69	409.71	4,067.25	11	11
50	0.00	0.00	0.00	0.00	0.00	0.00	0	0
61	0.01	0.01	57.33	57.33	0.00	173.19	1	1
62	0.02	0.02	15.61	15.61	0.00	53.81	1	1
82	0.28	0.23	510.63	418.28	0.00	1,442.56	2	2
90	0.00	0.00	0.00	0.00	0.00	0.00	0	0
Total	**4.10**	**0.53**	**202,183.98**	**26,258.18**	**150,192.78**	**254,175.19**	**219**	**219**
NBS								
70	2.72	0.60	21,527.00	4,794.77	11,836.77	31,217.24	44	44
71	0.02	0.01	165.62	88.35	0.00	344.18	4	4
81	2.61	1.18	10,015.43	4,509.28	744.35	19,286.51	12	12
Total	**1.59**	**0.33**	**31,708.05**	**6,582.65**	**18,542.75**	**44,873.35**	**60**	**60**

Butterfly Sculpin (*Hemilepidotus papilio*)

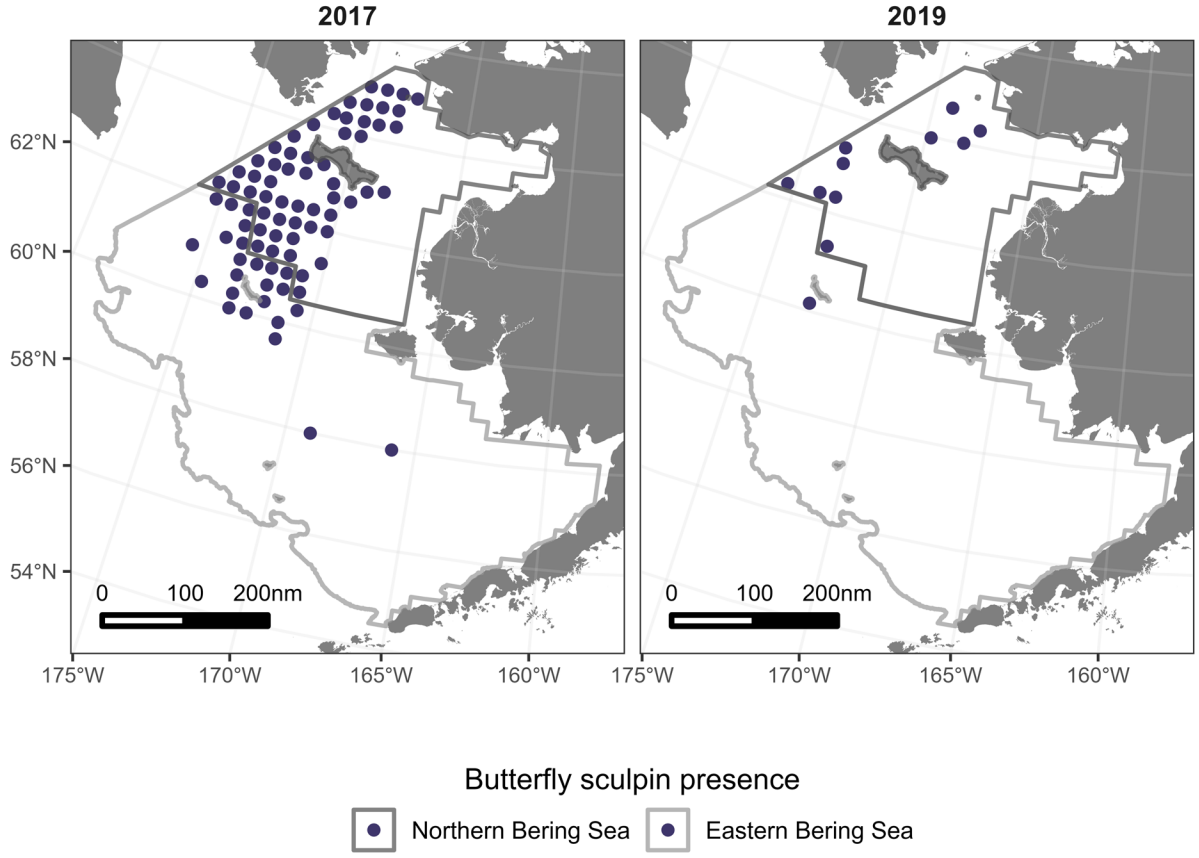

Figure 47. --Butterfly sculpin (*Hemilepidotus papilio*) presence from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species has not been caught in enough quantity or at enough stations to adequately characterize a distribution.

Table 36a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for butterfly sculpin (*Hemilepidotus papilio*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.00	0.00	0	0	0	0	0	0	0
20	0.00	0.00	0	0	0	0	0	0	0
31	0.00	0.00	0	0	0	0	0	0	0
32	0.00	0.00	0	0	0	0	0	0	0
41	0.00	0.00	0	0	0	0	0	0	0
42	0.00	0.00	0	0	0	0	0	0	0
43	0.00	0.00	8	8	0	24	1	1	1
50	0.00	0.00	0	0	0	0	0	0	0
61	0.00	0.00	0	0	0	0	0	0	0
62	0.00	0.00	0	0	0	0	0	0	0
82	0.00	0.00	0	0	0	0	0	0	0
90	0.00	0.00	0	0	0	0	0	0	0
Total	**0.00**	**0.00**	**8**	**8**	**0**	**23**	**1**	**1**	**1**
NBS									
70	0.00	0.00	0	0	0	0	0	0	0
71	0.00	0.00	4	2	0	9	4	4	2
81	0.02	0.01	86	38	8	164	6	6	5
Total	**0.00**	**0.00**	**90**	**38**	**13**	**167**	**10**	**10**	**7**

Table 36b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for butterfly sculpin (*Hemilepidotus papilio*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
31	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
41	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
42	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
43	0.02	0.02	35.57	35.57	0.00	109.56	1	1	1
50	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
61	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
82	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
90	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**0.00**	**0.00**	**35.57**	**35.57**	**0.00**	**105.29**	**1**	**1**	**1**
NBS									
70	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
71	0.03	0.02	283.11	148.19	0.00	582.60	4	4	2
81	0.08	0.04	303.78	151.81	0.00	615.30	6	6	5
Total	**0.03**	**0.01**	**586.88**	**212.15**	**158.13**	**1,015.64**	**10**	**10**	**7**

Bigmouth Sculpin (*Hemitripterus bolini*)

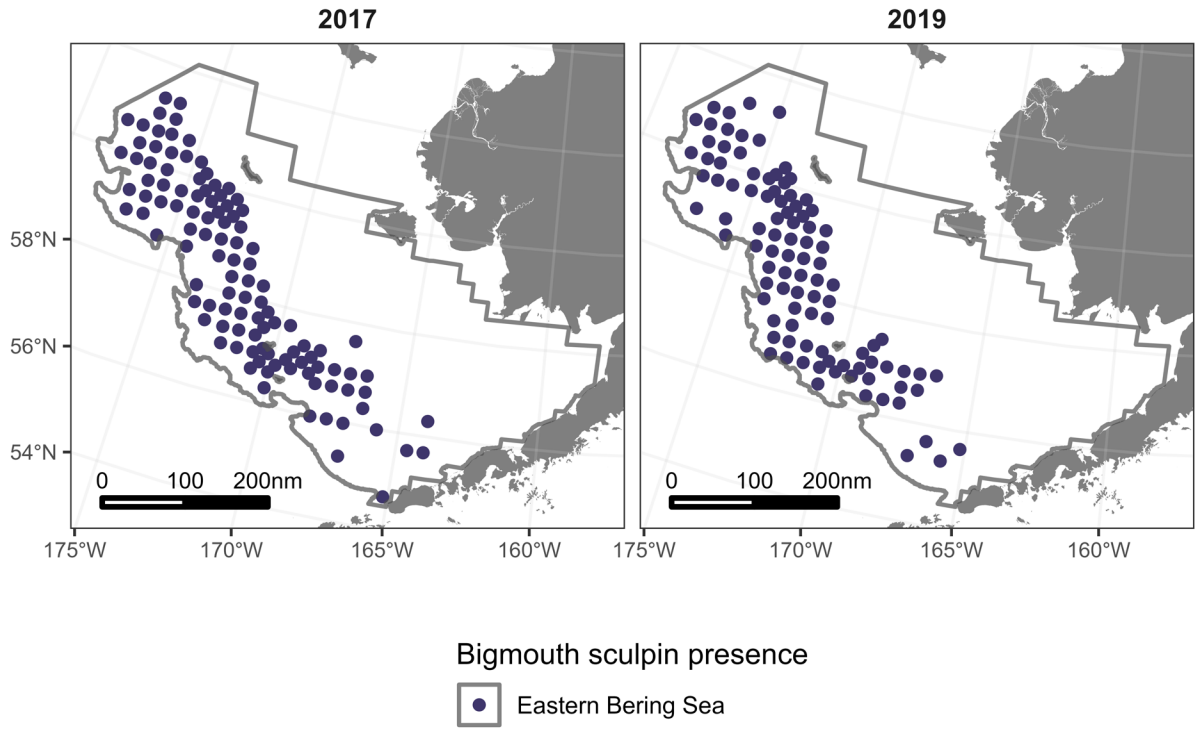

Figure 49. --Bigmouth sculpin (*Hemitripterus bolini*) presence from the 2017 (left) and 2019 (right) eastern Bering Sea shelf bottom trawl survey. This species has not been caught in enough quantity or at enough stations to adequately characterize a distribution.

Table 38a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for bigmouth sculpin (*Hemitripterus bolini*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species was not found in the NBS shelf trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
10	0.00	0.00	0	0	0	0	0	0	0
20	0.00	0.00	0	0	0	0	0	0	0
31	0.17	0.08	1,653	788	76	3,230	6	6	6
32	1.37	0.66	1,198	575	0	2,606	5	5	5
41	1.10	0.56	6,886	3,504	0	13,968	7	7	7
42	0.66	0.23	1,579	556	444	2,713	9	9	9
43	1.62	0.38	3,428	792	1,775	5,080	13	13	13
50	0.30	0.16	1,163	626	0	2,452	6	6	6
61	1.86	0.30	16,435	2,622	11,137	21,733	44	44	44
62	3.24	1.39	2,085	891	0	4,375	5	5	5
82	0.10	0.10	184	184	0	589	1	1	1
90	0.71	0.37	827	426	0	1,870	3	3	3
Total	**0.72**	**0.10**	**35,437**	**4,737**	**25,963**	**44,911**	**99**	**99**	**99**

Table 38b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for bigmouth sculpin (*Hemitripterus bolini*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species was not found in the NBS shelf trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
10	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
31	0.04	0.02	406.26	188.85	28.57	783.97	6	6	6
32	0.26	0.13	229.44	111.20	0.00	501.55	5	5	5
41	0.21	0.10	1,295.74	629.74	23.04	2,568.45	7	7	7
42	0.15	0.05	357.36	119.95	112.41	602.30	9	9	9
43	0.34	0.08	715.71	179.15	342.00	1,089.41	13	13	13
50	0.08	0.03	320.04	127.67	57.04	583.03	6	6	6
61	0.40	0.06	3,548.78	542.04	2,453.33	4,644.24	44	44	44
62	0.63	0.21	406.30	134.91	59.45	753.14	5	5	5
82	0.02	0.02	29.28	29.28	0.00	93.72	1	1	1
90	0.13	0.07	154.75	80.20	0.00	350.98	3	3	3
Total	**0.15**	**0.02**	**7,463.65**	**909.22**	**5,645.22**	**9,282.09**	**99**	**99**	**99**

Arctic Cod (*Boreogadus saida*)

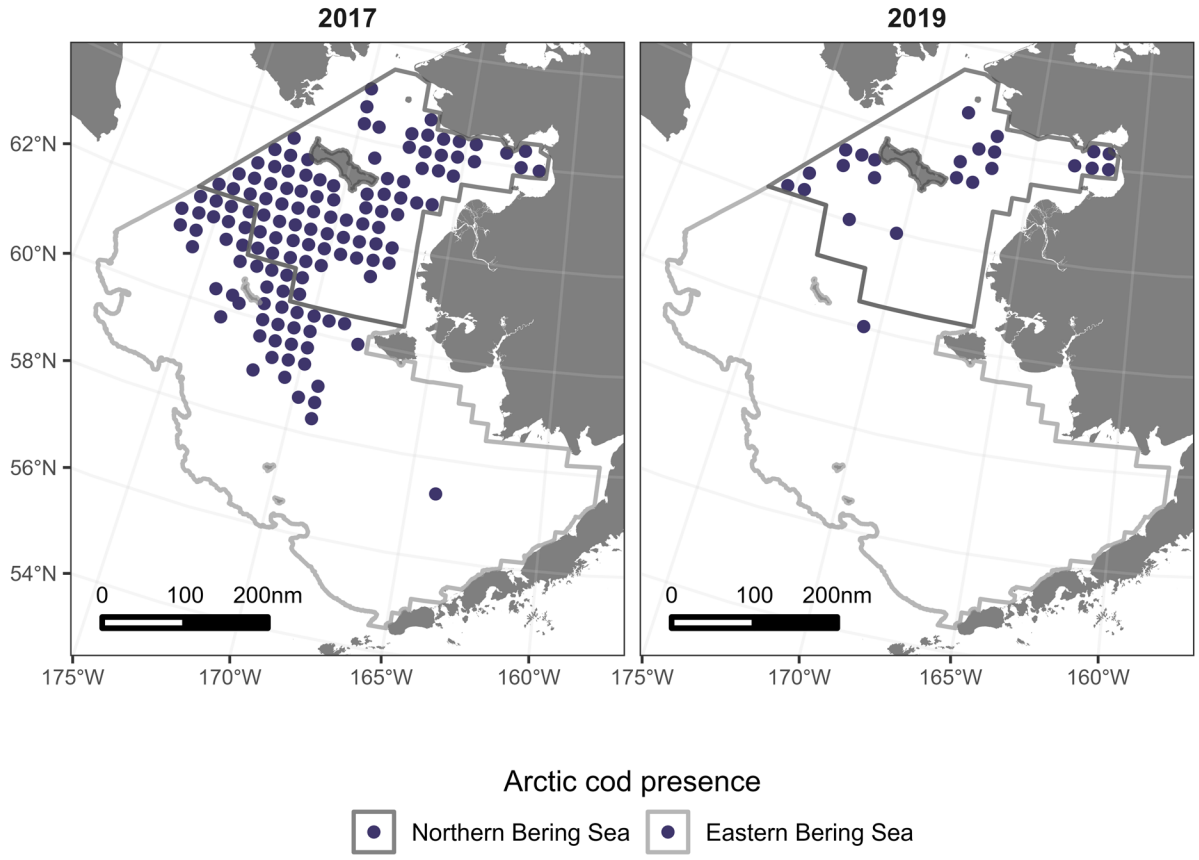

Figure 50. --Arctic cod (*Boreogadus saida*) presence from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species has not been caught in enough quantity or at enough stations to adequately characterize a distribution.

Table 39a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for Arctic cod (*Boreogadus saida*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.00	0.00	0	0	0	0	0	0	0
20	0.00	0.00	0	0	0	0	0	0	0
31	0.00	0.00	0	0	0	0	0	0	0
32	0.00	0.00	0	0	0	0	0	0	0
41	0.00	0.00	2	2	0	5	1	1	1
42	0.00	0.00	0	0	0	0	0	0	0
43	0.00	0.00	0	0	0	0	0	0	0
50	0.00	0.00	0	0	0	0	0	0	0
61	0.00	0.00	0	0	0	0	0	0	0
62	0.00	0.00	0	0	0	0	0	0	0
82	0.00	0.00	0	0	0	0	0	0	0
90	0.00	0.00	0	0	0	0	0	0	0
Total	**0.00**	**0.00**	**2**	**2**	**0**	**5**	**1**	**1**	**1**
NBS									
70	0.00	0.00	6	4	0	15	3	3	3
71	0.00	0.00	24	9	6	42	13	13	12
81	0.00	0.00	16	7	3	30	7	7	6
Total	**0.00**	**0.00**	**47**	**12**	**23**	**71**	**23**	**23**	**21**

Table 39b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for Arctic cod (*Boreogadus saida*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
31	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
41	0.00	0.01	31.38	31.38	0.00	94.81	1	1	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
43	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
50	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
61	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
82	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
90	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**0.00**	**0.00**	**31.38**	**31.38**	**0.00**	**93.52**	**1**	**1**	**1**
NBS									
70	0.03	0.02	233.76	158.20	0.00	553.49	3	3	3
71	0.11	0.04	894.89	322.74	242.64	1,547.14	13	13	12
81	0.12	0.05	466.96	198.85	58.91	875.01	7	7	6
Total	**0.08**	**0.02**	**1,595.61**	**410.77**	**774.07**	**2,417.15**	**23**	**23**	**21**

Saffron Cod (*Eleginus gracilis*)

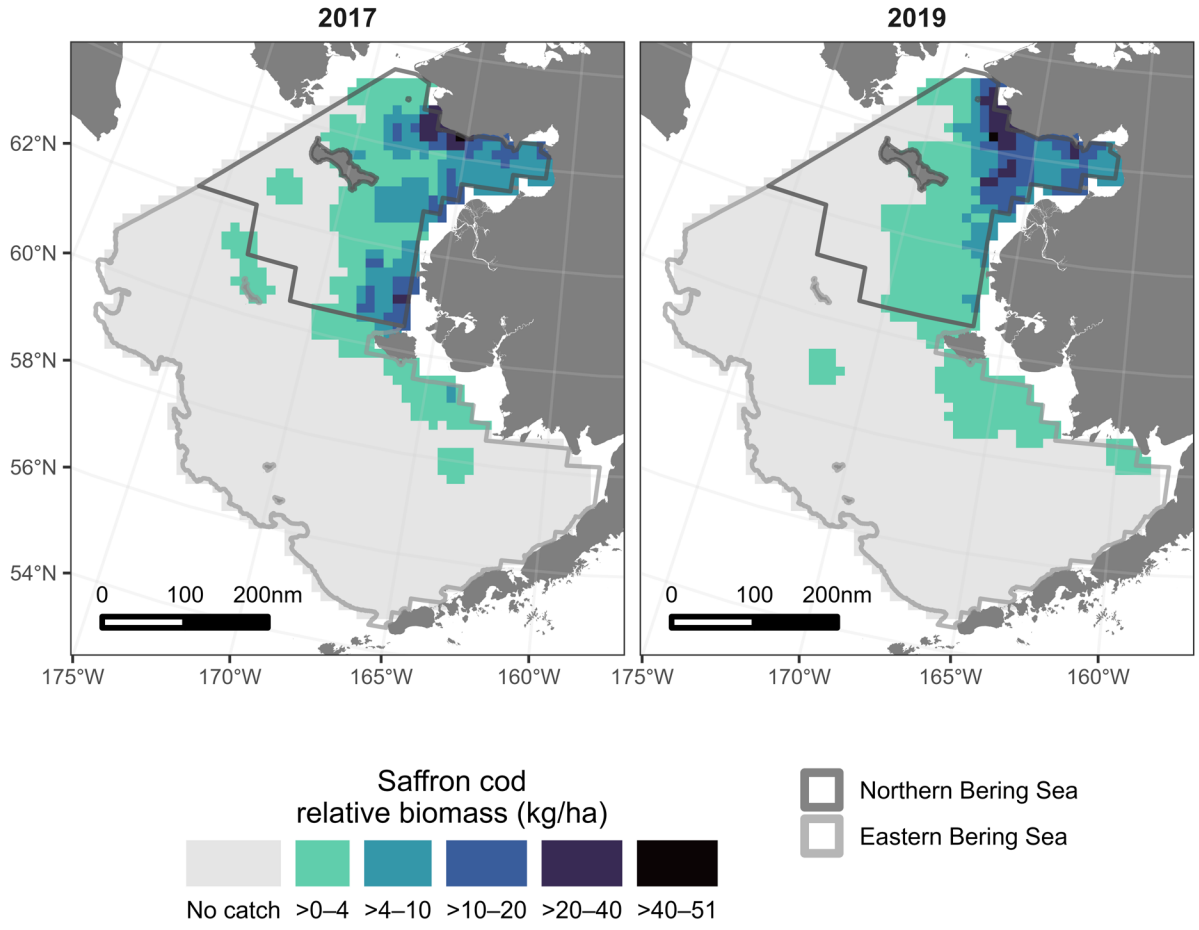

Figure 51. -- Saffron cod (*Eleginus gracilis*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 40a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for saffron cod (*Eleginus gracilis*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	0.14	0.08	1,094	596	0	2,299	9	9	6
20	0.07	0.06	271	237	0	756	6	6	5
31	0.00	0.00	0	0	0	0	0	0	0
32	0.00	0.00	0	0	0	0	0	0	0
41	0.00	0.00	5	5	0	16	1	1	1
42	0.00	0.00	0	0	0	0	0	0	0
43	0.00	0.00	0	0	0	0	0	0	0
50	0.00	0.00	0	0	0	0	0	0	0
61	0.00	0.00	0	0	0	0	0	0	0
62	0.00	0.00	0	0	0	0	0	0	0
82	0.00	0.00	0	0	0	0	0	0	0
90	0.00	0.00	0	0	0	0	0	0	0
Total	**0.03**	**0.01**	**1,370**	**642**	**99**	**2,641**	**16**	**16**	**12**
NBS									
70	1.60	0.36	12,716	2,834	6,989	18,443	36	36	35
71	8.44	1.42	68,553	11,577	45,157	91,950	42	42	41
81	0.00	0.00	0	0	0	0	0	0	0
Total	**4.09**	**0.60**	**81,269**	**11,919**	**57,432**	**105,106**	**78**	**78**	**76**

Table 40b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for saffron cod (*Eleginus gracilis*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts	Hauls with lengths
EBS									
10	1.48	0.80	11,532.25	6,207.83	0.00	24,078.26	9	9	6
20	0.58	0.47	2,366.79	1,910.87	0.00	6,274.51	6	6	5
31	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
41	0.01	0.01	32.12	32.12	0.00	97.03	1	1	1
42	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
43	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
50	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
61	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
82	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
90	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**0.28**	**0.13**	**13,931.15**	**6,495.35**	**1,070.36**	**26,791.94**	**16**	**16**	**12**
NBS									
70	28.79	7.43	228,153.75	58,853.82	109,210.18	347,097.31	36	36	35
71	129.90	20.96	1,055,407.85	170,255.67	711,321.15	1,399,494.55	42	42	41
81	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Total	**64.55**	**9.06**	**1,283,561.60**	**180,140.96**	**923,279.69**	**1,643,843.51**	**78**	**78**	**76**

Pacific Herring (*Clupea pallasii*)

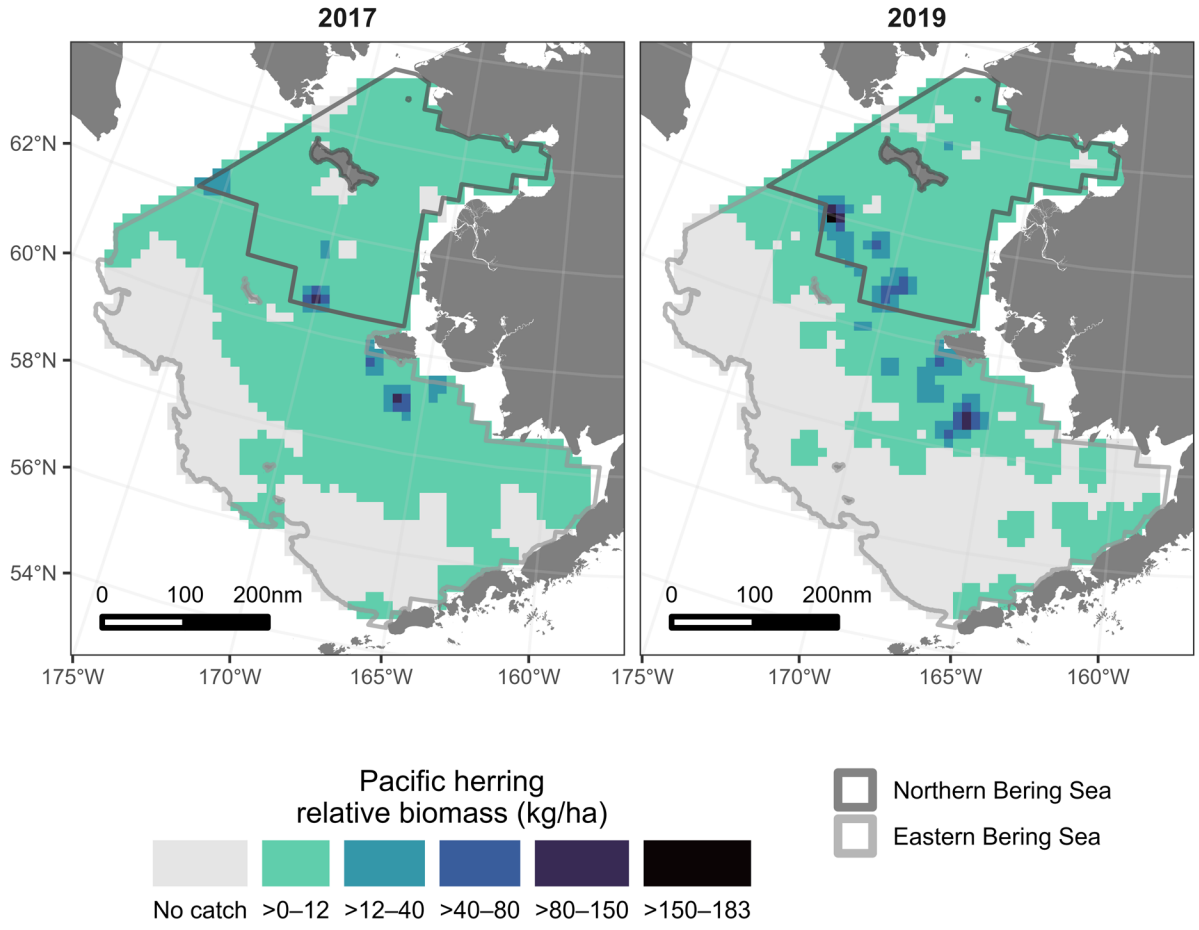

Figure 52. --Pacific herring (*Clupea pallasii*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 41a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for Pacific herring (*Clupea pallasii*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey. No lengths were collected for this taxon.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts
EBS								
10	4.48	2.97	34,896	23,112	0	81,606	15	15
20	7.71	2.32	31,652	9,524	12,176	51,129	23	23
31	0.08	0.05	727	500	0	1,727	6	6
32	0.00	0.00	0	0	0	0	0	0
41	1.47	0.77	9,188	4,797	0	18,884	16	16
42	0.02	0.02	55	47	0	151	2	2
43	0.01	0.01	21	15	0	52	2	2
50	0.00	0.00	0	0	0	0	0	0
61	0.00	0.00	0	0	0	0	0	0
62	0.00	0.00	0	0	0	0	0	0
82	0.06	0.03	105	51	0	216	5	5
90	0.09	0.06	99	65	0	253	2	2
Total	**1.56**	**0.52**	**76,743**	**25,459**	**25,825**	**127,661**	**71**	**71**
NBS								
70	3.62	1.73	28,723	13,681	1,073	56,372	44	44
71	0.84	0.38	6,815	3,102	545	13,085	28	28
81	13.66	6.73	52,380	25,808	0	105,338	22	22
Total	**4.42**	**1.48**	**87,918**	**29,375**	**28,552**	**147,284**	**94**	**94**

Table 41b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for Pacific herring (*Clupea pallasii*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey. No lengths were collected for this taxon.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts
EBS								
10	38.03	25.33	296,166.09	197,213.10	0.00	694,733.78	15	15
20	57.66	15.25	236,571.03	62,558.78	108,638.31	364,503.74	23	23
31	0.44	0.35	4,204.60	3,298.38	0.00	10,801.36	6	6
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0
41	11.27	6.05	70,657.60	37,944.27	0.00	147,342.98	16	16
42	0.10	0.08	243.69	196.78	0.00	645.51	2	2
43	0.04	0.03	77.58	61.32	0.00	205.49	2	2
50	0.00	0.00	0.00	0.00	0.00	0.00	0	0
61	0.00	0.00	0.00	0.00	0.00	0.00	0	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0	0
82	0.41	0.20	744.88	357.02	0.00	1,530.67	5	5
90	0.25	0.17	284.46	194.87	0.00	745.32	2	2
Total	**12.35**	**4.27**	**608,949.94**	**210,374.58**	**188,200.77**	**1,029,699.10**	**71**	**71**
NBS								
70	52.80	28.16	418,493.82	223,223.29	0.00	869,628.09	44	44
71	13.47	5.66	109,424.21	45,986.90	16,484.69	202,363.73	28	28
81	115.35	66.50	442,394.99	255,037.58	0.00	965,732.10	22	22
Total	**48.79**	**17.20**	**970,313.02**	**342,034.50**	**279,061.29**	**1,661,564.75**	**94**	**94**

Pacific Capelin (*Mallotus villosus*)

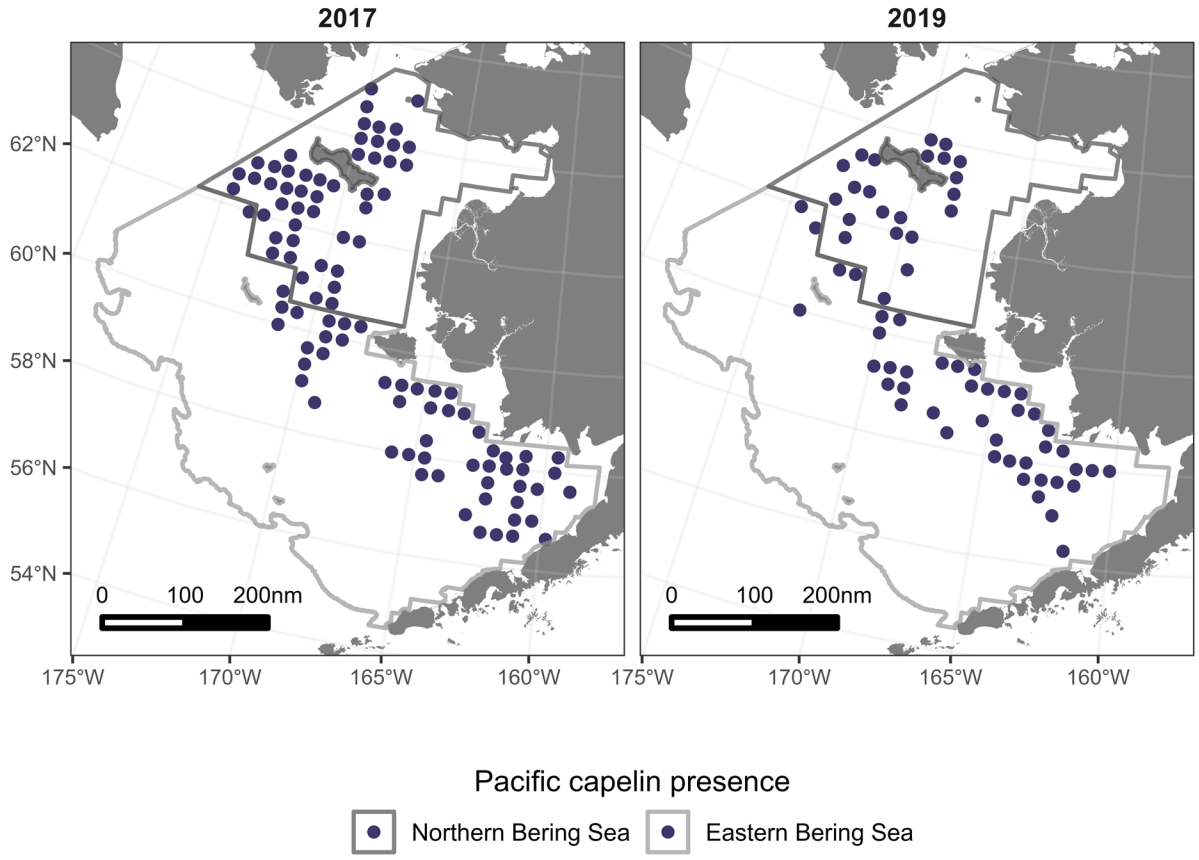

Figure 53. -- Pacific capelin (*Mallotus villosus*) presence from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species has not been caught in enough quantity or at enough stations to adequately characterize a distribution.

Table 42a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for Pacific capelin (*Mallotus villosus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey. No lengths were collected for this taxon.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts
EBS								
10	0.01	0.00	65	22	21	109	22	22
20	0.01	0.00	27	10	5	48	12	12
31	0.00	0.00	1	1	0	2	1	1
32	0.00	0.00	0	0	0	0	0	0
41	0.00	0.00	26	17	0	60	5	5
42	0.00	0.00	0	0	0	0	0	0
43	0.00	0.00	0	0	0	1	1	1
50	0.00	0.00	0	0	0	0	0	0
61	0.00	0.00	0	0	0	0	0	0
62	0.00	0.00	0	0	0	0	0	0
82	0.00	0.00	4	3	0	11	2	2
90	0.00	0.00	0	0	0	0	0	0
Total	**0.00**	**0.00**	**122**	**30**	**63**	**181**	**43**	**43**
NBS								
70	0.00	0.00	27	14	0	54	10	10
71	0.00	0.00	17	9	0	35	6	6
81	0.00	0.00	6	3	0	12	6	6
Total	**0.00**	**0.00**	**50**	**17**	**16**	**83**	**22**	**22**

Table 42b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for Pacific capelin (*Mallotus villosus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey. No lengths were collected for this taxon.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts
EBS								
10	0.50	0.17	3,925.11	1,337.50	1,222.02	6,628.20	22	22
20	0.38	0.15	1,575.36	628.54	289.99	2,860.72	12	12
31	0.00	0.00	31.07	31.07	0.00	93.21	1	1
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0
41	0.24	0.15	1,528.06	969.52	0.00	3,487.47	5	5
42	0.00	0.00	0.00	0.00	0.00	0.00	0	0
43	0.02	0.02	36.49	36.49	0.00	112.40	1	1
50	0.00	0.00	0.00	0.00	0.00	0.00	0	0
61	0.00	0.00	0.00	0.00	0.00	0.00	0	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0	0
82	0.13	0.11	229.70	196.92	0.00	668.44	2	2
90	0.00	0.00	0.00	0.00	0.00	0.00	0	0
Total	**0.15**	**0.04**	**7,325.80**	**1,779.05**	**3,767.69**	**10,883.90**	**43**	**43**
NBS								
70	0.32	0.19	2,548.18	1,473.64	0.00	5,526.42	10	10
71	0.09	0.04	718.29	298.03	115.97	1,320.61	6	6
81	0.11	0.05	422.98	183.61	46.22	799.74	6	6
Total	**0.19**	**0.08**	**3,689.46**	**1,514.65**	**660.16**	**6,718.75**	**22**	**22**

Rainbow Smelt (*Osmerus mordax*)

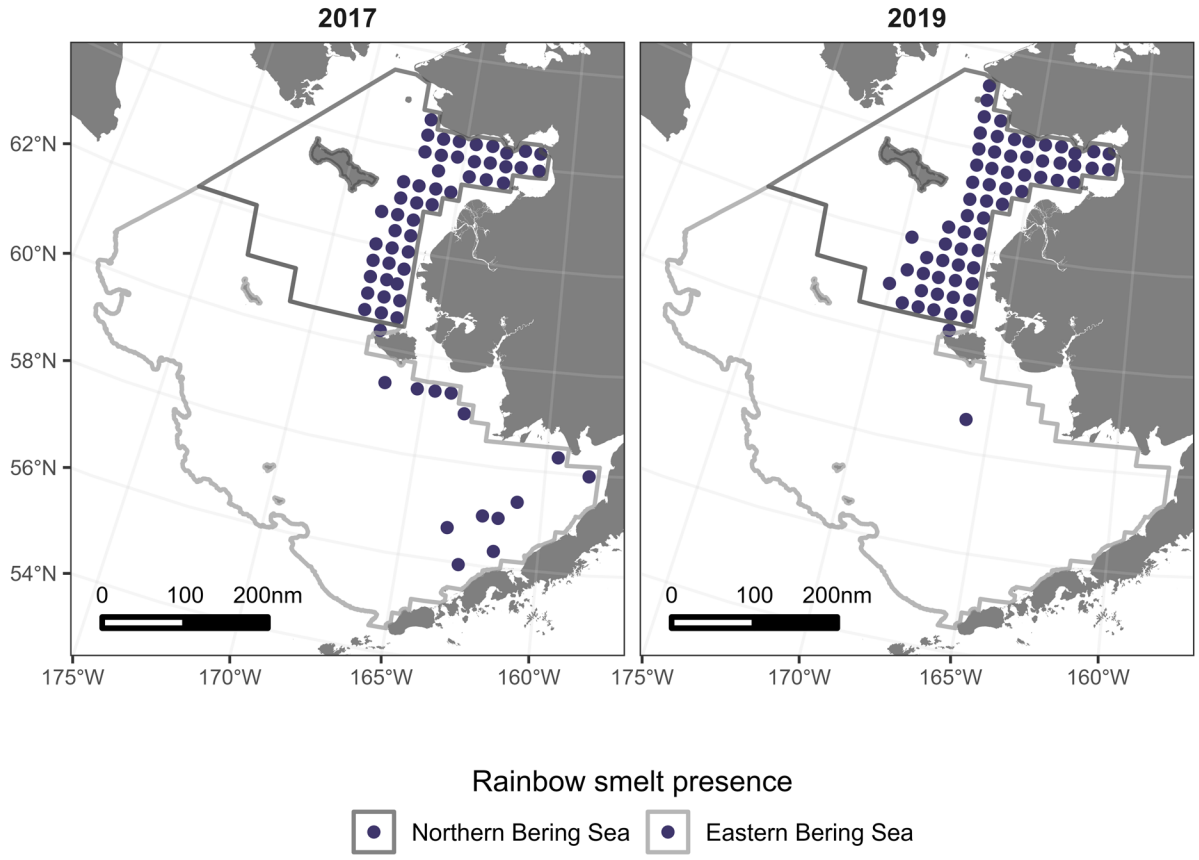

Figure 54. -- Rainbow smelt (*Osmerus mordax*) presence from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species has not been caught in enough quantity or at enough stations to adequately characterize a distribution.

Table 43a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for rainbow smelt (*Osmerus mordax*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey. No lengths were collected for this taxon.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts
EBS								
10	0.00	0.00	29	29	0	89	1	1
20	0.01	0.01	47	47	0	144	1	1
31	0.00	0.00	0	0	0	0	0	0
32	0.00	0.00	0	0	0	0	0	0
41	0.00	0.00	0	0	0	0	0	0
42	0.00	0.00	0	0	0	0	0	0
43	0.00	0.00	0	0	0	0	0	0
50	0.00	0.00	0	0	0	0	0	0
61	0.00	0.00	0	0	0	0	0	0
62	0.00	0.00	0	0	0	0	0	0
82	0.00	0.00	0	0	0	0	0	0
90	0.00	0.00	0	0	0	0	0	0
Total	**0.00**	**0.00**	**77**	**56**	**0**	**187**	**2**	**2**
NBS								
70	0.31	0.06	2,445	505	1,424	3,466	31	31
71	0.29	0.07	2,397	564	1,256	3,537	33	33
81	0.00	0.00	0	0	0	0	0	0
Total	**0.24**	**0.04**	**4,841**	**758**	**3,326**	**6,357**	**64**	**64**

Table 43b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for rainbow smelt (*Osmerus mordax*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey. No lengths were collected for this taxon.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts
EBS								
10	0.06	0.06	456.62	456.62	0.00	1,379.45	1	1
20	0.12	0.12	490.35	490.35	0.00	1,491.64	1	1
31	0.00	0.00	0.00	0.00	0.00	0.00	0	0
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0
41	0.00	0.00	0.00	0.00	0.00	0.00	0	0
42	0.00	0.00	0.00	0.00	0.00	0.00	0	0
43	0.00	0.00	0.00	0.00	0.00	0.00	0	0
50	0.00	0.00	0.00	0.00	0.00	0.00	0	0
61	0.00	0.00	0.00	0.00	0.00	0.00	0	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0	0
82	0.00	0.00	0.00	0.00	0.00	0.00	0	0
90	0.00	0.00	0.00	0.00	0.00	0.00	0	0
Total	**0.02**	**0.01**	**946.97**	**670.03**	**0.00**	**2,273.64**	**2**	**2**
NBS								
70	7.45	1.97	59,030.84	15,611.24	27,480.52	90,581.15	31	31
71	17.01	4.89	138,183.77	39,755.02	57,838.89	218,528.66	33	33
81	0.00	0.00	0.00	0.00	0.00	0.00	0	0
Total	**9.92**	**2.15**	**197,214.61**	**42,710.33**	**111,793.96**	**282,635.27**	**64**	**64**

Eulachon (*Thaleichthys pacificus*)

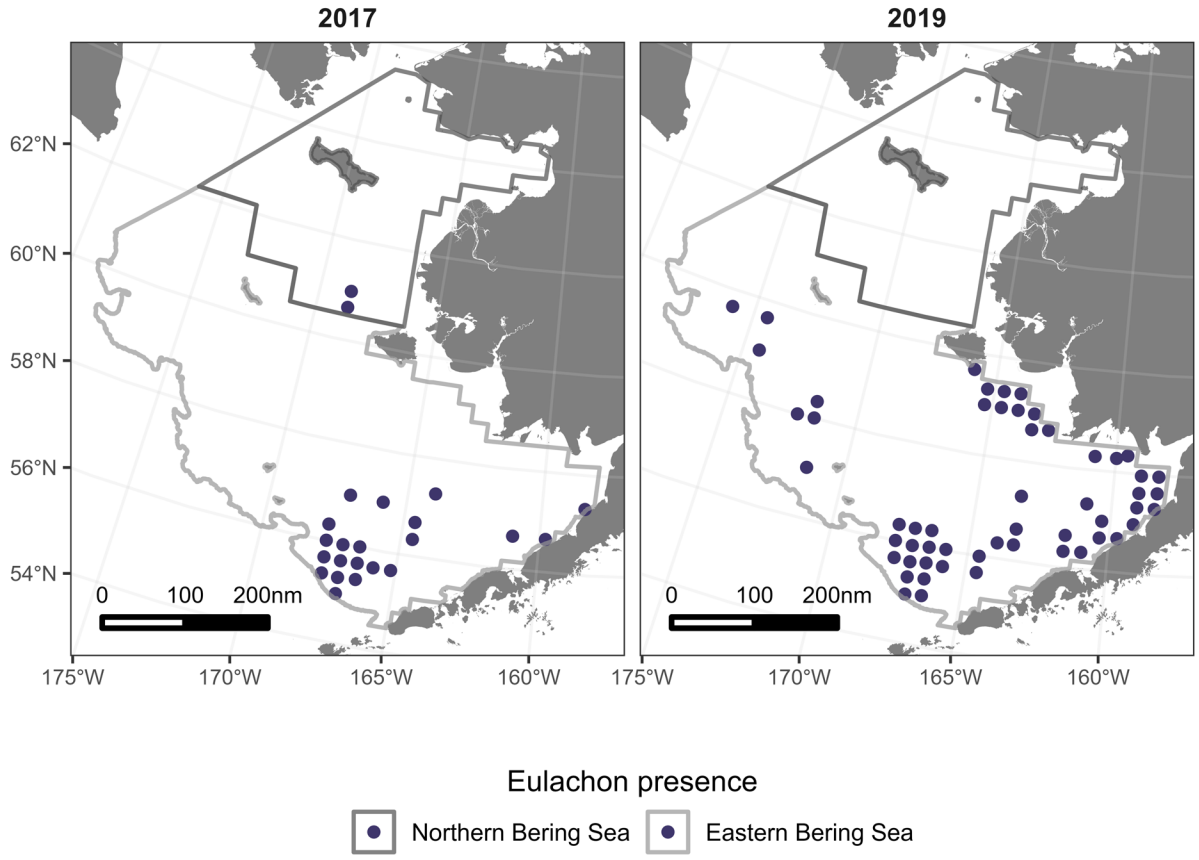

Figure 55. --Eulachon (*Thaleichthys pacificus*) presence from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species has not been caught in enough quantity or at enough stations to adequately characterize a distribution.

Table 44a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for eulachon (*Thaleichthys pacificus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species was not found in the NBS shelf trawl survey. No lengths were collected for this taxon.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts
10	0.15	0.05	1,136	407	313	1,959	22	22
20	0.00	0.00	11	8	0	27	2	2
31	0.01	0.00	103	43	17	189	11	11
32	0.00	0.00	0	0	0	0	0	0
41	0.00	0.00	11	9	0	29	2	2
42	0.00	0.00	0	0	0	0	0	0
43	0.00	0.00	0	0	0	0	0	0
50	0.12	0.03	477	112	246	707	13	13
61	0.00	0.00	16	8	0	33	4	4
62	0.01	0.01	4	4	0	14	1	1
82	0.00	0.00	0	0	0	0	0	0
90	0.00	0.00	0	0	0	0	0	0
Total	**0.04**	**0.01**	**1,757**	**425**	**908**	**2,607**	**55**	**55**

Table 44b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for eulachon (*Thaleichthys pacificus*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species was not found in the NBS shelf trawl survey. No lengths were collected for this taxon.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts
10	3.00	1.08	23,375.36	8,376.58	6,446.30	40,304.42	22	22
20	0.05	0.04	217.21	167.31	0.00	559.37	2	2
31	0.12	0.05	1,127.04	445.34	236.36	2,017.72	11	11
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0
41	0.02	0.01	121.80	85.18	0.00	293.95	2	2
42	0.00	0.00	0.00	0.00	0.00	0.00	0	0
43	0.00	0.00	0.00	0.00	0.00	0.00	0	0
50	2.53	0.67	9,824.98	2,584.23	4,501.47	15,148.49	13	13
61	0.04	0.02	314.83	165.99	0.00	650.29	4	4
62	0.11	0.11	70.82	70.82	0.00	244.13	1	1
82	0.00	0.00	0.00	0.00	0.00	0.00	0	0
90	0.00	0.00	0.00	0.00	0.00	0.00	0	0
Total	**0.71**	**0.18**	**35,052.04**	**8,781.31**	**17,489.42**	**52,614.66**	**55**	**55**

Shortfin Eelpout (*Lycodes brevipes*)

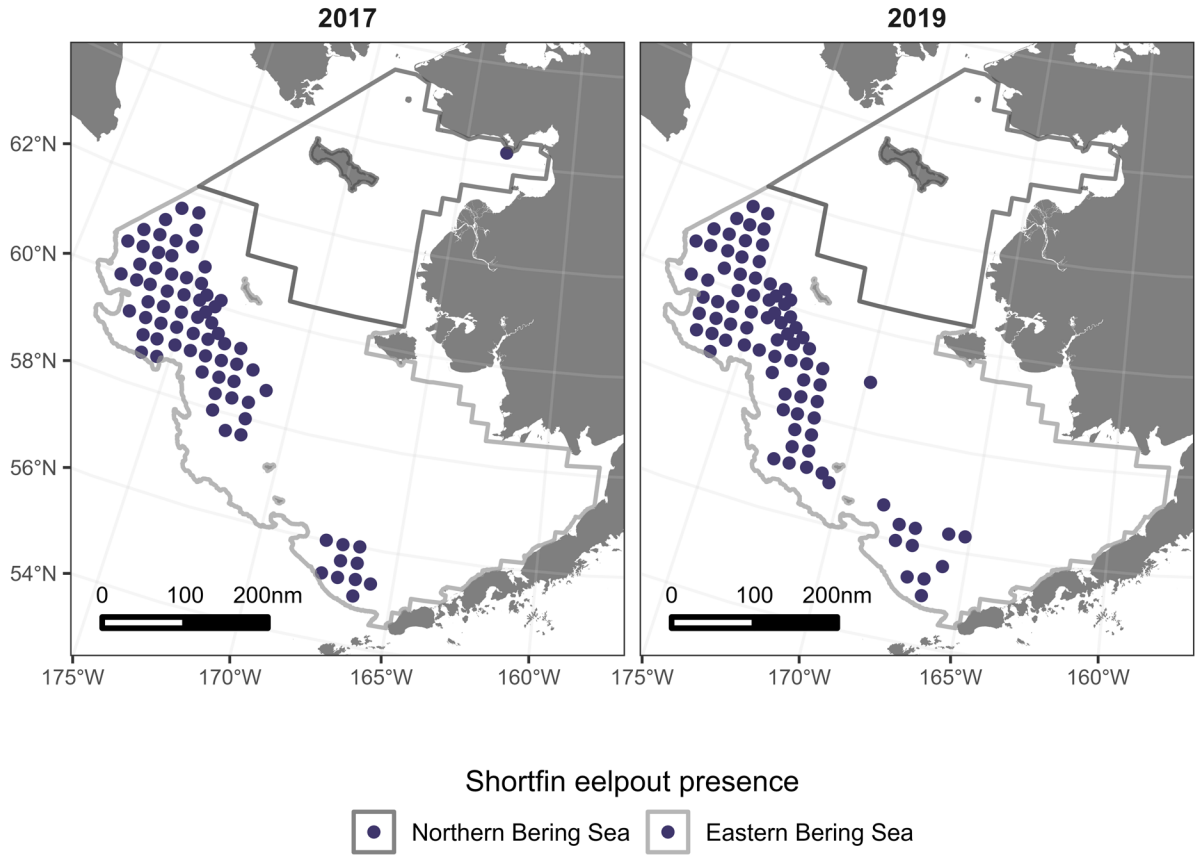

Figure 56. --Shortfin eelpout (*Lycodes brevipes*) presence from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species has not been caught in enough quantity or at enough stations to adequately characterize a distribution.

Table 45a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for shortfin eelpout (*Lycodes brevipes*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species was not found in the NBS shelf trawl survey. No lengths were collected for this taxon.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts
10	0.00	0.00	0	0	0	0	0	0
20	0.00	0.00	0	0	0	0	0	0
31	0.00	0.00	4	4	0	12	2	2
32	0.00	0.00	0	0	0	0	0	0
41	0.08	0.05	530	308	0	1,153	8	8
42	0.02	0.02	39	38	0	118	2	2
43	0.11	0.04	232	88	50	415	10	10
50	0.03	0.02	104	71	0	250	9	9
61	1.26	0.33	11,098	2,872	5,294	16,901	39	39
62	0.68	0.25	437	161	24	851	6	6
82	0.00	0.00	8	8	0	25	1	1
90	1.05	0.35	1,213	406	252	2,175	8	8
Total	**0.28**	**0.06**	**13,665**	**2,923**	**7,819**	**19,512**	**85**	**85**

Table 45b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for shortfin eelpout (*Lycodes brevipes*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species was not found in the NBS shelf trawl survey. No lengths were collected for this taxon.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts
10	0.00	0.00	0.00	0.00	0.00	0.00	0	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0	0
31	0.01	0.01	118.60	94.97	0.00	308.55	2	2
32	0.00	0.00	0.00	0.00	0.00	0.00	0	0
41	2.11	1.23	13,237.31	7,718.18	0.00	28,835.74	8	8
42	0.29	0.27	687.67	656.05	0.00	2,029.29	2	2
43	2.58	0.94	5,446.45	1,976.96	1,322.51	9,570.40	10	10
50	0.64	0.43	2,464.71	1,655.43	0.00	5,874.89	9	9
61	16.97	3.88	149,539.84	34,200.52	80,420.60	218,659.08	39	39
62	14.89	5.74	9,573.16	3,692.37	80.07	19,066.25	6	6
82	0.12	0.12	220.06	220.06	0.00	704.41	1	1
90	15.24	5.72	17,631.59	6,614.64	1,987.97	33,275.21	8	8
Total	**4.04**	**0.73**	**198,919.39**	**35,969.00**	**126,981.38**	**270,857.40**	**85**	**85**

Wattled Eelpout (*Lycodes palearis*)

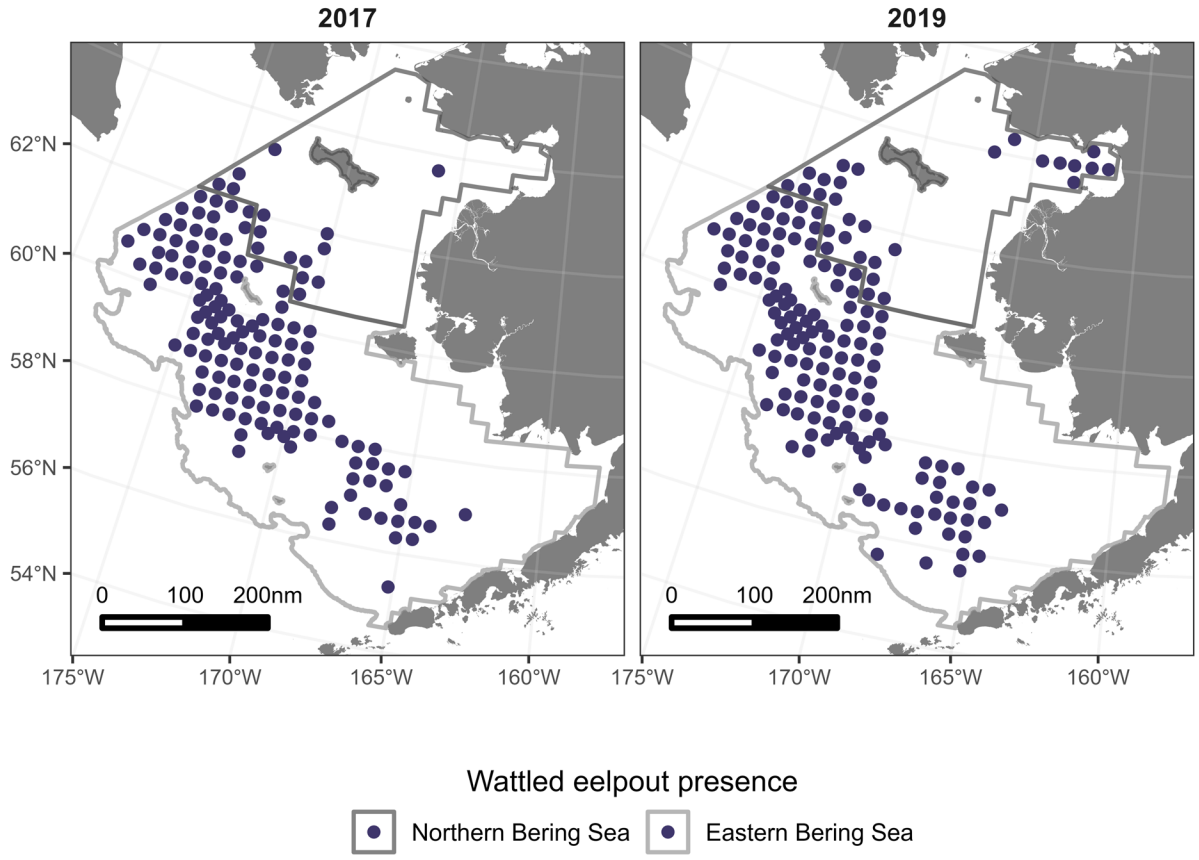

Figure 57. --Wattled eelpout (*Lycodes palearis*) presence from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys. This species has not been caught in enough quantity or at enough stations to adequately characterize a distribution.

Table 46a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for wattled eelpout (*Lycodes palearis*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey. No lengths were collected for this taxon.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts
EBS								
10	0.00	0.00	0	0	0	0	0	0
20	0.00	0.00	2	2	0	6	1	1
31	0.05	0.01	511	141	228	794	22	22
32	0.03	0.02	23	21	0	73	2	2
41	1.95	0.97	12,239	6,074	0	24,514	35	35
42	0.13	0.05	307	114	74	539	10	10
43	1.96	0.65	4,130	1,368	1,284	6,976	17	17
50	0.01	0.00	25	17	0	61	4	4
61	0.24	0.10	2,074	864	329	3,819	18	18
62	0.40	0.23	257	147	0	635	5	5
82	0.49	0.09	879	164	517	1,240	12	12
90	0.97	0.40	1,122	461	0	2,250	8	8
Total	**0.44**	**0.13**	**21,569**	**6,309**	**8,819**	**34,320**	**134**	**134**
NBS								
70	0.01	0.00	40	29	0	98	3	3
71	0.02	0.01	202	75	51	353	9	9
81	0.08	0.03	317	99	114	519	17	17
Total	**0.03**	**0.01**	**559**	**127**	**305**	**813**	**29**	**29**

Table 46b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (thousands) with standard deviation (thousands) and 95% lower (LCL; thousands) and upper (UCL; thousands) confidence limits for wattled eelpout (*Lycodes palearis*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey. No lengths were collected for this taxon.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (thousands)	SD population (thousands)	95% LCL (thousands)	95% UCL (thousands)	Hauls with weights	Hauls with counts
EBS								
10	0.00	0.00	0.00	0.00	0.00	0.00	0	0
20	0.01	0.01	28.67	28.67	0.00	87.29	1	1
31	0.32	0.08	3,042.75	772.87	1,497.02	4,588.49	22	22
32	0.29	0.27	258.10	234.36	0.00	812.36	2	2
41	6.50	2.44	40,766.77	15,290.65	9,864.37	71,669.16	35	35
42	0.57	0.18	1,363.32	422.81	498.67	2,227.97	10	10
43	6.86	1.78	14,473.32	3,763.43	6,645.38	22,301.26	17	17
50	0.03	0.01	116.92	54.85	3.92	229.91	4	4
61	1.64	1.07	14,485.10	9,398.81	0.00	33,480.09	18	18
62	1.46	0.77	939.44	492.53	0.00	2,205.72	5	5
82	5.55	1.01	9,956.42	1,806.67	5,979.95	13,932.90	12	12
90	5.18	2.21	5,987.87	2,559.42	0.00	12,250.76	8	8
Total	**1.85**	**0.38**	**91,418.68**	**18,633.22**	**53,760.94**	**129,076.43**	**134**	**134**
NBS								
70	0.03	0.02	259.04	152.49	0.00	567.23	3	3
71	0.23	0.08	1,844.78	662.12	506.64	3,182.92	9	9
81	0.87	0.27	3,319.36	1,037.97	1,189.45	5,449.27	17	17
Total	**0.27**	**0.06**	**5,423.18**	**1,240.58**	**2,942.03**	**7,904.33**	**29**	**29**

Purple-Orange Sea Star (*Asterias amurensis*)

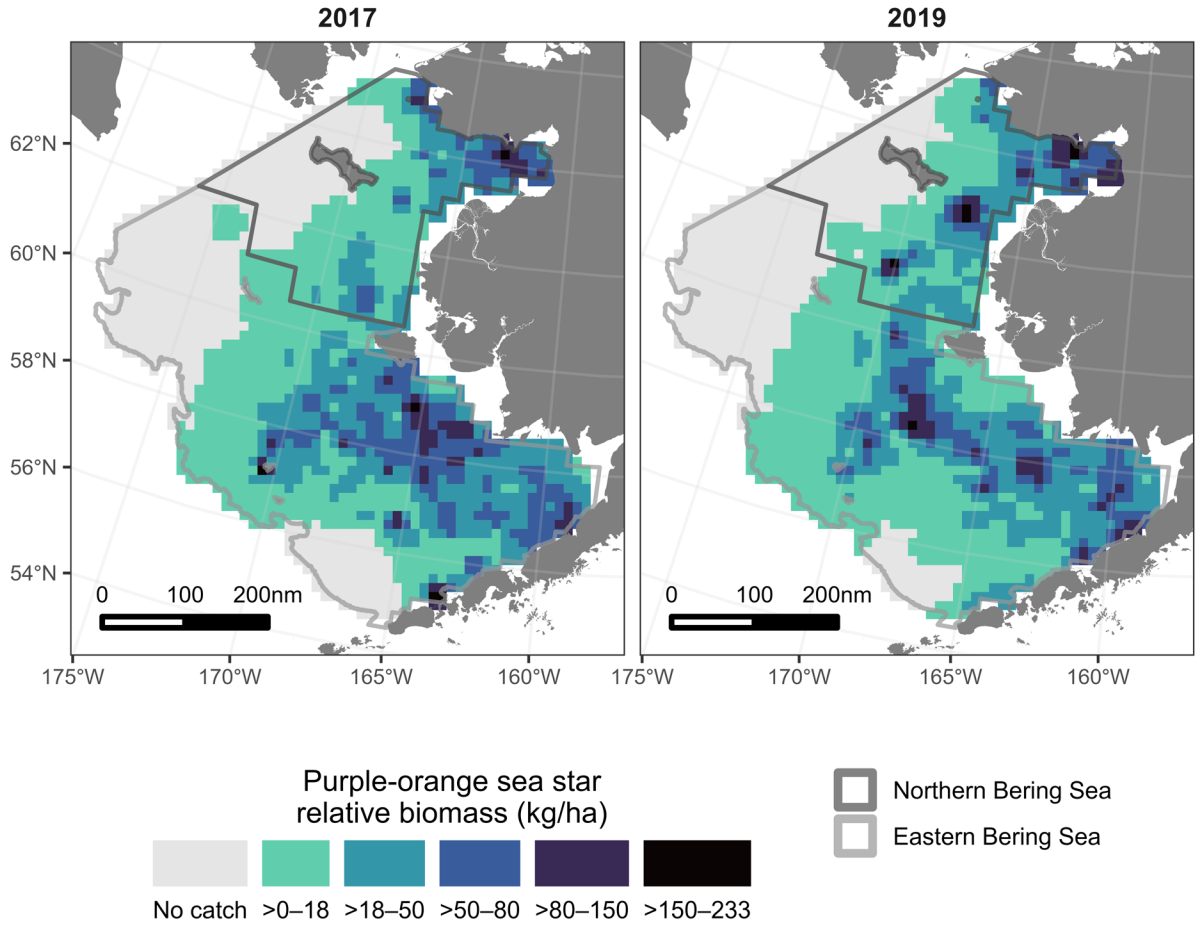

Figure 58. -- Purple-orange sea star (*Asterias amurensis*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Table 47a. -- Mean weight CPUE (kg/ha) with standard deviation, and estimated biomass (t) with standard deviation and 95% lower (LCL; t) and upper (UCL; t) confidence limits for purple-orange sea star (*Asterias amurensis*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey. No lengths were collected for this taxon.

Stratum	Mean CPUE (kg/ha)	SD CPUE	Estimated biomass (t)	SD biomass	95% LCL (t)	95% UCL (t)	Hauls with weights	Hauls with counts
EBS								
10	45.96	4.03	357,908	31,400	294,449	421,368	58	58
20	38.25	5.92	156,917	24,308	107,208	206,627	31	31
31	17.43	2.69	164,802	25,425	113,953	215,652	64	64
32	8.25	2.99	7,241	2,624	1,036	13,446	8	8
41	14.33	4.74	89,853	29,709	29,811	149,894	35	35
42	30.10	4.91	72,276	11,788	48,170	96,383	31	31
43	0.18	0.10	382	220	0	839	7	7
50	0.07	0.06	254	237	0	743	4	4
61	0.23	0.09	2,002	807	372	3,632	16	16
62	0.00	0.00	0	0	0	0	0	0
82	0.00	0.00	0	0	0	0	0	0
90	0.00	0.00	0	0	0	0	0	0
Total	**17.28**	**1.16**	**851,636**	**57,030**	**738,717**	**964,556**	**254**	**254**
NBS								
70	23.98	5.03	190,070	39,836	109,561	270,579	43	43
71	27.60	5.55	224,237	45,116	133,058	315,415	37	37
81	0.03	0.02	116	74	0	268	4	4
Total	**20.84**	**3.03**	**414,423**	**60,186**	**294,051**	**534,795**	**84**	**84**

Table 47b. -- Mean Number CPUE (no./ha) with standard deviation, and estimated population (millions) with standard deviation (thousands) and 95% lower (LCL; millions) and upper (UCL; millions) confidence limits for purple-orange sea star (*Asterias amurensis*) by stratum observed during the 2019 eastern Bering Sea and northern Bering Sea shelf bottom trawl survey. No lengths were collected for this taxon.

Stratum	Mean CPUE (no./ha)	SD CPUE	Estimated population (millions)	SD population (thousands)	95% LCL (millions)	95% UCL (millions)	Hauls with weights	Hauls with counts
EBS								
10	607.75	84.83	4,732.61	660,585.40	3,397.57	6,067.65	58	58
20	347.41	54.20	1,425.34	222,377.59	970.58	1,880.10	31	31
31	146.39	23.44	1,383.77	221,587.29	940.60	1,826.95	64	64
32	47.08	9.34	41.31	8,198.62	21.92	60.70	8	8
41	96.69	39.00	606.28	244,514.79	112.11	1,100.44	35	35
42	268.81	67.12	645.44	161,163.34	315.86	975.01	31	31
43	0.54	0.28	1.15	597.09	0.00	2.39	7	7
50	0.52	0.46	2.01	1,785.05	0.00	5.70	4	4
61	1.54	0.58	13.59	5,068.54	3.34	23.83	16	16
62	0.00	0.00	0.00	0.00	0.00	0.00	0	0
82	0.00	0.00	0.00	0.00	0.00	0.00	0	0
90	0.00	0.00	0.00	0.00	0.00	0.00	0	0
Total	**179.58**	**15.99**	**8,851.49**	**787,898.06**	**7,291.45**	**10,411.53**	**254**	**254**
NBS								
70	235.49	44.06	1,866.55	349,237.05	1,160.75	2,572.36	43	43
71	304.84	60.32	2,476.66	490,060.28	1,486.25	3,467.07	37	37
81	0.53	0.35	2.01	1,347.31	0.00	4.78	4	4
Total	**218.51**	**30.26**	**4,345.22**	**601,770.23**	**3,141.68**	**5,548.76**	**84**	**84**

Northern Neptune Whelk (*Neptunea heros*)

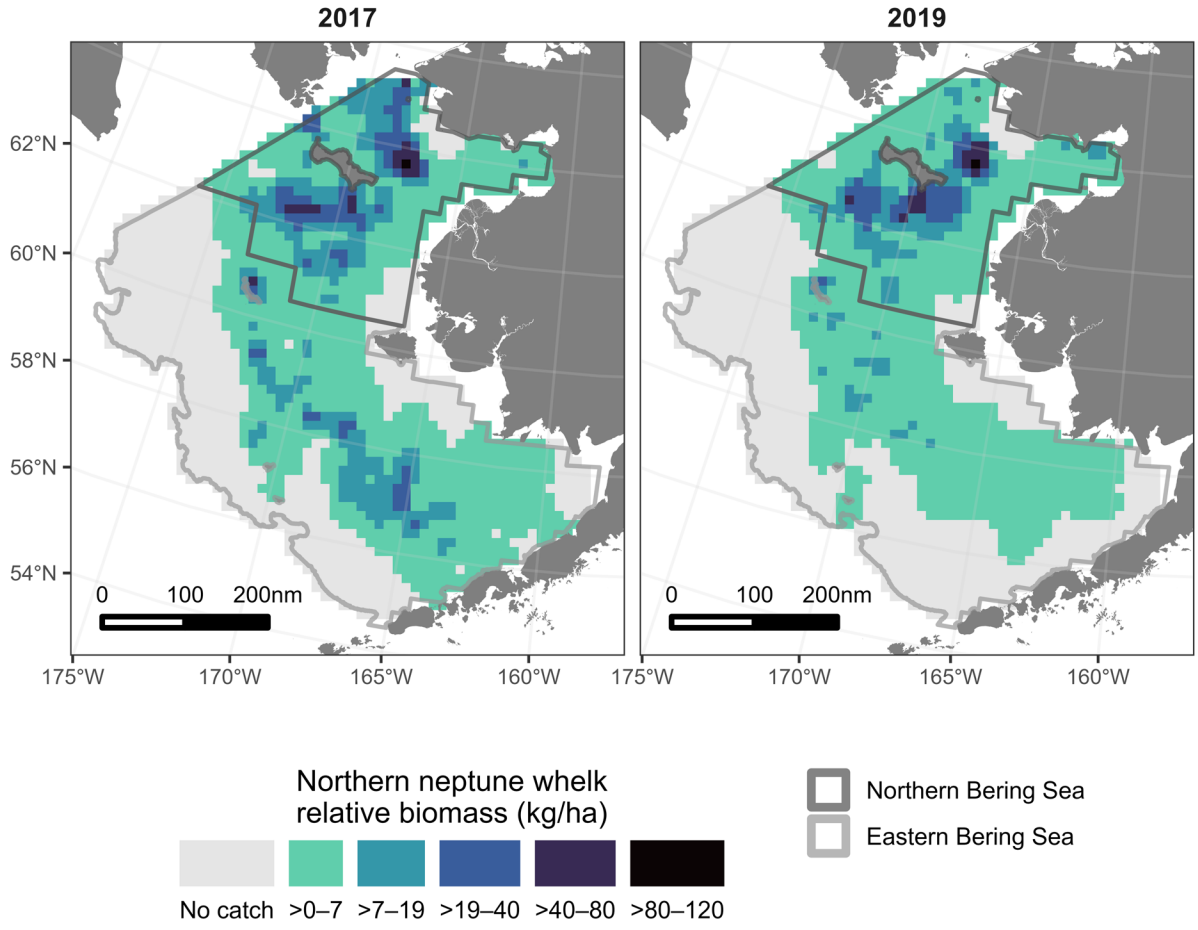

Figure 59. --Northern neptune whelk (*Neptunea heros*) distribution and relative biomass (kg/ha) from the 2017 (left) and 2019 (right) eastern Bering Sea and northern Bering Sea shelf bottom trawl surveys.

Data Sources

This report was generated in the R environment using R Markdown. The R Markdown framework allows for reproducible and documentable reporting. Many of the data sources and tools used to develop the plots and content of this report have been developed by members of the AFSC's Groundfish Assessment Program. The data collection efforts that constitute the annual Bering Sea bottom trawl survey take place over each summer by the Groundfish Assessment Program's Bering Sea Team. These data are then extrapolated to catch per unit effort (CPUE), population-level abundance, and biomass estimates by the Bering Sea Team.

Bering Sea group members are also working to develop several public-serving data products to increase transparency and accessibility to Bering Sea ecosystem data. The *akgfmaps* R package (https://github.com/afsc-gap-products/akgfmaps), developed by Sean Rohan, was used for producing the species distribution plots and maps for this report. The *coldpool* R package (https://github.com/afsc-gap-products/coldpool), developed by Sean Rohan and Lewis Barnett, uses newly developed and reproducible interpolation techniques to better understand changes in surface temperature, bottom temperature, and the cold pool in the Bering Sea.

The CPUE data with associated station information including position, surface and bottom temperatures, and bottom depth can be downloaded from the Fisheries One Stop Shop (https://www.fisheries.noaa.gov/foss/f?p=215:200:1099772399154:Mail:NO:::). There, users can interactively select, view, and download data for this and other surveys conducted by our team. An interactive map of species CPUE can be found at https://apps-st.fisheries.noaa.gov/dismap/.

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We would also like to thank the many local and tribal communities of the Bering Strait region. The knowledge, experiences, and insights of the people of the Bering Strait region have been instrumental in expanding the scope of our science and knowledge to encompass the many issues that face this important ecosystem. We appreciate feedback from those residing in the region that are willing to share insights into the region, including the local names used for the species covered by this report, identifying species of interest or concern that should be included in this report, and participating in an open dialog about how we can improve our collective knowledge of the ecosystem and the region.

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Appendix

Appendix A: List of taxa encountered in the EBS

Appendix A lists all fish and invertebrate taxa taken during the AFSC's EBS bottom trawl survey.

List of Tables

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Appendix Table A1. -- Fish taxa encountered during the 2019 eastern Bering Sea bottom trawl survey listed alphabetically by family.

Family	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
Agonidae	*Aspidophoroides monopterygius*	Aleutian alligatorfish	15	47	176	87.2	56.7	59.6
	Bathyagonus alascanus	gray starsnout	3	64	96	84.0	55.1	56.0
	Bathyagonus infraspinatus	spinycheek starsnout	1	68	68	68.0	58.3	58.3
	Bathyagonus sp.	starsnout poacher unid.	2	115	147	131.0	57.7	58.3
	Leptagonus frenatus	sawback poacher	67	71	176	103.9	54.8	61.0
	Occella dodecaedron	Bering poacher	12	22	53	33.2	57.7	60.3
	Pallasina barbata	tubenose poacher	1	28	28	28.0	59.7	59.7
	Podothecus accipenserinus	sturgeon poacher	219	21	148	60.6	54.7	62.0
Ammodytidae	*Ammodytes* sp.	sand lance unid.	2	23	55	39.0	57.3	59.7
Anarhichadidae	*Anarhichas orientalis*	Bering wolffish	4	31	83	45.5	54.7	60.3
Anoplopomatidae	*Anoplopoma fimbria*	sablefish	29	53	156	117.6	55.0	57.0
Bathymasteridae	*Bathymaster signatus*	searcher	31	71	160	128.8	54.8	60.7
Clupeidae	*Clupea pallasii*	Pacific herring	71	22	104	53.5	55.1	62.0
Cottidae	*Gymnocanthus galeatus*	armorhead sculpin	4	53	80	71.0	56.7	57.4
	Gymnocanthus pistilliger	threaded sculpin	14	21	47	29.6	57.3	59.3
	Hemilepidotus hemilepidotus	red Irish lord	1	53	53	53.0	55.3	55.3
	Hemilepidotus jordani	yellow Irish lord	85	49	142	85.8	54.7	61.3
	Hemilepidotus papilio	butterfly sculpin	1	60	60	60.0	60.2	60.2
	Icelus spatula	spatulate sculpin	20	69	156	109.2	55.0	60.0
	Icelus spiniger	thorny sculpin	50	100	176	128.1	55.0	61.0
	Leptocottus armatus	Pacific staghorn sculpin	1	32	32	32.0	57.3	57.3
	Myoxocephalus jaok	plain sculpin	163	22	92	53.0	55.3	62.0
	Myoxocephalus polyacanthocephalus	great sculpin	193	36	157	84.6	55.0	62.0
	Myoxocephalus scorpius	shorthorn (=warty) sculpin	49	45	125	70.2	57.3	62.0
	Triglops macellus	roughspine sculpin	4	71	151	122.8	55.7	57.4
	Triglops pingeli	ribbed sculpin	7	32	112	76.4	55.0	60.3
	Triglops scepticus	spectacled sculpin	7	138	157	149.0	54.8	58.8
Gadidae	*Boreogadus saida*	Arctic cod	1	64	64	64.0	60.0	60.0
	Eleginus gracilis	saffron cod	16	21	87	31.4	58.4	60.3
	Gadus chalcogrammus	walleye pollock	374	21	176	80.9	54.7	62.0
	Gadus macrocephalus	Pacific cod	365	21	176	80.1	54.7	62.0
Hemitripteridae	*Hemitripterus bolini*	bigmouth sculpin	99	71	176	109.8	55.3	61.3

Appendix Table A1. -- Fish taxa encountered during the 2019 eastern Bering Sea bottom trawl survey listed alphabetically by family.

Family	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Hemitripterus bolini egg	bigmouth sculpin egg	1	151	151	151.0	56.3	56.3
Hexagrammidae	*Hexagrammos decagrammus*	kelp greenling	2	75	78	76.5	55.4	60.0
	Hexagrammos stelleri	whitespotted greenling	16	22	63	34.1	57.0	60.3
	Pleurogrammus monopterygius	Atka mackerel	1	112	112	112.0	55.0	55.0
Liparidae	*Careproctus phasma*	monster snailfish	24	79	148	118.1	58.7	61.3
	Careproctus rastrinus	salmon snailfish	13	75	148	104.2	59.0	62.0
	Careproctus sp.		2	79	92	85.5	58.7	59.3
	Liparis gibbus	variegated snailfish	10	50	136	73.0	57.7	62.0
	Liparis tunicatus	kelp snailfish	3	41	53	47.0	57.3	58.0
Osmeridae	*Mallotus catervarius (=villosus)*	Pacific capelin	43	21	75	45.3	56.3	62.0
	Osmerus mordax	rainbow smelt	2	31	37	34.0	58.7	60.3
	Thaleichthys pacificus	eulachon	55	21	156	77.2	55.0	59.7
Pleuronectidae	*Atheresthes evermanni*	Kamchatka flounder	210	51	176	100.4	54.8	62.0
	Atheresthes stomias	arrowtooth flounder	284	45	176	92.6	54.7	62.0
	Glyptocephalus zachirus	rex sole	85	53	176	116.0	54.7	59.6
	Hippoglossoides elassodon	flathead sole	331	31	176	86.3	54.7	62.0
	Hippoglossoides robustus	Bering flounder	59	32	112	76.1	57.0	62.0
	Hippoglossus stenolepis	Pacific halibut	244	21	176	73.6	54.7	61.4
	Isopsetta isolepis	butter sole	29	35	83	60.4	54.7	58.0
	Lepidopsetta bilineata	southern rock sole	4	53	80	68.8	55.1	55.7
	Lepidopsetta polyxystra	northern rock sole	320	21	176	73.1	54.7	62.0
	Limanda aspera	yellowfin sole	270	21	108	63.9	54.7	62.0
	Limanda proboscidea	longhead dab	31	21	47	32.4	57.7	60.3
	Limanda sakhalinensis	Sakhalin sole	2	64	75	69.5	59.3	62.0
	Microstomus pacificus	Dover sole	9	53	155	114.6	55.0	58.3
	Parophrys vetulus	English sole	1	53	53	53.0	55.3	55.3
	Platichthys stellatus	starry flounder	78	21	88	43.9	54.7	60.3
	Platichthys stellatus X Pleuronectes quadrituberculatus hybrid	hybrid starry flounder X Alaska plaice	1	46	46	46.0	58.0	58.0
	Pleuronectes quadrituberculatus	Alaska plaice	277	21	128	67.2	55.3	62.0

Appendix Table A1. -- Fish taxa encountered during the 2019 eastern Bering Sea bottom trawl survey listed alphabetically by family.

Family	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Reinhardtius hippoglossoides	Greenland turbot	66	61	176	103.7	57.6	62.0
Psychrolutidae	*Dasycottus setiger*	spinyhead sculpin	66	70	176	119.9	55.0	61.0
	Malacocottus zonurus	darkfin sculpin	4	128	155	142.2	54.8	56.3
	Psychrolutes sp.		1	59	59	59.0	60.3	60.3
Rajidae	*Bathyraja aleutica*	Aleutian skate	25	103	176	136.1	54.8	59.6
	Bathyraja interrupta	Bering skate	81	68	176	117.8	54.7	61.7
	Bathyraja interrupta egg case		15	96	156	135.1	54.8	58.3
	Bathyraja minispinosa egg case	whitebrow skate egg case	1	138	138	138.0	56.3	56.3
	Bathyraja parmifera	Alaska skate	348	22	176	83.5	54.7	62.0
	Bathyraja parmifera egg case	Alaska skate egg case	33	47	155	94.5	55.0	60.7
	Bathyraja sp.		1	136	136	136.0	60.3	60.3
	Bathyraja taranetzi	mud skate	6	113	155	138.7	54.8	59.0
	Beringraja binoculata	big skate	10	50	155	73.4	54.7	57.7
Salmonidae	*Oncorhynchus gorbuscha*	pink salmon	1	120	120	120.0	57.3	57.3
	Oncorhynchus keta	chum salmon	12	44	141	90.6	55.3	60.0
	Oncorhynchus tshawytscha	chinook salmon	1	78	78	78.0	55.4	55.4
Scorpaenidae	*Sebastes aleutianus*	rougheye rockfish	2	126	138	132.0	55.7	56.3
	Sebastes alutus	Pacific ocean perch	16	117	157	141.6	54.8	59.3
	Sebastes melanostictus	blackspotted rockfish	3	128	140	134.3	55.3	56.3
	Sebastes polyspinis	northern rockfish	4	134	150	139.2	55.7	56.7
Stichaeidae	*Acantholumpenus mackayi*	pighead prickleback	1	31	31	31.0	60.3	60.3
	Leptoclinus maculatus	daubed shanny	25	73	137	108.0	55.3	60.0
	Lumpenus fabricii	slender eelblenny	6	31	116	74.8	56.3	61.0
	Poroclinus rothrocki	whitebarred prickleback	6	109	134	119.0	56.7	58.0
	Stichaeidae	prickleback unid.	1	148	148	148.0	55.3	55.3
Trichodontidae	*Trichodon trichodon*	Pacific sandfish	8	26	45	35.5	56.7	58.4
Zaproridae	*Zaprora silenus*	prowfish	2	138	147	142.5	56.3	57.7
Zoarcidae	*Lycodes brevipes*	shortfin eelpout	85	63	176	114.9	55.0	61.7
	Lycodes palearis	wattled eelpout	134	52	142	87.9	55.6	62.0
	Lycodes polaris	Canadian eelpout	1	87	87	87.0	61.3	61.3
	Lycodes raridens	marbled eelpout	3	78	94	87.7	59.5	62.0
	Lycodes sp.		1	95	95	95.0	59.8	59.8

Appendix Table A2. -- Invertebrate taxa encountered during the 2019 eastern Bering Sea bottom trawl survey listed alphabetically by phylum.

Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
Annelida	*Aphrodita negligens*		22	104	176	134.5	55.0	61.7
	Eunoe depressa	depressed scale worm	36	42	141	88.3	55.3	61.4
	Eunoe nodosa	giant scale worm	71	34	151	80.1	56.3	62.0
	Eunoe senta	thorny scaleworm	1	119	119	119.0	60.7	60.7
	Eunoe sp.		4	53	115	76.5	57.3	59.7
	Hirudinea	leech unid.	2	82	87	84.5	58.7	59.0
	Notostomum cyclostomum	striped sea leech	3	67	109	94.3	56.7	59.7
	Polychaeta	polychaete worm unid.	6	33	76	49.0	56.7	59.7
	Polychaete tubes		13	32	138	81.2	55.1	58.0
	Serpula sp.		2	128	150	139.0	56.0	56.3
	Serpulidae	serpulid worm	5	71	135	114.0	55.7	57.4
		tube worm unid.	15	32	156	83.9	55.0	62.0
Arthropoda	*Argis* sp.		16	49	142	113.1	55.7	61.7
	Balanus nubilus		3	67	100	78.3	56.8	59.7
	Balanus sp.		14	27	155	57.6	54.8	59.0
	Chionoecetes bairdi	Tanner crab	241	40	176	91.4	54.8	61.0
	Chionoecetes hybrid	hybrid Tanner crab	96	47	176	92.5	55.0	60.3
	Chionoecetes opilio	snow crab	251	26	176	89.4	55.0	62.0
	Chirona evermanni	giant barnacle	9	55	157	122.2	56.0	58.7
	Crangon alaskensis	shell shrimp	2	31	32	31.5	59.0	59.4
	Crangon sp.		60	23	156	82.4	55.0	62.0
	Elassochirus cavimanus	purple hermit	26	71	176	121.2	54.8	59.6
	Elassochirus tenuimanus	widehand hermit crab	6	51	78	61.8	55.1	56.7
	Erimacrus isenbeckii	horsehair crab	33	29	138	61.9	55.3	61.0
	Gammaridae	gammarid amphipod unid.	1	66	66	66.0	57.8	57.8
	Glebocarcinus oregonensis	Oregon rock crab	45	51	106	71.9	55.3	58.0
	Hyas coarctatus	circumboreal toad crab	119	22	113	63.0	56.0	61.7
	Hyas lyratus	Pacific lyre crab	109	33	155	83.4	54.8	60.0
	Labidochirus splendescens	splendid hermit	150	29	157	72.6	54.8	61.7
	Lebbeus polaris		1	69	69	69.0	60.0	60.0
	Lebbeus sp.		1	33	33	33.0	58.3	58.3
	Metacarcinus magister	Dungeness crab	1	53	53	53.0	55.3	55.3

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Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Oregonia gracilis	graceful decorator crab	33	26	155	59.7	54.8	60.0
	Paguridae	hermit crab unid.	2	53	113	83.0	56.3	57.3
	Pagurus aleuticus	Aleutian hermit	136	53	157	102.3	54.8	60.3
	Pagurus brandti	sponge hermit	3	53	155	91.3	54.8	57.7
	Pagurus capillatus	hairy hermit crab	192	23	155	77.1	54.8	60.3
	Pagurus confragosus	knobbyhand hermit	97	48	157	105.6	54.8	59.7
	Pagurus cornutus	hornyhand hermit	1	176	176	176.0	59.6	59.6
	Pagurus ochotensis	Alaskan hermit	112	21	88	46.3	55.7	60.3
	Pagurus rathbuni	longfinger hermit	113	45	176	98.1	56.7	62.0
	Pagurus trigonocheirus	fuzzy hermit crab	168	34	176	86.1	56.0	62.0
	Pandalus eous	Alaskan pink shrimp	100	48	176	114.5	54.8	61.7
	Pandalus goniurus	humpy shrimp	13	31	136	74.6	55.7	62.0
	Pandalus jordani	ocean shrimp	5	117	155	132.6	54.8	60.0
	Paralithodes camtschaticus	red king crab	96	31	88	59.1	55.3	60.0
	Paralithodes platypus	blue king crab	19	45	95	70.5	56.8	60.7
	Paralithodes rathbuni		1	66	66	66.0	61.0	61.0
	Rocinela angustata	sea cockroach	1	132	132	132.0	55.4	55.4
	Telmessus cheiragonus	helmet crab	30	21	50	32.7	57.0	60.3
	Thoracica	barnacle unid.	5	35	78	55.0	57.0	59.0
		empty barnacle shells	2	36	44	40.0	58.0	58.7
		shrimp unid.	1	69	69	69.0	57.7	57.7
Bryozoa	Bryozoa	bryozoan unid.	41	22	138	65.4	55.0	61.0
Chordata	*Aplidium* sp.		52	26	88	50.5	56.3	60.3
	Ascidiacea	tunicate unid.	4	32	106	67.0	57.3	61.7
	Boltenia ovifera	sea onion	112	22	100	54.8	56.0	60.7
	Boltenia sp.		1	27	27	27.0	59.0	59.0
	Halocynthia aurantium	sea peach	32	54	81	68.7	57.0	60.3
	Halocynthia sp.	sea peach unid.	3	43	74	62.7	57.5	60.3
	Styela rustica	sea potato	96	34	100	60.8	57.0	61.0
	Styela sp.		1	66	66	66.0	57.0	57.0
		compound ascidian unid.	1	75	75	75.0	56.7	56.7
Cnidaria	Actiniaria	sea anemone unid.	46	32	176	106.7	56.0	62.0
	Actiniidae	actinid sea anemones unid.	1	66	66	66.0	60.0	60.0
	Actinostolidae		32	33	142	97.4	56.0	62.0

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Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Aequorea sp.		19	81	155	121.2	54.8	61.0
	Anthozoa		1	115	115	115.0	61.4	61.4
	Aurelia labiata		18	47	135	65.8	56.0	60.3
	Aurelia sp.		11	47	95	68.1	56.7	61.7
	Chrysaora melanaster		267	32	155	78.8	54.7	62.0
	Cribrinopsis fernaldi	chevron-tentacled anemone	9	66	155	118.3	54.8	61.0
	Cyanea capillata	lion's mane jelly	32	88	148	117.5	55.0	61.0
	Cyanea sp.		5	53	95	75.4	57.0	59.0
	Gersemia rubiformis		2	61	67	64.0	58.0	60.0
	Gersemia sp.	sea raspberry	66	32	92	56.9	56.0	60.3
	Halipteris willemoesi		9	39	135	111.9	55.7	58.7
	Hydroidolina	hydroid unid.	33	22	132	48.2	56.0	60.3
	Liponema brevicorne	tentacle-shedding anemone	30	95	156	124.1	55.0	59.3
	Metridium farcimen	gigantic anemone	38	35	121	62.3	56.3	61.3
	Metridium sp.		56	31	130	68.8	55.0	60.3
	Pennatulacea	sea whip or sea pen unid.	3	95	134	108.7	55.7	56.7
	Phacellophora camtschatica	egg yolk jelly	1	135	135	135.0	58.7	58.7
	Scyphozoa	jellyfish unid.	35	23	176	93.5	55.0	61.7
	Stomphia coccinea	swimming anemone	13	51	121	86.5	55.7	62.0
	Stomphia sp.		33	53	156	87.9	55.0	60.0
	Urticina crassicornis	mottled anemone	14	35	101	68.2	55.3	57.3
	Urticina sp.		6	48	103	71.7	56.7	58.3
	Virgulariidae		2	109	156	132.5	55.0	57.0
		red striated sea anemone	15	62	135	106.5	55.7	60.3
Echinodermata	*Allocentrotus fragilis*	orange-pink sea urchin	1	135	135	135.0	55.7	55.7
	Asterias amurensis	purple-orange sea star	254	21	138	65.5	54.7	61.0
	Asteronyx loveni	serpent sea star	1	134	134	134.0	56.7	56.7
	Ceramaster japonicus	red bat star	1	140	140	140.0	55.3	55.3
	Ceramaster patagonicus	orange bat sea star	2	132	138	135.0	56.0	56.3
	Crossaster borealis	grooved sea star	2	138	160	149.0	56.3	60.6
	Crossaster papposus	rose sea star	23	58	155	80.6	54.8	61.0
	Ctenodiscus crispatus	common mud star	77	65	176	118.2	55.3	62.0

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Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Cucumaria fallax	sea football	31	35	92	66.0	56.0	58.0
	Diplopteraster multipes	pincushion sea star	4	134	155	146.5	56.0	58.3
	Dipsacaster borealis	northern sea star	1	141	141	141.0	57.0	57.0
	Dipsacaster sp.		2	155	157	156.0	58.3	58.7
	Echinarachnius parma	parma sand dollar	10	37	91	73.8	54.7	60.7
	Evasterias echinosoma	giant sea star	25	35	88	62.1	55.3	58.0
	Gorgonocephalus eucnemis	basketstar	236	36	155	82.1	55.0	62.0
	Henricia sp.		20	52	157	128.2	54.8	60.7
	Holothuroidea	sea cucumber unid.	1	147	147	147.0	57.7	57.7
	Leptasterias arctica		49	39	157	67.6	57.0	62.0
	Leptasterias groenlandica		12	66	109	81.7	56.7	59.5
	Leptasterias polaris		137	45	160	92.7	56.7	62.0
	Leptasterias sp.		5	64	78	73.4	59.7	61.7
	Leptychaster anomalus		9	64	130	106.1	55.1	59.3
	Leptychaster sp.		1	155	155	155.0	54.8	54.8
	Lethasterias nanimensis	blackspined sea star	87	53	157	86.6	55.1	60.7
	Odontohenricia sp.		4	47	135	72.5	55.7	58.0
	Ophiopholis longispina		3	70	151	123.7	56.0	57.3
	Ophiura sarsii	notched brittlestar	98	23	155	79.8	54.8	62.0
	Ophiura sp.		1	66	66	66.0	57.8	57.8
	Pentamera lissoplaca	crescent sea cucumber	2	69	71	70.0	57.0	57.0
	Pseudarchaster alascensis		3	109	150	130.3	56.0	56.3
	Pseudarchaster parelii	scarlet sea star	13	115	157	137.1	54.8	59.3
	Pseudarchaster sp.		1	138	138	138.0	56.3	56.3
	Psolus sp.		3	59	75	64.7	60.0	60.3
	Pteraster jordani		1	53	53	53.0	57.3	57.3
	Pteraster obscurus	obscure sea star	46	61	148	103.6	55.7	62.0
	Pteraster sp.		1	155	155	155.0	54.8	54.8
	Pycnopodia helianthoides	sunflower sea star	1	80	80	80.0	55.7	55.7
	Solaster sp.		5	61	155	83.8	54.8	60.7
	Strongylocentrotus droebachiensis	green sea urchin	29	49	150	93.3	55.7	61.0
	Strongylocentrotus sp.		40	35	157	101.1	54.8	61.0

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Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
Ectoprocta	*Alcyonidium pedunculatum*	fruit leather bryozoan	7	35	61	46.3	56.7	58.3
	Alcyonidium sp.		2	50	55	52.5	57.3	57.7
	Flustra serrulata	leafy bryozoan	7	36	75	54.0	57.8	60.3
	Rhamphostomella costata	ribbed bryozoan	7	47	80	67.7	56.7	58.3
Mollusca	*Aforia circinata*	keeled Aforia	26	81	149	114.2	56.7	61.0
	Aforia sp.		1	92	92	92.0	56.3	56.3
	Ancistrolepis bicinctus	two-ribbed whelk	1	155	155	155.0	54.8	54.8
	Arctomelon stearnsii	Alaska volute	1	155	155	155.0	54.8	54.8
	Benthoctopus leioderma	smoothskin octopus	13	88	176	122.8	56.3	61.0
	Beringius behringi	Bering beringius	35	52	148	103.1	55.0	61.0
	Beringius sp.		43	46	160	93.7	55.0	61.4
	Bivalvia	bivalve unid.	2	71	72	71.5	56.8	57.5
	Boreotrophon sp.		4	83	160	110.5	57.3	60.6
	Buccinum angulosum	angular whelk	70	47	148	92.4	56.3	62.0
	Buccinum oedematum	swollen whelk	24	31	151	85.3	56.0	61.0
	Buccinum plectrum	sinuous whelk	24	34	155	94.8	55.4	60.7
	Buccinum polare	polar whelk	60	52	111	75.1	56.7	62.0
	Buccinum scalariforme	ladder whelk	123	34	157	95.9	54.8	62.0
	Buccinum sp.		30	35	176	75.8	55.3	60.7
	Chlamys sp.		3	72	155	112.0	56.8	58.3
	Ciliatoclinocardium ciliatum	hairy cockle	15	52	105	73.4	56.7	61.7
	Clinocardium sp.		16	39	136	78.2	56.7	61.3
	Clinopegma magnum	helmet whelk	53	64	142	93.3	56.3	62.0
	Colus halli	shrew whelk	3	94	129	108.3	59.5	61.0
	Colus herendeenii	thin-ribbed whelk	6	74	119	104.8	57.0	59.0
	Colus sp.		26	62	148	102.0	55.3	62.0
	Crepidula sp.	slipper shell	13	47	84	65.5	56.6	58.3
	Cryptonatica aleutica	Aleutian moonsnail	3	29	80	57.3	56.7	59.0
	Cryptonatica russa	rusty moonsnail	20	42	148	84.8	55.7	62.0
	Cryptonatica sp.		2	64	67	65.5	56.3	59.7
	Cyclocardia crassidens	thick carditid	1	47	47	47.0	60.0	60.0
	Cyclocardia sp.		9	32	53	43.1	57.3	58.7
	Dorididae	dorid nudibranch unid.	4	79	138	95.8	56.3	57.0
	Enteroctopus dofleini	giant octopus	28	49	160	121.8	55.7	61.0

Appendix Table A2. -- Invertebrate taxa encountered during the 2019 eastern Bering Sea bottom trawl survey listed alphabetically by phylum.

Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Fusitriton oregonensis	Oregon triton	100	53	176	108.9	54.8	60.1
	Fusitriton oregonensis egg		2	118	135	126.5	55.7	57.0
	gastropod egg	snail egg	185	26	157	75.3	55.3	62.0
	Grandicrepidula grandis	great slippersnail	1	64	64	64.0	57.7	57.7
	Hiatella arctica	Arctic Hiatella	12	35	74	48.3	57.5	60.3
	Lunatia pallida	pale moonsnail	14	45	102	76.6	57.0	62.0
	Lussivolutopsius filosus	threaded whelk	1	136	136	136.0	59.3	59.3
	Macoma inquinata	pointed Macoma	1	35	35	35.0	57.0	57.0
	Macoma nasuta	bent-nose Macoma	1	44	44	44.0	58.3	58.3
	Macoma sp.		17	26	86	51.1	56.7	60.7
	Mactromeris polynyma	Arctic surfclam	38	27	79	49.9	55.7	60.0
	Modiolus modiolus	northern horsemussel	20	32	86	60.9	56.3	60.0
	Musculus discors	discordant mussel	14	26	88	56.6	56.7	62.0
	Musculus sp.		2	53	71	62.0	57.7	61.7
	Mya sp.		1	46	46	46.0	58.0	58.0
	Mytilidae	mussel unid.	3	64	75	71.0	61.0	61.3
	Mytilus edulis	blue mussel	2	42	44	43.0	58.7	59.0
	Mytilus sp.		4	33	53	39.8	55.3	58.7
	gastropod egg	moonsnail egg unid.	8	22	71	51.9	57.0	59.3
	Neoberingius frielei		2	118	156	137.0	55.0	57.0
	Neptunea borealis		52	44	115	70.5	56.7	62.0
	Neptunea heros		121	35	87	60.2	56.3	62.0
	Neptunea lyrata	lyre whelk	109	32	176	92.1	55.0	60.7
	Neptunea pribiloffensis	Pribilof whelk	140	65	176	112.2	55.0	61.7
	Neptunea sp.		8	23	155	71.2	54.8	59.0
	Neptunea ventricosa	fat whelk	129	34	151	60.8	56.3	60.7
	Nodulotrophon coronatus		1	84	84	84.0	56.7	56.7
	Nuculana pernula	northern nutclam	2	91	106	98.5	61.3	62.0
	Nudibranchia	nudibranch unid.	6	75	118	84.5	59.0	59.8
	Octopodidae	octopus unid.	11	82	157	118.5	57.0	59.0
	Octopus sp.		1	120	120	120.0	57.3	57.3
	Onchidiopsis sp.		3	60	68	63.7	58.3	59.4
	Patinopecten caurinus	weathervane scallop	12	85	135	105.8	55.3	57.3
	Plicifusus kroyeri		33	66	155	101.9	54.8	61.0

Appendix Table A2. -- Invertebrate taxa encountered during the 2019 eastern Bering Sea bottom trawl survey listed alphabetically by phylum.

Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Plicifusus sp.		20	60	176	116.8	56.3	61.0
	Pododesmus macrochisma	Alaska falsejingle	1	75	75	75.0	56.7	56.7
	Pyrulofusus deformis	warped whelk	46	44	176	98.5	55.0	60.3
	Pyrulofusus dexius		2	61	68	64.5	57.3	57.7
	Pyrulofusus harpa	left-hand whelk	6	61	73	65.8	57.0	58.0
	Pyrulofusus melonis		33	60	150	112.2	55.0	61.0
	Pyrulofusus sp.		6	66	119	94.7	55.4	57.6
	Rossia pacifica	eastern Pacific bobtail	13	127	157	140.2	54.8	59.7
	Serripes groenlandicus	Greenland cockle	13	28	65	44.8	57.0	59.7
	Serripes notabilis	oblique smoothcockle	25	34	137	74.9	55.3	62.0
	Serripes sp.		25	31	109	59.8	56.3	60.3
	Siliqua alta	Alaska razor	4	22	32	27.8	58.7	60.3
	Siliqua sp.		6	22	37	28.8	58.7	59.3
	Tachyrhynchus erosus	eroded turretsnail	1	28	28	28.0	59.7	59.7
	Tellina lutea	Alaska great-tellin	8	26	55	38.5	57.3	59.7
	Tellina sp.		2	60	76	68.0	59.8	61.0
	Tochuina gigantea	giant orange tochui	4	72	121	91.8	57.0	59.8
	Tritonia diomedea	rosy Tritonia	6	63	135	99.3	55.7	60.3
	Tritonia sp.		5	74	120	89.0	56.3	59.7
	Volutopsius fragilis	fragile whelk	7	70	134	92.9	56.7	58.3
	Volutopsius sp.		37	56	160	107.4	55.3	61.0
	Volutopsius stefanssoni	shouldered whelk	5	59	74	69.6	57.0	60.3
	Yoldia sp.		14	33	91	67.0	56.0	61.0
		empty bivalve shells	275	21	160	74.1	55.0	62.0
		empty gastropod shells	319	21	176	81.2	54.8	62.0
		limpet unid.	1	52	52	52.0	57.6	57.6
Porifera	*Aphrocallistes vastus*	clay pipe sponge	1	151	151	151.0	56.3	56.3
	Craniella sp.	puffball sponges	1	155	155	155.0	54.8	54.8
	Porifera	sponge unid.	82	23	160	76.4	55.3	61.0
	Suberites montalbidus	stinky sponge	3	67	88	76.7	56.7	60.0
	Suberites sp.		6	51	155	85.8	54.8	56.3
Sipuncula	Sipuncula	peanut worm unid.	9	32	148	75.2	55.3	61.7
Other		unsorted catch and debris	4	60	100	74.5	59.3	60.3

Appendix B: List of taxa encountered in the NBS

Appendix B lists all fish and invertebrate taxa taken during the AFSC's NBS bottom trawl survey.

List of Tables

Appendix Table B1. -- Fish taxa encountered during the 2019 NBS bottom trawl survey listed alphabetically by family.

Family	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
Agonidae	*Aspidophoroides olrikii*	Arctic alligatorfish	10	31	53	41.3	64.0	65.3
	Leptagonus frenatus	sawback poacher	1	71	71	71.0	62.3	62.3
	Occella dodecaedron	Bering poacher	29	12	30	20.6	60.7	64.3
	Pallasina barbata	tubenose poacher	17	14	38	22.1	60.7	65.3
	Podothecus accipenserinus	sturgeon poacher	60	14	62	37.6	60.7	64.0
	Podothecus sp.		1	23	23	23.0	64.3	64.3
	Podothecus veternus	veteran poacher	45	18	63	38.9	62.3	65.3
Ammodytidae	*Ammodytes personatus*	Pacific sand lance	1	32	32	32.0	64.0	64.0
Anarhichadidae	*Anarhichas orientalis*	Bering wolffish	8	15	25	19.6	64.0	64.3
Clupeidae	*Clupea pallasii*	Pacific herring	94	12	80	38.6	60.7	65.0
Cottidae	*Artediellus scaber*	hamecon	1	35	35	35.0	64.0	64.0
	Cottidae	sculpin unid.	6	30	45	36.2	64.3	65.0
	Enophrys diceraus	antlered sculpin	22	12	56	24.4	63.7	65.0
	Gymnocanthus pistilliger	threaded sculpin	23	15	45	22.0	61.0	65.0
	Gymnocanthus sp.		14	29	53	39.4	64.0	65.3
	Gymnocanthus tricuspis	Arctic staghorn sculpin	2	34	41	37.5	64.7	65.0
	Hemilepidotus jordani	yellow Irish lord	2	59	66	62.5	61.7	62.3
	Hemilepidotus papilio	butterfly sculpin	10	31	80	56.0	61.3	64.7
	Megalocottus platycephalus	belligerent sculpin	4	15	19	16.0	63.3	64.3
	Myoxocephalus jaok	plain sculpin	110	12	66	34.1	60.7	65.3
	Myoxocephalus polyacanthocephalus	great sculpin	32	21	80	47.4	61.7	65.3
	Myoxocephalus scorpioides	Arctic sculpin	1	19	19	19.0	64.3	64.3
	Myoxocephalus scorpius	shorthorn (=warty) sculpin	46	23	69	44.7	60.7	65.3
	Myoxocephalus sp.		4	33	53	40.2	63.7	65.3
	Triglops pingeli	ribbed sculpin	12	16	34	25.6	60.7	65.0
Cyclopteridae	*Eumicrotremus* sp.	spiny lumpsuckers	1	47	47	47.0	64.7	64.7
Gadidae	*Boreogadus saida*	Arctic cod	23	15	80	43.6	62.0	64.7
	Eleginus gracilis	saffron cod	78	12	53	28.5	60.7	65.3
	Gadus chalcogrammus	walleye pollock	132	12	80	40.6	60.7	65.3
	Gadus macrocephalus	Pacific cod	114	21	80	43.6	60.7	65.3
Gasterosteidae	*Pungitius pungitius*	ninespine stickleback	3	15	19	16.3	63.7	64.0
Hemitripteridae	*Nautichthys pribilovius*	eyeshade sculpin	5	16	32	23.0	64.0	64.3
	Nautichthys sp.		2	40	44	42.0	64.3	64.7

Appendix Table B1. -- Fish taxa encountered during the 2019 NBS bottom trawl survey listed alphabetically by family.

Family	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
Hexagrammidae	*Hexagrammos stelleri*	whitespotted greenling	38	12	36	23.4	60.7	64.6
	Pleurogrammus monopterygius	Atka mackerel	1	39	39	39.0	62.9	62.9
Liparidae	*Careproctus phasma*	monster snailfish	1	71	71	71.0	62.3	62.3
	Liparis gibbus	variegated snailfish	18	18	80	50.6	61.7	65.3
	Liparis sp.		4	21	59	39.2	63.3	64.7
Osmeridae	*Mallotus catervarius (=villosus)*	Pacific capelin	22	33	70	46.5	60.7	64.0
	Osmerus mordax	rainbow smelt	64	12	48	26.2	60.7	65.3
Pleuronectidae	*Atheresthes evermanni*	Kamchatka flounder	1	59	59	59.0	60.7	60.7
	Atheresthes stomias	arrowtooth flounder	8	41	63	50.4	60.7	61.7
	Hippoglossoides elassodon	flathead sole	15	42	80	58.6	60.7	62.3
	Hippoglossoides robustus	Bering flounder	92	20	80	45.2	60.7	65.3
	Hippoglossus stenolepis	Pacific halibut	40	14	63	35.5	60.7	65.3
	Lepidopsetta polyxystra	northern rock sole	121	14	80	41.4	60.7	65.3
	Limanda aspera	yellowfin sole	141	12	80	38.6	60.7	65.3
	Limanda proboscidea	longhead dab	54	12	41	26.5	60.7	65.3
	Limanda sakhalinensis	Sakhalin sole	44	31	74	49.9	61.3	65.3
	Liopsetta glacialis	Arctic flounder	5	15	19	16.6	63.7	64.3
	Platichthys stellatus	starry flounder	54	12	53	26.4	60.7	65.3
	Platichthys stellatus X Pleuronectes quadrituberculatus hybrid	hybrid starry flounder X Alaska plaice	1	30	30	30.0	63.7	63.7
	Pleuronectes quadrituberculatus	Alaska plaice	138	12	74	37.7	60.7	65.3
	Reinhardtius hippoglossoides	Greenland turbot	6	55	80	66.0	61.3	62.7
Psychrolutidae	*Eurymen gyrinus*	smoothcheek sculpin	1	19	19	19.0	64.3	64.3
Rajidae	*Bathyraja parmifera*	Alaska skate	73	27	80	47.1	60.7	65.2
	Bathyraja parmifera egg case	Alaska skate egg case	9	21	50	37.9	61.0	64.0
Salmonidae	*Oncorhynchus gorbuscha*	pink salmon	1	40	40	40.0	64.2	64.2
	Oncorhynchus keta	chum salmon	7	27	58	45.7	60.7	64.0
	Oncorhynchus sp.	salmon unid.	1	34	34	34.0	65.0	65.0

Appendix Table B1. -- Fish taxa encountered during the 2019 NBS bottom trawl survey listed alphabetically by family.

Family	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Oncorhynchus tshawytscha	chinook salmon	1	41	41	41.0	61.0	61.0
Stichaeidae	*Acantholumpenus mackayi*	pighead prickleback	21	12	23	18.0	60.7	64.3
	Chirolophis snyderi	bearded warbonnet	1	19	19	19.0	64.3	64.3
	Eumesogrammus praecisus	fourline snakeblenny	3	25	53	36.0	64.3	65.3
	Lumpenus fabricii	slender eelblenny	52	12	59	28.4	61.0	65.3
	Lumpenus sagitta	snake prickleback	2	23	30	26.5	64.3	64.3
	Stichaeus punctatus	Arctic shanny	7	15	21	18.7	64.0	64.3
Zoarcidae	*Lycodes palearis*	wattled eelpout	29	15	80	48.9	60.7	64.3
	Lycodes raridens	marbled eelpout	7	47	74	60.0	62.3	65.2
	Lycodes sp.		1	71	71	71.0	62.3	62.3
	Lycodes turneri	polar eelpout	21	12	53	25.6	63.7	65.3
Other		fish egg unid.	2	20	21	20.5	64.0	64.2

Appendix Table B2. -- Invertebrate taxa encountered during the 2019 NBS bottom trawl survey listed alphabetically by phylum.

Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
Annelida	Annelida	worm unid.	1	31	31	31.0	64.3	64.3
	Eunoe depressa	depressed scale worm	13	18	59	34.8	60.7	65.3
	Eunoe nodosa	giant scale worm	11	36	71	52.8	62.3	65.0
	Eunoe sp.		5	29	40	32.2	62.4	64.0
	Notostomum cyclostomum	striped sea leech	2	71	74	72.5	62.7	63.3
	Polychaeta	polychaete worm unid.	6	29	53	36.5	62.0	65.0
	Polychaete tubes		3	25	35	30.3	61.7	63.7
		tube worm unid.	3	31	40	35.0	63.0	65.0
Arthropoda	Amphipoda	amphipod unid.	2	36	40	38.0	63.0	63.7
	Argis lar	kuro argid	2	23	30	26.5	64.3	64.3
	Argis sp.		49	18	74	39.6	61.7	65.3
	Chionoecetes opilio	snow crab	99	21	80	44.8	60.7	65.3
	Chirona evermanni	giant barnacle	6	15	53	33.5	61.7	64.3
	Crangon sp.		43	12	80	25.5	60.7	65.3
	Erimacrus isenbeckii	horsehair crab	7	29	50	39.0	60.7	61.3
	Eualus sp.		1	31	31	31.0	63.3	63.3
	Eualus suckleyi	shortscale eualid	1	30	30	30.0	64.3	64.3
	Hapalogaster grebnitzkii	soft crab	2	34	49	41.5	65.0	65.0
	Hyas coarctatus	circumboreal toad crab	100	18	74	42.2	60.7	65.3
	Hyas lyratus	Pacific lyre crab	1	25	25	25.0	64.6	64.6
	Isopoda	isopod unid.	2	15	23	19.0	63.3	64.3
	Labidochirus splendescens	splendid hermit	59	12	63	33.5	60.7	65.0
	Pagurus capillatus	hairy hermit crab	58	15	46	29.2	60.7	65.0
	Pagurus dalli	whiteknee hermit	1	35	35	35.0	64.0	64.0
	Pagurus ochotensis	Alaskan hermit	38	12	42	24.9	60.7	64.3
	Pagurus rathbuni	longfinger hermit	27	35	80	55.8	60.7	65.0
	Pagurus trigonocheirus	fuzzy hermit crab	100	18	71	41.5	60.7	65.3
	Pandalidae	pandalid shrimp unid.	1	23	23	23.0	64.3	64.3
	Pandalus eous	Alaskan pink shrimp	2	24	32	28.0	64.0	64.0
	Pandalus goniurus	humpy shrimp	23	16	80	39.3	62.3	65.3
	Pandalus hypsinotus	coonstripe shrimp	1	25	25	25.0	64.3	64.3
	Pandalus sp.		4	18	49	26.5	63.7	65.0

Appendix Table B2. -- Invertebrate taxa encountered during the 2019 NBS bottom trawl survey listed alphabetically by phylum.

Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Paralithodes camtschaticus	red king crab	22	16	53	28.5	60.7	65.3
	Paralithodes platypus	blue king crab	17	29	59	40.6	63.3	65.3
	Sclerocrangon boreas	sculptured shrimp	9	19	53	29.1	63.3	65.2
	Telmessus cheiragonus	helmet crab	34	12	39	22.9	60.7	65.3
	Thoracica	barnacle unid.	9	21	39	31.4	61.7	64.7
		empty barnacle shells	5	31	48	38.4	62.7	64.2
		shrimp unid.	2	31	34	32.5	64.3	65.0
Bryozoa	Bryozoa	bryozoan unid.	6	15	53	34.0	60.7	64.7
Chordata	*Aplidium* sp.		26	20	40	29.6	60.7	65.3
	Ascidiacea	tunicate unid.	2	34	45	39.5	65.0	65.0
	Boltenia ovifera	sea onion	24	18	53	36.3	60.7	64.7
	Halocynthia aurantium	sea peach	4	21	40	33.8	63.6	64.3
	Styela rustica	sea potato	78	20	64	39.2	60.7	65.0
	Styela sp.		3	24	66	41.0	61.3	63.7
		compound ascidian unid.	15	25	49	38.1	63.3	65.3
Cnidaria	*Abietinaria* sp.		1	35	35	35.0	63.7	63.7
	Actiniaria	sea anemone unid.	31	12	80	29.2	60.7	65.3
	Actinostolidae		1	58	58	58.0	62.0	62.0
	Aurelia labiata		6	21	54	41.3	61.0	64.7
	Chrysaora melanaster		89	18	80	43.1	60.7	65.3
	Chrysaora sp.	chrysaora jelly	1	27	27	27.0	63.7	63.7
	Cyanea capillata	lion's mane jelly	37	21	74	47.5	61.0	65.3
	Gersemia rubiformis		8	43	71	55.2	61.7	62.3
	Gersemia sp.	sea raspberry	55	15	74	36.0	60.7	65.3
	Hydroidolina	hydroid unid.	15	20	53	31.9	60.7	64.3
	Metridium farcimen	gigantic anemone	6	15	23	19.3	62.4	64.2
	Metridium sp.		4	23	48	34.0	61.0	64.6
	Phacellophora camtschatica	egg yolk jelly	3	36	41	39.0	63.7	64.7
	Scyphozoa	jellyfish unid.	35	12	53	26.2	60.7	65.3
	Staurostoma mertensii	whitecross jelly	2	37	41	39.0	64.0	64.7
	Stomphia coccinea	swimming anemone	2	62	66	64.0	61.7	61.7
	Stomphia sp.		36	25	74	48.1	61.3	65.3
	Urticina crassicornis	mottled anemone	6	19	34	28.5	63.0	64.3
Echinodermata	*Asterias amurensis*	purple-orange sea star	84	12	62	30.8	60.7	65.3

Appendix Table B2. -- Invertebrate taxa encountered during the 2019 NBS bottom trawl survey listed alphabetically by phylum.

Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Asteroidea	sea star unid.	5	25	40	32.6	63.3	64.6
	Crossaster papposus	rose sea star	19	19	63	34.9	63.3	65.3
	Cucumaria fallax	sea football	1	25	25	25.0	64.6	64.6
	Echinarachnius parma	parma sand dollar	6	30	37	33.0	63.3	64.3
	Evasterias echinosoma	giant sea star	22	12	53	24.5	63.7	65.3
	Gorgonocephalus eucnemis	basketstar	76	18	80	40.3	60.7	65.3
	Henricia sp.		17	16	41	29.5	63.0	65.3
	Holothuroidea	sea cucumber unid.	7	30	70	42.7	63.0	65.3
	Leptasterias arctica		77	18	80	39.1	60.7	65.3
	Leptasterias groenlandica		10	53	74	64.1	62.6	63.3
	Leptasterias polaris		93	15	80	44.2	61.3	65.3
	Lethasterias nanimensis	blackspined sea star	33	16	53	28.2	63.3	65.3
	Ophiopholis kennerleyi		2	31	53	42.0	63.3	64.0
	Ophiura sarsii	notched brittlestar	19	27	80	57.5	62.0	63.7
	Ophiuroidea	brittlestar unid.	2	34	37	35.5	64.3	65.0
	Psolus fabricii	brownscaled sea cucumber	10	25	53	35.9	63.0	65.3
	Pteraster obscurus	obscure sea star	7	25	63	42.3	63.3	65.0
	Pteraster tesselatus		1	25	25	25.0	64.6	64.6
	Stegophiura nodosa		2	38	63	50.5	62.7	63.3
	Strongylocentrotus droebachiensis	green sea urchin	31	21	53	38.2	61.7	65.3
	Strongylocentrotus sp.		19	15	33	21.1	63.0	64.3
Echiura	Echiura	echiuroid worm unid.	1	30	30	30.0	64.7	64.7
Ectoprocta	*Alcyonidium disciforme*	disc bryozoan	1	31	31	31.0	64.3	64.3
	Alcyonidium enteromorpha	noodle bryozoan	7	31	53	43.3	64.3	65.2
	Alcyonidium pedunculatum	fruit leather bryozoan	12	29	53	37.4	63.3	65.2
	Alcyonidium A sp.	medusa bryozoan	2	33	33	33.0	63.4	63.7
	Flustra serrulata	leafy bryozoan	5	24	41	30.8	61.3	63.7
	Flustrellidra corniculata		5	21	48	36.0	63.0	64.2
	Myriapora subgracilis		2	37	40	38.5	64.2	64.3
	Rhamphostomella costata	ribbed bryozoan	2	31	33	32.0	63.3	63.3
Mollusca	*Amicula vestita*		8	31	53	38.5	63.0	65.0
	Astarte arctica		3	31	53	44.3	64.3	65.2

Appendix Table B2. -- Invertebrate taxa encountered during the 2019 NBS bottom trawl survey listed alphabetically by phylum.

Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Astarte sp.		1	15	15	15.0	64.3	64.3
	Beringius behringi	Bering beringius	1	25	25	25.0	64.3	64.3
	Beringius sp.		8	15	53	32.2	63.7	65.3
	Boreotrophon beringi	Bering trophon	1	26	26	26.0	62.0	62.0
	Buccinum angulosum	angular whelk	19	27	71	46.1	61.0	65.0
	Buccinum castaneum	chestnut whelk	4	38	48	41.5	62.7	63.0
	Buccinum oedematum	swollen whelk	3	38	54	44.0	61.0	63.0
	Buccinum plectrum	sinuous whelk	3	21	53	35.7	63.4	64.0
	Buccinum polare	polar whelk	53	26	80	47.3	61.0	65.2
	Buccinum scalariforme	ladder whelk	37	34	80	48.7	60.7	65.2
	Buccinum sp.		11	25	69	39.2	61.7	64.7
	Chlamys sp.		2	35	53	44.0	64.0	64.0
	Ciliatoclinocardium ciliatum	hairy cockle	1	62	62	62.0	61.7	61.7
	Clinocardium blandum	low-rib cockle	1	19	19	19.0	64.0	64.0
	Clinocardium sp.		10	23	71	44.4	62.4	65.3
	Colus halli	shrew whelk	1	34	34	34.0	62.7	62.7
	Colus herendeenii	thin-ribbed whelk	3	29	49	38.3	63.7	65.0
	Colus sp.		9	37	71	48.2	60.7	64.7
	Crepidula sp.	slipper shell	1	40	40	40.0	63.0	63.0
	Cryptonatica russa	rusty moonsnail	20	23	74	58.0	61.7	65.2
	Cryptonatica sp.		3	33	40	37.3	62.9	63.4
	Cyclocardia sp.		5	18	59	28.6	60.7	64.2
	gastropod egg	snail egg	100	16	80	43.8	60.7	65.3
	Grandicrepidula grandis	great slippersnail	1	34	34	34.0	65.0	65.0
	Hiatella arctica	Arctic Hiatella	4	21	53	39.5	63.7	65.0
	Hiatella sp.		1	36	36	36.0	61.0	61.0
	Lamellariidae	lamellarid unid.	3	31	47	40.7	63.3	64.7
	Lunatia pallida	pale moonsnail	8	35	71	51.9	61.3	65.0
	Macoma sp.		6	23	55	42.8	62.7	65.2
	Mactromeris polynyma	Arctic surfclam	9	15	36	24.2	60.7	64.7
	Musculus discors	discordant mussel	15	18	47	36.5	60.7	65.0
	Musculus sp.		2	56	62	59.0	61.7	61.7
	Mya sp.		1	16	16	16.0	64.3	64.3
	Naticidae	moonsnail	1	66	66	66.0	61.7	61.7
	Neptunea borealis		50	19	71	45.2	60.7	65.3
	Neptunea heros		106	15	71	39.7	60.7	65.3
	Neptunea lyrata	lyre whelk	3	29	54	37.3	61.0	62.0

Appendix Table B2. -- Invertebrate taxa encountered during the 2019 NBS bottom trawl survey listed alphabetically by phylum.

Phylum	Scientific name	Common name	Number stations present	Bottom depth (m)			Latitude range	
				Min.	Max.	Avg.	N	S
	Neptunea sp.		3	31	47	38.7	61.3	65.3
	Neptunea ventricosa	fat whelk	66	18	59	36.0	60.7	65.3
	Nuculana pernula	northern nutclam	1	69	69	69.0	62.6	62.6
	Nudibranchia	nudibranch unid.	9	30	45	36.2	62.7	65.0
	Onchidiopsis sp.		1	53	53	53.0	65.2	65.2
	Panomya norvegica	Arctic roughmya	1	16	16	16.0	64.3	64.3
	Plicifusus kroyeri		1	40	40	40.0	64.2	64.2
	Pyrulofusus deformis	warped whelk	7	19	59	35.7	63.3	65.3
	Serripes groenlandicus	Greenland cockle	5	40	53	48.0	64.0	65.0
	Serripes laperousii	broad cockle	2	21	32	26.5	63.7	64.0
	Serripes notabilis	oblique smoothcockle	24	15	66	32.3	61.0	64.3
	Serripes sp.		12	23	63	44.2	61.0	65.3
	Siliqua alta	Alaska razor	9	12	30	20.7	60.7	63.7
	Tellina lutea	Alaska great-tellin	3	23	25	24.0	61.0	61.7
	Tellina sp.		5	18	40	26.2	62.0	63.7
	Trichotropis bicarinata	two-keel hairysnail	3	31	35	32.3	63.3	64.3
	Tritonia sp.		3	25	53	36.0	64.0	64.6
	Velutina sp.		1	35	35	35.0	64.0	64.0
	Yoldia hyperborea	northern Yoldia	2	55	69	62.0	62.6	62.7
	Yoldia sp.		5	35	74	63.0	62.7	63.7
		empty bivalve shells	112	15	80	36.8	60.7	65.3
		empty gastropod shells	128	12	80	37.9	60.7	65.3
Porifera	*Halichondria* sp.		1	31	31	31.0	63.3	63.3
	Monanchora alaskensis		4	31	48	41.0	62.7	63.3
	Porifera	sponge unid.	12	16	53	33.8	63.3	65.3
	Suberites sp.		9	20	36	27.2	60.7	61.7
	Suberites A (Clark 2006) sp.	wax sponge	1	31	31	31.0	63.3	63.3
Sipuncula	Sipuncula	peanut worm unid.	5	15	43	28.8	62.3	64.0

Appendix C: Population estimates by sex and size group for principal fish species in the EBS

Appendix C presents population estimates by sex and size group from the 2019 EBS bottom trawl survey for principal fish species.

List of Tables

Appendix Table C1. -- Population estimates by sex and size for Alaska plaice (*Pleuronectes quadrituberculatus*) from the 2019 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
11	58,542	0	0	58,542	0.0001	0.0001
12	28,844	0	0	28,844	0.0001	0.0002
13	146,454	29,587	0	176,041	0.0004	0.0005
14	177,795	56,672	0	234,467	0.0005	0.0010
15	207,790	60,561	0	268,351	0.0005	0.0015
16	298,188	176,062	0	474,250	0.0010	0.0025
17	151,076	245,257	0	396,333	0.0008	0.0033
18	412,779	291,207	0	703,986	0.0014	0.0047
19	1,175,811	512,447	0	1,688,258	0.0034	0.0081
20	1,563,245	963,987	0	2,527,232	0.0051	0.0131
21	1,540,843	1,365,798	0	2,906,641	0.0058	0.0190
22	2,031,629	3,262,049	0	5,293,678	0.0106	0.0296
23	3,191,625	2,029,243	0	5,220,868	0.0105	0.0400
24	4,829,632	2,951,974	0	7,781,606	0.0156	0.0556
25	4,818,982	4,012,540	0	8,831,522	0.0177	0.0733
26	4,780,014	3,881,264	0	8,661,278	0.0174	0.0907
27	5,143,952	4,102,254	0	9,246,206	0.0185	0.1092
28	6,353,591	4,934,330	0	11,287,921	0.0226	0.1318
29	7,427,222	4,643,862	0	12,071,084	0.0242	0.1560
30	8,320,445	5,194,586	0	13,515,031	0.0271	0.1830
31	10,502,121	5,924,239	89,487	16,515,847	0.0331	0.2161
32	12,630,686	5,824,969	0	18,455,655	0.0370	0.2531
33	17,347,723	5,637,907	0	22,985,630	0.0460	0.2992
34	25,619,818	5,919,910	0	31,539,728	0.0632	0.3623
35	28,578,434	6,455,470	89,487	35,123,391	0.0704	0.4327
36	31,239,102	6,985,361	268,460	38,492,923	0.0771	0.5098
37	24,479,851	7,461,537	268,460	32,209,848	0.0645	0.5743
38	16,079,516	9,636,389	447,434	26,163,339	0.0524	0.6268
39	9,855,867	9,557,581	715,894	20,129,342	0.0403	0.6671
40	5,157,443	11,669,394	89,487	16,916,324	0.0339	0.7010
41	3,485,047	13,008,223	536,920	17,030,190	0.0341	0.7351
42	1,191,465	13,383,551	447,434	15,022,450	0.0301	0.7652
43	952,792	16,828,514	805,380	18,586,686	0.0372	0.8024
44	375,216	16,859,262	357,947	17,592,425	0.0352	0.8377
45	77,624	16,023,713	984,354	17,085,691	0.0342	0.8719
46	252,643	14,129,916	894,867	15,277,426	0.0306	0.9025
47	0	10,782,896	805,380	11,588,276	0.0232	0.9257
48	67,049	10,280,767	626,407	10,974,223	0.0220	0.9477
49	193,646	7,409,824	1,342,301	8,945,771	0.0179	0.9656
50	0	4,848,478	268,460	5,116,938	0.0103	0.9759
51	89,832	4,492,498	626,407	5,208,737	0.0104	0.9863
52	0	2,593,971	447,434	3,041,405	0.0061	0.9924
53	29,264	1,525,536	0	1,554,800	0.0031	0.9955
54	0	890,497	0	890,497	0.0018	0.9973
55	0	478,723	89,487	568,210	0.0011	0.9984
56	0	497,531	0	497,531	0.0010	0.9994
57	0	119,521	0	119,521	0.0002	0.9997

Appendix Table C1. -- Population estimates by sex and size for Alaska plaice (*Pleuronectes quadrituberculatus*) from the 2019 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
58	0	111,364	0	111,364	0.0002	0.9999
60	0	29,530	0	29,530	0.0001	0.9999
63	0	28,020	0	28,020	0.0001	1.0000
Total	**240,863,598**	**248,108,772**	**10,201,487**	**499,173,857**	**1.0000**	**1.0000**

Appendix Table C2. -- Population estimates by sex and size for arrowtooth flounder (*Atheresthes stomias*) from the 2019 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
3	0	51,127	0	51,127	0.0001	0.0001
9	70,415	0	57,667	128,082	0.0001	0.0002
10	0	0	118,129	118,129	0.0001	0.0003
11	95,582	55,182	0	150,764	0.0001	0.0004
12	0	241,534	395,125	636,659	0.0006	0.0011
13	428,271	350,508	591,147	1,369,926	0.0014	0.0024
14	404,418	1,714,909	1,285,896	3,405,223	0.0034	0.0058
15	1,269,469	1,522,592	830,459	3,622,520	0.0036	0.0094
16	1,518,795	2,954,901	0	4,473,696	0.0044	0.0138
17	2,147,956	2,341,382	108,580	4,597,918	0.0045	0.0183
18	3,257,806	3,486,739	98,203	6,842,748	0.0067	0.0250
19	3,050,949	4,635,916	182,190	7,869,055	0.0078	0.0328
20	4,382,657	4,635,984	281,566	9,300,207	0.0092	0.0420
21	4,339,073	8,107,476	165,627	12,612,176	0.0124	0.0544
22	5,660,360	9,292,130	364,380	15,316,870	0.0151	0.0695
23	4,366,701	9,262,747	242,255	13,871,703	0.0137	0.0832
24	7,529,698	8,264,638	114,766	15,909,102	0.0157	0.0989
25	10,651,579	9,923,391	81,640	20,656,610	0.0204	0.1193
26	16,590,036	16,375,769	31,952	32,997,757	0.0325	0.1518
27	24,124,544	22,003,262	63,905	46,191,711	0.0455	0.1973
28	30,231,159	30,719,129	95,857	61,046,145	0.0602	0.2575
29	34,095,691	40,519,010	159,761	74,774,462	0.0737	0.3313
30	24,210,204	38,425,681	63,905	62,699,790	0.0618	0.3931
31	14,857,731	36,716,777	63,905	51,638,413	0.0509	0.4440
32	10,346,535	28,109,544	0	38,456,079	0.0379	0.4819
33	11,440,414	17,858,789	31,952	29,331,155	0.0289	0.5109
34	9,576,840	19,370,021	31,952	28,978,813	0.0286	0.5394
35	11,451,048	16,144,973	95,857	27,691,878	0.0273	0.5667
36	11,567,318	19,483,613	0	31,050,931	0.0306	0.5974
37	8,220,836	17,978,625	0	26,199,461	0.0258	0.6232
38	7,805,150	14,427,936	0	22,233,086	0.0219	0.6451
39	9,108,482	12,077,125	0	21,185,607	0.0209	0.6660
40	9,020,423	13,809,316	0	22,829,739	0.0225	0.6885
41	9,297,186	15,602,237	0	24,899,423	0.0246	0.7131
42	9,309,486	15,966,548	0	25,276,034	0.0249	0.7380
43	9,014,832	16,401,955	0	25,416,787	0.0251	0.7631
44	8,015,026	13,811,899	0	21,826,925	0.0215	0.7846
45	7,869,609	16,445,061	0	24,314,670	0.0240	0.8086
46	4,852,546	16,560,307	0	21,412,853	0.0211	0.8297
47	3,336,173	18,301,368	0	21,637,541	0.0213	0.8510
48	2,312,329	15,804,054	0	18,116,383	0.0179	0.8689
49	1,669,241	16,348,089	0	18,017,330	0.0178	0.8867
50	848,690	13,126,296	0	13,974,986	0.0138	0.9004
51	729,710	11,908,782	0	12,638,492	0.0125	0.9129
52	72,591	9,146,373	0	9,218,964	0.0091	0.9220
53	135,617	8,190,050	0	8,325,667	0.0082	0.9302
54	93,735	5,606,025	0	5,699,760	0.0056	0.9358

Appendix Table C2. -- Population estimates by sex and size for arrowtooth flounder (*Atheresthes stomias*) from the 2019 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
55	86,511	5,549,548	0	5,636,059	0.0056	0.9414
56	172,285	4,949,752	0	5,122,037	0.0051	0.9464
57	28,488	5,751,416	0	5,779,904	0.0057	0.9521
58	89,397	4,779,746	0	4,869,143	0.0048	0.9569
59	72,766	6,273,999	0	6,346,765	0.0063	0.9632
60	74,003	6,252,753	0	6,326,756	0.0062	0.9694
61	227,472	5,381,760	0	5,609,232	0.0055	0.9750
62	76,537	4,877,123	0	4,953,660	0.0049	0.9798
63	0	4,128,317	0	4,128,317	0.0041	0.9839
64	134,032	3,942,647	0	4,076,679	0.0040	0.9879
65	28,974	4,077,120	0	4,106,094	0.0040	0.9920
66	0	2,382,232	0	2,382,232	0.0023	0.9943
67	0	1,884,252	0	1,884,252	0.0019	0.9962
68	0	1,209,265	0	1,209,265	0.0012	0.9974
69	0	873,928	0	873,928	0.0009	0.9982
70	0	606,459	0	606,459	0.0006	0.9988
71	0	773,669	0	773,669	0.0008	0.9996
72	0	72,508	0	72,508	0.0001	0.9997
74	0	36,140	0	36,140	0.0000	0.9997
76	0	47,098	0	47,098	0.0000	0.9998
78	0	245,576	0	245,576	0.0002	1.0000
Total	**340,367,376**	**668,175,078**	**5,556,676**	**1,014,099,130**	**1.0000**	**1.0000**

Appendix Table C3. -- Population estimates by sex and size for Bering flounder (*Hippoglossoides robustus*) from the 2019 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
9	0	0	544,110	544,110	0.0152	0.0152
10	0	62,768	367,238	430,006	0.0120	0.0272
11	76,262	0	427,704	503,966	0.0141	0.0413
12	140,522	94,474	73,890	308,886	0.0086	0.0499
13	540,877	203,908	743,003	1,487,788	0.0416	0.0915
14	360,440	599,528	897,301	1,857,269	0.0519	0.1433
15	593,001	300,924	0	893,925	0.0250	0.1683
16	438,971	232,724	295,534	967,229	0.0270	0.1953
17	304,476	303,579	103,357	711,412	0.0199	0.2152
18	287,967	433,470	42,680	764,117	0.0213	0.2365
19	170,482	479,097	0	649,579	0.0181	0.2547
20	210,958	784,514	0	995,472	0.0278	0.2825
21	315,021	876,140	0	1,191,161	0.0333	0.3157
22	259,303	681,257	0	940,560	0.0263	0.3420
23	411,509	499,659	0	911,168	0.0254	0.3675
24	470,706	901,755	0	1,372,461	0.0383	0.4058
25	538,570	796,579	0	1,335,149	0.0373	0.4431
26	249,442	1,065,987	0	1,315,429	0.0367	0.4798
27	233,770	1,334,219	0	1,567,989	0.0438	0.5236
28	19,225	1,245,455	0	1,264,680	0.0353	0.5589
29	60,678	1,202,541	0	1,263,219	0.0353	0.5942
30	113,324	698,516	0	811,840	0.0227	0.6169
31	150,128	1,762,356	0	1,912,484	0.0534	0.6703
32	0	2,695,081	0	2,695,081	0.0753	0.7456
33	95,487	1,970,635	0	2,066,122	0.0577	0.8033
34	60,678	1,826,122	0	1,886,800	0.0527	0.8560
35	46,733	1,562,795	0	1,609,528	0.0450	0.9009
36	158,012	1,207,252	0	1,365,264	0.0381	0.9391
37	0	460,565	0	460,565	0.0129	0.9519
38	0	725,035	0	725,035	0.0202	0.9722
39	0	340,802	0	340,802	0.0095	0.9817
40	28,769	449,430	0	478,199	0.0134	0.9950
41	0	88,185	0	88,185	0.0025	0.9975
42	0	28,573	0	28,573	0.0008	0.9983
44	0	60,678	0	60,678	0.0017	1.0000
Total	**6,335,311**	**25,974,603**	**3,494,817**	**35,804,731**	**1.0000**	**1.0000**

Appendix Table C4. -- Population estimates by sex and size for flathead sole (*Hippoglossoides elassodon*) from the 2019 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
5	0	0	73,605	73,605	0.0000	0.0000
6	0	0	333,475	333,475	0.0002	0.0002
7	0	0	158,442	158,442	0.0001	0.0003
8	30,680	0	553,732	584,412	0.0003	0.0005
9	165,213	109,976	1,128,891	1,404,080	0.0006	0.0012
10	379,696	736,509	5,182,674	6,298,879	0.0028	0.0040
11	1,082,390	298,777	6,005,310	7,386,477	0.0033	0.0073
12	2,710,999	2,351,669	12,714,810	17,777,478	0.0080	0.0153
13	7,368,735	6,060,024	15,112,604	28,541,363	0.0129	0.0282
14	10,333,214	11,551,948	14,304,809	36,189,971	0.0163	0.0445
15	20,158,149	14,599,844	10,815,726	45,573,719	0.0206	0.0651
16	32,651,800	23,528,639	11,916,037	68,096,476	0.0307	0.0958
17	41,853,011	30,532,572	7,230,126	79,615,709	0.0359	0.1317
18	52,178,721	42,221,419	4,258,734	98,658,874	0.0445	0.1762
19	48,847,289	42,659,315	1,697,478	93,204,082	0.0420	0.2182
20	42,812,963	37,978,878	1,684,213	82,476,054	0.0372	0.2554
21	40,735,970	37,442,110	1,476,565	79,654,645	0.0359	0.2914
22	34,669,293	30,156,782	801,570	65,627,645	0.0296	0.3210
23	36,946,743	33,129,809	655,566	70,732,118	0.0319	0.3529
24	40,599,368	31,119,124	220,114	71,938,606	0.0324	0.3853
25	37,161,424	29,826,174	436,743	67,424,341	0.0304	0.4157
26	38,392,785	33,343,380	1,100,568	72,836,733	0.0329	0.4486
27	46,275,342	34,755,014	770,398	81,800,754	0.0369	0.4855
28	48,892,513	38,636,815	550,284	88,079,612	0.0397	0.5252
29	52,831,292	35,285,773	1,210,625	89,327,690	0.0403	0.5655
30	55,690,943	41,981,895	550,284	98,223,122	0.0443	0.6098
31	58,611,511	42,082,367	660,341	101,354,219	0.0457	0.6555
32	58,758,589	47,822,222	539,832	107,120,643	0.0483	0.7038
33	40,066,242	47,326,470	110,057	87,502,769	0.0395	0.7433
34	39,318,384	44,382,102	763,430	84,463,916	0.0381	0.7814
35	33,314,718	37,735,601	983,544	72,033,863	0.0325	0.8139
36	32,995,567	31,053,315	0	64,048,882	0.0289	0.8427
37	26,929,674	25,209,236	326,687	52,465,597	0.0237	0.8664
38	22,739,493	26,078,260	543,316	49,361,069	0.0223	0.8887
39	22,209,399	16,154,588	106,573	38,470,560	0.0174	0.9060
40	19,736,046	18,591,904	639,437	38,967,387	0.0176	0.9236
41	10,511,950	17,777,111	213,146	28,502,207	0.0129	0.9364
42	3,973,089	19,069,287	106,573	23,148,949	0.0104	0.9469
43	2,837,908	20,852,645	323,202	24,013,755	0.0108	0.9577
44	1,258,534	18,942,777	0	20,201,311	0.0091	0.9668
45	593,930	20,581,312	213,146	21,388,388	0.0096	0.9765
46	121,146	15,561,273	319,718	16,002,137	0.0072	0.9837
47	29,314	11,559,362	213,146	11,801,822	0.0053	0.9890
48	0	8,043,373	0	8,043,373	0.0036	0.9926
49	0	6,408,592	106,573	6,515,165	0.0029	0.9956
50	0	3,684,913	106,573	3,791,486	0.0017	0.9973
51	0	3,620,195	0	3,620,195	0.0016	0.9989

Appendix Table C4. -- Population estimates by sex and size for flathead sole (*Hippoglossoides elassodon*) from the 2019 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
52	0	1,533,619	0	1,533,619	0.0007	0.9996
53	0	512,493	106,573	619,066	0.0003	0.9999
54	0	131,632	0	131,632	0.0001	1.0000
55	0	95,444	0	95,444	0.0000	1.0000
Total	**1,066,774,027**	**1,043,116,539**	**107,325,250**	**2,217,215,816**	**1.0000**	**1.0000**

Appendix Table C5. -- Population estimates by sex and size for Greenland turbot (*Reinhardtius hippoglossoides*) from the 2019 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
38	32,506	0	0	32,506	0.0064	0.0064
40	30,970	0	0	30,970	0.0061	0.0124
44	0	27,507	0	27,507	0.0054	0.0178
45	30,970	79,640	0	110,610	0.0217	0.0395
48	61,376	0	0	61,376	0.0120	0.0515
49	92,349	0	0	92,349	0.0181	0.0697
50	60,080	0	0	60,080	0.0118	0.0814
53	32,506	0	0	32,506	0.0064	0.0878
54	147,880	29,152	0	177,032	0.0347	0.1225
55	0	31,879	0	31,879	0.0062	0.1288
56	0	31,491	0	31,491	0.0062	0.1349
57	61,888	31,879	0	93,767	0.0184	0.1533
58	0	61,387	0	61,387	0.0120	0.1653
59	56,903	118,501	0	175,404	0.0344	0.1997
60	0	31,355	0	31,355	0.0061	0.2059
61	58,753	28,576	0	87,329	0.0171	0.2230
62	30,977	31,879	0	62,856	0.0123	0.2353
63	76,758	147,939	0	224,697	0.0440	0.2794
64	0	88,020	0	88,020	0.0173	0.2966
65	29,279	89,328	0	118,607	0.0233	0.3199
66	60,843	159,934	0	220,777	0.0433	0.3631
67	62,605	118,177	0	180,782	0.0354	0.3986
68	32,118	85,040	0	117,158	0.0230	0.4215
69	32,506	138,518	0	171,024	0.0335	0.4551
70	0	127,328	0	127,328	0.0250	0.4800
71	66,097	508,149	0	574,246	0.1126	0.5926
72	0	172,619	0	172,619	0.0338	0.6264
73	0	470,361	0	470,361	0.0922	0.7186
74	0	276,231	0	276,231	0.0541	0.7728
75	28,950	334,292	0	363,242	0.0712	0.8440
76	30,245	257,816	0	288,061	0.0565	0.9005
77	26,085	136,595	0	162,680	0.0319	0.9324
78	0	137,310	0	137,310	0.0269	0.9593
79	0	56,923	0	56,923	0.0112	0.9704
80	28,627	0	0	28,627	0.0056	0.9760
81	0	60,286	0	60,286	0.0118	0.9879
86	0	33,302	0	33,302	0.0065	0.9944
92	0	28,627	0	28,627	0.0056	1.0000
Total	**1,171,271**	**3,930,041**	**0**	**5,101,312**	**1.0000**	**1.0000**

Appendix Table C6. -- Population estimates by sex and size for Kamchatka flounder (*Atheresthes evermanni*) from the 2019 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
10	0	0	33,125	33,125	0.0004	0.0004
11	0	0	90,172	90,172	0.0011	0.0016
12	0	0	68,898	68,898	0.0009	0.0024
13	28,939	57,986	57,174	144,099	0.0018	0.0043
14	171,871	29,046	0	200,917	0.0026	0.0068
15	143,128	66,259	28,587	237,974	0.0030	0.0098
16	82,549	332,163	0	414,712	0.0053	0.0151
17	332,066	74,868	0	406,934	0.0052	0.0203
18	226,780	126,390	0	353,170	0.0045	0.0248
19	317,192	346,203	0	663,395	0.0084	0.0332
20	395,123	214,845	0	609,968	0.0077	0.0409
21	573,306	370,543	0	943,849	0.0120	0.0529
22	428,466	676,767	0	1,105,233	0.0140	0.0670
23	490,408	385,393	0	875,801	0.0111	0.0781
24	876,341	614,021	0	1,490,362	0.0189	0.0970
25	998,267	884,174	0	1,882,441	0.0239	0.1209
26	1,604,821	1,166,296	0	2,771,117	0.0352	0.1561
27	1,484,847	1,500,673	0	2,985,520	0.0379	0.1940
28	1,964,392	1,055,376	0	3,019,768	0.0383	0.2324
29	1,445,176	975,886	0	2,421,062	0.0307	0.2631
30	943,957	783,844	0	1,727,801	0.0219	0.2850
31	985,448	694,831	0	1,680,279	0.0213	0.3064
32	1,171,355	1,161,619	0	2,332,974	0.0296	0.3360
33	1,699,757	1,319,787	0	3,019,544	0.0383	0.3743
34	1,906,189	2,152,759	0	4,058,948	0.0515	0.4259
35	2,592,746	1,578,719	0	4,171,465	0.0530	0.4789
36	2,059,052	1,822,349	0	3,881,401	0.0493	0.5281
37	2,289,805	2,224,052	0	4,513,857	0.0573	0.5855
38	1,938,080	2,040,496	0	3,978,576	0.0505	0.6360
39	1,883,454	1,625,133	0	3,508,587	0.0446	0.6805
40	1,310,205	1,411,005	0	2,721,210	0.0346	0.7151
41	1,393,685	1,617,194	0	3,010,879	0.0382	0.7533
42	1,036,100	944,779	0	1,980,879	0.0252	0.7785
43	850,337	945,858	0	1,796,195	0.0228	0.8013
44	983,228	676,450	0	1,659,678	0.0211	0.8224
45	448,861	1,096,408	0	1,545,269	0.0196	0.8420
46	441,321	863,633	0	1,304,954	0.0166	0.8586
47	606,130	870,731	0	1,476,861	0.0188	0.8773
48	347,217	515,620	0	862,837	0.0110	0.8883
49	376,927	568,643	0	945,570	0.0120	0.9003
50	194,320	864,908	0	1,059,228	0.0135	0.9137
51	151,917	834,183	0	986,100	0.0125	0.9263
52	195,128	675,249	0	870,377	0.0111	0.9373
53	413,356	402,803	0	816,159	0.0104	0.9477
54	331,729	584,677	0	916,406	0.0116	0.9593
55	168,839	274,243	0	443,082	0.0056	0.9649
56	158,094	114,563	0	272,657	0.0035	0.9684

Appendix Table C6. -- Population estimates by sex and size for Kamchatka flounder (*Atheresthes evermanni*) from the 2019 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
57	52,132	263,461	0	315,593	0.0040	0.9724
58	29,041	148,753	0	177,794	0.0023	0.9747
59	0	341,791	0	341,791	0.0043	0.9790
60	0	291,607	0	291,607	0.0037	0.9827
61	0	178,579	0	178,579	0.0023	0.9850
62	0	114,808	0	114,808	0.0015	0.9864
63	0	214,018	0	214,018	0.0027	0.9891
64	62,691	26,951	0	89,642	0.0011	0.9903
65	29,314	323,982	0	353,296	0.0045	0.9948
66	0	36,494	0	36,494	0.0005	0.9952
67	0	270,365	0	270,365	0.0034	0.9987
69	0	76,414	0	76,414	0.0010	0.9996
82	0	28,645	0	28,645	0.0004	1.0000
Total	**38,614,087**	**39,857,293**	**277,956**	**78,749,336**	**1.0000**	**1.0000**

Appendix Table C7. -- Population estimates by sex and size for northern rock sole (*Lepidopsetta polyxystra*) from the 2019 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
6	0	0	198,458	198,458	0.0000	0.0000
7	0	340,847	608,037	948,884	0.0002	0.0002
8	0	681,695	4,346,565	5,028,260	0.0009	0.0011
9	763,419	680,849	3,278,784	4,723,052	0.0008	0.0019
10	5,729,462	4,623,972	11,574,051	21,927,485	0.0039	0.0058
11	35,425,298	22,642,578	44,371,050	102,438,926	0.0180	0.0238
12	93,569,901	63,223,687	83,697,744	240,491,332	0.0424	0.0662
13	147,260,651	115,911,011	70,390,651	333,562,313	0.0588	0.1250
14	187,369,611	151,028,524	63,337,294	401,735,429	0.0708	0.1958
15	252,500,643	208,174,070	67,209,492	527,884,205	0.0930	0.2888
16	282,441,385	219,176,235	55,605,756	557,223,376	0.0982	0.3869
17	239,474,452	204,334,596	26,411,129	470,220,177	0.0828	0.4698
18	165,192,035	151,408,522	7,980,655	324,581,212	0.0572	0.5270
19	107,124,451	95,922,870	1,511,741	204,559,062	0.0360	0.5630
20	86,545,514	86,825,812	970,200	174,341,526	0.0307	0.5937
21	75,344,286	77,320,132	1,966,729	154,631,147	0.0272	0.6210
22	59,468,949	65,057,065	2,622,306	127,148,320	0.0224	0.6434
23	55,169,746	62,136,214	1,966,729	119,272,689	0.0210	0.6644
24	46,007,578	50,540,970	3,933,459	100,482,007	0.0177	0.6821
25	52,023,814	45,984,653	5,900,188	103,908,655	0.0183	0.7004
26	54,142,941	45,674,780	6,072,267	105,889,988	0.0187	0.7191
27	45,452,291	34,740,431	3,449,962	83,642,684	0.0147	0.7338
28	59,324,622	27,635,905	3,277,882	90,238,409	0.0159	0.7497
29	126,386,378	26,951,526	3,449,962	156,787,866	0.0276	0.7773
30	138,317,872	31,421,570	5,105,273	174,844,715	0.0308	0.8081
31	102,705,242	35,715,704	1,827,391	140,248,337	0.0247	0.8328
32	79,776,139	41,150,100	1,311,153	122,237,392	0.0215	0.8544
33	31,821,113	48,136,099	2,622,306	82,579,518	0.0145	0.8689
34	19,013,903	63,294,438	1,311,153	83,619,494	0.0147	0.8836
35	7,210,037	121,692,744	1,966,729	130,869,510	0.0231	0.9067
36	1,727,883	138,968,394	1,966,729	142,663,006	0.0251	0.9318
37	1,188,988	134,076,084	1,966,729	137,231,801	0.0242	0.9560
38	4,562,654	99,308,040	1,311,153	105,181,847	0.0185	0.9746
39	551,122	63,728,275	655,576	64,934,973	0.0114	0.9860
40	102,313	46,049,771	0	46,152,084	0.0081	0.9941
41	490,689	19,999,283	0	20,489,972	0.0036	0.9977
42	39,089	7,366,777	0	7,405,866	0.0013	0.9990
43	0	3,035,758	0	3,035,758	0.0005	0.9996
44	167,798	1,699,755	0	1,867,553	0.0003	0.9999
45	0	424,647	0	424,647	0.0001	1.0000
46	0	127,775	0	127,775	0.0000	1.0000
Total	**2,564,392,269**	**2,617,212,158**	**494,175,283**	**5,675,779,710**	**1.0000**	**1.0000**

Appendix Table C8. -- Population estimates by sex and size for Pacific cod (*Gadus macrocephalus*) from the 2019 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
11	0	120,180	431,760	551,940	0.0010	0.0010
12	717,280	222,929	413,764	1,353,973	0.0026	0.0036
13	1,373,338	932,392	645,486	2,951,216	0.0056	0.0092
14	2,355,058	2,418,079	501,992	5,275,129	0.0100	0.0193
15	6,105,769	6,110,049	676,090	12,891,908	0.0245	0.0438
16	9,157,031	8,249,550	306,449	17,713,030	0.0337	0.0775
17	15,286,509	9,998,630	455,865	25,741,004	0.0490	0.1265
18	10,592,758	10,866,801	0	21,459,559	0.0408	0.1673
19	13,118,672	11,320,015	66,873	24,505,560	0.0466	0.2139
20	14,548,879	14,111,272	30,094	28,690,245	0.0546	0.2685
21	15,240,539	17,737,870	0	32,978,409	0.0627	0.3312
22	18,693,847	14,114,741	0	32,808,588	0.0624	0.3936
23	14,590,389	16,671,260	0	31,261,649	0.0595	0.4531
24	17,428,988	15,694,220	0	33,123,208	0.0630	0.5161
25	17,101,726	13,293,711	0	30,395,437	0.0578	0.5739
26	11,113,648	13,585,934	0	24,699,582	0.0470	0.6209
27	9,898,220	9,835,271	0	19,733,491	0.0375	0.6584
28	5,373,234	7,188,576	0	12,561,810	0.0239	0.6823
29	1,790,760	2,026,125	0	3,816,885	0.0073	0.6896
30	1,159,737	903,514	0	2,063,251	0.0039	0.6935
31	279,503	523,201	0	802,704	0.0015	0.6950
32	391,602	126,631	0	518,233	0.0010	0.6960
33	171,497	336,089	0	507,586	0.0010	0.6970
34	247,427	256,178	0	503,605	0.0010	0.6980
35	325,701	181,202	0	506,903	0.0010	0.6989
36	448,774	492,716	28,322	969,812	0.0018	0.7008
37	550,170	495,145	0	1,045,315	0.0020	0.7028
38	940,467	674,967	0	1,615,434	0.0031	0.7058
39	1,003,300	867,801	0	1,871,101	0.0036	0.7094
40	1,585,282	1,094,469	0	2,679,751	0.0051	0.7145
41	1,263,963	1,652,438	0	2,916,401	0.0055	0.7200
42	1,272,604	1,707,441	0	2,980,045	0.0057	0.7257
43	2,226,336	2,042,721	0	4,269,057	0.0081	0.7338
44	2,077,965	1,543,623	0	3,621,588	0.0069	0.7407
45	1,953,803	1,556,078	0	3,509,881	0.0067	0.7474
46	1,985,848	2,014,157	0	4,000,005	0.0076	0.7550
47	2,255,260	2,027,347	0	4,282,607	0.0081	0.7631
48	1,827,967	1,984,773	0	3,812,740	0.0073	0.7704
49	1,872,605	1,176,171	0	3,048,776	0.0058	0.7762
50	2,337,066	1,769,042	0	4,106,108	0.0078	0.7840
51	1,834,155	1,507,458	0	3,341,613	0.0064	0.7904
52	1,529,268	1,922,267	0	3,451,535	0.0066	0.7969
53	1,608,966	1,584,751	0	3,193,717	0.0061	0.8030
54	1,928,012	2,168,188	0	4,096,200	0.0078	0.8108
55	1,874,076	1,969,071	0	3,843,147	0.0073	0.8181
56	2,272,922	2,027,172	0	4,300,094	0.0082	0.8263
57	2,084,387	1,836,928	0	3,921,315	0.0075	0.8337

Appendix Table C8. -- Population estimates by sex and size for Pacific cod (*Gadus macrocephalus*) from the 2019 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
58	2,363,745	1,732,299	0	4,096,044	0.0078	0.8415
59	1,651,116	1,532,761	0	3,183,877	0.0061	0.8476
60	2,043,815	1,464,043	0	3,507,858	0.0067	0.8543
61	1,837,511	1,848,264	0	3,685,775	0.0070	0.8613
62	1,888,910	1,620,210	0	3,509,120	0.0067	0.8680
63	2,290,700	1,803,891	0	4,094,591	0.0078	0.8757
64	2,317,832	1,796,903	0	4,114,735	0.0078	0.8836
65	1,999,393	1,512,243	0	3,511,636	0.0067	0.8903
66	2,189,702	1,993,253	0	4,182,955	0.0080	0.8982
67	1,624,455	1,731,349	0	3,355,804	0.0064	0.9046
68	1,928,785	1,830,430	0	3,759,215	0.0072	0.9117
69	1,715,966	1,539,640	0	3,255,606	0.0062	0.9179
70	1,828,811	1,516,891	0	3,345,702	0.0064	0.9243
71	1,556,142	1,877,041	0	3,433,183	0.0065	0.9308
72	1,280,261	1,864,871	0	3,145,132	0.0060	0.9368
73	1,528,588	2,280,664	0	3,809,252	0.0072	0.9441
74	1,443,080	2,025,809	0	3,468,889	0.0066	0.9507
75	1,031,063	1,529,397	0	2,560,460	0.0049	0.9555
76	1,417,883	1,420,188	0	2,838,071	0.0054	0.9609
77	956,404	1,578,949	0	2,535,353	0.0048	0.9658
78	1,049,428	1,918,372	0	2,967,800	0.0056	0.9714
79	639,760	1,072,051	0	1,711,811	0.0033	0.9747
80	679,857	1,316,676	0	1,996,533	0.0038	0.9785
81	543,999	1,062,459	0	1,606,458	0.0031	0.9815
82	351,697	756,806	0	1,108,503	0.0021	0.9836
83	274,819	668,422	0	943,241	0.0018	0.9854
84	427,175	784,052	0	1,211,227	0.0023	0.9877
85	243,377	657,763	0	901,140	0.0017	0.9894
86	156,872	446,557	0	603,429	0.0011	0.9906
87	185,251	637,118	0	822,369	0.0016	0.9921
88	259,305	355,540	0	614,845	0.0012	0.9933
89	77,041	579,653	0	656,694	0.0012	0.9946
90	217,323	443,852	0	661,175	0.0013	0.9958
91	0	315,653	0	315,653	0.0006	0.9964
92	60,505	269,413	0	329,918	0.0006	0.9970
93	16,861	252,038	0	268,899	0.0005	0.9976
94	46,428	251,683	0	298,111	0.0006	0.9981
95	0	235,588	0	235,588	0.0004	0.9986
96	0	97,090	0	97,090	0.0002	0.9988
97	0	140,363	0	140,363	0.0003	0.9990
98	0	164,671	0	164,671	0.0003	0.9993
99	30,245	75,682	0	105,927	0.0002	0.9995
100	32,118	57,477	0	89,595	0.0002	0.9997
101	0	31,400	0	31,400	0.0001	0.9998
102	0	28,717	0	28,717	0.0001	0.9998
104	0	62,114	0	62,114	0.0001	0.9999
107	0	29,821	0	29,821	0.0001	1.0000

Appendix Table C8. -- Population estimates by sex and size for Pacific cod (*Gadus macrocephalus*) from the 2019 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
Total	**263,981,531**	**258,149,271**	**3,556,695**	**525,687,497**	**1.0000**	**1.0000**

Appendix Table C9. -- Population estimates by sex and size for walleye pollock (*Gadus chalcogrammus*) from the 2019 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
4	0	0	58,101	58,101	0.0000	0.0000
5	0	779,725	0	779,725	0.0001	0.0001
9	0	0	1,213,945	1,213,945	0.0001	0.0002
10	177,522	0	11,800,409	11,977,931	0.0013	0.0015
11	3,428,810	401,706	65,973,758	69,804,274	0.0076	0.0092
12	5,198,094	3,403,822	181,973,092	190,575,008	0.0209	0.0301
13	24,563,960	22,568,321	238,121,408	285,253,689	0.0312	0.0613
14	56,075,935	44,239,115	190,265,319	290,580,369	0.0318	0.0931
15	57,615,040	47,520,468	77,452,122	182,587,630	0.0200	0.1131
16	39,629,885	41,575,660	31,553,533	112,759,078	0.0123	0.1255
17	29,298,011	28,151,133	17,587,405	75,036,549	0.0082	0.1337
18	14,770,966	13,856,898	5,535,736	34,163,600	0.0037	0.1374
19	7,616,884	8,532,855	1,096,910	17,246,649	0.0019	0.1393
20	3,590,428	5,711,538	0	9,301,966	0.0010	0.1403
21	7,281,974	7,478,815	0	14,760,789	0.0016	0.1419
22	12,577,480	14,067,409	0	26,644,889	0.0029	0.1449
23	21,144,366	22,013,115	299,193	43,456,674	0.0048	0.1496
24	27,951,296	31,296,148	0	59,247,444	0.0065	0.1561
25	38,854,900	32,814,496	0	71,669,396	0.0078	0.1640
26	32,706,997	30,097,366	0	62,804,363	0.0069	0.1708
27	38,789,048	23,322,548	0	62,111,596	0.0068	0.1776
28	26,972,447	22,833,368	0	49,805,815	0.0055	0.1831
29	29,687,238	17,444,712	0	47,131,950	0.0052	0.1883
30	20,929,602	26,789,346	0	47,718,948	0.0052	0.1935
31	21,197,047	18,009,914	0	39,206,961	0.0043	0.1978
32	20,745,114	19,515,185	0	40,260,299	0.0044	0.2022
33	23,296,458	18,532,451	0	41,828,909	0.0046	0.2068
34	24,051,730	17,358,919	0	41,410,649	0.0045	0.2113
35	15,217,375	19,512,701	0	34,730,076	0.0038	0.2151
36	16,134,582	17,773,991	0	33,908,573	0.0037	0.2188
37	19,198,301	13,502,411	0	32,700,712	0.0036	0.2224
38	22,610,603	21,459,877	0	44,070,480	0.0048	0.2272
39	31,323,043	20,162,538	0	51,485,581	0.0056	0.2329
40	57,551,609	29,968,261	0	87,519,870	0.0096	0.2425
41	102,743,176	38,575,410	0	141,318,586	0.0155	0.2579
42	166,661,847	83,394,145	0	250,055,992	0.0274	0.2853
43	258,363,509	128,180,961	0	386,544,470	0.0423	0.3277
44	378,766,320	208,629,365	0	587,395,685	0.0643	0.3920
45	464,110,092	284,716,428	0	748,826,520	0.0820	0.4740
46	519,276,695	382,025,484	0	901,302,179	0.0987	0.5727
47	434,452,292	398,308,370	0	832,760,662	0.0912	0.6639
48	382,618,971	383,311,976	0	765,930,947	0.0839	0.7478
49	285,038,472	365,768,570	0	650,807,042	0.0713	0.8191
50	194,714,607	295,317,603	0	490,032,210	0.0537	0.8727
51	140,636,225	222,084,757	0	362,720,982	0.0397	0.9125
52	92,280,430	155,851,188	30,974	248,162,592	0.0272	0.9397
53	56,747,633	122,917,653	0	179,665,286	0.0197	0.9593

Appendix Table C9. -- Population estimates by sex and size for walleye pollock (*Gadus chalcogrammus*) from the 2019 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
54	39,308,477	84,106,240	61,948	123,476,665	0.0135	0.9729
55	22,081,298	54,575,593	61,948	76,718,839	0.0084	0.9813
56	16,609,955	40,278,542	0	56,888,497	0.0062	0.9875
57	9,089,282	27,321,012	0	36,410,294	0.0040	0.9915
58	6,842,534	25,079,985	0	31,922,519	0.0035	0.9950
59	4,545,045	11,976,025	30,974	16,552,044	0.0018	0.9968
60	4,890,302	6,595,820	0	11,486,122	0.0013	0.9980
61	1,185,097	4,590,581	30,974	5,806,652	0.0006	0.9987
62	923,619	1,579,411	0	2,503,030	0.0003	0.9989
63	931,576	2,044,490	0	2,976,066	0.0003	0.9993
64	1,290,260	1,408,829	0	2,699,089	0.0003	0.9996
65	179,492	1,212,180	0	1,391,672	0.0002	0.9997
66	125,749	619,077	0	744,826	0.0001	0.9998
67	307,856	126,700	0	434,556	0.0000	0.9999
68	0	561,154	0	561,154	0.0001	0.9999
69	212,671	201,889	0	414,560	0.0000	1.0000
70	148,747	61,916	0	210,663	0.0000	1.0000
71	28,312	143,317	0	171,629	0.0000	1.0000
Total	**4,335,297,286**	**3,972,259,483**	**823,147,749**	**9,130,704,518**	**1.0000**	**1.0000**

Appendix Table C10. -- Population estimates by sex and size for yellowfin sole (*Limanda aspera*) from the 2019 eastern Bering Sea bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
9	500,198	0	262,450	762,648	0.0001	0.0001
10	9,221,814	4,657,808	3,679,187	17,558,809	0.0028	0.0029
11	22,969,973	20,880,700	12,071,784	55,922,457	0.0088	0.0117
12	54,009,981	49,731,526	6,121,370	109,862,877	0.0173	0.0289
13	52,451,875	61,014,227	9,230,829	122,696,931	0.0193	0.0482
14	51,473,393	61,602,918	4,258,766	117,335,077	0.0184	0.0666
15	60,308,830	57,821,754	1,638,710	119,769,294	0.0188	0.0855
16	59,839,663	58,284,695	0	118,124,358	0.0186	0.1040
17	70,806,447	58,083,015	0	128,889,462	0.0202	0.1243
18	59,310,622	62,870,178	0	122,180,800	0.0192	0.1435
19	54,769,890	51,935,510	180,866	106,886,266	0.0168	0.1602
20	66,508,713	77,052,381	0	143,561,094	0.0226	0.1828
21	64,418,528	57,547,357	904,329	122,870,214	0.0193	0.2021
22	56,260,771	57,930,733	1,808,658	116,000,162	0.0182	0.2203
23	75,479,373	75,367,730	2,893,852	153,740,955	0.0242	0.2445
24	75,973,227	76,793,032	2,893,852	155,660,111	0.0245	0.2689
25	92,648,855	89,540,894	3,255,584	185,445,333	0.0291	0.2981
26	136,120,045	101,214,044	3,255,584	240,589,673	0.0378	0.3359
27	149,108,347	138,262,226	723,463	288,094,036	0.0453	0.3811
28	162,497,631	139,257,887	180,866	301,936,384	0.0474	0.4286
29	177,065,773	137,327,529	1,266,060	315,659,362	0.0496	0.4782
30	208,584,111	167,006,429	723,463	376,314,003	0.0591	0.5373
31	270,228,250	174,658,971	542,597	445,429,818	0.0700	0.6073
32	320,351,370	212,879,475	542,597	533,773,442	0.0839	0.6911
33	257,271,271	255,447,618	1,085,195	513,804,084	0.0807	0.7718
34	180,418,807	238,976,418	361,732	419,756,957	0.0659	0.8378
35	89,545,958	220,988,306	361,732	310,895,996	0.0488	0.8866
36	53,711,863	187,962,736	904,329	242,578,928	0.0381	0.9247
37	18,491,945	159,276,585	361,732	178,130,262	0.0280	0.9527
38	5,146,250	124,576,307	542,597	130,265,154	0.0205	0.9732
39	2,211,273	84,483,984	361,732	87,056,989	0.0137	0.9869
40	1,646,285	39,734,063	0	41,380,348	0.0065	0.9934
41	312,001	25,456,847	180,866	25,949,714	0.0041	0.9975
42	29,314	10,483,006	0	10,512,320	0.0017	0.9991
43	0	4,238,637	0	4,238,637	0.0007	0.9998
44	0	1,134,777	0	1,134,777	0.0002	0.9999
45	0	307,705	0	307,705	0.0000	1.0000
50	0	29,499	0	29,499	0.0000	1.0000
Total	**2,959,692,647**	**3,344,817,507**	**60,594,782**	**6,365,104,936**	**1.0000**	**1.0000**

Appendix D: Population estimates by sex and size group for principal fish species in the NBS

Appendix D presents population estimates by sex and size group from the 2019 NBS bottom trawl survey for principal fish species.

List of Tables

Appendix Table D1. -- Population estimates by sex and size for Alaska plaice (*Pleuronectes quadrituberculatus*) from the 2019 NBS bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
7	0	0	66,382	66,382	0.0001	0.0001
8	139,209	116,143	99,471	354,823	0.0007	0.0008
9	787,211	99,135	244,937	1,131,283	0.0021	0.0029
10	1,819,279	809,976	287,857	2,917,112	0.0055	0.0084
11	4,372,302	2,221,138	1,286,442	7,879,882	0.0148	0.0232
12	8,766,339	4,329,087	925,341	14,020,767	0.0263	0.0495
13	9,022,770	5,817,244	815,673	15,655,687	0.0294	0.0789
14	9,464,575	7,240,939	563,530	17,269,044	0.0324	0.1113
15	8,298,564	7,618,624	0	15,917,188	0.0299	0.1412
16	6,037,677	7,448,251	0	13,485,928	0.0253	0.1665
17	6,411,199	7,559,446	0	13,970,645	0.0262	0.1928
18	5,338,861	6,200,248	0	11,539,109	0.0217	0.2144
19	4,098,322	4,590,503	0	8,688,825	0.0163	0.2307
20	4,159,168	5,014,324	0	9,173,492	0.0172	0.2480
21	3,562,257	4,532,986	0	8,095,243	0.0152	0.2632
22	3,457,491	4,080,769	0	7,538,260	0.0142	0.2773
23	3,641,194	4,380,439	0	8,021,633	0.0151	0.2924
24	3,279,414	3,771,596	0	7,051,010	0.0132	0.3056
25	4,162,023	3,770,882	0	7,932,905	0.0149	0.3205
26	2,310,805	3,538,547	0	5,849,352	0.0110	0.3315
27	3,511,154	2,635,837	0	6,146,991	0.0115	0.3430
28	4,145,889	2,703,284	0	6,849,173	0.0129	0.3559
29	5,391,588	3,505,096	0	8,896,684	0.0167	0.3726
30	6,769,525	2,521,993	0	9,291,518	0.0174	0.3901
31	8,454,657	4,615,843	0	13,070,500	0.0245	0.4146
32	12,402,267	3,377,201	0	15,779,468	0.0296	0.4442
33	12,934,310	5,808,948	0	18,743,258	0.0352	0.4794
34	19,855,421	3,875,383	0	23,730,804	0.0446	0.5240
35	21,587,779	4,688,154	0	26,275,933	0.0493	0.5733
36	26,026,395	5,685,061	0	31,711,456	0.0595	0.6328
37	26,560,805	5,741,077	0	32,301,882	0.0606	0.6935
38	21,414,150	5,367,684	0	26,781,834	0.0503	0.7438
39	12,930,362	4,919,131	0	17,849,493	0.0335	0.7773
40	7,789,626	6,973,931	0	14,763,557	0.0277	0.8050
41	3,166,998	8,733,087	0	11,900,085	0.0223	0.8274
42	1,079,099	10,019,180	0	11,098,279	0.0208	0.8482
43	622,920	7,853,168	0	8,476,088	0.0159	0.8641
44	754,062	10,898,162	0	11,652,224	0.0219	0.8860
45	275,369	10,934,420	0	11,209,789	0.0210	0.9070
46	246,509	10,252,603	0	10,499,112	0.0197	0.9267
47	91,401	8,874,326	0	8,965,727	0.0168	0.9436
48	0	7,456,632	0	7,456,632	0.0140	0.9576
49	128,528	7,209,826	0	7,338,354	0.0138	0.9714
50	0	4,411,628	0	4,411,628	0.0083	0.9796
51	0	4,131,759	0	4,131,759	0.0078	0.9874
52	0	2,048,878	0	2,048,878	0.0038	0.9913
53	0	1,735,719	0	1,735,719	0.0033	0.9945

Appendix Table D1. -- Population estimates by sex and size for Alaska plaice (*Pleuronectes quadrituberculatus*) from the 2019 NBS bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
54	0	1,080,016	0	1,080,016	0.0020	0.9965
55	0	675,710	0	675,710	0.0013	0.9978
56	0	420,794	0	420,794	0.0008	0.9986
57	0	281,207	0	281,207	0.0005	0.9991
58	0	132,262	0	132,262	0.0002	0.9994
59	0	156,136	0	156,136	0.0003	0.9997
60	0	32,411	0	32,411	0.0001	0.9997
61	0	61,487	0	61,487	0.0001	0.9998
62	0	84,398	0	84,398	0.0002	1.0000
Total	**285,267,474**	**243,042,709**	**4,289,633**	**532,599,816**	**1.0000**	**1.0000**

Appendix Table D2. -- Population estimates by sex and size for arrowtooth flounder (*Atheresthes stomias*) from the 2019 NBS bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
23	50,495	0	0	50,495	0.0354	0.0354
26	34,585	0	58,408	92,993	0.0653	0.1007
29	59,197	0	0	59,197	0.0415	0.1422
40	143,169	0	0	143,169	0.1005	0.2427
42	71,584	0	0	71,584	0.0502	0.2929
43	162,776	0	0	162,776	0.1142	0.4071
44	118,395	0	0	118,395	0.0831	0.4902
45	45,596	0	0	45,596	0.0320	0.5222
47	100,990	0	0	100,990	0.0709	0.5931
48	32,404	0	0	32,404	0.0227	0.6158
50	0	45,596	0	45,596	0.0320	0.6478
51	0	91,202	0	91,202	0.0640	0.7118
53	0	214,753	0	214,753	0.1507	0.8625
56	0	136,798	0	136,798	0.0960	0.9585
58	59,197	0	0	59,197	0.0415	1.0000
Total	**878,388**	**488,349**	**58,408**	**1,425,145**	**1.0000**	**1.0000**

Appendix Table D3. -- Population estimates by sex and size for Bering flounder (*Hippoglossoides robustus*) from the 2019 NBS bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
5	0	0	155,277	155,277	0.0013	0.0013
6	0	0	184,168	184,168	0.0015	0.0028
7	52,764	60,823	262,146	375,733	0.0031	0.0059
8	0	0	123,816	123,816	0.0010	0.0069
9	0	0	31,903	31,903	0.0003	0.0071
10	90,207	355,499	486,851	932,557	0.0077	0.0148
11	1,127,134	1,177,875	1,375,865	3,680,874	0.0302	0.0450
12	2,244,144	2,141,141	2,796,297	7,181,582	0.0589	0.1040
13	2,242,282	1,472,042	1,468,906	5,183,230	0.0425	0.1465
14	1,688,583	879,079	364,657	2,932,319	0.0241	0.1706
15	2,434,437	1,151,575	182,816	3,768,828	0.0309	0.2015
16	4,428,562	1,582,615	270,574	6,281,751	0.0516	0.2531
17	4,790,483	2,035,914	55,884	6,882,281	0.0565	0.3096
18	3,488,903	3,197,047	112,541	6,798,491	0.0558	0.3654
19	3,042,042	4,307,424	114,862	7,464,328	0.0613	0.4267
20	1,753,551	5,048,080	0	6,801,631	0.0558	0.4825
21	1,259,794	5,698,851	0	6,958,645	0.0571	0.5396
22	1,395,537	6,407,227	0	7,802,764	0.0640	0.6037
23	778,732	4,050,226	0	4,828,958	0.0396	0.6433
24	261,094	4,043,012	0	4,304,106	0.0353	0.6786
25	759,833	2,742,337	0	3,502,170	0.0287	0.7074
26	231,785	2,719,909	0	2,951,694	0.0242	0.7316
27	118,754	2,853,193	0	2,971,947	0.0244	0.7560
28	29,665	1,924,117	0	1,953,782	0.0160	0.7720
29	45,492	1,747,133	0	1,792,625	0.0147	0.7867
30	45,492	2,713,807	0	2,759,299	0.0226	0.8094
31	270,554	3,692,422	0	3,962,976	0.0325	0.8419
32	102,860	3,824,896	0	3,927,756	0.0322	0.8742
33	150,716	3,353,667	0	3,504,383	0.0288	0.9029
34	0	3,692,196	0	3,692,196	0.0303	0.9332
35	0	3,027,259	0	3,027,259	0.0248	0.9581
36	55,544	1,822,434	0	1,877,978	0.0154	0.9735
37	0	1,830,757	0	1,830,757	0.0150	0.9885
38	0	459,633	0	459,633	0.0038	0.9923
39	0	545,130	0	545,130	0.0045	0.9968
40	0	175,496	0	175,496	0.0014	0.9982
42	0	107,904	0	107,904	0.0009	0.9991
43	48,333	0	0	48,333	0.0004	0.9995
44	0	60,888	0	60,888	0.0005	1.0000
Total	**32,937,277**	**80,901,608**	**7,986,563**	**121,825,448**	**1.0000**	**1.0000**

Appendix Table D4. -- Population estimates by sex and size for flathead sole (*Hippoglossoides elassodon*) from the 2019 NBS bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
10	0	0	64,963	64,963	0.0270	0.0270
11	0	0	199,946	199,946	0.0831	0.1101
12	35,010	0	0	35,010	0.0145	0.1246
14	63,231	0	0	63,231	0.0263	0.1509
16	49,143	125,720	0	174,863	0.0727	0.2235
17	0	112,374	31,553	143,927	0.0598	0.2833
18	0	49,143	0	49,143	0.0204	0.3038
19	46,727	28,486	0	75,213	0.0312	0.3350
20	111,689	87,235	0	198,924	0.0826	0.4176
21	28,486	0	0	28,486	0.0118	0.4295
22	84,153	28,220	0	112,373	0.0467	0.4762
23	26,696	205,606	0	232,302	0.0965	0.5727
24	101,794	26,696	0	128,490	0.0534	0.6261
25	64,963	0	0	64,963	0.0270	0.6531
26	0	26,696	0	26,696	0.0111	0.6642
27	0	226,546	0	226,546	0.0941	0.7583
29	98,286	26,696	0	124,982	0.0519	0.8102
31	0	26,696	0	26,696	0.0111	0.8213
32	0	84,386	0	84,386	0.0351	0.8564
33	0	53,391	0	53,391	0.0222	0.8785
34	46,727	0	0	46,727	0.0194	0.8980
36	0	26,696	0	26,696	0.0111	0.9091
38	0	28,220	0	28,220	0.0117	0.9208
41	0	64,963	0	64,963	0.0270	0.9478
44	0	125,720	0	125,720	0.0522	1.0000
Total	**756,905**	**1,353,490**	**296,462**	**2,406,857**	**1.0000**	**1.0000**

Appendix Table D5. -- Population estimates by sex and size for Greenland turbot (*Reinhardtius hippoglossoides*) from the 2019 NBS bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
39	27,435	0	0	27,435	0.1248	0.1248
51	25,631	0	0	25,631	0.1166	0.2413
54	0	84,386	0	84,386	0.3837	0.6250
63	0	28,342	0	28,342	0.1289	0.7539
65	28,486	0	0	28,486	0.1295	0.8834
73	0	25,631	0	25,631	0.1166	1.0000
Total	**81,552**	**138,359**	**0**	**219,911**	**1.0000**	**1.0000**

Appendix Table D6. -- Population estimates by sex and size for Kamchatka flounder (*Atheresthes evermanni*) from the 2019 NBS bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
43	83,515	0	0	83,515	1.0000	1.0000
Total	**83,515**	**0**	**0**	**83,515**	**1.0000**	**1.0000**

Appendix Table D7. -- Population estimates by sex and size for northern rock sole (*Lepidopsetta polyxystra*) from the 2019 NBS bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
4	0	0	30,068	30,068	0.0000	0.0000
7	0	0	33,408	33,408	0.0001	0.0001
8	0	0	529,836	529,836	0.0008	0.0009
9	102,252	0	1,034,951	1,137,203	0.0018	0.0027
10	430,775	983,631	2,285,783	3,700,189	0.0058	0.0086
11	2,088,456	1,858,880	5,472,536	9,419,872	0.0149	0.0234
12	8,009,878	7,656,452	7,265,616	22,931,946	0.0362	0.0596
13	15,914,235	15,212,513	7,705,249	38,831,997	0.0613	0.1209
14	26,010,629	27,097,723	13,534,304	66,642,656	0.1052	0.2261
15	43,608,325	45,322,585	11,305,211	100,236,121	0.1582	0.3844
16	34,513,016	49,947,689	12,396,081	96,856,786	0.1529	0.5373
17	17,996,780	29,937,606	8,246,119	56,180,505	0.0887	0.6259
18	12,468,546	17,352,942	2,309,256	32,130,744	0.0507	0.6767
19	9,755,067	17,908,044	1,873,000	29,536,111	0.0466	0.7233
20	5,685,638	11,117,744	2,027,416	18,830,798	0.0297	0.7530
21	4,861,753	9,820,027	596,163	15,277,943	0.0241	0.7771
22	4,130,045	7,808,634	220,302	12,158,981	0.0192	0.7963
23	2,158,921	4,212,916	296,346	6,668,183	0.0105	0.8069
24	1,136,896	4,319,245	56,217	5,512,358	0.0087	0.8156
25	1,151,363	1,197,436	0	2,348,799	0.0037	0.8193
26	1,488,002	774,907	57,952	2,320,861	0.0037	0.8229
27	215,701	819,017	28,976	1,063,694	0.0017	0.8246
28	945,408	378,758	28,976	1,353,142	0.0021	0.8267
29	1,499,416	1,563,075	28,976	3,091,467	0.0049	0.8316
30	3,452,514	633,800	28,976	4,115,290	0.0065	0.8381
31	6,152,416	1,125,010	28,976	7,306,402	0.0115	0.8497
32	5,342,335	1,766,275	114,169	7,222,779	0.0114	0.8611
33	7,693,543	4,360,801	28,976	12,083,320	0.0191	0.8801
34	3,216,418	2,946,422	57,952	6,220,792	0.0098	0.8899
35	2,058,376	5,980,821	28,976	8,068,173	0.0127	0.9027
36	960,224	6,143,395	269,106	7,372,725	0.0116	0.9143
37	427,217	10,470,355	538,211	11,435,783	0.0181	0.9324
38	136,719	12,387,443	115,904	12,640,066	0.0200	0.9523
39	32,488	12,774,000	57,952	12,864,440	0.0203	0.9726
40	62,682	5,906,431	57,952	6,027,065	0.0095	0.9821
41	27,454	4,625,269	28,976	4,681,699	0.0074	0.9895
42	34,973	2,926,406	0	2,961,379	0.0047	0.9942
43	0	1,777,878	0	1,777,878	0.0028	0.9970
44	0	949,297	0	949,297	0.0015	0.9985
45	0	400,396	0	400,396	0.0006	0.9992
46	0	280,287	0	280,287	0.0004	0.9996
47	0	133,160	0	133,160	0.0002	0.9998
49	0	76,543	0	76,543	0.0001	0.9999
52	0	47,582	0	47,582	0.0001	1.0000
Total	**223,768,461**	**331,001,395**	**78,718,868**	**633,488,724**	**1.0000**	**1.0000**

Appendix Table D8. -- Population estimates by sex and size for Pacific cod (*Gadus macrocephalus*) from the 2019 NBS bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
13	59,248	34,143	0	93,391	0.0005	0.0005
14	227,274	156,939	0	384,213	0.0019	0.0024
15	480,479	542,919	0	1,023,398	0.0051	0.0074
16	490,825	593,752	34,585	1,119,162	0.0055	0.0130
17	1,626,609	1,126,115	34,585	2,787,309	0.0138	0.0268
18	2,115,283	1,942,390	0	4,057,673	0.0201	0.0468
19	3,132,783	2,767,449	0	5,900,232	0.0292	0.0760
20	3,411,587	2,252,289	0	5,663,876	0.0280	0.1040
21	3,509,318	3,123,745	697,833	7,330,896	0.0363	0.1403
22	2,952,688	4,028,623	0	6,981,311	0.0345	0.1748
23	3,908,540	2,566,442	0	6,474,982	0.0320	0.2069
24	4,093,377	4,106,551	0	8,199,928	0.0406	0.2474
25	3,408,610	3,476,310	0	6,884,920	0.0341	0.2815
26	4,033,786	2,772,104	0	6,805,890	0.0337	0.3152
27	2,739,978	2,512,525	0	5,252,503	0.0260	0.3411
28	1,958,488	1,224,654	0	3,183,142	0.0157	0.3569
29	1,522,511	1,091,763	0	2,614,274	0.0129	0.3698
30	684,909	751,082	0	1,435,991	0.0071	0.3769
31	881,979	648,916	0	1,530,895	0.0076	0.3845
32	895,509	956,365	0	1,851,874	0.0092	0.3937
33	793,315	700,921	0	1,494,236	0.0074	0.4010
34	737,865	691,311	0	1,429,176	0.0071	0.4081
35	760,510	740,886	0	1,501,396	0.0074	0.4155
36	414,987	483,515	0	898,502	0.0044	0.4200
37	431,202	344,032	0	775,234	0.0038	0.4238
38	381,286	562,046	0	943,332	0.0047	0.4285
39	370,667	302,068	0	672,735	0.0033	0.4318
40	516,698	804,218	0	1,320,916	0.0065	0.4383
41	479,405	715,803	0	1,195,208	0.0059	0.4443
42	612,289	533,973	0	1,146,262	0.0057	0.4499
43	753,931	687,180	0	1,441,111	0.0071	0.4571
44	892,616	979,443	0	1,872,059	0.0093	0.4663
45	923,537	868,149	0	1,791,686	0.0089	0.4752
46	619,327	1,142,271	0	1,761,598	0.0087	0.4839
47	1,094,645	1,159,602	0	2,254,247	0.0112	0.4950
48	846,190	852,384	0	1,698,574	0.0084	0.5035
49	980,786	1,386,284	0	2,367,070	0.0117	0.5152
50	1,255,918	822,229	0	2,078,147	0.0103	0.5254
51	1,223,363	1,507,834	0	2,731,197	0.0135	0.5390
52	1,356,300	1,483,588	0	2,839,888	0.0140	0.5530
53	1,467,553	1,095,595	0	2,563,148	0.0127	0.5657
54	1,965,212	1,291,218	0	3,256,430	0.0161	0.5818
55	2,085,510	2,065,241	0	4,150,751	0.0205	0.6023
56	2,102,985	1,689,411	0	3,792,396	0.0188	0.6211
57	1,730,988	1,264,416	0	2,995,404	0.0148	0.6359
58	1,782,679	2,612,581	0	4,395,260	0.0217	0.6576
59	2,175,830	1,689,158	0	3,864,988	0.0191	0.6768

Appendix Table D8. -- Population estimates by sex and size for Pacific cod (*Gadus macrocephalus*) from the 2019 NBS bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
60	1,523,757	1,310,177	0	2,833,934	0.0140	0.6908
61	1,346,483	1,740,767	0	3,087,250	0.0153	0.7061
62	1,505,451	2,009,320	0	3,514,771	0.0174	0.7234
63	1,044,533	1,085,647	0	2,130,180	0.0105	0.7340
64	2,354,074	1,484,510	0	3,838,584	0.0190	0.7530
65	1,856,709	2,004,868	0	3,861,577	0.0191	0.7721
66	2,146,771	1,944,383	0	4,091,154	0.0202	0.7923
67	1,569,318	1,164,174	0	2,733,492	0.0135	0.8058
68	2,266,198	987,923	0	3,254,121	0.0161	0.8219
69	2,028,385	1,407,637	0	3,436,022	0.0170	0.8389
70	2,100,036	1,703,642	0	3,803,678	0.0188	0.8577
71	2,347,419	1,905,652	0	4,253,071	0.0210	0.8788
72	1,580,790	1,247,089	0	2,827,879	0.0140	0.8928
73	1,347,684	1,998,078	0	3,345,762	0.0166	0.9093
74	1,208,967	1,664,520	0	2,873,487	0.0142	0.9235
75	883,203	1,340,125	0	2,223,328	0.0110	0.9345
76	1,185,202	1,114,402	0	2,299,604	0.0114	0.9459
77	496,514	1,550,035	0	2,046,549	0.0101	0.9560
78	517,203	1,032,325	0	1,549,528	0.0077	0.9637
79	716,499	1,020,078	0	1,736,577	0.0086	0.9723
80	321,255	784,657	0	1,105,912	0.0055	0.9778
81	101,593	692,688	0	794,281	0.0039	0.9817
82	283,318	448,382	0	731,700	0.0036	0.9853
83	421,828	222,213	0	644,041	0.0032	0.9885
84	191,163	69,128	0	260,291	0.0013	0.9898
85	57,282	263,637	0	320,919	0.0016	0.9914
86	32,397	452,730	0	485,127	0.0024	0.9938
87	106,798	239,033	0	345,831	0.0017	0.9955
88	67,271	104,140	0	171,411	0.0008	0.9963
89	63,764	100,922	0	164,686	0.0008	0.9971
90	29,599	55,904	0	85,503	0.0004	0.9976
91	29,943	28,497	0	58,440	0.0003	0.9979
92	0	35,429	0	35,429	0.0002	0.9980
93	0	65,769	0	65,769	0.0003	0.9984
94	28,267	64,922	0	93,189	0.0005	0.9988
95	0	29,131	0	29,131	0.0001	0.9990
96	0	59,939	0	59,939	0.0003	0.9993
99	0	29,836	0	29,836	0.0001	0.9994
100	0	32,397	0	32,397	0.0002	0.9996
101	0	29,599	0	29,599	0.0001	0.9997
102	0	57,692	0	57,692	0.0003	1.0000
Total	**102,649,049**	**98,732,430**	**767,003**	**202,148,482**	**1.0000**	**1.0000**

Appendix Table D9. -- Population estimates by sex and size for walleye pollock (*Gadus chalcogrammus*) from the 2019 NBS bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
7	0	0	26,109	26,109	0.0000	0.0000
8	0	0	3,064,676	3,064,676	0.0011	0.0011
9	0	0	1,740,695	1,740,695	0.0006	0.0017
10	0	0	19,676,487	19,676,487	0.0068	0.0084
11	2,272,179	2,272,179	36,521,222	41,065,580	0.0141	0.0226
12	0	0	106,420,416	106,420,416	0.0366	0.0592
13	1,839,072	1,121,663	211,397,406	214,358,141	0.0738	0.1330
14	4,344,218	5,375,162	264,258,633	273,978,013	0.0943	0.2273
15	4,159,226	4,952,384	203,195,285	212,306,895	0.0731	0.3003
16	2,354,996	3,296,617	131,822,351	137,473,964	0.0473	0.3476
17	5,119,891	4,914,694	72,833,180	82,867,765	0.0285	0.3761
18	5,634,383	1,209,992	12,932,162	19,776,537	0.0068	0.3830
19	3,912,559	5,563,693	14,085,321	23,561,573	0.0081	0.3911
20	2,743,823	4,984,673	3,122,623	10,851,119	0.0037	0.3948
21	6,019,461	8,609,734	1,462,178	16,091,373	0.0055	0.4003
22	5,144,639	10,485,639	0	15,630,278	0.0054	0.4057
23	9,480,760	14,407,293	674,229	24,562,282	0.0085	0.4142
24	18,001,398	15,567,375	205,752	33,774,525	0.0116	0.4258
25	12,664,653	16,151,322	0	28,815,975	0.0099	0.4357
26	9,413,138	6,267,037	0	15,680,175	0.0054	0.4411
27	12,196,622	9,764,565	0	21,961,187	0.0076	0.4487
28	6,440,101	9,248,157	0	15,688,258	0.0054	0.4541
29	8,160,313	7,036,448	0	15,196,761	0.0052	0.4593
30	9,860,708	6,123,458	0	15,984,166	0.0055	0.4648
31	6,841,431	6,877,604	113,720	13,832,755	0.0048	0.4695
32	8,527,772	5,328,636	0	13,856,408	0.0048	0.4743
33	3,801,039	4,842,660	0	8,643,699	0.0030	0.4773
34	4,601,032	4,066,992	0	8,668,024	0.0030	0.4803
35	7,000,347	3,849,513	0	10,849,860	0.0037	0.4840
36	3,534,501	5,543,230	0	9,077,731	0.0031	0.4871
37	4,398,616	5,630,157	0	10,028,773	0.0035	0.4906
38	2,864,265	6,090,224	0	8,954,489	0.0031	0.4937
39	6,204,853	5,570,458	0	11,775,311	0.0041	0.4977
40	8,381,738	6,065,459	0	14,447,197	0.0050	0.5027
41	12,009,230	10,202,849	0	22,212,079	0.0076	0.5103
42	22,803,751	14,444,518	0	37,248,269	0.0128	0.5232
43	35,383,981	20,804,263	0	56,188,244	0.0193	0.5425
44	51,979,767	34,294,798	0	86,274,565	0.0297	0.5722
45	70,409,965	53,442,251	0	123,852,216	0.0426	0.6148
46	74,829,950	71,071,560	0	145,901,510	0.0502	0.6650
47	67,020,611	71,726,783	0	138,747,394	0.0477	0.7128
48	73,661,440	80,115,885	0	153,777,325	0.0529	0.7657
49	61,688,935	80,868,081	0	142,557,016	0.0491	0.8147
50	45,277,911	68,936,579	0	114,214,490	0.0393	0.8541
51	36,402,669	53,535,217	0	89,937,886	0.0310	0.8850
52	24,944,313	44,130,838	0	69,075,151	0.0238	0.9088
53	18,667,352	38,927,879	0	57,595,231	0.0198	0.9286

Appendix Table D9. -- Population estimates by sex and size for walleye pollock (*Gadus chalcogrammus*) from the 2019 NBS bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
54	14,171,542	34,545,171	0	48,716,713	0.0168	0.9454
55	12,374,862	20,528,455	0	32,903,317	0.0113	0.9567
56	11,133,821	16,357,277	0	27,491,098	0.0095	0.9662
57	6,960,864	18,028,441	0	24,989,305	0.0086	0.9748
58	5,123,015	18,023,789	0	23,146,804	0.0080	0.9827
59	2,490,730	11,592,944	0	14,083,674	0.0048	0.9876
60	2,392,797	7,733,424	0	10,126,221	0.0035	0.9910
61	1,368,496	5,185,002	0	6,553,498	0.0023	0.9933
62	967,724	3,182,114	0	4,149,838	0.0014	0.9947
63	1,050,962	4,724,645	0	5,775,607	0.0020	0.9967
64	352,044	1,323,797	0	1,675,841	0.0006	0.9973
65	257,589	1,140,255	0	1,397,844	0.0005	0.9978
66	398,358	1,202,913	0	1,601,271	0.0006	0.9983
67	116,938	484,883	0	601,821	0.0002	0.9985
68	52,776	853,497	0	906,273	0.0003	0.9988
69	33,775	692,889	0	726,664	0.0003	0.9991
70	33,388	1,003,444	0	1,036,832	0.0004	0.9995
71	0	170,634	0	170,634	0.0001	0.9995
72	0	631,670	0	631,670	0.0002	0.9997
73	0	36,171	0	36,171	0.0000	0.9997
74	33,651	63,565	0	97,216	0.0000	0.9998
75	0	647,289	0	647,289	0.0002	1.0000
Total	**840,310,941**	**981,870,788**	**1,083,552,445**	**2,905,734,174**	**1.0000**	**1.0000**

Appendix Table D10. -- Population estimates by sex and size for yellowfin sole (*Limanda aspera*) from the 2019 NBS bottom trawl survey.

Length (cm)	Males	Females	Unsexed	Total	Proportion	Cumulative proportion
5	0	185,976	1,355,560	1,541,536	0.0008	0.0008
6	0	476,504	6,856,594	7,333,098	0.0036	0.0043
7	0	256,355	5,848,013	6,104,368	0.0030	0.0073
8	291,545	1,965,331	10,551,250	12,808,126	0.0063	0.0136
9	2,904,622	1,398,154	10,341,582	14,644,358	0.0072	0.0208
10	5,557,974	3,446,250	4,916,475	13,920,699	0.0068	0.0276
11	10,269,638	10,847,513	1,409,797	22,526,948	0.0110	0.0387
12	13,122,615	12,400,187	695,428	26,218,230	0.0128	0.0515
13	27,813,232	19,804,248	383,555	48,001,035	0.0235	0.0750
14	39,381,426	31,196,310	64,986	70,642,722	0.0346	0.1096
15	48,684,230	46,391,731	0	95,075,961	0.0466	0.1562
16	56,063,798	49,943,443	0	106,007,241	0.0519	0.2082
17	54,793,657	48,299,213	0	103,092,870	0.0505	0.2587
18	46,397,520	43,275,466	0	89,672,986	0.0439	0.3027
19	50,032,311	44,152,774	0	94,185,085	0.0462	0.3488
20	54,416,019	47,142,229	0	101,558,248	0.0498	0.3986
21	43,859,923	46,359,089	0	90,219,012	0.0442	0.4428
22	41,485,008	43,814,201	0	85,299,209	0.0418	0.4846
23	40,303,244	40,423,995	0	80,727,239	0.0396	0.5242
24	32,970,739	31,871,831	0	64,842,570	0.0318	0.5559
25	28,792,876	34,052,502	0	62,845,378	0.0308	0.5867
26	27,459,321	29,182,652	0	56,641,973	0.0278	0.6145
27	30,717,404	28,984,276	0	59,701,680	0.0293	0.6437
28	29,316,819	26,550,825	0	55,867,644	0.0274	0.6711
29	37,992,300	25,657,561	0	63,649,861	0.0312	0.7023
30	30,265,741	26,933,846	0	57,199,587	0.0280	0.7303
31	34,891,585	28,282,026	0	63,173,611	0.0310	0.7613
32	26,302,164	29,940,897	0	56,243,061	0.0276	0.7889
33	21,281,788	25,805,615	0	47,087,403	0.0231	0.8119
34	27,838,391	27,386,955	0	55,225,346	0.0271	0.8390
35	36,023,929	27,017,764	0	63,041,693	0.0309	0.8699
36	31,874,944	28,569,387	0	60,444,331	0.0296	0.8995
37	25,763,636	29,683,759	0	55,447,395	0.0272	0.9267
38	15,307,541	36,327,269	0	51,634,810	0.0253	0.9520
39	11,950,267	28,596,789	0	40,547,056	0.0199	0.9719
40	6,690,721	18,202,711	0	24,893,432	0.0122	0.9841
41	1,712,977	12,073,180	0	13,786,157	0.0068	0.9908
42	124,065	8,537,797	0	8,661,862	0.0042	0.9951
43	382,823	3,969,684	0	4,352,507	0.0021	0.9972
44	813,053	2,035,198	0	2,848,251	0.0014	0.9986
45	0	1,192,647	0	1,192,647	0.0006	0.9992
46	0	1,018,484	0	1,018,484	0.0005	0.9997
47	0	294,422	0	294,422	0.0001	0.9998
48	0	174,732	0	174,732	0.0001	0.9999
49	0	174,732	0	174,732	0.0001	1.0000
Total	**993,849,846**	**1,004,296,510**	**42,423,240**	**2,040,569,596**	**1.0000**	**1.0000**

U.S. Secretary of Commerce
Gina M. Raimondo

Under Secretary of Commerce for Oceans and Atmosphere
Dr. Richard W. Spinrad

Assistant Administrator, National Marine Fisheries Service. Also serving as Acting Assistant Secretary of Commerce for Oceans and Atmosphere, and Deputy NOAA Administrator
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